Document of

The World Bank

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Report No: PAD2441

INTERNATIONAL DEVELOPMENT ASSOCIATION

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED STRATEGIC CLIMATE FUND SCALING UP RENEWABLE ENERGY PROGRAM (SREP) GRANT

IN THE AMOUNT OF US$5.61 MILLION

AND A

PROPOSED STRATEGIC CLIMATE FUND SCALING UP RENEWABLE ENERGY PROGRAM (SREP) CREDIT

IN THE AMOUNT OF US$2.0 MILLION

TO

NEPAL

FOR A

NEPAL: BUSINESS MODELS FOR PRIVATE SECTOR-LED MINI-GRID ENERGY ACCESS PROJECT

MARCH 2018

Energy and Extractives Global Practice

South Asia Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective March 4, 2018)

Currency Unit =	Nepalese Rupee (NPR)
NPR 102.639 =	US$1
US$0.00974 =	NPR 1

FISCAL YEAR

July 1 - June 30

ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
AEPC	Alternative Energy Promotion Centre
CREF	Central Renewable Energy Fund
DD	Detail Design
EIRR	Economic Internal Rate of Return
ESCO	Energy Service Company
ESMAP	Energy Sector Management Assistance Programme
ESMF	Environmental and Social Management Framework
ESMP	Environmental and Social Management Plan
ESIA	Environmental and Social Impact Assessment
FI	Financial Intermediary
FM	Financial Management
GIS	Geographic Information System
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GoN	Government of Nepal
IP	Indigenous Peoples
IRR	Internal Rate of Return
ITA	Independent Technical Advisors
MHP	Micro Hydropower Plant
MoPE	Ministry of Population and Environment
NEA	Nepal Electricity Authority
NPV	Net Present Value
NRREP	National Rural and Renewable Energy Programme
O&M	Operation and Maintenance
PAD	Project Appraisal Document
PDO	Project Development Objective
PIU	Project Implementation Unit
POM	Project Operational Manual
PPA	Power Purchase Agreement
PPSD	Project Procurement Strategy for Development
PV	Photovoltaic

RAP	Resettlement Action Plan
RPF	Resettlement Policy Framework
SCF	Strategic Climate Fund
SHS	Solar Home System
SPP	Small Power Producer
SREP	Scaling Up Renewable Energy Program
TA	Technical Assistance
TRC	Technical Review Committee
VCDF	Vulnerable Community Development Framework
VCDP	Vulnerable Community Development Plan

Regional Vice President:	Annette Dixon
Country Director:	Qimiao Fan
Senior Global Practice Director:	Riccardo Puliti
Practice Manager:	Demetrios Papathanasiou
Task Team Leader(s):	Subodh Adhikari

BASIC INFORMATION

Is this a regionally tagged project?	Country(ies)	Financing Instrument
No		Investment Project Financing

[ ] Situations of Urgent Need of Assistance or Capacity Constraints

[✓] Financial Intermediaries

[ ] Series of Projects

Approval Date	Closing Date	Environmental Assessment Category
05-Jul-2018	30-Apr-2023	F - Financial Intermediary Assessment
Bank/IFC Collaboration		
No		

Proposed Development Objective(s)

The Project Development Objective (PDO) is to increase electricity delivery from renewable energy mini-grids in selected areas by mobilizing private energy service companies.

Components

Component Name	Cost (US$, millions)
Component 1: Credit Facility to support Renewable Mini-grids Subprojects	5.61
Component 2: Technical Assistance to the Mini-grid Sector, ESCOs and Partner Banks and Project Management Support	2.00

Organizations

Borrower : Ministry of Finance

Implementing Agency : Alternative Energy Promotion Centre (AEPC)

PROJECT FINANCING DATA (US$, Millions)

[ ] Counterpart Funding	[✓] Trust Funds	[ ] Parallel Financing

Total Project Cost:	Total Financing:	Financing Gap:
7.61	7.61	0.00
	Of Which Bank Financing (IBRD/IDA):	
	0.00	

Financing (in US$, millions)

Financing Source	Amount
Strategic Climate Fund Credit	2.00
Strategic Climate Fund Grant	5.61
Total	**7.61**

Expected Disbursements (in US$, millions)

Fiscal Year	2018	2019	2020	2021	2022	2023
Annual	0.00	0.25	1.84	1.84	1.84	1.84
Cumulative	0.00	0.25	2.09	3.93	5.77	7.61

INSTITUTIONAL DATA

Practice Area (Lead)

Energy & Extractives

Contributing Practice Areas

Climate Change and Disaster Screening

This operation has been screened for short and long-term climate change and disaster risks

Gender Tag

Does the project plan to undertake any of the following?

a. Analysis to identify Project-relevant gaps between males and females, especially in light of country gaps identified through SCD and CPF

Yes

b. Specific action(s) to address the gender gaps identified in (a) and/or to improve women or men's empowerment

Yes

c. Include Indicators in results framework to monitor outcomes from actions identified in (b)

Yes

SYSTEMATIC OPERATIONS RISK-RATING TOOL (SORT)

Risk Category	Rating
1. Political and Governance	High
2. Macroeconomic	Moderate
3. Sector Strategies and Policies	Substantial
4. Technical Design of Project or Program	Moderate
5. Institutional Capacity for Implementation and Sustainability	Substantial
6. Fiduciary	Substantial
7. Environment and Social	Moderate
8. Stakeholders	Moderate
9. Other	
10. Overall	Substantial

COMPLIANCE

Policy

Does the project depart from the CPF in content or in other significant respects?

[ ] Yes [✓] No

Does the project require any waivers of Bank policies?

[ ] Yes [✓] No

Safeguard Policies Triggered by the Project	Yes	No
Environmental Assessment OP/BP 4.01	✓	
Natural Habitats OP/BP 4.04	✓	
Forests OP/BP 4.36		✓
Pest Management OP 4.09		✓
Physical Cultural Resources OP/BP 4.11	✓	
Indigenous Peoples OP/BP 4.10	✓	
Involuntary Resettlement OP/BP 4.12	✓	
Safety of Dams OP/BP 4.37		✓
Projects on International Waterways OP/BP 7.50	✓	
Projects in Disputed Areas OP/BP 7.60		✓

Legal Covenants

Conditions

PROJECT TEAM

Bank Staff

Name	Role	Specialization	Unit
Subodh Adhikari	Team Leader(ADM Responsible)	Energy	GEE06

Chandra Kishor Mishra	Procurement Specialist(ADM Responsible)	Procurement Management	GGOPZ
Shambhu Prasad Uprety	Procurement Specialist	Procurement Management	GGOPZ
Timila Shrestha	Financial Management Specialist	Financial Management	GGOES
Alina Thapa	Team Member	Project Coordination	SACNP
Aminata Ndiaye	Team Member	Financial Market	GFCSN
Barsha Pandey	Team Member	Energy	GEE06
Drona Raj Ghimire	Environmental Safeguards Specialist	Safeguards Management (Environment)	GEN06
Ekaterina Grigoryeva	Social Safeguards Specialist	Safeguards Management (Environment)	GEN03
Eriko Ichikawa	Team Member	Energy	GEE06
Francesca Lo Re	Team Member	Financial Sector	GFCS1
Gunjan Gautam	Team Member	Quality Management	GEE06
Johannes (Jon) C. Exel Exel	Team Member	Renewable Energy based Mini-Grid	GEEES
Joonkyung Seong	Team Member	SREP Fund Management	GEEES
Qingtao Yang	Team Member	Program Assistant (HQ)	GEE06
Rabin Shrestha	Team Member	Energy Planning	GEE06
Ramesh Raj Bista	Team Member	Procurement Management	GGOPZ
Rekha Shreesh	Social Safeguards Specialist	Social Development	GSU06
Shaukat Javed	Team Member		GEE06
Tara Shrestha	Team Member		SACNP
Xiaoping Wang	Team Member	Energy	GEE06

Extended Team

Name	Title	Organization	Location

NEPAL

NEPAL: BUSINESS MODELS FOR PRIVATE SECTOR-LED MINI-GRID ENERGY ACCESS PROJECT~~NEPAL: BUSINESS MODELS FOR PRIVATE SECTOR-LED MINI-GRID ENERGY ACCESS PROJECT~~

TABLE OF CONTENTS

I. STRATEGIC CONTEXT

A. Country Context

1. Over the past decade, Nepal's economy has performed reasonably well. Growth averaged 4.3 percent (at market prices) over the period of 2005-15. Although declining as a share in the economy, agriculture continues to play a large role, contributing one third of value-added. The service sector has grown in importance, accounting for more than half of value-added in recent years. Industry in general, and manufacturing has grown more slowly and its relative share in the economy is falling. Similarly, exports continue to struggle, while imports are fueled by remittances that exceed 30 percent of GDP. Inflation was in single digit for most of the past decade, with the peg of the Nepalese rupee to the Indian rupee providing a nominal anchor. Fiscal balances remained sustainable owing to strong revenue growth and modest spending. The incidence of poverty measured against the national poverty line fell by 19 percentage points from 2003/04 to 2010/11, and in 2010/11, 25 percent of the population was counted as poor. Most multidimensional indicators of poverty also showed improvements across regions in Nepal. However, these gains remain vulnerable to shocks and setbacks, like the 2015 earthquakes which were followed by trade disruptions resulting in the lowest economic growth in 14 years in 2016.

2. Economic activity, which rebounded strongly in FY2017, following two challenging years, has once again been disrupted by floods affecting more than one-third of the country. Rebound in FY2017 stemmed partly from a base effect, as well as a favorable monsoon boosting agricultural output and earthquake reconstruction gathering speed to raise investment. High inflation in the past two years has moderated sharply and has decelerated to 2.7 percent (y/y)[1] in July 2017. Government revenue continued to perform well, and spending has also picked up significantly in FY2017 compared to previous years. Nevertheless, ambitious expenditure targets envisioned in the budget have not been met and the quality of spending has not improved with 60 percent of capital spending occurring in the last quarter. Meanwhile, rapid credit growth in early 2017 has slowed but deposits growth has continued to decline, pushing up the interest rates. On the external side, the cumulative effect of a sharp trade balance deterioration and a slow growth of remittances, has put some pressure on current account. Economic activity, which was expected to progress well in FY2018, has been affected by the worst floods in decades particularly affecting the agriculture output.

3. A new constitution that defined Nepal as a federal democratic republic was promulgated in September 2015. With the formulation of the new Constitution, Nepal has migrated to a federal state structure with autonomous sub-national governments. Fresh general and provincial elections have recently been completed, electing new central and provincial tier of governments. One major impact of the transition is the redundancy of the district offices and their sub offices to be replaced by the newly elected local governments. The country now has 7 Provinces and 753 Municipalities. Funds, functions and functionaries hitherto managed through the 75 District Development Committees will move to new local governments. While the proposed 753 Municipalities are expected to provide better outreach and services, they will likely take significant time to become fully operational.

[1] Year on year

4. Nepal must improve its electricity sector making supply adequate and reliable, both in urban and rural areas**.** Despite having rich hydropower resources, the current total installed capacity is 976 MW,[2] including generation from the Nepal Electricity Authority (NEA) and independent power producers. Existing generation, even after being supplemented by purchases from India, is insufficient to meet the demand. Peak demand in 2016 was 1385 MW. Although load shedding has recently ended in the capital, Kathmandu, and the tourism hub of Pokhara, it still plagues the rest of the country despite the import of about 250 MW in average from India. Electricity access has been extended to 75 percent of the population. Around 50 percent of the population of 27.5 million has access to grid electricity, while the remaining 25 percent is served by off-grid solutions.[3] However, Access to the grid does not always imply adequate and reliable availability of electricity. Actual consumption of electricity remains very low at about 132 kWh per capita compared to per capita consumption levels of 1,010 kWh for India, 2,600 kWh for China, and 13,246 kWh for the United States.[4] Off-grid solutions provide relatively reliable, albeit limited, electricity supply in the rural areas where the grid extension is difficult and uneconomical.

B. Sectoral and Institutional Context

5. In order to improve off-grid energy access, the government has realized the need to introduce commercial financing and private-sector management. The government's Renewable Energy Subsidy Policy of 2016 (RESP 2016) envisages reducing and eventually replacing subsidies – which currently is the predominant form of support -- with credits mobilized through private financial institutions. Furthermore, RESP 2016 requires potential mini-grid[5] owners to demonstrate the ability to close the financing gap before subsidies can be accessed. RESP 2016 seeks to address the following key issues:

   a. Lack of mobilization of credit and high dependence on subsidy is hampering the expected promotion of and innovations in renewable energy technologies (RETs).

   b. Communities strive to identify multiple sources of subsidies and grants on top of that provided by AEPC instead of accessing loan. In addition, the private financial institutions are reluctant to provide loans to the communities as the communities are perceived not to have adequate project implementation and O&M capabilities. Thus, financial closure for community-owned electrification projects takes long time.

   c. Policy barriers for private sector investors and service providers was hampering private sector investment, keeping out management skills and technology dissemination that private companies can bring.

   d. Tariffs designs usually does not take into account the type customers and their willingness to pay for the electricity by different customers categories.

6. The RESP 2016 has the strategy of: (i) reducing upfront cost of RETs; (ii)maximizing use of renewable

[2] NEA Annual Report 2017.

[3] National Planning Commission 2015.

[4] International Energy Agency 2014.

[5] Mini-grids are off-grid power supply schemes consisting of either single or multiple sources supplying power to a cluster of customers types

energy resources and technologies, and service delivery; (iii) supporting growth of renewable energy market by mobilizing credit, attracting private sector, and reducing investment risks; and (iv) encouraging public-private partnerships. Despite the efforts, however, existing implementation model of Alternate Energy Promotion Centre (AEPC) has stagnated and the mini-grid sector is still largely dependent on subsidies.

7. At present, off-grid communities are served by more than 1,700 community-owned micro hydropower plants (MHPs) with total installed capacity of about 30 MW. However, these MHPs which are operated at low (plant) utilization factor -- between 20-40 percent-- and with consumer tariff in the range of US$ 0.6-0.8/ kilo-Watt hour (kWh), are unable to recover capital costs. The critical issues threatening the sustainability of mini-grid sector are:

   a. Although MHPs are typically designed to operate at nameplate capacity for around 11 months of a year, most of the community owned schemes are typically operated to supply electricity mostly to residential loads. This results in low utilization factor, which is the ratio of energy supplied to consumers over energy that can be generated. Low utilization factor reduces the revenue for MHPs making them financially unattractive.

   b. Community-owned MHPs set tariff to barely recover operating costs (mostly staff salary and administration). The mindset of meeting only operating costs and lack of pressure to deliver returns on equity or repay debt leads to disinterest in diversifying the loads and generating more revenue.

   c. Community led mini-grid ownership model struggle to raise commercial capital. Achieving the financial close for a typical community mini-grid takes 1-3 years to complete.

   d. Subsidy was not available for MHPs under private ownership in the earlier version of RESP until 2016, impeding the private sector participation. Even though the revised RESP of 2016 addresses this shortcoming, the private sector is still not encouraged as the sector it still perceived as risky.

   e. The arrival of Nepal Electricity Authority (national electric utility) grid in rural areas currently served by mini-grids is another challenge. In Nepal, it is estimated that about 30 percent of existing MHP mini-grids may face grid arrival in their service areas. To address this challenge, NEA has recently agreed to consider Power Purchase Agreement (PPA) with mini-grids, which connect to the NEA's grid. So far, there has been only 2 interconnections between the NEA grid and a mini-grid in Nepal, although there is abundant experience internationally.

   f. There were about 80 AEPC prequalified companies in the MHP development business. However, only 35 are active now. In the last few years, the number of MHP construction has decreased. One of the major issues that the micro hydropower projects are currently facing is the delay in achieving the financial closures.

8. At present AEPC channels subsidies and credits to the mini-grids by channeling funds through one transaction bank (Handling Bank - HB) and seven lending banks (Partner Banks -- PB) selected in 2014 through Request for Proposal. HB supports in disbursing subsidies in compliance with RESP 2016 and associated Renewable Energy Subsidy Delivery Mechanism 2016 while the PBs disburse credits. Both the

HB and PB, are incentivized by liquidity[6] and risk mitigation[7] support from AEPC's programs to provide subsidies and credits.

9. In FY16/17, AEPC disbursed approximately US$ 15 million as subsidies to MHP and solar mini-grids. In the same period, two PBs debt-financed two MHP mini-grids for NPR 0.26 million. Currently a total of 40 mini-grid subprojects have received loans. These subprojects are implemented, managed and operated by the communities. As the communities lack professional experiences, many of these projects are not operated and managed properly. The GoN has requested the World Bank's support to pilot new approaches and increase commercial financing and private-sector participation in deployment of renewable energy mini-grids.

C. Higher Level Objectives to which the Project Contributes

10. The proposed project is consistent with the joint IDA/IFC/MIGA Country Partnership Strategy for Nepal (FY2014–18) dated May 1, 2014 (Report No. 83148-NP), which stresses the importance of boosting economic growth and competitiveness through increased electricity supply and improved energy access. Specifically, the proposed project will contribute to Pillar 1, Outcome 1.1 of the Nepal Country Partnership Strategy: 'Increased supply of electricity, including import, and improved access to reliable and affordable electricity within Nepal'.

11. The project is consistent with the GoN's strategy of meeting the domestic demand by developing renewable energy sources and improving energy security of the country, as articulated in the concept note on National Energy Crisis Prevention and Electricity Development Decade. The project will also support Nepal in achieving the objectives of Sustainable Energy for All Initiative, particularly on access to modern energy and renewable energy.

12. This project complements the Scaling Up Renewable Energy Program (SREP) Investment Plan for Nepal by bringing in an innovative approach, which resulted in project's funding from the SREP private sector set aside. The Strategic Climate Fund (SCF) of the Climate Investment Funds (CIF) established a new funding window called the private sector set aside in 2012. It was designed to increase private sector investment through competitive allocation of concessional funding and to spur innovation and flexible delivery to meet the objectives of the SCF. In October 2013, the subcommittee of the SREP, one of the targeted programs under the SCF, endorsed the concept of this project with the funding request of US$7.61 million, with US$5.61 million as grant and US$2.0 million as non-grant.

13. The project incrementally takes the sector towards commercial practices and maximizes financing for development. At the subproject level, a typical financing plan will feature ESCO's equity contribution, debt from PBs (on-lending of a credit facility on a marginally commercial interest rate), and public-sector subsidy to buy down the electricity tariff to end-users. Private ESCOs, that have been largely absent from the sector, are expected to be revived by the project. Commercial debt financing of mini-grid subprojects,

[6] The liquidity support is provided in the form of deposits in the interest-bearing account of both the HB and PB. HB disburses subsidies to the ESCOs based on the instruction from AEPC. PB on-lends, from the pool of available liquidity, to RE sub-projects after assessing the relevant credit risks.

[7] The risk mitigation support is provided in the form of deposit write-offs for the PBs who on-lends to the RE subprojects and whose credit becomes non-performing

which has been nominal, will be promoted by the project for further market uptake and mainstreaming.

II. PROJECT DEVELOPMENT OBJECTIVES

A. PDO

14. The Project Development Objective (PDO) is to increase electricity delivery from renewable energy mini grids in selected areas by mobilizing private energy service companies.

