

CLIMATE INVESTMENT FUNDS

April 10, 2015

SREP REVISED INVESTMENT PLAN FOR NEPAL

Proposed Decision
SREP Revised Investment Plan for Nepal

The SREP Sub-Committee reviewed the *SREP Revised Investment Plan for Nepal* (March 2015), submitted by the Government of Nepal in collaboration with the Asian Development Bank and the World Bank Group, and takes note of the updates on the implementation of the projects and programs financed by the SREP and the following revisions to the *SREP Investment Plan for Nepal*:

- a) Cancelling USD 20 million in SREP funding approved by the Sub-Committee for the *Nepal SREP