B. Project Beneficiaries

15. The ultimate project beneficiaries are rural residential and non-residential customers, which will gain access to new or improved energy services in rural areas through renewable energy based mini-grid developed by ESCOs. The non-residential beneficiaries will be the ones, who need reliable supply around the clock, such as industries, commercial establishments, public institutions etc. The use of electricity will replace their consumption of diesel, kerosene, storage batteries as well as other energy sources that they have been relying upon.

16. The ESCOs will benefit from a credit facility mobilized by the project through selected private Partner Banks. Additionally, capacity development funded by the project will be extended to AEPC, participating PBs, as well as mini-grid technical and managerial staff. The project will fund targeted communication and capacity building to women to increase their participation in the sector.

17. Finally, the PBs will benefit from liquidity and risk mitigation support from the project as they increase their lending in a sector, which is relatively new for them. The project will also support the capacity development and training needs for PBs to enhance their knowledge and confidence with mini-grid subprojects.

C. PDO-Level Results Indicators

18. The achievement of the PDO will be measured using the following indicators:

    (a) Electricity generation capacity constructed or rehabilitated (MW)
    (b) People provided with new or improved electricity service
    (c) Annual electricity output from renewable energy (GWh)

III. PROJECT DESCRIPTION

A. Project Components

19. The project is designed to support RE mini-grids market by introducing conditions to gradually shift from subsidized to commercial model. The proposed project consists of two components: (1) Credit Facility to support Renewable Mini-grids Subprojects; and (2) Technical Assistance to the Mini-grid Sector, ESCOs and Partner Banks, and Project Management Support. The total cost for the proposed project is US$7.61 million.

Component 1: Credit Facility to Support Renewable Mini-grids Subprojects (US$5.61million)

20. This component will support renewable energy (RE) mini-grid subprojects by providing a total of approximately US$ 5.61 million to be intermediated by AEPC through on-lending to Partner Banks (PBs)[8], the financial intermediaries.

21. The component will mainly support the construction of new micro-hydro and solar hybrid[9] mini-grid subprojects. In addition, based on the commercial viability, the rehabilitation of existing mini-grid subprojects and the interconnected operation of the mini-grids with the national grids will also be supported. The subprojects will be selected based on the established eligibility criteria agreed with the Bank. Implementation of these subprojects will be led by the private ESCOs and/or cooperatives, and financed by a combination of equity, subsidies, and credit mobilization through the credit facility as appropriate[10]. The equity will be invested by the ESCOs, while the subsidies will be provided by the GoN through AEPC.

22. A US$5.61 million credit facility established at AEPC under this component will provide long term source of funds for lending. AEPC will on-lend funds through financial intermediaries or PBs to ESCOs to finance micro-hydro and solar hybrid mini-grids subprojects. AEPC will select PBs according to criteria agreed upon with the World Bank. On-lending will take place on an 'open door' and 'first come first serve' model to the eligible ESCOs and subprojects through interested and qualifying financial institutions. The credit facility will be intermediated by AEPC, which will also be implementing agency for this project.

23. AEPC will assume the credit risk of lending to PBs, and the PBs will assume the credit risk of the sub-projects beneficiaries that will be selected based on agreed upon eligibility criteria. AEPC will, nevertheless, cover certain sub-project related risks (mainly related to force majeure, or the loss of commercial viability by the arrival of the grid in the operation area), by embedding a clause in the subsidiary loan agreements with PBs and writing off the related loss against the project's grant. The subsidiary loan agreement will, among others, also specify the nature of co-financing including the percentage of equity, subsidy, credits for a sub-project. Subsidies will be available to the sub-projects from the GoN's own resources through AEPC on the annual basis. AEPC will estimate the subsidy amount and recommend to the GoN to be allocated on its annual budget.

24. This credit facility will incentivize financial institutions to invest in Renewable Energy (RE) mini-grids by making available the funds for on-lending at the competitive interest rates. The model will crowd in the private sector in line with the Government strategy to move away from reliance on subsidies.

25. ***Risk coverage:*** AEPC will be writing-off PB's obligation to repay AEPC for the above two events: i) force majeure events and ii) arrival of grid to the effect that the operation of the mini-grid becomes

[8] Partner Banks (PBs) are the participating financial institutions that will on-lend to the mini-grid subprojects. The phrase 'partner banks' and 'financial institutions' are used interchangeably in the document.

[9] Solar hybrid subprojects include solar-MHP subprojects, solar-battery storage subprojects, solar-wind subprojects, and solar-diesel generator subprojects, among others.

[10] According to the current GoN subsidy policy the mini-grid interconnection and rehabilitation projects will not be provided with subsidy. However, credit facility will be provided to these projects provided that they meet the eligibility criteria.

uneconomical. A separate reserve account will not be necessary in this arrangement for writing-off PBs' obligation as AEPC will be writing-off obligation of PBs to repay AEPC. AEPC is a Government of Nepal (GoN) entity and it has access to the GoN resources to fulfil such obligation.

Component 2: Technical Assistance to the Mini-grid Sector, ESCOs and Partner Banks and Project Management Support (US$2 million)

26. This component will provide required technical assistance (TA) to the Implementing Agency (IA), ESCOs, and PBs to implement the project and also to open-up the commercial mini-grid market. This component will support to institute and sustainably maintain the Project Implementation Unit (PIU) at AEPC. It will help in hiring key staffs/specialists/consultants in the PIU to ensure there is adequate capacity to implement the project. As this is the new project implementation model in Nepal, it is essential that this component should also support capacity building of AEPC, ESCO, and PBs. Among others, the funds allocated under this component will be utilized in the support of following:

- Enhancement of AEPC's capacity as wholesaler, including support in the establishment of a Credit Vertical Unit (CVU) dedicated to loan disbursement and portfolio monitoring. Support will be provided to establish/strengthen unit within AEPC with adequate credit appraisal and monitoring procedures and systems in place, alongside hiring dedicated staff to enhance AEPC's capacity to act as financial intermediary during Project's implementation.

- Support to cover PIU staffs and incremental operating costs, goods for AEPC (such as equipment and software necessary for subproject design, supervision, and monitoring and evaluation(M&E)).
- Establishment of Technical Review Committee (TRC) to assist the AEPC in reviewing subprojects, so that AEPC management can make timely, well-vetted and informed decisions.
- Hiring of Independent Technical Advisors (ITA), who will be sector experts, to support the AEPC and PBs in appraising and strengthening unsolicited project proposals from the ESCOs. ITA can advise ESCOs, as required, to develop bankable subprojects. ITA will also monitor subproject construction to inform ESCOs, AEPC, and PBs of risks during construction phase and to advise on them on mitigation measures.
- Preparation of feasibility studies, technical design, environmental and social assessments, and bid documents of subprojects, which will be competitively awarded to ESCOs by AEPC with provision of GoN subsidies;
- Preparation of key project documents including the Project Operational Manual (POM), M&E framework, and other instruments such as Memorandum of Understanding (MOU), agreements, contracts among AEPC, ESCOs, and PBs;
- Support on trainings and capacity of development of Ministry of Energy and Water Resources (MoE)[11] ESCOs, PBs, and AEPC on commercial operations of mini-grids. Private sector led mini-grid is new concept in Nepal and capacity of MEWR and AEPC need to be strengthened to provide oversight and coordinating role for off-grid electrification. For ESCOs, these trainings will also cover business models, company registration and business administration, tariff management,

[11] Under the recent restructuring AEPC is under the remit of Ministry of Energy and Water Resources(MEWR)

and project financing, among others. For PBs, trainings will cover credit due-diligence, monitoring of loan performance, and risk assessment, etc. For AEPC as well as ESCOs, trainings can focus on procurement, financial management, E&S assessment and management, among others;

- Preparation of necessary technical standards and guidelines for MHPs, solar, wind mini-grid and interconnection subprojects;
- Support on the promotional activities and capacity building workshops to connect various stakeholders (ESCOs, financiers, business/household customers), rural community mobilization, and matchmaking events/programs; and
- Monitoring and evaluation and socio-economic surveys.

B. Project Cost and Financing

27. The US$7.61 million project will be financed by the SREP Trust Fund. Of this, US$5.61 million will be a grant to the GoN and US$2 million will be a concessional loan. Detailed cost allocation to the project components is summarized in Table below. The grant from SREP to GoN, and thereafter from GoN to AEPC, enables AEPC to: (i) provide low-cost risk-mitigated credit to PBs; (ii) institute a sustainable revolving debt fund; and (iii) complement credit facility with much needed technical assistance. The credit support is expected to be provided to more than 25 subprojects. With such support, it is expected that the private sector will mobilize approximately US$ 3.12 in the form of equity and GoN will mobilize US$ 6 million in the form of subsidies.

Table 1: Project cost and financing

Project Components	Project Cost	IBRD or IDA Financing	Trust Funds	Counterpart Funding
Component 1: Support to Renewable Energy Mini-grid Subprojects	**5.61**	**-**	**5.61**	**-**
Component 2: Technical Assistance to the Mini-grid Sector, ESCOs and Partner Banks and Project Management Support	**2**		**2**	**-**
Total Costs	**7.61**	**-**	**7.61**	**-**
SREP Grant to GoN	***5.61***		***5.61***	
SREP Loan to GoN	***2.0***	**-**	***2.0***	**-**

C. Lessons Learned and Reflected in the Project Design

28. The project draws on the lessons and experience from WB's rural electrification and financial intermediation operations. Project design is informed by the current subsidy and credit mobilization

mechanisms adopted by AEPC to the mini-grids in Nepal. These include Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) supported debt fund for implementation of community micro-hydropower mini-grids; Asian Development Bank (ADB) supported subsidy and loan program for community managed mini-grids; NORAD and DANIDA supported Energy Sector Assistance Program (ESAP) and National Rural and Renewable Energy Program (NRREP)[12] which provided support in drafting mechanism and guidelines for the mobilization of grant and credit to the renewable energy projects including for the mini-grids; and KfW supported program for the mobilization of credit to the bio-gas projects.

29. The recommendation of WB and United Nations Development Program research have been incorporated in the project. The project considers the WB study, "Nepal Scaling Up Electricity Access through Mini and Micro Hydropower Application," recommendations to improve overall, technical, financial/economic, and institutional performance of MHP mini-grids. The study finds MHP mini-grids are two to three times more cost effective than diesel and solar home system based solution in providing the same level of electricity service in rural Nepal. UNDP's "Study on Performance of REDP/RERL Supported Community Managed Micro Hydropower Projects (2014)" found that people are willing and able to pay for adequate and reliable electricity service, management of mini-grids must be improved, and grid arrival is a major threat to existing mini-grids. In line with recommendations of the studies, the project prioritizes: (i) deploying medium to large scale MHP mini-grids; and (ii) connecting existing MHPs to national grid upon grid arrival. On technical side, the project will: (i) promote grid compatible MHP mini-grids and quality assurance/control of equipment and civil works; (ii) encourage energy based tariff; and (iii) support sector capacity-building for operations and maintenance. For improving financial and economic performance, the project will: (i) increase access of ESCOs to finance and educate lenders on financial sustainability of mini-grids; and (ii) encourage cost benchmarking and standardization of design and equipment. For improving policy and institutional aspects, the project will work with AEPC to: (i) optimize site-potential in mini-grids; and (ii) gradually transition the mini-grids' ownership and management from informal 'functional groups/user committees' to formal companies and cooperative.

IV. IMPLEMENTATION

A. Institutional and Implementation Arrangements

30. The AEPC will be the project Implementation Agency (IA) and hosts the Project Implementation Unit (PIU), instituted under component 2. PIU will be responsible for the overall project implementation. PIU will comprise of AEPC staff assigned to manage the project, and specialists such as solar and MHP engineers, financial analyst, procurement specialist, etc. as described in Annex 2. It will also be responsible for following Bank's policies on safeguard, financial management and procurement. Additionally, Independent Technical Advisor (ITA) who will be expert consultants will support PIU. PIU will make technical and financial and economic appraisal of the subproject and recommend for the decision to AEPC management through a Technical Review Committee (TRC). The project organization is presented in the figure below:

31.

[12] ESAP and NRREP projects were closed on FY 2017

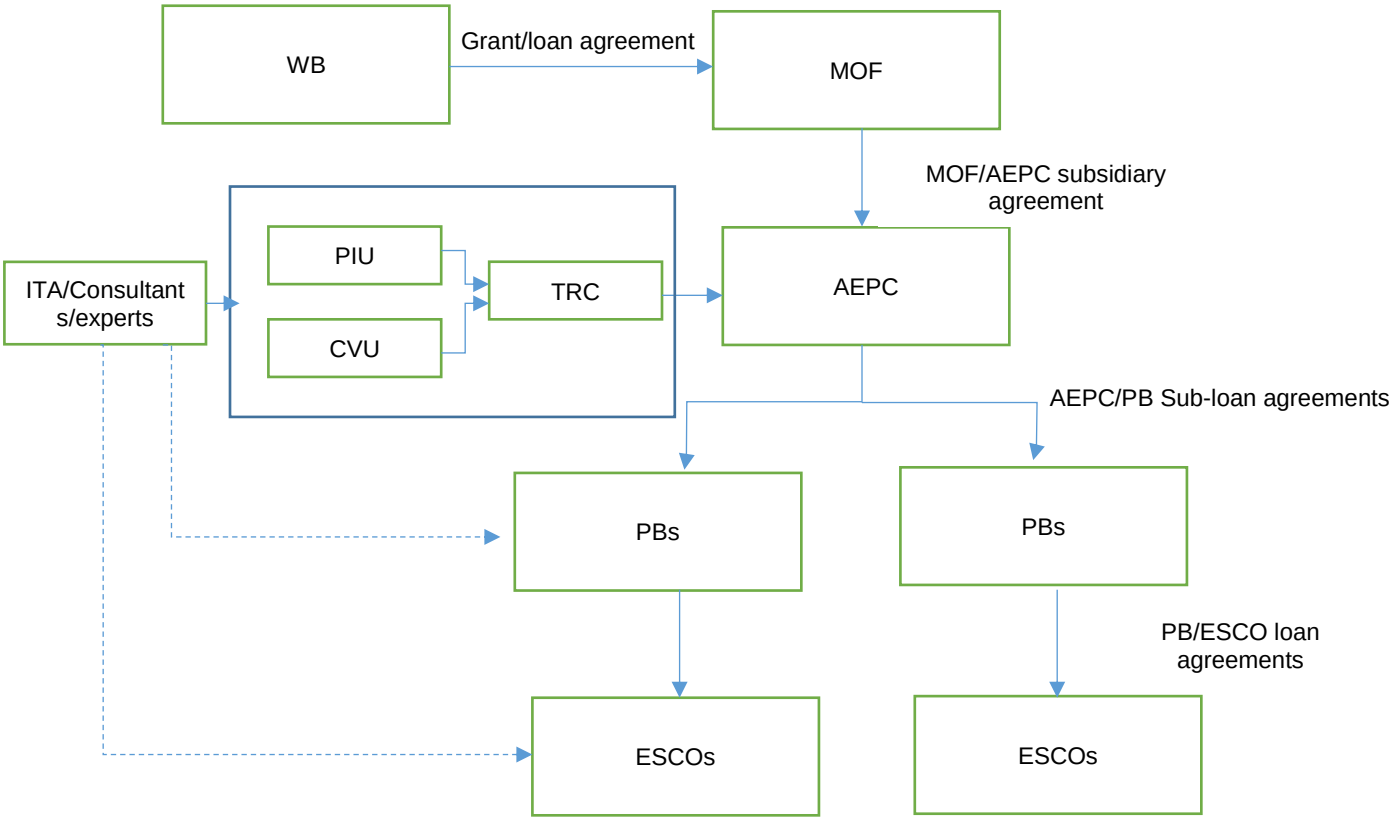

Figure 1: project organization

32. **DRAFT:** *The project design has been appraised and found compliant to the OP10 procedure 'Financial Intermediary Financing' by the OP10 reviewers. AEPC is considered as eligible partner to implement the project in partnership with commercial banks who has capacity to act as financial intermediary as required for the private sector led mini-grid model in view of: 1) experience in implementing projects in the renewal energy sector; 2) availability of a pool of banks having adequate profitability, capital and quality portfolio with sound financial indicators and experience in RE lending for the selection of partner banks and; 3) recommended AECP's capacity enhancements, including establishment of a Credit Vertical Unit (CVU) dedicated to loan disbursement and portfolio monitoring.*

33. The subprojects that are considered for the development can be broadly classified into two categories: a) subproject identified by AEPC, where ESCOs are solicited for development; b) subprojects identified by ESCO and proposed for development. For the subprojects under category (a), AEPC will conduct a preliminary due diligence to be able to solicit proposal on the competitive basis from the potential ESCOs for the implementation. ESCO will conduct further studies and propose the subproject to AEPC and PB for the investment decision. For the subprojects under category (b), ESCOs will be responsible for selecting the subprojects on their own and after completing necessary studies, propose the subprojects to AEPC and PBs for the decision. PBs, in coordination with AEPC and with technical assistance from AEPC – as and when required, will conduct credit appraisal on proposed subproject and make credit decisions. Under both the categories, technical support from AEPC PIU will be provided to PBs to facilitate their credit

appraisal. The steps for subproject decision will be as follows:

a. The ESCOs will make a commercial loan application to the PBs after conducting necessary studies for the projects under both the categories.

b. PBs will conduct preliminary assessment to determine the project viability and will present a subproject brief to the PIU for necessary technical due diligence with the intention to extend the credit to subprojects subject to the outcome of the due diligence process.

c. PIU will evaluate the subprojects (including based on the agreed eligibility criteria) and advise the PBs of whether the proposed subprojects by ESCO are eligible for support from credit facility, AEPC's subsidies, and at PIU's option, any other additional support programs that subproject is eligible for from APEC.

d. The PBs will take the credit risk and hence will conduct their own detailed credit appraisal and follow their internal credit approval process for the loan evaluation and monitoring. PBs may rely on the PIUs' due diligence or they may request technical assistance from PIU to assist their evaluation.

e. The subprojects if approved by PBs' credit committee will be notified to PIU for the PB's intention to credit finance under Component 1.

f. PIU will then make recommendation to TRC for the final decision on the project approval

34. The process flow chart is presented in the figure below

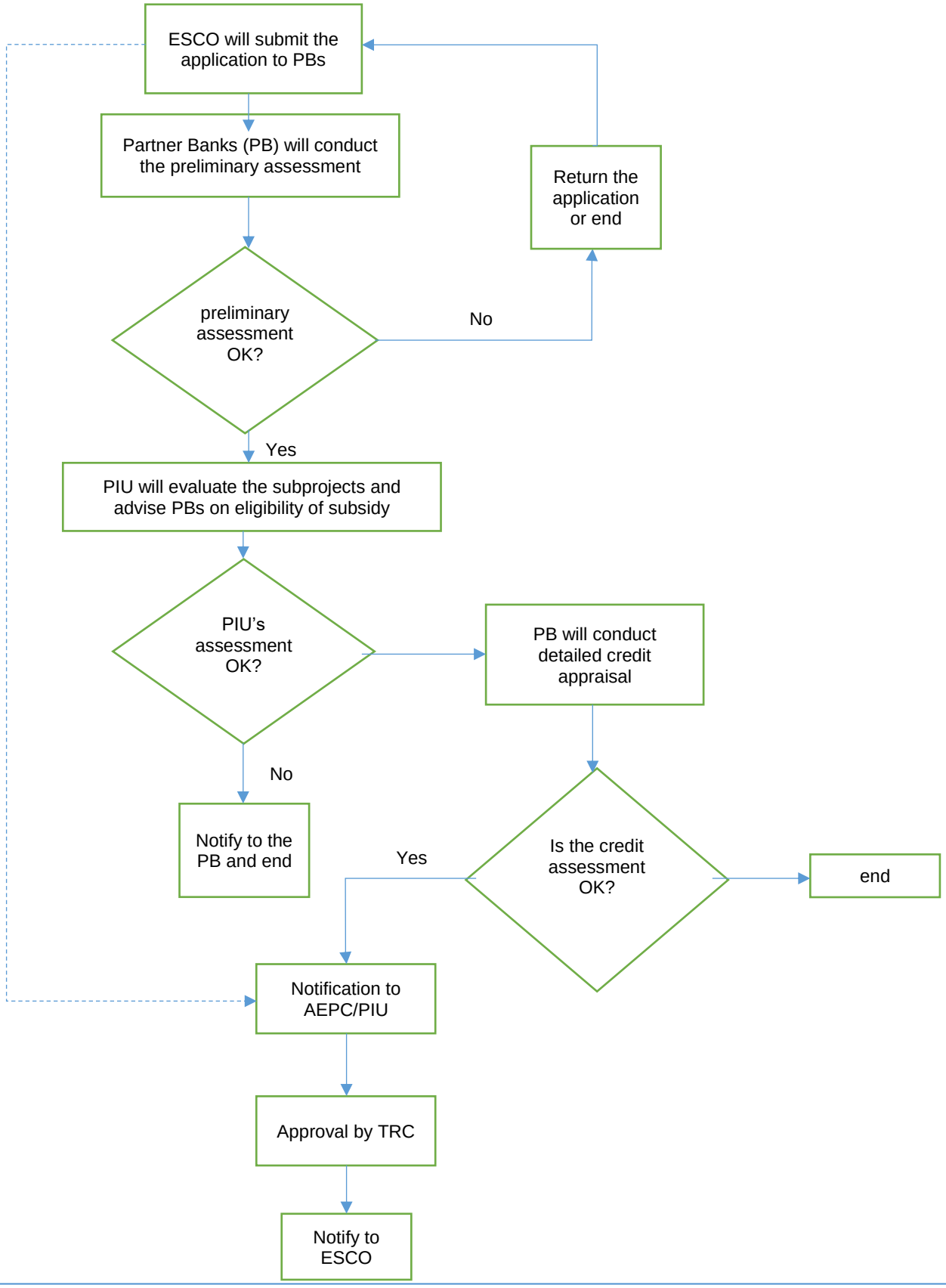
ESCO will submit the application to PBs
Partner Banks (PB) will conduct the preliminary assessment
Return the application or end
preliminary assessment OK?
No
Yes
PIU will evaluate the subprojects and advise PBs on eligibility of subsidy
PIU's assessment OK?
PB will conduct detailed credit appraisal
No
Notify to the PB and end
Is the credit assessment OK?
Yes
end
Notification to AEPC/PIU
Approval by TRC
Notify to ESCO

Figure 2: Implementation process flow chart

35. ESCOs may also contact APEC directly to avail of subproject preparation support and any additional support mechanism provided by GoN through AEPC for the subproject studies and development.

36. The eligibility criteria for the subprojects will include promotion of rural energy access, proposed incremental renewable energy capacity, projected utility timelines for national grid extension to the subproject area, and promotion of mini-grids that has most potential for commercial viability. In addition, to be eligible for the credit facility, ESCOs will need to demonstrate best efforts to reduce subsidy from GoN by investing their equity and receive government subsidy based on the project capacity and number of households connected. (The eligibility criteria for the ESCOs and subprojects are presented in Annex 1). Currently AEPC has identified and prepared a list of 12 projects that can potentially be taken up for development. Out of these, 2 projects (micro-hydro project of 990 kW capacity and solar project of 335 kW capacity) are in advanced stage of studies by ESCOs and can be implemented soon if WB's Board approves the project. For the remaining subprojects, AEPC is in touch with their developers (ESCOs) to initiate necessary studies.

37. Due to availability of grant from SREP, the interest rate on credit from AEPC to PBs can be benchmarked with low-interest yielding instruments such as one-year treasury bills. ESCOs will be informed of this caveat in the credit facility; and it is expected that ESCOs will negotiate suitable terms and tenure with PBs on subproject loans. When subproject loans issued by PBs are paid off by borrowing ESCOs, the reflows to PBs will be transferred back to AEPC. The reflows after netting out the spread of the PBs will be transferred back to AEPC. PBs will take most of the credit risk and their spread is the compensation for taking on the risk and to cover their costs. AEPC can utilize the reflows and set up a sustainable revolving debt fund. These revolving debt funds can be used to credit finance the future mini-grids implemented after the end of this project. The technical assistance financed by the grant is critical for preparing subprojects and building confidence and capacity of ESCOs and PBs.

38. The ESCOs will be responsible for compliance with Bank's safeguards instruments. AEPC and PBs will review and monitor ESCO's compliance. Bank's Procurement Regulations is not applicable in Component 1. For subprojects receiving subsidy from GoN, AEPC and ESCOs may have to comply with GoN's procurement policy and regulation. The details of roles in subproject preparation and implementation are in Annex 2.

B. Results Monitoring and Evaluation

39. Monitoring of project implementation progress and results indicators, as well as progress toward achievement of the PDO, will be the responsibility of the AEPC as well as PBs and ESCOs. The ESCOs will provide primary data on installed capacity of mini-grids, number and type of customers, and electricity supplied. ESCOs and PBs will provide data on private capital mobilized. The PIU will collect data and reports from PBs and ESCOs. PIU will also report on Component 2 indicators pertaining to technical assistance and sector capacity building. PIU will prepare and submit semi-annual project progress report to the World Bank in conjunction with Bank's supervision and implementation support missions.

40. The project will engage citizen and stakeholders in designing as well as monitoring and evaluating the

performance of the mini-grid subprojects. Baseline data on subprojects will be collected through their detailed feasibility studies and environmental and social assessments. ESCOs and/or AEPC will organize rural community meetings (inviting potential residential and non-residential costumers, both men and women), focus group discussions, and socioeconomic surveys, as necessary, during subproject preparation. AEPC and ESCOs will be encouraged to assess: (i) willingness- and ability-to-pay; (ii) citizens' attitudes towards energy use and service; and (iii) customer feedback on flat tariffs versus segmented tariffs. The impacts of electrification, including specifically on women, will be monitored by continuing the socioeconomic surveys targeting the same subprojects on an annual basis after the subprojects' commissioning. A report summarizing findings will be publicly disclosed once a year during this project period.

41. An Implementation Completion and Results Report (ICR) of the project will be prepared upon closure of the project to evaluate the project's performance.

C. Sustainability

42. The GoN has demonstrated strong commitment and ownership of the proposed operation. The project concept was developed under the AEPC's leadership through an extensive and participative consultation process that started as part of the SREP Investment Plan preparation for Nepal. The focus is on improving the enabling environment for private sector participation in mini-grid subprojects. The project brings together AEPC, ESCOs, and PBs to deploy mini-grid subprojects. Project helps in demystifying policies and procedures for stakeholders to engage and collaborate with each other in a relatively certain and sustainable manner. The project will help in achieving the government's goal of universal access by 2030.

43. The project is designed to improve sustainability of mini-grid sector in Nepal. The project strengthens experience of AEPC and PBs in working with ESCOs and moves the mini-grid sector towards a financially sustainable model. An outreach was carried out by AEPC on November 20, 2017 to get stakeholder feedback on project design. Seven PBs, four potential ESCOs, representatives of solar and micro hydro industry associations, non-profit organizations, and other stakeholders participated in the outreach. The participants supported the project design, including: (i) provision of subproject loans by PBs to ESCOs based on PBs loan review practices; (ii) project's risk coverage for grid arrival (making the project operation not commercially viable) and force majeure and PB taking credit risk in all other circumstances; and (iii) back-to-back basis of marginally commercial loans from AEPC to PBs. It is expected that by the end of the project, commercial banks will have increased confidence for investing in mini-grid subprojects; and their familiarity with the sector will be reflected in more favorable loan terms and conditions.

44. Privately owned and operated mini-grids are expected to be financially sustainable. To be eligible for the subproject loan, ESCOs will need to mobilize their equity. The motivation to repay debt and earn returns on equity is expected to instill prudent management practices by ESCOs. The subprojects will benefit from technical assistance and due diligence financed by Component 2. Furthermore, by increasing subproject development and management capacity of ESCOs and subproject appraisal capacity of PBs, the project will steer the sector towards sustainability.

45. The project helps AEPC establish a sustainable revolving fund for financing mini-grid subprojects. There can be a provision where reflows from loan issued by AEPC to PBs accrue in revolving fund, 'Reflows

Account,' of AEPC. The funds in the Reflows Account can be used for financing future mini-grids and RETS in line with the mandate and policies of AEPC and government of Nepal.

46. The project will also help enhance ESCOs and PBs working knowledge of E&S risk management. The training provided by the project should help them analyze and manage such risks on their own in future.

D. Role of Partners

47. The project will coordinate closely with other donors that provide investment and TA support to rural energy access programs in Nepal. At present, concessional loan to ESCOs from other international development partners is not available or operationalized. Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) has been supporting community-developed micro hydropower mini-grids having capacity less than 100 kW. GIZ is planning to expand their financing support to ESCOs, but their target scale is still less than 100 kW. Asian Development Bank (ADB) is preparing a loan support to ESCOs through AEPC (about US$5 million) for mini-hydropower mini-grids having capacity from 100 kW to 1,000 kW. ADB is still in the design stage for supporting private ESCOs. The World Bank team will share the information and coordinate with GIZ and ADB as the project is also mobilizing debt financing through PBs. Coordination with other development partners will be important to send consistent signals to the market.

48. The World Bank executed the renewable energy sector's current capacity and future needs assessments in 2016 and identified 35 training modules to be provided to stakeholders in the renewable energy sector in Nepal within five years. Currently, AEPC is coordinating with all donors to share the responsibilities/tasks to deliver all these 35 training modules on time. A part of the project budget will be used for some training modules related to the renewable energy and mini-grid subproject implementation.

V. KEY RISKS

A. Overall Risk Rating and Explanation of Key Risks

49. The overall implementation risk is **Substantial**. The project risks were identified based on the AEPC's lack of recent experience in working with ESCOs. Risk mitigation measures were identified based on lessons learned from the previous/ongoing donor-funded energy projects; the successful experiences in other countries to address similar governance-specific issues in the energy sector; and consultations with development partners, concerned local and national groups, and experts. The key risks and mitigation measures are discussed in the following paragraphs.

50. **Political and governance risks.** Political and Governance risks are rated as High. Nepal's transition has been characterized by frequent government changes. The country has constitutionally adopted a federal government system; however, it is currently facing the daunting task of smoothening the transition from the old unitary system to the new federal one. The new system takes effect in January 2018 and, in principle, provides opportunities to decentralize development benefits and make service delivery more effective and accountable. However, the risks of jurisdictional overlap between the three tiers of government, lack of clarity and coherence between policies and devolved powers, and duplication of

efforts will remain high. Political interference and ambiguities in jurisdiction may delay subproject implementation and risk achievement of PDOs.

51. **Mitigation measures.** The World Bank has developed a close relationship with the stakeholders of the renewable energy and rural electrification sectors and welcomes the convergence of the main political parties toward a commitment to renewable energy development and improved energy access in rural areas, especially after the fuel crisis that occurred from September 2015 to February 2016. In addition, there is strong commitment from AEPC to coordinate and build consensus among government agencies. The World Bank is also deeply involved in discussions of federalism and devolution of decision-making.

52. **Sector strategies and policies risk.** The risk from sector strategies and policies is Substantial. Policies in the sectors are still evolving. Policies and regulations relating to tariff determination and concessions in rural electrification subprojects and co-existence of grid and mini-grid solutions are necessary to mitigate risks to PDO.

53. **Mitigation measures.** The risk coverage from the project will reduce exposure of PBs to risks of grid arrival and force majeure. Component 2 will increase capacity of AEPC and ESCOs in designing grid-compatible mini-grids compliant with NEA's grid code. The World Bank will also advise the GoN in preparing the renewable energy policy, including license issuing system, to scale up renewable energy development as a part of the Power Sector Reform and Sustainable Hydropower Development Project.

54. **Institutional capacity for implementation and sustainability risk.** The risk is rated Substantial. To achieve the PDO, several stakeholders in the renewable energy and rural electrification sector, including potential ESCOs, local communities/villagers, residential and non-residential customers, consultants, contractors, the GoN, development partners, and local partner banks, need to perform.

55. **Mitigation measures.** The comprehensive renewable energy training program, targeting (a) renewable energy policy makers, (b) renewable energy financers, (c) renewable energy developers, and (d) renewable energy technical experts and technicians, started in August 2016 and will continue until December 2019. The training program will focus on five renewable technologies available in Nepal: MHP/mini-hydropower, solar, wind, bioenergy, and cooking stove. Among the training modules in comprehensive training program, the ones related to this project will be financed by the project. The project envisions supporting the AEPC and ESCOs in identifying candidate sites/communities and developing business models and implementation plans. Furthermore, the project will support the preparation of the POM and standard formats for necessary documents, as well as execution of technical and financial analyses, by hiring national and international consultants. Working with these consultants, the stakeholders will enhance their capacity through on-the-job trainings.

56. **Fiduciary risk.** Fiduciary risk is Substantial. The AEPC's capacity in financial management (FM) and procurement needs to be enhanced. Review of previous and current AEPC-implemented projects have revealed that areas to be strengthened are project management and monitoring.

57. **Mitigation measures.** The AEPC PIU will be provided with training and software, as needed, and guidance to mitigate the fiduciary risk by implementing FM and procurement practices satisfactory to the World Bank. A POM, acceptable to the World Bank, will be developed to guide the project staff in financial and

procurement management of the project. The FM and procurement practices at the AEPC will be periodically assessed as part of regular monitoring. FM and procurement capacity will be enhanced by hiring consultants as being done in other World Bank-financed projects implemented by the AEPC.

58. **Environmental and Social.** This risk has been rated Moderate. The environmental and social impacts of mini-grid construction and operation subprojects will vary depending on the location and scope of each subproject. Environmental and social impacts of most of the subprojects are expected to be moderate given the small size. However, as subproject sites are not known and will be decided based on the results of DD of subproject proposals (pilot subprojects were considered during project preparation, but did not get confirmed), some of the mini-grids are likely to be located in relatively remote rural areas in the mountains/hills, with heightened risk of degradation of protected areas/sensitive natural habitats and cultural heritage. Additionally, due to the nature of the project, where Indigenous Peoples (IPs) will often be intended beneficiaries of electrification in remote rural areas and impacts on them must be carefully analyzed and adverse impacts avoided.

59. **Mitigation measures.** To ensure the above risks and mitigation requirements are adequately understood and implemented by all involved parties (the AEPC, PBs, and ESCOs), an Environmental and Social Management Framework (ESMF) has been prepared and will be put into practice by AEPC in consultation with project participants and other stakeholders. The ESMF includes the screening process for categorization of subprojects (high, medium, low) and details of the applicable requirements in line with the GoN regulations, World Bank safeguards polices, and relevant good international practices. This will ensure that adequate Environmental and Social Impact Assessments (ESIAs), Environmental and Social Management Plans (ESMPs), and other necessary instruments are prepared and implemented by ESCOs for all subprojects. Subprojects that involve (i) significant adverse impacts on ecologically sensitive areas, (ii) large-scale resettlement resulting from potential land acquisition[13], (ii) significant adverse impacts on cultural heritage, or (iv) activities in disputed areas be excluded from financing through subprojects' selection criteria, which would allow to keep the project E&S risk below substantial. Given that the project is implemented through Financial Intermediaries, where World Bank has limited oversight over the preparation and execution of E&S risk management instruments, as well as legal enforcement of WB policy compliance requirements, the exclusion of high-risk situations technique is the most effective way of lowering overall project risk profile (especially taking into account small project size). Impacts on IPs will be mitigated in line with the Vulnerable Communities Development Plan, which forms part of the ESMF.

VI. APPRAISAL SUMMARY

A. Economic and Financial Analysis

60. In case of Nepal, the typical capital cost of 200kW mini-grid hydropower subproject is approximately US$4000/kW. While there is not much of solar mini-grid experience in the country, however, elsewhere this cost is also about the same as US$4000/kW[14] with the battery storage option. Based on the current

[13] For the purposes of exclusion, large-scale resettlement is defined as physical displacement of a significant number of people / households. Physical displacement would mean relocation/ loss of shelter and assets resulting from the acquisition of land that requires the affected persons to move to another location.

[14] Solar installed capacity considered is higher than demand as excess capacity is needed to meet night-time demand that is required for storage incl. storage losses. Hence kW peak of solar is different from kW load unlike hydro and other technologies.

estimation, these costs can be applicable for the subprojects up to 1MW range. For these subprojects, the economic analysis shows a robust economic rate of returns making them sound investments for expanding electricity access in Nepal. Each of the hydro and solar mini-grid, has the economic return of 26% and 28.5%, respectively. The slightly higher economic return for solar subprojects is due to lower operating costs and shorter construction period (6 months vs 18 months) offsetting the higher capital replacement costs for on-going maintenance of storage batteries. The economic evaluation takes a conservative approach to the estimation of benefits of mini-grids in Nepal – these include the avoided cost of diesel use and reduced environmental damage (in terms of CO2 emission) which are estimated as US Cents 0.84/liter and US$30/ton respectively with the annual escalation of 3 percent. In addition, there are significant additional benefits from productive uses triggering job creation and economic growth opportunities besides catalytic efforts of stimulating private renewable industry to add low cost distributed generation options to the utility generation mix.

61. Hydro mini-grids financial returns are about 15 percent, with the average residential and non-residential tariff of NRP 10and 15/kWh[15] respectively at the utilization factor of 40 percent. This return is roughly the minimum equity threshold for private sector to consider investment in these subprojects. Sensitivity analysis shows, that with the increase of utilization factor to 55 percent, the return on equity is more than 25 percent, which will be a good return to attract active private sector interest and catalyze growth in the market. With the same level of tariff, the solar mini-grid financial returns are just breakeven with 0.4 percent equity return. For the solar subprojects the tariffs need to be close to 13-16 NPR/kWh for 15-25 percent equity rate of return which is in line with the tariffs proposed by solar mini-grid developers in Nepal. Capacity utilization increase is not really a lever for solar subprojects as they are sized optimally to meet demand already. Other option is to reduce capital costs by 30-50 percent or have higher subsidies. A 30 percent reduction in capital costs is possible with more optimal planning of distribution networks (splitting the generation and keeping them close to demand)

62. The economic returns for grid integration for the hydro mini-grids are quite high given that the subprojects' utilization factor is assumed to increase from 40 percent to 90 percent (given that the hydro subprojects in mini-grid are typically sized to meet the demand during driest periods). This combined with the assumption that additional output generated replaces diesel generation yields an economic IRR of close 135 percent. For micro-hydro grid interconnection subprojects, assuming that the subproject will have to discontinue without any revenue if they do not interconnect to the grid once the main grid arrives near its operation area, the financial IRR is quite healthy at 31 percent. However, this may not be the case for the solar mini-grid interconnection. For the solar mini-grids, given that they are already sized for the local demand, there will be no meaningful jump in their utilization after the integration with the grid. Thus, the economic and financial benefit from the solar grid interconnection is nominal.

B. Technical

63. The project will facilitate debt financing of three types of subprojects: (a) new renewable energy mini-grids; (b) rehabilitation of existing mini-grids; and (c) interconnection of the existing or new subprojects with the other mini-grids and also with NEA grid. The project will support the electrification of currently unelectrified households in rural areas, where 25 percent of the population in the country still has no access to electricity. The national grid has not yet been able to reach this population, nor are private

[15]This tariff is comparable to the NEA's tariff for urban households and other commercial and non-commercial customers. However, NEA's tariff for typical rural households and small industry are less.

suppliers able to serve this population. Furthermore, the financial sector in Nepal is constrained by inadequate long-term sources of finance and interest rates that are relatively high and floating for the tenor of the project, which discourage private sector from investing in infrastructure projects. As such, the financial support to mini-grid electrification subprojects (or the rural model) as the SREP loans is crucial to ESCOs through the existing financing mechanism at a marginally commercial interest rates.

64. The project provides for long-term source of funds to commercial banks to lend to prospective borrowers for a long tenor that makes repayment achievable and sustainable through cash flow generated from the subproject operation. In addition, the prospective investors are expected take advantage of low cost of capital to PBs by negotiating interest rate and terms that ensure their subprojects' cash flow is sufficient to service debts. Both the tenor and the low cost of financing makes the project financially viable and thus attractive for banks to invest in this sector.

65. The project's design will help enhance the financial viability of mini-grid subprojects through sound appraisal and adequate technical assistance. The project will strengthen ESCOs capacity to prepare technically and commercially sustainable subprojects through trainings and advisory support. The project will finance ITA, which will complement the ability of PBs to appraise the subprojects; and concurrently build capacity of PBs' staff through trainings. Furthermore, the project will support improvement and standardization in both technical and commercial fronts. Nonetheless, there are other risks and concerns beyond the control of ESCOs or PBs such as force majeure and arrival of national grid in ESCOs' service areas. The project's risk mitigation approach enables AEPC to absorb these two risks on behalf of ESCOs and PBs.

66. The project will also address the NEA distribution line extension into mini-grid electrified areas. To avoid abandonment of mini-grids after the NEA grid extension into their distribution areas, the project will also support the interconnection of mini-grids with the national grid. If such interconnection is not feasible, then a risk mitigation mechanism will mitigate the risk of the local banks in providing loans to ESCOs.

67. **OP 10.0 compliance review. DRAFT**. *The project includes a line of credit and therefore is subject to OP10.10 on Financial Intermediary Financing. The arrangements outlined in the PAD are compliant with OP10 requirements.*

68. **Institutional set-up and FIs eligibility criteria-** Assessment of AEPC to act as financial intermediary to on-lend SREP loan to ESCOs for private sector-led mini-grid energy access project was conducted. AEPC's capacity to act as financial intermediary is limited, considering limited on-lending track record, lack of systems, procedures and staffing to conduct credit appraisal and portfolio monitoring. However, AEPC has been considered as eligible partner to implement the project, in partnership with commercial Banks who have capacity to act as financial intermediary as required for private sector led mini-grid projects, in view of: i) AEPC's governance and administrative structure, policies, effective project monitoring mechanism in technical aspects and its present and past experience in implementing the projects in renewal energy sector; ii) Pool of banks available having adequate profitability, capital and quality portfolio with sound financial indicators and experience in RE lending for the selection of partner banks.

69. It is however recommended to set up a plan to enhance AEPC capacity to act as financial intermediary during Project's implementation. Establishment of a Credit Vertical Unit (CVU) within AEPC to support the

PIU with adequate procedures and systems in place alongside hiring dedicated with adequate skills is recommended.

70. **Financial Institutions**- There are in total 28 commercial banks that might participate in this project. Out of these 28 commercial banks in 2014 AEPC has already screened and selected seven well-performing partner banks with experience in extending credit in the energy sector (total portfolio of USD 133 Million). Five of those banks are IFC investee clients in Nepal and are well-managed, with adequate corporate governance structure and sound financial performance indicators to operate at market conditions and to implement the project. The review and selection of PB will be conducted separately based on the agreed upon eligibility criteria. Such review and selection can continue during the implementation phase.

71. **Use of directed credit-** The approach of mixing subsidies with commercially priced credit for ESCOs and households is consistent with the Government's strategy. By crowding in the private sector, it meets the Cascade approach of the WBG. Without incentives, scarce credit will not flow to renewable energy projects.

72. **Financial sector and interest rate-** By providing funds at a marginally commercial interest rates in an under-developed segment of the financial market, the model is close to a market based approach for commercial lending. By providing long-term credit, the project will contribute reducing the maturity mismatch.

73. **Recommendations and monitoring-** A mid-term review it is recommended to consider leveraging factors (commercial banks using their own funds to leverage the credit received through the Project and expand the pipeline. As the subprojects financed by the Credit Facility are an under-developed segment of the financial market it will be important to track the interest rates charged by FIs to the companies and households.

C. Financial Management

74. An FM consultant dedicated for the project will support the PIU for ensuring effective project FM including financial monitoring that needs to be strengthened in the AEPC. For loan payment to beneficiaries (ESCOs), the World Bank will disburse funds to AEPC's designated account as a pass-through to be immediately disbursed to the PBs based on their loan request. The Bank will not provide advance to the PBs. The involvement of the PBs throughout the process including from screening subprojects will ensure quality assessment of the financial viability of the potential beneficiaries. The PBs will also contribute to monitoring and follow up of funds-utilization by ESCOs in the course of doing their business. The financial statements (preferably audited for annual) from the ESCOs will be obtained by the partner banks, which will reflect expenditures incurred by the beneficiaries. The details of implementation arrangements and required internal controls will be included in the POM.

75. The interim unaudited financial reports for the Project will be submitted by AEPC forty-five days from each trimester-end. The audited project financial statements will be submitted by six months from the end of each fiscal year.

D. Procurement

76. Substantial amount of fund is expected to be utilized toward non-procurement activities such as SREP loans to ESCOs through local banks. Selection of the PB and out-flow of SREP loans will follow the standard procedures in the implementation arrangements. Procurement of goods and services mainly small value procurements and selection of individual consultants under the Component 2 possess moderate procurement risks. Procurement risks will be minimized by selecting a procurement consultant for the project and oversight of the Bank. Details of major procurement activities and procurement strategy will be developed by the AEPC using the simplified form of Project Procurement Strategy for Development (PPSD) with the assistance of the task team. Procurement plan for the first 18 months of the project implementation period will be prepared to submit to the Bank using STEP system before project negotiation.

E. Social (including Safeguards)

77. The project supports mini-grid subprojects using renewable energy based solutions such as mini-hydropower, solar and solar hybrid systems, as well as upgrading and interconnecting existing mini-grids. The precise size and locations of subprojects are not known at this stage. While the subprojects' construction and operation are expected to have a number of identifiable environmental and social (E&S) risks, it is also seeking to bring positive outcomes for local livelihoods of communities and also represent a more sustainable and cleaner power source based on renewable energy in places where other sources of energy are not easily available.

78. The project is a Financial Intermediary (FI) project in accordance with OP 4.01 (Environmental Assessment)[16], and therefore management of E&S risks and impacts should be carried out in a fully integrated manner through the framework / systems design approach that will govern risk management process for subprojects supported from the credit facility (both new mini-grid development and upgrading and interconnecting existing mini-grids will be supported), with AEPC/CREF, ESCOs, interconnection subproject owners, and PBs all fulfilling their respective responsibilities. Due to the PAD format that isn't adapted to such projects, social risks and descried below and environmental- in Section F. More details on the system design for assessing and managing E&S risks in an integrated manner is presented in section F below and in Annex 2.

79. In terms of specific social risks, the project will deliver positive social benefits to rural communities in Nepal by providing rural electrification service. The project will be operating in areas where the overwhelming majority of the beneficiaries may be underserved, vulnerable, and marginalized. It is expected that there would be Indigenous Peoples (IP) communities present in the proposed subproject areas under consideration by the AEPC. The World Bank's OP 4.10 (Indigenous Peoples) is therefore

[16] Even though the project involves private sector companies and financial intermediaries, application of OP4.03 (Performance Standards for Private Sector Activities) in lieu of OP4.01 and consequently World Bank Safeguard policies was not found to be suitable for the project design and implementation arrangements. AEPC, a government agency in charge of managing the wholesale FI under the project (CREF), will assume primary responsibility for assuring timely preparation and quality of E&S impact assessment and mitigation measures. Use of OP4.03 is optional where substantial benefits of the use of this policy can be identified (not the case for this project).

triggered. Vulnerable Community Development Framework (VCDF) has been prepared and will be implemented by AEPC to ensure negative impacts on these communities are reduced and positive benefits are enhanced. If project screening indicates presence of IPs, Vulnerable Community Development Plan (VCDP) will be prepared by ESCOs according to VCDF . The World Bank will review and clear the VCDPs for subprojects categorized as high risk in line with the ESMF.[17] Both the VCDF and VCDPs will be disclosed and consulted upon.

80. The construction of mini-grid systems may lead to taking of land. Thus, OP/BP 4.12 (Involuntary Resettlement) is triggered. Given that subprojects that involve large-scale resettlement resulting from potential land acquisition would not considered for financing through subproject selection criteria in order to avoid the possibilities of significant resettlement impacts that may make the project's impacts consistent with WB category A. Since subproject sites for mini-grid systems are not identified during project preparation, a Resettlement Policy Framework (RPF) has been prepared by AEPC and disclosed before project appraisal. Based on the RPF guidance, each subproject will be screened, and if Resettlement Action Plans (RAPs) are found to be necessary, these will be prepared by ESCOs, cleared by the World Bank (where subprojects involving resettlement are categorized as high risk in line with ESMF and first medium risk project if involving this aspect), disclosed, consulted upon, and implemented before the commencement any works, in accordance with the World Bank OP 4.12. A grievance mechanism for affected communities will also be prepared and implemented by ESCOs for subprojects they implement.

81. The prepared VCDF and RPF are reviewed by the World Bank as part of the ESMF, and is expected to be disclosed locally in January 2018; the English version of these documents will be also disclosed globally via the World Bank external website in January 2018.

82. ***Gender***: Renewable energy sector is an area dominated by men. For instance, women's ownership of the different renewable technologies such as biogas plants or improved water mills continues to remain low. Within mini-grid sector, the trend is the same. The AEPC works with 78 Energy Service Companies (ESCOs), of which the GESI Unit of AEPC estimates that may be two are owned and led by women. They do not have gender-disaggregated data on ESCOs' ownership. Women's leadership and meaningful participation within the ESCO teams engaged in the mini-grid has yet to be investigated. Moreover, they have not examined team composition of the ESCOs. It is therefore difficult to ascertain women's engagement within the ESCOs. A thorough assessment of ESCO leadership and composition is necessary to ascertain the gender dynamics. During project implementation AEPC will carry out this survey and inform the project team.

83. Women appear to be more visible as beneficiaries and participate from the early stages of project cycle including consultations. Data continues to be scarce in this area as well. While number of female beneficiaries tend to high, it is important to consider female-headed households because the gendered impact of electricity services will be multiplied. However, available data from AEPC's nine mini-grid based renewable energy project shows that 6% of the total beneficiaries are female headed households. In a context where male migration is high, this data indicated that targeted approach towards sub-groups of women is essential.

[17] ESMF categorization relative to the nature and magnitude of risks of subprojects that would be considered for financing, and high-risk categorization does not equal WB category A. This is a standard/ best practice for FI operations supported by DFIs globally.

84. Overall, improved electricity services will reduce drudgery and time poverty for women. As rural Nepal depends primarily on firewood for fuel, the shift to electricity will also have effects on women's health. There will be positive impact on women's labor and provide more socio-economic opportunities. However, challenges remain in women's engagement in mini-grid sector as distribution system favors small enterprises mostly led by men and reduce energy supply for micro enterprises where majority women are involved.

F. Environment (including Safeguards)

85. The project is categorized as FI and exact locations and associated risks and impacts of subprojects are not known at this stage. Hence a coherent E&S risk management framework / system design and corresponding capacity of all key project participants (the AEPC/CREF, ESCOs and interconnection subproject owners, and PBs) for adequately fulfilling their respective responsibilities for E&S assessment, management, and monitoring will be the key determinant of strong E&S risk management in the project. To that end, Environmental and Social Management Framework (ESMF) is prepared by the AEPC. More details on the E&S system design are provided in Annex 2.

86. In terms of specific environmental risks, some of the subprojects may be located in protected or conservation areas/sensitive natural habitats. These subprojects could be considered to require more attention with regard to risk assessment and management measures as such areas is associated with potential impacts on areas with biodiversity values. Hence, besides OP 4.01, OP 4.04 (Natural Habitats) has been triggered. OP4.36 was not, however, triggered, as it is expected that the predominant nature of impacts on natural habitats and IPs are covered under these respective policies and would be managed accordingly. A detailed approach to E&S risk management in biodiversity-sensitive areas is incorporated in the ESMF and subprojects with significant adverse impacts on these areas will not be considered for financing as part of subproject selection criteria.

87. Besides being rich in biodiversity, such areas are also geologically fragile in terms of landslides and soil erosions. E&S screening process to be carried out by AEPC as part of the ESMF procedures will take this into account and advice will be provided to mini-grid developers to comprehensively address this risks in the subprojects' DD.

88. Impacts on cultural heritage are also identified as likely in many rural areas of Nepal where mini-grids may be located, and hence OP4.11 has been triggered. The ESMF includes screening measures for these impacts and subprojects with significant adverse impacts on cultural heritage will not be considered for financing as part of subproject selection criteria.

89. Support to interconnection subprojects (minor equipment installation and line connections) most probably not result in any adverse environmental and social impacts necessitating environmental and social screening and implementation of mitigation measures. An ESMP should be prepared and implemented to address common risks and impacts. Mini-grids for which connection options would be tested are likely to be located in rural areas, may be community or privately owned, and powered by MHPs and solar sources.

90. Additionally, E&S impacts associated with all subprojects may involve labor and working conditions issues during construction and operation, as well as community health and safety issues, including those associated with access roads.

91. In FI projects, capacity of all key stakeholders is paramount for adequately managing the risks. Currently, AEPC has on its team three E&S experts who are responsible for preparation and execution of the ESMF provisions. Since AEPC will assume the clearance function for E&S assessment and management instruments prepared by ESCOs and interconnection subproject owners[18] In case of subprojects categorized as high risk in line with the ESMF, these instruments will also be reviewed and formally cleared by the World Bank until it can be established that AEPC has developed adequate expertise to assume the full clearance function.[19] Accordingly, the ESMF will incorporate a capacity building plan for AEPC and all key stakeholders, as needed and commensurate with their respective roles and including a dedicated budget. Budget will cover costs of E&S expect in PIU at AEPC, E&S screening, E&S audits ad performance evaluation, and training for AEPC, ESCOs, and PBs. Support will also be considered to ESCOs for conducting ESIAs and preparing management plans.

92. The project will follow the World Bank's consultation and disclosure requirements. The ESMF (including VCDF and PRPF) will be disclosed locally/in-country and on the World Bank's external website, following public consultation with the main event conducted on November 9, 2017.

G. Other Safeguard Policies (if applicable)

93. Mini-hydropower schemes (subproject) under this project will divert a small quantity of water from streams, and in some cases, such streams may be part of international waterways for the purpose of OP 7.50 (Projects on International Waterways). However, subprojects implemented under this project are part of a larger ongoing schemes under the Government's rural electrification program set out in the Rural Energy Policy (2006). The subprojects will involve minor additions or alterations to the ongoing schemes and in the judgment of the Bank: (i) will not adversely change the quality or quantity of water flows to the other riparians; and (ii) will not be adversely affected by the other riparians' possible water use. Therefore, the exception to the notification requirement under paragraph 7(a) of OP 7.50[20] will be requested to the

[18] In case of interconnections, AEPC will support interconnection subproject owners and PBs providing sub-loans for interconnection subprojects in E&S due diligence. To that extend, AEPC will prepare standard ESMPs for interconnection subprojects and ensure these are provided to interconnection subproject owners and PBs that will finance these projects (to be included in financing agreements by PBs).

19 As an option, an E&S Technical Committee will be considered to be established by AEPC to assume the clearance function, to ensure sufficient transparency and independence of the clearance decisions, as well as to assist AEPC in technical review of the instruments. Such committee can be comprised of experts in the energy field.

[20] Exceptions to Notification Requirement under paragraph 7 of OP 7.50.

7. The following exceptions are allowed to the Bank's requirement that the other riparian states be notified of the proposed project:

(a) For any ongoing schemes, projects involving additions or alterations that require rehabilitation, construction, or other changes that in the judgment of the Bank (i) will not adversely change the quality or quantity of water flows to the other riparians; and (ii) will not be adversely affected by the other riparians' possible water use. This exception applies only to minor additions or alterations to the ongoing scheme; it does not cover works and activities that would exceed the original scheme, change its nature, or so alter or expand its scope and extent as to make it appear a new or different scheme. In case of doubt regarding the extent to which a project meets the criteria of this exception, the executive directors representing the riparians concerned are

Regional Vice President by the board approval scheduled in March 2018. Subprojects in disputed areas will not be considered for financing and hence OP7.60 is not triggered.

H. World Bank Grievance Redress

94. Communities and individuals who believe that they are adversely affected by a World Bank (WB) supported project may submit complaints to existing project-level grievance redress mechanisms or the WB's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed in order to address project-related concerns. Project affected communities and individuals may submit their complaint to the WB's independent Inspection Panel which determines whether harm occurred, or could occur, as a result of WB non-compliance with its policies and procedures. Complaints may be submitted at any time after concerns have been brought directly to the World Bank's attention, and Bank Management has been given an opportunity to respond. For information on how to submit complaints to the World Bank's corporate Grievance Redress Service (GRS), please visit http://www.worldbank.org/en/projects-operations/products-and-services/grievance-redress-service. For information on how to submit complaints to the World Bank Inspection Panel, please visit www.inspectionpanel.org.

informed and given at least two months to reply. Even if projects meet the criteria of this exception, the Bank tries to secure compliance with the requirements of any agreement or arrangement between the riparians.

(b) Water resource surveys and feasibility studies on or involving international waterways. However, the state proposing such activities includes in the terms of reference for the activities an examination of any potential riparian issues.

(c) Any project that relates to a tributary of an international waterway where the tributary runs exclusively in one state and the state is the lowest downstream riparian, unless there is concern that the project could cause appreciable harm to other states.

VII. RESULTS FRAMEWORK AND MONITORING

Results Framework
COUNTRY : Nepal
Nepal: Business Models for Private Sector-Led Mini-Grid Energy Access Project

Project Development Objectives

The Project Development Objective (PDO) is to increase electricity delivery from renewable energy mini-grids in selected areas by mobilizing private energy service companies.

Project Development Objective Indicators

Indicator Name	Core	Unit of Measure	Baseline	End Target	Frequency	Data Source/Methodology	Responsibility for Data Collection
Name: Generation capacity of energy constructed or rehabilitated	✓	Megawatt	0.00	3.80	Trimester	Project Progress Report	AEPC
Description:							
Name: People provided with new or improved electricity service	✓	Number	0.00	126000.00	Trimester	Project Progress Report	AEPC

Indicator Name	Core	Unit of Measure	Baseline	End Target	Frequency	Data Source/Methodology	Responsibility for Data Collection
Description:							
Name: Annual electricity output from renewable energy		Gigawatt-hour (GWh)	0.00	27.50	Trimester	Project Progress Report	AEPC
Description:							

Intermediate Results Indicators

Indicator Name	Core	Unit of Measure	Baseline	End Target	Frequency	Data Source/Methodology	Responsibility for Data Collection
Name: Number of new mini-grid subprojects supported by the project		Number	0.00	15.00	Trimester	Project Progress Report	AEPC
Description:							
Name: Number of rehabilitated mini-grid subproject supported by the project		Number	0.00	4.00		Project Progress Report	AEPC

Indicator Name	Core	Unit of Measure	Baseline	End Target	Frequency	Data Source/Methodology	Responsibility for Data Collection
Description:							
Name: Number of mini-grid interconnection subproject supported by the project		Number	0.00	9.00		Project Progress Report	
Description:							
Name: Number of households provided with new or improved electricity service		Number	0.00	27000.00	Trimester	Project Progress Report	AEPC
Description:							
Name: Number of women provided with new or improved electricity service		Number	0.00	63000.00	Trimester	Project Progress Report	AEPC
Description: Half of the number of total people/customers							
Name: Number of women trained to engage in mini-grid sector		Number	0.00	50.00	Trimester	Project Progress Report	AEPC

Indicator Name	Core	Unit of Measure	Baseline	End Target	Frequency	Data Source/Methodology	Responsibility for Data Collection
Description: One third of total training							
Name: Consultations with citizens and consumer feedback surveys with publicly disclosed reports summarizing findings		Yes/No	N	Y	Trimester	Project Progress Report	AEPC
Description:							
Name: Specialist services procured for project implementaiton		Yes/No	N	Y	Trimester	Project Progress Report	AEPC
Description:							
Name: People trained in project preparation and implementaiton		Number	0.00	150.00	Trimester	Project Progress Report	AEPC
Description:							
Name: Private capital mobilized by the project		Amount(USD)	0.00	3363000.00	Trimester	Project Progress Report	AEPC

Indicator Name	Core	Unit of Measure	Baseline	End Target	Frequency	Data Source/Methodology	Responsibility for Data Collection
Description:							
Name: Net greenhouse gas emissions	✓	Tones/year	0.00	29486.86	Trimester	Project Progress Report	AEPC
Description:							
Name: Number of businesses provided with new or improved electricity service		Number	0.00	82.00	Trimester	Project Progress Report	AEPC
Description:							

Target Values

Project Development Objective Indicators

Indicator Name	Baseline	YR1	YR2	YR3	YR4	YR5	End Target
Generation capacity of energy constructed or rehabilitated	0.00	0.00	0.40	1.60	1.60	0.20	3.80
People provided with new or improved electricity service	0.00	0.00	18000.00	50400.00	50400.00	7200.00	126000.00
Annual electricity output from renewable energy	0.00	0.00	4.60	10.30	10.30	2.30	27.50

Intermediate Results Indicators

Indicator Name	Baseline	YR1	YR2	YR3	YR4	YR5	End Target
Number of new mini-grid subprojects supported by the project	0.00	0.00	2.00	6.00	6.00	1.00	15.00
Number of rehabilitated mini-grid subproject supported by the project	0.00	0.00	0.00	2.00	2.00	0.00	4.00
Number of mini-grid interconnection subproject supported by the project	0.00	0.00	2.00	3.00	3.00	1.00	9.00
Number of households provided with new or improved electricity service	0.00	0.00	3600.00	10800.00	10800.00	1800.00	27000.00

Indicator Name	Baseline	YR1	YR2	YR3	YR4	YR5	End Target
Number of women provided with new or improved electricity service	0.00	0.00	9000.00	25200.00	25200.00	3600.00	63000.00
Number of women trained to engage in mini-grid sector	0.00	10.00	10.00	10.00	10.00	10.00	50.00
Consultations with citizens and consumer feedback surveys with publicly disclosed reports summarizing findings	N	Y	Y	Y	Y	Y	Y
Specialist services procured for project implementaiton	N	Y	Y	Y	Y	Y	Y
People trained in project preparation and implementaiton	0.00	30.00	30.00	30.00	30.00	30.00	150.00
Private capital mobilized by the project	0.00	0.00	374000.00	1401000.00	1401000.00	187000.00	3363000.00
Net greenhouse gas emissions	0.00	0.00	4883.17	11081.05	11081.05	2441.59	29486.86
Number of businesses provided with new or improved electricity service	0.00	0.00	20.00	20.00	22.00	20.00	82.00

ANNEX 1: DETAILED PROJECT DESCRIPTION

COUNTRY: Nepal
Nepal: Business Models for Private Sector-Led Mini-Grid Energy Access Project

Component 1: Support to Renewable Energy Mini-grid Subprojects (US$5.61 million Grant)

1. The project will promote ESCOs to enter the mini-grid energy services business using renewable-energy-based solutions. The project will support ESCOs to increase energy access in rural areas. The project is designed to support RE mini-grids market by introducing conditions to gradually shift from heavily subsidized to commercial model.

2. The current community led mini-grid model depend significantly on public sector subsidies for capital costs for the projects. However, despite the substantial subsidies, these projects struggle to maintain financial sustainability. The communities who are implementing the projects, in general, do not have business acumen to run these plants in commercially feasible ways. Optimal mix of residential and non-residential customers (businesses, commercial etc), efficient plant O&M, innovative tariff mechanisms, high utilization factors etc are all important for the plant's commercial viability. However, once complete, community led plants usually end up supplying electricity mostly to the residential customers only for few hours per day during the morning and evening times. The plant capacity is not fully utilized and the unit cost of electricity production is higher than it needs to be, affecting the revenue generation. Likewise, the communities often lack capacity in properly operating and maintaining the plants. Insufficient revenue generation combined with the lack of proper plant O&M practice results in serious degradation of plant's generation capacity over the period of time. Most of these plants fall into disrepair and cease to operate after few years of operation. As such there is not much apatite among the private banks to lend to the mini-grid projects in Nepal.

3. It is expected that the involvement of private sector led ESCOs will have more innovative business, tariff, O&M approaches for these mini-grids and increase the confidence of private banks to lend to the mini-grid projects. This forms the basis for ESCO led development of mini-grid in Nepal. The project will support three types of sub projects: a) installation of new mini-grid projects, b) rehabilitation of existing mini-grid subprojects and c) interconnection of the existing or new subprojects with the other mini-grids and also with NEA grid. ESCOs will take lead in implementation and operation and maintenance of these projects with the support from AEPC and the PBs in the form of subsidy (as applicable) and loan respectively.

4. To make ESCO subprojects financially viable and reach financial closure, support from the Project is needed. As the private sector led mini-grid concept is relatively new in Nepal, commercial banks are still not confident about subproject's and ESCO's ability to pay back their debt on time. Currently AEPC has made available a limited volume of loan through private banks for mini-grid development (with funds from GIZ and ADB). In this case, the AEPC funds are provided as the liquidity support (in the form of deposit) to the banks which will then on-lend to the mini-grid projects (mainly community managed).

5. To provide loans with sufficiently attractive conditions to ESCOs and also to generate interest from the commercial bank to lend in the mini-grid projects, the SREP resources will be used as the credit facility

to the willing ESCOs and commercial banks. The credit will be available at a marginally commercial interest rate. Such credit facility is also expected to be the seed fund for the banks to attract other funds and build up their loan portfolio in the RE sector. This is in line with the GoN's strategy to move the renewable energy sector away from excessive reliance on subsidies and toward a credit-based model. The SREP loan will be provided to ESCOs to be intermediated by AEPC through on-lending to Partner Banks. AEPC will assume the credit risk of lending to PBs, and the PBs will assume the credit risk of the sub-projects beneficiaries that will be selected based on agreed upon eligibility criteria. AEPC will, nevertheless, cover certain sub-project related risks (mainly related to force majeure, or the loss of commercial viability by the arrival of the grid in the operation area), by embedding a clause in the subsidiary loan agreements with PBs and writing off the related loss against the Project's grant. The favorable interest rate will be complemented by the adequate TA and capacity development activities under component 2 for the AEPC, PBs, and ESCOs to effectively and efficiently implement their subprojects. The selected PBs have been appraised as per the banks OP 10 assessment for the financial intermediation mechanism.

6. **Financial intermediation and Fund flows**

The subprojects will be implemented by ESCOs. The subprojects will be screened by PIU to ensure that they meet eligibility criteria and are feasible to receive support from credit facility (Component 1). In addition, AEPC will appraise the subprojects for decision on subsidy allocation. Furthermore, PB's with the technical appraisal support from AEPC's PIU will appraise the subprojects for decision on credit allocation and commercial loans. The anticipated fund flow mechanism, subsequent to the subproject appraisal will be as per the figure below

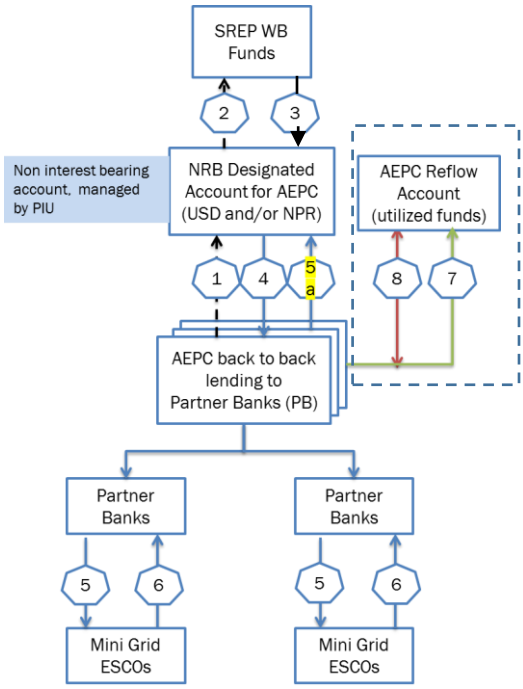

Figure 3: Anticipated fund flow

7. GoN will open a non-interest bearing Designated Account at the Nepal Rastra Bank (NRB), the central bank of Nepal. This account will be managed by PIU for the fund disbursement. From the Designated Account, the fund will be disbursed to the PBs as sub-loans. The flow of fund will be as follows (The bullet numbers correspond to the fund flow stage referenced in the figure above):
    1) Partner Banks provide information of approved loans to PIU. PIU approves and allocates back to back financing of the loan to enable on-lending to the eligible subprojects by PBs. Following information will be provided by the PB to PIU on quarterly basis to facilitate the drawdown of the funds to the Designated account.
        a) Disbursement schedules for the underlying subproject loans
        b) Amortization schedule for the underlying subproject loans
        c) Rolling forecast for the fund requirements matching expected underlying subprojects loan disbursement schedules
        d) Disbursement request matching expected underlying subproject loan disbursement schedule/s
    2) PIU sends to WB the consolidated quarterly fund request based on the information received from the PBs.
    3) WB disburses the SREP funds to AEPC Designated Account based on the consolidated quarterly fund request submitted by PIU. Alternatively, an advance up to a ceiling specified in the disbursement letter will be provided in the DA.
    4) PIU disburses back to back loan to the Partner Banks matching the PB's quarterly disbursement request.
    5) PB on-lends to the subprojects. 5a) PBs pay back to PIU in its Designated Account or (any other account designated by AEPC) the fund received from AEPC but not disbursed and remained un-utilized for more than 2 quarters.
    6) PBs receive repayment as per the underlying subproject loan amortization schedule.

8. It is assumed that the proceeds of loan repayment by the PBs is expected to service annual loan repayment obligation of the GoN/AEPC to the World Bank. However, for the sustainability of the process, the remaining amount of the proceeds can be deposited into the reflow account to as per below.
    7) PB pays back to PIU reflow account.
    8) In case of underlying subproject loan default, the PB: a) returns the loan principal and accrued interest from defaulted subprojects; and b) activates risk coverage for partial protection where applicable.

9. AEPC will assume the credit risk of lending to PBs, and the PBs will assume the credit risk of the subprojects beneficiaries that will be selected based on agreed upon eligibility criteria. AEPC will, nevertheless, cover certain subproject related risks (mainly related to force majeure, or the loss of commercial viability by the arrival of the grid in the operation area), by embedding a clause in the subsidiary loan agreements with PBs and writing off the related loss against the Project's grant.

10. **Selection criteria of ESCOs and subprojects.** The ESCOs and subproject selection criteria for the loan flows will be as follows:

ESCOs[21]

(a) Legally registered in Nepal (A Copy of Updated Company/Firm/Tax/Vat/PAN registration/clearance certificate).
(b) Self-Declaration that the Entity has not been punished for an offence relating to the concerned profession or business.
(c) Capacity and commitment for carrying out environmental and social risk management measures/ plans[22] based on adequately completed E&S assessment studies.
(d) Clean track record in terms of compliance with any relevant environmental and social regulations of Nepal (for example, absence of environmental or labor-related fines or other evidence of non-compliance in the past two years).

Mini-grid subprojects

(a) Areas that are at least 5 km away from the NEA distribution network
(b) Areas that have sufficient renewable energy potential to meet demand.
(c) Generation capacity is between 100 kW to 1,000 kW for mini-hydro, 20 kWp to 1,000 kWp for solar, and 20 kW to 1,000 kW for wind projects.
(d) ESCO should produce the evidence of communities buy-in for the project. This could be in the form of relevant letters, MOUs, or any other for forms of consents and agreements.
(e) Should not have significant adverse impacts on ecologically sensitive areas
(f) Should have bankable business plan
(g) Subprojects must have all relevant and up-to-date permits from the GoN.
(h) Third party E&S due diligence of the subprojects (in case of high risk category).
(i) Subprojects with significant adverse impacts on ecologically sensitive areas,23 if deemed unacceptable by AEPC, will not be eligible
(j) Subprojects involving large-scale resettlement[24] will not be eligible
(k) Subprojects with significant adverse impacts on cultural heritage will not be eligible.
(l) Subprojects in disputed areas will not be eligible.

11. **Subproject pipeline.** In order to expedite the project implementation process as soon as the grant and loan becomes effective, AEPC has planned to build a robust subproject pipeline. In that regards, AEPC has called for the proposal from interested ESCOs and has subsequently received several proposals from different developers and ESCOs. Besides, AEPC also has its own list of potential projects that it intends to develop by involving ESCOs and utilizing commercial financing. However most of these projects currently are at the preliminary study level and the developers are in the process of negotiating with AEPC to

[21] ESCOs include, registered private companies and cooperatives

[22] Determination of adequate capacity for ESCOs will include: (i) commitment to timely engagement of E&S risk management expertise; (ii) sufficient budget allocated to environmental and social assessment and monitoring.

[23] Significant adverse impacts on ecologically sensitive areas will be determined using international best practice and tools, as well as based on the outcomes of relevant studies conducted as part of subproject the ESIA.

[24] For the purposes of exclusion, large-scale resettlement is defined as physical displacement of a significant number of people / households. Physical displacement would mean relocation/ loss of shelter and assets resulting from the acquisition of land that requires the affected persons to move to another location.

receive partial financial support, as per the current subsidy policy, to conduct the necessary studies Among these, one subproject (999kW micro hydro –Ghami mini hydro project) has completed its feasibility study while the other (374kW solar –Baitadi rural solar project) is in the process of completing the relevant studies. The long list of subprojects that currently proposed by AEPC is as follows:

Table 2: List of potential subprojects

S. No.	Name of the Subproject	Location/district	Proposed Capacity of the System in KW
1	Baitadi Rural Solar Mini Grid	Baitadi	374
2	Ghami Mini Hydro	Mustang	999
3	Marma Solar Mini Grid	Darchula	200
4	Jumla Solar Mini Grid	Jumla	200
5	Elun Khola Mini Hydro	Okhaldhunga	987
6	Tila Goru Khola Mini Hydro	Jumla	300
7	Syankhu Khola Mini Hydro	Dolakha	996
8	Sishakhola Mini Hydro	Solukhumbu	660
9	Ghatte Khola Mini Hydro	Sindhupalchok	970
10	Dhankaul Solar Mini Grid	Sarlahi	100
11	Patkari Mini Hydro	Ramechhap	500
12	Bijuchamla Mini Hydro	Ramechhap	500

Component 2: Technical Assistance to the Mini-grid Sector, ESCOs and Partner Banks and Project Management Support (US$2million)

12. Component 2, through funding for technical assistance and project management, will support the implementation of Component 1. Additionally, it will increase the overall capacity of the sector stakeholders to deploy renewable energy mini-grids. *A procurement plan with details of contracts under Component 2 will be prepared before negotiations.*

- PIU consultant costs and incremental operating costs, goods for AEPC (such as equipment and software necessary for subproject design, supervision, and monitoring and evaluation(M&E)). TRC with international and national technical and commercial experts will be mobilized through Component 2. TRC will assist AEPC in screening and appraising subprojects, so that AEPC management can make timely, well-vetted, and informed decisions.
- Feasibility studies, technical design, environmental and social assessments, and bid documents of subprojects which will be competitively awarded to ESCOs by AEPC with provision of GoN subsidies;

- Independent Technical Advisors (ITA), who will be sector experts, to support the AEPC and PBs in appraising and strengthening unsolicited project proposals from the ESCOs; ITA can advise ESCOs, as required, to develop bankable subprojects. ITA will also monitor subproject construction to inform ESCOs, AEPC, and PBs of risks during construction phase and to advise on them on mitigation measures.
- Preparation key project documents including the Project Operational Manual (POM), M&E framework, and other instruments such as Memorandum of Understanding (MOU), agreements, contracts among AEPC, ESCOs, and PBs;
- Trainings to develop capacity of ESCOs, PBs, and AEPC on commercial operations of mini-grids. For ESCOs, these trainings will also cover business models, company registration and business administration, tariff management, and project financing, among others. For PBs, trainings will cover credit due-diligence, monitoring of loan performance, and risk assessment, etc. For AEPC as well as ESCOs, trainings can focus on procurement, financial management, E&S assessment and management, among others;
- Technical standards and guidelines for MHPs, solar, wind mini-grid and interconnection subprojects. Training on design as well as O&M of mini-grids will be supported by Component 2;
- Promotional activities and capacity building workshops to connect various stakeholders (ESCOs, financiers, household/business customers), rural community mobilization, and matchmaking events/programs; and
- Monitoring and evaluation and socio-economic surveys.

ANNEX 2: IMPLEMENTATION ARRANGEMENTS

COUNTRY: Nepal

Nepal: Business Models for Private Sector-Led Mini-Grid Energy Access Project

Project Institutional and Implementation Arrangements

1. The AEPC will be the government counterpart and implementing agency for this project. AEPC has experience of implementing World Bank projects and is currently implementing SREP-Supported Extended Biogas Project ((P131592). A PIU for this project will be instituted in AEPC. AEPC PIU will be staffed as follows:
   - Project Manager
   - Mini and Micro Hydropower Expert
   - Solar Energy Expert
   - Procurement Specialist
   - Monitoring and Evaluation Specialist
   - Financial Specialist
   - Business Development Officer
   - Social Safeguard Specialist
   - Environmental Safeguard Specialist
   - Financial Management Specialist
   - Credit Officer for CVU

2. AEPC has been considered as eligible partner to implement the Project as wholesaler, in partnership with commercial Banks who have capacity to act as financial intermediary as required for Private Sector led Mini-grid projects, in view of: i) AEPC's governance and administrative structure, policies, effective project monitoring mechanism in technical aspects and its present and past experience in implementing the projects in renewal energy sector; ii) Pool of banks available having adequate profitability, capital and quality portfolio with sound financial indicators and experience in RE lending for the selection of partner banks.

3. The AEPC responsibilities as wholesaler will include: i) selection and on-lending to PBs; ii) monitoring of PBs to ensure compliance with project criteria; iii) responsibility for adherence to all fiduciary and safeguard requirements of the World Bank for final borrowers; and iv) monitoring and evaluation based on key indicators.

4. AECP's capacity as wholesaler will be enhanced by establishing a separate Credit Vertical Unit (CVU) within AEPC with adequate credit appraisal and monitoring procedures and systems in place, alongside hiring dedicated staff to enhance AEPC capacity to act as financial intermediary during Project's implementation.

5. AEPC PIU will facilitate implementation of Component 1 and administer the credit facility. The decision to provide debt financing, mobilized by Component 1, to subprojects lies with PBs. ESCOs will build, own, and operate the subprojects. ESCOs may design subprojects and submit to AEPC as unsolicited proposals or ESCOs may bid on subprojects proposed by AEPC. AEPC PIU will support solicitation of ESCOs, review of unsolicited ESCOs proposals, and supervision of subprojects. For the subprojects under this WB project, AEPC's Technical Review Committee (TRC), which should be acceptable to the Bank, will supplement AEPC PIU. TRC will comprise of Solar Expert (for solar-hybrid mini-grids), Hydropower Expert (for micro/mini hydropower mini-grids), Environmental Specialist, and Social Specialist (as appropriate). AEPC PIU will submit its recommendations to TRC, which will make the final decision on provision of GoN subsidies to subprojects and eligibility of subprojects to participate in WB project. Roles of different

stakeholder in preparing and implementing mini-grid subprojects are explained in Table below.

6. AEPC will administer technical assistance under Component 2. Consultants will be mobilized to prepare necessary studies by AEPC for the subprojects, which will be bid-out to ESCOs. A consulting firm will also be recruited to function as Independent Technical Advisors (ITA) to AEPC and PBs. ITA will assist AEPC PIU and PBs in: (i) reviewing feasibility studies and ESCO proposals; and (ii) supervising construction of subprojects. ITA will also support AEPC PIU in developing technical standards and guidelines and in building sector capacity through trainings. At minimum, ITA will comprise of Technical Lead, with sound knowledge of mini-grid technologies, policies, standards, and regulations; Solar Expert, Hydropower Expert, Energy Economist, and Supervision Engineers. Capacity building and training will be provided through Component 2 to improve technical capacity of the AEPC, partner banks, potential ESCOs, and rural communities as applicable.

Table 3: Roles for preparation and implementation of subprojects

Stages	Key Functions	AEPC	Partner Banks	ESCOs	World Bank
1	**Feasibility studies of subprojects**	**For competitive selection of ESCOs in the case of identified subprojects:** AEPC PIU will mobilize consultants, using funds under Component 2, to prepare feasibility studies of subprojects. These subprojects can apply for debt financing supported by Component 1; but the decision on debt financing will be made by PBs.		**For unsolicited proposal from ESCOs:** ESCOs will carry out feasibility studies of subprojects and apply for debt financing supported by Component 1. The decision on debt financing will be made by PBs.	
2	**Appraisal of subprojects**				
	Technical	For all subprojects under this WB project, AEPC PIU will assess technical feasibility in detail. AEPC PIU can receive support from an Independent Technical Advisor (ITA), financed by Component 2. AEPC PIU will submit its recommendation to **Technical Review Committee (TRC)** of AEPC, which will make the final decision on provision of subsidy.	ITA will be hired by AEPC through Project's Component 2. For subprojects under this WB project, PBs may rely on ITA and decision of the TRC for technical appraisal for PBs to make a final credit decision.		Based on the recommendation of TRC and ITA, WB will provide no-objection to the subprojects. TRC and ITA, including their key staff, must be acceptable to the WB.
a	*Economic and Financial*	AEPC PIU will appraise all subprojects for economic and financial performance. AEPC PIU will submit its recommendation to TRC of AEPC, which will make the final decision on provision of subsidy.	PB's will carry out financial appraisal for all subprojects.	ESCOs will prepare and submit data and analysis on economic and financial performance of subprojects.	Based on the recommendation of TRC and PBs, WB will provide no-objection to the subprojects. TRC, including its key staff, must be acceptable to the WB.

Stages	Key Functions	AEPC	Partner Banks	ESCOs	World Bank
b	*Procurement*	For all subprojects under this WB project receiving GoN subsidies, AEPC will **either** (i) procure ESCOs competitively following PPA and PPR, where AEPC PIU will manage procurement and bid evaluation **or** (ii) in case of ESCOs that are not competitively solicited, AEPC PIU will monitor application of PPA and PPR by such ESCOs as relevant and required. For competitively selected ESCOs, AEPC PIU will submit its bid evaluation report to TRC for its final decision. For non-competitively selected ESCOs, AEPC PIU will appraise procurement capacity, process, and plan of ESCOs when ESCOs are applying PPA and PPR.		For subprojects receiving only the debt financing supported by Component 1, ESCOs can follow their commercial practices. Neither PPA and PPR nor WB's Procurement Regulations apply to subprojects receiving only debt financing.	WB's Procurement Regulations do not apply to subprojects supported by Component 1.
c	*Financial Management*	For all subproject and all PBs, AEPC PIU will assess FM reporting practices.	PBs will assess FM arrangement of subprojects receiving credit from them.		WB will assess FM arrangement at AEPC PIU.
d	*Environmental and Social*	AEPC PIU may mobilize consultants, using funds under Component 2, to prepare ESIA of subprojects. AEPC PIU will screen and categorize subprojects based on criteria agreed with WB. AEPC PIU will review safeguard instruments prepared by ESCOs.	PBs will accept subprojects based on recommendation from AEPC PIU, TRC, and WB, as applicable.	ESCOs may prepare and will adopt ESIAs, ESMPs, and other relevant safeguard instruments for subprojects.	WB will review safeguard instruments of risky subprojects.
3	**Implementation of subprojects - construction and operation phase of subprojects**				

a	*Technical Performance and Results*	ITA will monitor progress all subprojects during construction up to commissioning. AEPC PIU will monitor technical performance and results of all subprojects during operation until closing of WB project.	ITA will monitor progress of all subprojects during construction up to commissioning and inform PBs.	ESCO will comply to technical standards and requirements of WB project during construction and operation.	WB will monitor subprojects in its implementation support and review and project evaluation.
b	*Economic and Financial*	AEPC PIU will monitor economic and financial performance of subprojects until closing of WB project.	PBs will monitor financial performance of subprojects.	ESCOs will provide data and analysis on economic and financial performance.	WB will monitor and evaluate economic and financial performance in implementation support and review and project evaluation.
c	*Procurement*	For ESCOs that are not competitively solicited and receive subsidy from GoN, AEPC PIU will monitor such ESCO's compliance with PPA and PPR.		ESCOs, that are not competitively selected and receive subsidy from GoN, will adhere to PPA and PPR for procuring goods, works, and services for their subprojects.	
d	*Financial Management*	AEPC will review financial reports from PBs and ESCOs.	PBs will collect and review financial reports and FM arrangement of ESCOs.		WB will review financial reports and FM implementation in AEPC PIU
e	*Environmental and Social*	AEPC will review and monitor subprojects' compliance with safeguard instruments.		ESCOs and their contractors will implement ESMPs.	WB will review and monitor subprojects' compliance with safeguard instruments.

Financial Management

7. The AEPC has been implementing the World Bank financed projects and hence has gained experience managing the World Bank financed projects. However, the FM capacity of the AEPC for the project needs to be strengthened with support of consultant and the area of financial monitoring requires particular focus.

8. **Funds flow.** WB disburses the SREP funds in a segregated designated account (DA) established for the project based on the consolidated quarterly fund request submitted by PIU. Alternatively, an advance up to a ceiling specified in the disbursement letter will be provided in the DA. The DA can also be used for payments to vendors/consultants (Under Component 2)). The DA will also be used to reflow the unutilized credit funds from AEPC/ESCOs back to GoN treasuries as needed. However for the utilized fund, a separate reflow account can be set up to receive the payments back from ESCOs which can then be utilized as the revolving fund for credit financing of future mini-grids or other RETS. . Direct payments to the vendors (for Component 2) can also be made directly from the World Bank for amounts above specified threshold.

9. **Staffing.** The accounts unit of AEPC consists of one account officer supported by an assistant. As the capacity is not adequate to manage the project due to multiple projects and programs being handled by the AEPC, a full-time FM consultant will be required to ensure effective FM similar to other World Bank financed projects.

10. **Budgeting.** The Government planning and budgeting procedures will apply to the project. The Planning and Financial Administration Sections of the AEPC are responsible for preparation and approval of budgets. Based on experience of World Bank financed projects, the budgeting process of the AEPC is considered satisfactory. The FM consultant will also support in budget preparation process. A separate budget line for the project will be required to track project expenditures.

11. **Accounting, financial reporting and internal controls.** The AEPC follows the government cash-basis accounting system and project accounting and financial reporting will also be based on the same. The AEPC will maintain computerized accounting system for the project. The AEPC will also maintain accounts based on approved program/activities and the required ledgers/registers related to the grant provided by the World Bank. The dedicated FM consultant has helped ensure timely accounting and financial reporting for other World Bank financed projects, which will be continued in the project.

12. **External audit.** The internal controls of the AEPC are based on the Government's financial rules and regulations. The dedicated FM consultant of the project will help ensure internal controls for the project are complied with. The FM consultant will also contribute in financial monitoring of the project expenditures, which is a major area to be strengthened in the AEPC. The AEPC will ensure internal audit on trimester basis as per the Government policy. The POM will lay out details on internal controls and other FM aspects specific for the project including for the SREP grant/loan, design costs, and guarantee. The POM will also include required monitoring measures. The involvement of the partner banks is expected to contribute in regular monitoring of the beneficiaries.

13. Audit of the AEPC is conducted by the Office of the Auditor General (OAG). The AEPC needs to work on timeliness of the audit reports. The FM consultant will help in ensuring that the audit report is submitted to the World Bank by six months from the end of the fiscal year.

Disbursements

14. The disbursements and advance to the DA will be based on statement of expenditures (SOEs) and the PB's loan drawdown schedule. During implementation, SOE claims and loan drawdown schedules will be reviewed to ensure that funds are utilized for the intended purposes. Any ineligible expenditure identified during such reviews will need to be refunded to the SREP.

Procurement

15. Procurement shall follow the procedures outlined in the Bank's Procurement Regulations for IPF Borrowers July 2016 (revised November 2017) and most of the procurement activities do not exceed the thresholds allowable for adopting national approach in Nepal.

16. Details of procurement activities and procurement strategy will be developed by the AEPC using the simplified form of the PPSD with the assistance of the task team. Procurement arrangements that are agreed through Project Procurement Strategy for Development (PPSD), prepared by doing proper market analysis will help for efficient procurement processes to ensure value for money.

Environmental and Social (including safeguards)

17. The project involves investment of the World Bank funds through a wholesale-retail financial intermediation model, where AEPC represents a wholesale FI/apex that channels financing to ESCOs and interconnection subprojects owners for design, construction, and operation of mini-grid subprojects/mini-grid interconnections through several local partner banks (retail FIs) in the form of loans with a marginally commercial interest rate. Managing E&S risks and impacts for this multilevel project means that AEPC, the PBs, and ESCOs shall develop and maintain adequate systems, procedures, and capacity for identifying, managing, and monitoring risks and impacts of subprojects commensurate with the types, scope, and nature of subprojects financed. The system must stipulate clear responsibilities and accountabilities of all key stakeholders in this process, including legal requirements. In this scenario, the AEPC is the key stakeholder responsible for overseeing the entire process of assessment of environmental and social risks and impacts and ensuring that all relevant parties (retail FIs, ESCOs, interconnection subproject owners) are fulfilling their responsibilities. Hence, the AEPC will play a key role in the processes of E&S risk management in the context of proposed institutional arrangements, as described in the following paragraphs.

18. Because the subprojects may result in adverse environmental and social risks and impacts, OP 4.01 (Environmental Assessment) is triggered. The project is categorized as FI in accordance with OP 4.01 and subprojects will involve application of relevant safeguard polices based on site-specific E&S risks and impacts identified during E&S assessment.

19. In accordance with OP 4.01 provisions for projects involving FIs, the World Bank requires appropriate E&S screening and assessment of all proposed subprojects and ensuring that sub-borrowers carry out appropriate ESIAs for each subproject and prepare ESMPs that will describe the necessary mitigation measures. Before being funded by FIs, it must be verified that subprojects meet the E&S requirements of appropriate national and local authorities and are consistent with OP 4.01 and other applicable E&S safeguards policies of the World Bank.

20. AEPC will act as main project implementing agency with CREF acting as a wholesale financial intermediary as it relates to flow of funds and will also assume primary responsibility for:

    (i) initial E&S screening of subprojects supported from the credit facility for mini-grid development and including E&S conditions in the legal documents for ESCOs and interconnection subproject owners;
    (ii) identifying subproject E&S category/risk level (High, Medium, or Low) and commensurate site-specific risks and mitigation measures;
    (iii) reviewing and ensuring quality of the ESIAs and/ or ESMPs that must be prepared by ESCOs or interconnection subproject owners25 once locations of subprojects are identified and DD are in the process of being prepared;
    (iv) ensuring all relevant clearances are obtained under GoN regulations and World Bank requirements;
    (v) ensuring that outcomes of the ESIA – including resulting ESMPs for mitigation of identified risks and impacts – will be integrated into the process for subproject selection and preparation conducted by the AEPC (because partner banks predominantly will not be the ones selecting subprojects)
    (vi) through its legal and contractual relationships with partner banks, the AEPC (with assistance from the CREF, as feasible) ensuring that appropriate legal covenants concerning E&S compliance are included in lending agreements between partner banks and ESCOs for financing of identified subprojects
    (vii) ensuring ESCOs and interconnection subproject owners carry out risk mitigation and monitoring measures under the ESMPs, including the associated costs;
    (viii) monitoring compliance of ESCOs and interconnection subproject owners with the ESMPs; (viii) ensuring that PBs incorporate adequate legal covenants in loan agreements in order to ensure compliance and provide AEPC with leverage to enforce E&S mitigation measures with ESCOs and interconnection subproject owners.

21. In order to facilitate coherent implementation of the above processes, AEPC has prepared an Environmental and Social Management Framework (ESMF), which also incorporates RPF, VCDP, Citizen Engagement, and a GRM. The ESMF includes the E&S screening process, categorization/determining risk level of subprojects (High, Medium, or Low) and detail the applicable requirements in line with the World Bank safeguard polices and relevant good international practices, to ensure that adequate ESIAs, ESMPs, and other necessary instruments are prepared and implemented for all subprojects.

[25] In case of interconnections, full ESIAs may not be required and only an ESMP may be sufficient.

22. While E&S impacts of most of the subprojects are likely to be moderate, there is a possibility that some of the subprojects may be located in protected or conservation areas, due to the fact that mini-grids represent more sustainable and cleaner power sources based on renewable energy in places where other sources of energy are not easily available. For example, these mini-grids may be used by eco-lodges in national parks built and operated to allow Nepal to benefit from its rich natural capital sustainably, while also preserving it for future generations. Nevertheless, construction and operation of subprojects in such areas is associated with potential impacts on areas with biodiversity values (for example, national legally protected areas, internationally recognized areas, and other habitats and ecosystems of significant importance for biodiversity, in line with the World Bank Safeguard Policies, and more specifically OP 4.04 (Natural Habitats) many of which are located across Nepal.

23. Subprojects involving mini-grid interconnections will most probably not result in significant adverse environmental and social impacts necessitating comprehensive E&S assessment, because all works (minor equipment installation and line connections) will be executed within existing facility area, such as in power houses. However, OP 4.01 and relevant safeguards policies would be triggered, if necessary, where E&S risks are identified through initial E&S screening done by AEPC and this require implementation of mitigation measures, as would be described in ESMPs to be complied with by subproject owners

24. Some of the subprojects may involve land taking. Thus OP/BP 4.12 on involuntary resettlement is triggered. Although most of the subprojects are likely to require small amount of land and thus have moderate social impacts, and large-scale resettlement impact would be excluded. There may be IP communities collectively attached to the subprojects' area. Thus OP 4.10 on Indigenous Peoples is triggered. Since exact location and associated socials risks and impacts of subprojects are not known at this stage, Resettlement Policy Framework (RPF) and Vulnerable Community Development Framework (VCDF) as a part of ESMF are prepared. Both RPF and VCDF will be disclosed locally and in-country and on the World Bank's website.

25. The ESMF will incorporate a capacity-building plan for AEPC and all key stakeholders, as needed and commensurate with their respective roles.

Monitoring and Evaluation

26. Monitoring of project implementation progress and results indicators, as well as progress toward achievement of the PDO, will be the responsibility of the AEPC as well as participating entities, such as local partner banks, and private companies engaged in mini-grid development and interconnections (ESCOs. The AEPC PIU will collect data and reports from participating entities and present progress in achieving the key and intermediate indicators to the World Bank every trimester. This will be carried in conjunction with the World Bank team's implementation and support missions.

Role of Partners (if applicable)

27. The project will work closely with other donors that provide investment and TA support to rural energy access programs in Nepal. GIZ has been supporting community-developed micro hydropower mini-grids having capacity less than 100 kW and is now planning to expand their financing support to ESCOs through

the CREF for developing mini-grids less than 100 kW capacity. ADB is providing the loan and subsidy support to ESCOs through the CREF (about US$5 million) for mini-hydro mini-grids having capacity from 100 kW to 1,000 kW. The World Bank team will share the information and coordinate with GIZ and ADB, especially for the financing mechanism to provide the SREP loans to the ESCOs for mini-grid development. Coordination with other development partners will be also sought to send consistent signals to the market, as well as increase accessible financing support to ESCOs. Especially, the U.K. Department for International Development (DFID) is now in the project preparation phase of the Nepal Renewable Energy Program (approximately GBP 18 million) to take over the current European donors' support project, NRREP, being closed in July 2017.

28. The World Bank executed the renewable energy sector's current capacity and future needs assessments in 2016, and identified 35 training modules to be provided to stakeholders in the renewable energy sector in Nepal within five years. Currently, the AEPC is coordinating with all donors to share the responsibilities/tasks to deliver all these 35 training modules on time.

ANNEX 3: IMPLEMENTATION SUPPORT PLAN

COUNTRY: Nepal
Nepal: Business Models for Private Sector-Led Mini-Grid Energy Access Project

Strategy and Approach for Implementation Support

1. The AEPC will prepare a POM, which describes in detail the process for (a) intake, (b) screening, (c) selection, (d) notification of applicants, (e) disbursement, and (f) monitoring and evaluation.

2. To facilitate smooth project implementation, capacity development is planned for all relevant stakeholders, such as the AEPC ESCOs, and local partner banks, by providing support during the subproject preparation and providing training through on-the-job-training and the project activities.

3. As described in the main text, the overall implementation risk for the project is rated **Substantial**. Accordingly, the Implementation Support Plan will focus on implementation of risk mitigation measures, considering the following factors:

   (a) The project implementation agency, the AEPC, has sufficient experience in financing for rural community-based mini-grid development, but limited experience in private sector-led mini-grid development.

   (b) partner banks have limited or no experience in financing for private sector-led mini-grid electricity services (ESCO business) and do not have in-house technical expertise to undertake due diligence on submitted loan request from ESCOs.

   (c) There are limited number of ESCOs, which developed mini-grid in rural areas. Most of these developed mini-grids were solar based with micro scale (less than 50 kWp generation capacity).

   (d) The interconnection market is at the emerging stage. As of now only few interconnection projects have been implemented by communities. As such there is limited knowledge on about the interconnection business processes, O&M, technologies etc among ESCO's and communities.

Implementation Support Plan and Resource Requirements

4. The proposed implementation support requirements are as described in the following tables.

Time	Focus	Skills Needed	Resource Estimate	Partner Role
First twelve months	- Project start-up - Finalizing POM - Establishing SREP loan financing mechanism -Overseeing the process of E&S	- Project management - Rural electrification (mini-grid, mini-hydro, solar, wind, hybrid, interconnection)	US$ 250,000	

	risk assessment for subprojects - Enhancing capacity of ESCOs on E&S assessment and management - Promotion activities for private sector-led mini-grid development - Selection of mini-grid subprojects other than pilot subprojects - DD execution for the subproject - Technical and financial studies for interconnection of existing mini-grids - Studies and designing SREP risk sharing mechanism - Capacity development	- Financial market - Financial solution - Environmental and social safeguards - Procurement - FM - Marketing - Monitoring and evaluation - Capacity development	
12-48 months	- Construction of subprojects - Monitoring ESCOs' mini-grid constructions - Monitoring ESCOs' mini-grid business operation - Annual survey to monitor impacts of ESCOs' mini-grid - Monitoring and evaluation of SREP loan lending by partner banks and repayment from ESCOs - Review and update (if needed) POM - Implementation of interconnection projects - Establishing risk sharing mechanism - Monitoring the project procurement and disbursement - Monitoring safeguards	- Project management - Rural electrification (mini-grid, mini-hydro, solar, wind, hybrid, interconnection) - Financial market - Financial solution - Environmental and social safeguards - Procurement - FM - Marketing - Monitoring and evaluation - Capacity development	US$ 175,000/year

Skills Mix Required (annual)

Skills Needed	Number of Staff Weeks	Number of Trips	Comments
Team leader	20	-	CO Based
Energy Specialist	20	2	HQ based
Financial Sector Specialist	10	-	CO based (International Staff)
Financial Sector Specialist	5	-	CO based
Environmental Specialist	15	2	CO based
Social Specialist	15	-	CO based
Procurement Specialist	5	-	CO based
Financial Management Specialist	5	-	CO based

ANNEX 4: Economic and financial analysis

COUNTRY: Nepal
Nepal: Business Models for Private Sector-Led Mini-Grid Energy Access Project

1. This annex discusses the summary of economic and financial analysis of the typical subprojects to be supported by the proposed mini-grid project. The economic viability of the project was assessed through a cost-benefit analysis. Net economic benefits for the project was calculated by comparing total system costs and benefits for the "*with*" and "*without*" project scenarios. The financial benefits were calculated based on the estimated costs, probable tariffs and plant utilization. A range of scenarios and sensitivities that meaningfully reflect the uncertainties of key input variables are also evaluated. The analysis also includes a consideration of the relevant environmental and social externalities.

2. **Project size and demand:** The underlying subproject data for the economic and financial analysis (including costs and demand profile) is derived from few solar and hydro mini-grid data provided by AEPC based on actual implementations experience of past mini-grid projects in Nepal. Typical mini-grid modeled is a 200kW peak demand system serving about 1,800 households and with about 20% load (on a kWh demand basis) from productive and institutional customers. Average household consumption (mainly for lighting) is assumed about 25 kWh/month, a typical household load in rural Nepal.

3. ***Capital Costs:*** For solar subprojects, total installed cost was estimated at $2,200/ kW for a 400 kWp system serving 200 kW average demand (both during sunshine and evening hours)[26]. The direct generation system costs were at $1,250 / kW (56% of total investment value) with distribution and connection costs (36%) and rest being project management, transaction, and land costs. For the generation system, solar panels ($400/W) and invertor were at 17% and 10% respectively. Storage capacity was sized at one day of demand and at $150/ kWh constituted about 40% of the costs. The balance of system and installation was at 35% (refer Table below for breakup of costs).

4. For the hydro mini-grid subprojects, total installed costs were $4,000 /kW about the same as solar on a kW of demand basis. Generation system costs were at $2,000 /kW forming 57% of total project costs. Distribution and connection costs were the same as solar mini-grid. The civil and electromechanical works costs were 50% and 30% of the generation system costs with rest 20% for access roads, electrical interconnection and installation etc. (refer Table 1 below for breakup of costs).

[26] The solar mini-grid should be overdesigned to generate extra energy that will be stored during the during the sun-shine hours for use after the sun-set hours and/or during the cloudy days when the solar irradiation is reduced.

Table 4: Typical cost breakup for solar mini-grids

Solar mini-grids	$ / kW(peak)	%
PV modules	200	9%
BOS	579	26%
Storage	469	21%
Total Generation	1,249	56%
Distribution + connection	806	36%
Other	179	8%
Total (per kWp of generation)	2,233	9%
Total (per kW demand)	4,466	

Table 5: Typical cost breakup for micro-hydro mini-grids

Hydro mini-grids	$ / kW (demand)	%
Civil works	900	23%
Electro-mechanical	600	15%
BOP	490	12%
Total Generation	1,990	50%
Distribution + connection*	1,529	38%
Other	456	11%
Total (per kW of generation or kW of demand)	3,975	100%
* note Distribution and generation is same for both mini-grids irrespective of solar or hydro. In Solar it is expressed as $/kWp hence appears lower		

5. ***Operating and Maintenance costs:*** The operation and maintenance (O&M) costs are estimated as 2.6 c/kWh and 3.6 c/kWh for solar and hydro mini-grids respectively based on the current experience in Nepal. This works out to about $19,000-26,000 per year for solar and hydro mini-grids respectively. The O&M costs include the skilled and unskilled labor, routine annual maintenance costs and about 15% management overheads. The solar mini-grids assume that the 1-day of storage capacity provides adequate level of service and so no costs for running diesel operations on a steady basis is provided for. Refer table below for breakup of operating cost assumptions

Table 6: Cost breakup for solar and hydro mini-grids

Operating Costs US$/ month	Solar- battery	Hydro
Maintenance and spares	6,000	9,500
Labor costs	9,500	12,000
Overheads and others (15%)	3,500	4,500
Total Annual O&M	19,000	26,000

6. The replacement cost for capital maintenance is provided for separately by technology. This includes replacing batteries every six years and major maintenance for hydro electro mechanical equipment every 10 years. A maintenance reserve (100% of battery replacement cost for solar and 30% of Electro mechanical equipment for hydro) is provided for to allow capital replacement four years before the major maintenance is due.

7. ***Grid integration costs:*** Nepal has many small hydro mini-grids of capacities in the 10-80kW range that can be connected to the national grid. The economic and financial analysis of a scenario where these grids are interconnected to the national grid have also been modelled. Average mini-grid capacity is modeled at 60kW, with distance for grid interconnection point is at the distance of 3 km. The cost for 11kV interconnection is assumed at $20,000 per kM, with $20,000 for transformers and switchgears and $10000 for the project management costs. Total project cost is estimated at $90,000.

Program Benefits

8. ***Fuel costs of the diesel generation alternative:*** The mini-grids and grid integration projects are assumed to displace 100% diesel generation for the end customers. In absence of these mini-grids it is assumed that the rural consumers have to resort to operating the diesel generators to supply the electricity. Diesel cost of generation is at 34.6 US c/ kWh in year 1 (based on diesel cost of $0.84/ litre) and escalated at 3% annually in dollar terms.

9. ***Avoided global environmental damage cost:*** The carbon emissions avoided to factor in the global externalities have been considered. Any local environmental costs due to Sulphur Dioxide, Nitrogen Oxides, or Particulate Matters etc have not been considered. The carbon cost base case is set at $30 / ton increasing 3% in $ terms annually to about $50/ ton in 20 years. The sensitivity analysis for the carbon cost is also conducted in the analysis.

10. ***Other Benefits and Costs:*** The proposed Program is also expected to have a number of additional benefits which are either uncertain or difficult to quantify such as (i) macroeconomic benefits through the development solar manufacturing industries; (ii) employment generation; (iii) learning and economy of scale benefits that can add more low cost distributed generation options to national generation mix etc. However, these benefits have not been included in this economic analysis as these could not be quantified clearly.

Economic analysis

11. **Assumptions:** In addition to the costs and benefits noted in the previous section, the economic analysis rests on the following additional assumptions:

    - Discount rate for calculation of NPV: 6.5%
    - The exchange rate was increased by a factor of 5% for economic analysis while calculating the impact of imported bill of materials.

- The labor costs were reduced by a factor of 25% for economic analysis to factor in economic benefits of job creation and thus reduce the net economic cost of the project.
- Construction period of 6 months and 18 months has been assumed for solar and hydro mini-grids respectively.

12. **Results:** The economic analysis shows a robust economic rate of returns of 25% for mini-grids making them sound investments for expanding electricity access in Nepal. The each of the hydro and solar mini-grid subprojects have an economic return of 25.6% (NPV US$ 2.2Mn) and 27.90% (NPV US$2.3Mn) respectively. The slightly higher economic return for solar projects is due to lower operating costs and shorter construction period (6 months vs 18 months) offsetting the higher capital replacement costs for on-going maintenance of storage batteries.

13. The economic evaluation takes a conservative approach to the estimation of benefits of mini-grids in Nepal. As discussed earlier there are significant additional benefits productive uses triggering job creation and economic growth opportunities besides catalytic efforts of stimulating private renewable industry to add low cost distributed generation options to the utility generation mix.

14. Tables below shows the summary of the calculations of the economic returns, for 6.5% percent discount rate with various sensitivity analysis

Table 7: Summary of economic analysis – micro hydro mini grids

Variable (s)	Unit	Baseline	Switching Value for 10% EIRR
Installed Capital Cost (actual)	US$/kW	4,000	10,800
Utilization Factor (total supplied energy/total available energy)	%	39.0%	17.1%
Cost of Diesel Generation	US $ / MWh	$33.5	$13.0

Economic Return – Carbon Cost Sensitivity				
Estimate	**Baseline**	**Variable1**	**Variable2**	
Discount Rate		6.5%	10.0%	
Social Cost of Carbon	**Carbon cost**	**NPV**	**NPV**	**EIRR**
Base	$30	2,237,376	1,418,600	25.6%
Low	$15	2,087,653	1,308,626	24.5%
High	$50	2,437,006	1,565,233	26.9%
Zero	$0	1,937,930	1,198,651	23.50%

Table 8: Summary of economic analysis – Solar mini grids

Variable (s)	Unit	Baseline	Switching Value for 10% EIRR
Installed Capital Cost (actual)	US$/kW	4,100	5,980

Utilization Factor (total supplied energy/total available energy)	%	90.0%	Not applicable
Cost of Diesel Generation	US $ / MWh	$37.5	$14.0

Economic Return – Carbon Cost Sensitivity				
Estimate	**Baseline**	**Variable1**	**Variable2**	
Discount Rate		6.5%	10.0%	
Social Cost of Carbon	**Carbon cost**	**NPV**	**NPV**	**EIRR**
Base	$30	2,314,449	1,499,539	27.9%
Low	$15	2,149,080	1,375,466	26.5%
High	$50	2,534,941	1,664,971	29.7%
Zero	$0	1,983,711	1,251,392	25.10%

15. The switching values above show the sensitivity of EIRR to key input assumptions. While doing the switching analysis the selected variables are changed, while keeping the other input assumptions constant, to understand the threshold value at which a parameter (like capital costs) tips the EIRR below a certain point (10% EIRR in this case). Note that for solar, the utilization factor is constant as the solar system is sized to match demand unlike micro-hydro which is generally designed to cater the loads during the driest period

16. ***Grid Integration Economic Analysis:*** The economic returns for grid integration for the hydro mini-grids are quite high given that the projects utilization factor assumed to increase to 90% (given that the hydro projects in mini-grid are typically sized to meet the demand during driest periods). This combined with the assumption that additional output generated replaces diesel generation yields an economic IRR of close to 135%.

17. For the solar mini-grid no grid interconnection analysis was done as most of existing mini-grids that are candidates for grid integration in Nepal are hydro based. Also given that the solar systems are already sized for the local demand, there will be no meaningful jump in utilization for the solar mini-grids, thus not having any additional diesel displacement benefits to the grid integration costs.

18. **Sensitivity Analysis:** Sensitivity analysis using the low case (increasing from US$15 per ton in 2018) and high case (from US$50 per ton in 2018) social values of carbon recommended by Bank guidance does not have much impact on the economic returns as shown above, with the scenario with zero carbon credits still having a robust 23-25% economic rate of return for the different technologies.

19. Both the hydro and solar mini-grids have robust economic returns much more than a base case return of 10% Economic rate of return. They have more marginal financial rates, and given the programs emphasis on market creation and encouraging private sector participation we have done more sensitivity analysis around the Financial rate of returns.

Financial analysis.

20. The financial analysis of the Project was carried out by valuing the electricity generated at prevailing mini-grid tariffs in Nepal, adding taxes and duties to the Project costs used in the economic analysis and excluding global environmental benefits from the benefits.

21. The tariffs are assumed to be 10 NPR (Nepal Rupees) for residential customers, and 15 NPR for institutional and commercial customers (about 20% of the load in base case). Tariff for lifeline households (below 10kWh monthly consumption or 50 W load) is assumed at 20% discount to regular residential tariffs. The concession period is assumed for 20 years for mini-grids.

22. A 5% loss due to transmission and collection losses and tariff/ demand growth of 5% is assumed throughout the mini-grid concession period. In practice these losses might be higher in initial years which may coming down after mini-grids operations are optimized. Tariff and demand growth on the other hand will taper off after initial years.

23. Leverage was added to the analysis at prevailing debt terms. Nepal has a well-developed and very competitive local banking system. Based on interactions with banks debt of 7 years at 60% leverage (for investment costs excluding subsidy) and 8% interest in local currency is assumed. Additionally, subsidies to the extent of 50% for base case was assumed in line with existing programs in Nepal by the implementing agency AEPC. This results in net equity contribution of 20% for the financial analysis base case. The results for the financial analysis along with different switching values is given in Tables below.

Table 9: Summary of financial analysis – micro hydro mini grids

Micro-hydropower Mini-grid - Financial Analysis	
System Size (kW	210
Number of Households	1,800
Tenure of Debt (years)	9
Investor Equity (% of total financing)	20%
Subsidy	50%
% Productive Load (by kwh)	20%
Base Case FIRR	14.50%

Variable (s)	Unit	Baseline	Switching Value for 15% FIRR	Switching Value for 25% RoE
Installed Capital Cost	US$/kW	4,100	4,000	2,900
Subsidies	US$/kW	2,050	2,100	2,650
Utilization Factor(total supplied energy/total available energy)	%	39%	40.00%	55.00%
Average Residential Tariff	US$/kWh	10	10.2	15.0
Average Non-Residential Tariff	US$/kWh	15	16.0	37.00
Interest Rate of Debt	%	8%	7.0%	NA

Table 10: Summary of financial analysis – solar mini grids

Solar Mini-grid - Financial Analysis	
System Size (kW	400
Number of Households	1,800
Tenure of Debt (years)	9
Investor Equity (% of total financing)	20%
Subsidy	50%
% Productive Load (by kwh)	20%
Base Case FIRR	0.40%

Variable (s)	Unit	Baseline	Switching Value for 15% FIRR	Switching Value for 25% RoE
Installed Capital Cost	US$/kW	2,400	1,700	1,350
Subsidies	US$/kW	1,200	1,500	1,700
Utilization Factor (total supplied energy/total available energy)	%	90.0%	NA	NA
Average Residential Tariff	US$/kWh	10	13.3	17.5
Average Non-Residential Tariff	US$/kWh	15	30.0	NA
Interest Rate of Debt	%	8%	NA	NA

24. Hydro mini-grids financial returns are already close to the equity return of 15% which is roughly the minimum equity threshold for private sector to consider investment in these projects. Reasonable optimization in capital costs or higher utilization or increase in productive loads will lead them to acceptable market rate of return for equity at 50% subsidy levels.

25. A 60% subsidy or 30% reduction in capital costs or a fifth increase in capacity utilization will increase the financial returns for hydro – mini-grids to 25% equity IRR which will be a good return to attract active private sector interest and catalyze growth in the market.

26. *Solar mini-grids financial returns are just breakeven with a 0.4% equity return at the base tariffs of 10 and 15 NPR/ kWh for residential and commercial customer respectively.* The lower financial returns in solar compared to hydro mini-grids is due to the fact that there are substantive and frequent battery replacement costs. Due to the provision for a maintenance replacement reserve established from project cashflow the distributions to equity in initial years are lower, thus reducing financial returns. The tariffs need to be close to 13-17 NPR/ kWh for household for 15-25% equity rate of return which is in line with the tariffs proposed by solar mini-grid developers in Nepal. Capacity utilization increase is not really a lever for solar projects as they are sized optimally to meet demand already. Other option is to reduce capital costs by 30-50% or have higher subsidies. A 30% reduction in capital costs is possible with more optimal planning of distribution networks (splitting the generation and keeping them close to demand).

27. **Grid Interconnection:** For grid interconnection projects, it has been assumed that the projects will have to discontinue without any revenue if they don't interconnect to the grid once the main grid arrives. With this assumption the financial IRR is quite healthy at 31%. The low national feed in tariff compared to the mini-grid tariff rates is offset by higher capacity utilization and also lower marginal capital cost for grid

interconnection. 90% plant factor has been assumed for the grid interconnection given that the hydro mini-grids are sized for lowest monthly output to provide continuous baseload power.

28. In summary the mini-grid projects have a very robust economic rate of return and with some reasonable optimizations can return in close to market equity returns with a 50% subsidy program. Given the maturity of local industry and supply chain in renewables (due to long history of contractors installing fully subsidized mini-grids) and also a very competitive and willing banking sector, Nepal seems to have the right conditions for fostering a private sector led investment programs in mini-grids that can become sustainable and scalable in medium term.

29. However, the sector seems long dependent on subsidies, and the private sector developers seem to lack the business and financial maturity required to handle the risks associated with commercial renewable projects. The banks also need some support and capacity building to develop appropriate risk monitoring and mitigation for mid-size commercial lending to renewables and mini-grids. The SREP Nepal mini-grids program aims to address these gaps in developers and banks while providing a liquidity and credit mechanism to catalyze private sector market in renewable mini-grids.

ANNEX 5: SCALING UP RENEWABLE ENERGY PROGRAM (SREP)

COUNTRY: Nepal

Nepal: Business Models for Private Sector-Led Mini-Grid Energy Access Project

Results Framework

Indicator	SREP-funded Project	Transformational scaled-up (150 mini-grids developed by private sector) [27]
Additional RE Installed capacity [MW]	3.8[28]	22
Annual electricity output from RE as a result of SREP interventions [GWh/year]	29.1	140
Number of women and men, businesses and community services benefiting from improved access to electricity and as a result of SREP interventions	- 126,000 people, of which 63,000 are women - 27,000 households, of which 420 are women-headed	600,000 people, of which 300,000 are women
Financing leveraged through SREP funding [US$ million]	US$9.51 million, of which - US$6 million from government subsidy[29] - US$3.36 million from private sector for mini-grid development and interconnection[30] - US$0.15 million from ESMAP Trust Fund	US$ 81 million from public and private sector
SREP leverage ratio [1:X]	1: 1.3	1:11

[27] In the scaled-up phase it is estimated that 150 mini-grid projects (70 new mini-grids, 40 rehabilitations, and 40 interconnection) will be constructed.

[28] This is total of new and rehabilitated generation capacity.

[29] As per the current GoN subsidy policy the mini-grid projects are eligible for about 50% of subsidies. As per the current subsidy policy the subsides are only applicable for the new mini-grid projects in the areas not covered by the main grid.

[30] This amount only refers the equity financing by ESCOs. The new mini-grids are eligible for subsides and in such cases the subsidy/debt/equity structures will be 50/30/20. However, the existing mini grid rehabilitation and interconnection projects will not be eligible for GoN subsidies according to current policy. In such case the financing structure will be debt/equity as 70/30.

Tons of GHG emissions reduced or avoided -Tons per year [tCO2eq/yr] - Tons over lifetime of the project [tCO2eq]	7,372 147,435	150,251 3,005,020[31]
Co-benefits	• Economic benefit including reduced fuel consumption, lower dependence on imported fuel, enhanced energy security and improved reliability • Social benefit including positive educational and health impacts, employment opportunities • Environmental benefit, both on local pollutants and global GHG emissions and gender equality	

Country and Sector Context

1. Despite having rich hydropower resources of up to 82,000 MW, the current total installed capacity is about 1000 MW, including generation from the Nepal Electricity Authority (NEA) and independent power producers. Existing generation, even after being supplemented by purchases from India, is insufficient to meet the demand. Forced load shedding, with attendant economic consequences, has been inevitable. Although load shedding has recently ended in the capital, Kathmandu, and the tourism hub of Pokhara, it still plagues the rest of the country. Electricity access has been extended to 75 percent of the population. Around 50 percent of the population has access to grid electricity, while the remaining 25 percent is served by off-grid solutions. Off-grid communities are served by 1,700 community-owned micro hydropower plants (MHPs) with total installed capacity of about 30 MW.

2. The structure of the GoN's renewable energy subsidy program and incentives offered for off-grid electrification may be inadvertently contributing to the low consumption levels of electricity in off-grid areas. The AEPC has been implementing a subsidy-driven model that has subsidized renewable energy based rural electrification, which has limited efforts to support operation and maintenance (O&M) of installed facilities and to incentivize demand growth. There has been no incentive to promote electricity as a 'service' that will enable higher consumption, greater productivity, and improved quality of life. Due to the community ownership model, the development impact of off-grid solutions has remained rather low and is mostly confined to basic lighting and mobile phone charging. Operation, maintenance, repair, and revenue collection (for example, in community-owned MHPs) are the responsibility of beneficiaries/owners. End users of MHPs (community members) have been trained in basic operation of the asset, but they lack the capacity to perform detailed maintenance or solve technical and mechanical problems.

3. The Renewable Energy Subsidy Policy of 2016 recognizes the need for public-private partnership in off-grid electrification and that the lack of mobilization of credit and high dependence on subsidy is hampering the deployment of renewable energy. The policy proposes the gradual replacement of subsidy

[31] Lifetime is assumed as 20 years

with credit. The new Renewable Energy Subsidy Policy approved in May 2016 allows privately owned ESCOs to receive subsidies, which was not allowed in the 2013 Policy. This is expected to facilitate the entry of ESCOs into the mini-grid energy services market. However, due to the challenges in access to finance for the rather new ESCO business, since the revision of the Subsidy Policy in May 2016, no mini-grid has been developed by private ESCOs.

4. The NEA grid extension to rural areas served by mini-grids is another challenge for ESCOs. Private developers are unlikely to invest in a mini-grid without some certainty on what their business options will be when the NEA grid is extended to their service areas. In Nepal, it is estimated that about 30 percent of existing mini-grid projects in rural areas may face grid arrival and/or seek connection to the NEA grid in the near and midterm. To address this challenge, NEA and AEPC has recently entered into a understanding and published guidelines to enter into a Power Purchase Agreement (PPA) with mini-grids that can be connected to its central grid. However, there has are only about two interconnections made between the grid and a mini-grid in Nepal, although there is abundant experience internationally[32]. Effective intervention harnesses a large number of existing mini-grids that would have otherwise been stranded if the NEA distribution line reaches their service areas

SREP Private Sector Set-Aside

5. Under the SREP US$90 million in concessional funds was set aside to contribute to the financing of innovative programs and projects in six SREP pilot countries that engage the private sector in piloting and demonstrating the economic, social and environmental viability of low carbon development pathways in the energy sector by creating new economic opportunities and increasing energy access through the use of renewable energy. At its meeting in October 2013, the SREP Sub-Committee endorsed US$5.61 million of grant and US$2 million of non-grant for *Program for Supporting Private Sector Led Commercially Viable Business Models for Off-Grid Energy Access in Nepal*. The endorsed project concept aimed at supporting the development of a local market for private-sector led off-grid energy provision using the innovative and renewable energy (RE) based business models through the provision of (i) technical assistance, and (ii) results based finance and (iii) risk sharing instruments, such as risk coverage, and loan write off under certain events will leverage significant amount from private sector. The proposed Project will be a critical attempt to address various existing barriers and to shift the mini-grid market toward a private sector driven approach, which will improve the quality and quantity of electricity service in rural areas and contribute to universal access to electricity.

6. During project preparation, market sounding provided additional information that would need changes in the project design. The financial sector in Nepal is constrained by inadequate long-term sources of finance and interest rates that are relatively high and not fixed for the tenor of the project, which discourage private sector from investing in infrastructure projects. Access to finance has been the major challenge for potential ESCOs to invest in mini-grids, as the ESCO-led mini-grid business is at a very nascent stage, only allowed in 2016, and many ESCOs are relatively new entities with limited credit history. Even though ESCOs can borrow from local banks, the financing terms are not sufficient to set the level of retail tariff to meet cost-recovery and affordability of potential consumers at the same time. The scale of mini-grid is relatively small, not taking advantage of economies of scale. Furthermore, in rural

[32] As of now, only two projects has achieved grid interconnection in Nepal.

areas, electricity demand profile is low, which deters the optimal use of a generation facility.

7. To enhance financial viability of the mini-grids and at the same time to get away from the heavily subsidized financing model, a financing mechanism to provide loans with favorable terms to fill the financing gap is necessary. A majority of the SREP grant is allocated to capitalize a revolving fund, which offers a marginally commercial interest rate and longer repayment period, to address this bottleneck. To meet the increasing demand on technical assistance and capacity building which are required to open up a new market driven by private sector ESCOs, the allocation to TA activities has increased. The purpose of the SREP risk sharing mechanism has changed to support the commercialization of mini-grid projects and interconnections, to address another significant risk to mini-grid developers and to promote commercial financing to interconnection after showcasing the technical and financial feasibility through TA components. The risk sharing mechanism will include the write-off of loan by AEPC in certain events that are beyond the control of both ESCO and PBs

Project Description

8. The Project Development Objective (PDO) is to increase electricity delivery from renewable energy mini-grids in selected areas by mobilizing private energy service companies.

9. The proposed project consists of two components: (1) Support to Renewable Energy Mini-grid Subprojects, and (2) Technical assistance, and project Management. The summary of the components and their subcomponents are as below. Please see the main text of the PAD and the Annex 1 for more details.

10. **SREP Additionality.** To enhance financial viability of renewable energy based mini-grids to attract private sector investment, and in parallel to offer an affordable tariff to consumers, a new financing mechanism that extends loans with favorable terms and conditions is essential. Without the SREP resource, ESCO-led mini-grid will remain subsidy based, and thus number of implementable mini-grids will be limited due to limited Government budget for subsidy. Therefore, scaling up ESCO-led mini-grid will not be expected, and may take significantly longer time to take off until the existing barriers are addressed. The SREP grant allows such a financing mechanism with high risk appetite to absorb potential losses from the loans to private sector ESCOs, without imposing additional liability. Part of the SREP resources offered for technical assistance and capacity building is essential to move the market from the public sector subsidy based model to the private sector driven model.

11. The SREP grant which will help provide marginally commercially interest rate, have the provision of loan write off for certain events, and the TA will incentivize commercial lending to mini-grid and to open up the private sector driven market mini-grid market.

12. This is a standalone SREP project without any cross support from IDA or other sources. Thus, this project's role in developing the capacity of different individuals/institutions such as GoN ministries, AEPC, policy makers, financiers, developers, etc. is important. Such support will be instrumental in mitigating the project risks and helping GoN/AEPC to commercialize the RETs and wean off the subsidies. AEPC is mandated to implement off-grid RETs schemes in Nepal and is an eligible partner for the Bank to

implement the private sector led mini-grid projects in partnership with the commercial banks and ESCOs. However, its experience in this area is limited. AEPC's experience is mostly limited to administering GoN subsidies to the community managed projects with limited consideration for commercial applications. Thus, AEPC managed RETs are considered as the risky investments by private sector in Nepal, primarily due to institutional weakness, limited capacities in technology assessment; project reviews; credit appraisal, etc within the AEPC, ESCOs and other institutions and agencies working in RE sector in Nepal. This project tries to address these issues. The technical and capacity development component will among others, support in the establishment of Credit Units in AEPC staffed by competent credit officers; preparation of technical standards and guidelines for different RETs; establishment of appropriate business models for RETs; support the partner banks and ESCOs in project appraisals, evaluation, including on the job trainings etc. This will both be helpful in developing the capacity and mitigating the risks while building confidence among the private entities to be involved in the off-grid projects

Assessment of Proposed Project with SREP Investment Criteria

Increased installed capacity from renewable energy sources

13. The proposed Project will support additional installed capacity of about 3 MW from renewable energy, mainly MHP and solar PV, through private sector-developed mini-grids under Component 1. In addition, through the rehabilitation the project will revitalize about 0.8 MW of MHPs that would have otherwise been stranded.

Increased access to energy through renewable energy sources

14. A total of 27,000 households (equivalent to 126,000 people) will benefit from increased access to electricity through renewable energy. 75 business customers and 7 anchor customers will be also connected to the private sector mini-grids.

Low Emission Development

15. The Project is projected to reduce greenhouse gas (GHG) emission by approximately 7,372 tCO_2eq annually, as both the private sector mini-grids and interconnection of mini-grids will replace alternatives with high carbon emissions.

Affordability and competitiveness of renewable sources

16. Renewable energy-based mini-grid has been supported by the subsidy from the government. Given its small scale that doesn't allow economies of scale and limited demand profile from sparse population in rural areas, the cost-recovery tariff is not affordable to a majority of consumers if supported by commercial financing. The Project attempts to establish a new financing mechanism, capitalized by the SREP grant, to offer loans that are attractive to developers and necessary to offer retail tariffs that potential consumers are willing to pay. The availability of the loan product is critical to enhance financial viability of renewable energy-based mini-grid subprojects, and to promote renewable energy off-grid solutions in rural areas where the main grid is not expected to come in a near future. The financing mechanism will operate as a revolving fund, therefore even after the project ends it will continue to extend loans from the reflows of the first-round loans. If the model is proven successful, the financing

mechanism may attract more capital from the Bank or other development partners to further scale up renewable-based mini-grids in Nepal.

17. Going forward, the key to enhance affordability is to increase demand and consumption of electricity within the service areas of mini-grids. This business model is meant to incorporate appropriate customer classes (combinations of households, business, commercials etc), as deemed necessary by the implementing ESCOs to improve it compared to the community-owned mini-grids. Various technical assistance and capacity building will further promote the increase in electricity demand and its productive use, which eventually improve the affordability of electricity from mini-grids in a long run.

Productive use of energy

18. Acknowledging the challenge of low demand profile for mini-grids during daytime, the ESCOs will select appropriate customer base to enhance the plant factor and sell as much as electricity as possible to increase the profitability. This will be complemented by the appropriate tariff mechanisms to distinguish the services which will help attract the different customer bases. Through technical assistance activities, business opportunities and productive use of electricity will be advised and supported within the area of the mini-grids, including agribusiness and other rural enterprises.

Economic, social and environmental development impact

19. *Economic benefit.* The mini-grids will bring economic benefit to rural consumers as electricity will be more affordable compared to other alternatives such as diesel generators. It will help reduce fuel consumption and thus high dependence on imported fossil fuel, leading to enhanced energy security. Interconnecting mini-grids to the main grid will increase supply of electricity to the grid, improving service reliability and reducing load shedding that is prevalent throughout the nation.

20. *Social benefit.* Educational and health benefits are expected to accrue from the improved level and quality of lighting and reduced indoor air pollution from reduced use of diesel, kerosene, batteries or other energy sources. The mini-grids will generate local employment opportunities, mainly on construction, operation and maintenance of the systems. The creation of a private sector ESCO market will provide more sustainable employment opportunities at the ESCOs. Increasing access to electricity in rural areas is projected to have significant impact to improve gender equality and women's socioeconomic status.

21. *Environmental benefit.* The proposed Project will bring in positive environmental impact, not only by avoiding greenhouse gas emissions but also by reducing local air pollution emissions. This will lead to reduction in local pollution from the use of diesel, kerosene, candles and biomass (firewood) that are used as alternative sources of energy.

Economic and financial viability

22. Model subproject of a MHP and solar mini-grid was analyzed to assess economic and financial viability. The model investment is economically viable. The economic internal rate of return (EIRR) is more than 25% for the mini-grids. This is mainly due to high avoided cost of fuel to generate the same amount of electricity. Based on the suggested financing structure under the Project and the tentative financing

terms of the loans offered by the financing mechanism, the mini-grid subproject (particularly micro-hydro) is also financially viable.

23. Interconnection of mini-grids is also assessed to be economically and financially viable. The EIRR is projected over 100 percent, as it would avoid high cost of fuel and enhance utilization rate of the plant with a relatively small amount of investment in grid interconnection. The original cost of constructing MHPs was considered as a sunken cost so not included in the economic analysis. The FIRR to equity investors is estimated at around 31 percent, providing private sector ESCOs with incentives to invest in the interconnection. For more details on assumptions used and financing structure, please refer to the economic and financial analysis in the main PAD and Annex 7

Leveraging of additional resources

24. The proposed Project will mobilize additional US$7.61 million in total. It is estimated that a US$6 million will come from the government to provide subsidy to mini-grid subprojects. US$3.12 million is expected to come to meet the 20 percent equity of mini-grids to be eligible for the subsidy support. The leverage ratio will be 1 to 1.3. After the project close, the financing mechanism will continue to operate as a revolving fund.

Gender

25. A gender impact assessment has been conducted as part of a social impact assessment. Given the direct and significant impact of rural electrification on gender, the Project plans address gender issues through various mechanisms including support to female-headed households and female-headed businesses to get connected to mini-grids and have electricity access, and consumer awareness campaigns targeting female-headed households. Community consultations throughout the implementation of the Project will include monitoring gender-related impact.

Co-benefits of renewable energy scale up

26. Scaling up renewable energy-based mini-grids in rural areas will further strengthen the economic case, by avoiding consumptions of diesel, kerosene and other alternatives and reducing dependence on imported fuel. The Project will contribute to the creation of the ESCO market for developing and operating mini-grids in remote areas, to improve the quality and quantity of electricity service in these areas where the grid is not expected for years. A good number of ESCOs are expected to be established to take business opportunities under the Project and beyond. It will create a new ecosystem of ESCOs, which may expand its business to other energy related areas, such as rooftop solar PV, energy efficiency, etc. Local employment opportunities will also increase in the sector.

27. There are still about 25 percent of total population without access to electricity. Providing electricity to this underserved population will bring in positive co-benefit in many aspects. Improved lighting will enable additional study hours in the evening, and supplying electricity to schools will allow more effective education through IT solutions. Indoor air pollution, which has significant negative impact on health, will be avoided by connecting to renewables-based mini-grids. Increasing use of renewable energy sources will reduce GHG emissions as well as local pollutants such as sulfur dioxide (SO2), nitrogen oxide (NOx), and total suspended particulates (TSP).

28. Scaling up interconnections of mini-grids will address supply shortage in the grid system, while reviving stranded generation assets that were supported heavily by the government in the past. The commercialization of interconnection, if successful, will unlock the potential of over a thousand of MHPs and allow the scaling up without much support from the public sector. It will also address one of the biggest risks of mini-grid developers, promoting mini-grid investment at the same time.

Monitoring and Evaluation

29. Monitoring of project implementation progress and results indicators, as well as progress toward achievement of the PDO, will be the responsibility of the AEPC as well as participating entities. The PIU will collect data and reports from participating entities and present progress in achieving the key and intermediate indicators to the World Bank every trimester. This will be carried out in conjunction with the World Bank team implementation and support missions.

30. Rural community meetings (inviting both men and women from business and community customers), focus group discussions, and socioeconomic surveys will be carried out in subprojects areas by the AEPC to collect baseline data for the project monitoring indicators during the subproject preparation period. Willingness- and ability-to-pay analysis will also be executed using collected data, as well as an assessment of citizens' attitudes about energy use and service, flat tariffs versus segmented tariffs for moving toward more modern service provision, and the overall concept of energy as a service rather than a product as it is currently viewed by citizens. The impacts of electrification, including specifically on women, will be monitored by continuing the socioeconomic surveys targeting the same interviewees on an annual basis after the subprojects' commissioning. A report summarizing findings will be publicly disclosed once a year during this project period.

Implementation Readiness

31. AEPC has built a pipeline of about 13 mini-grid subprojects. At least two of the ESCOs with the support from AEPC and with the anticipation that SREP mini-grid project will is expected to be complete their feasibility studies very soon. Such These projects will be ready to be implemented immediately after the approval.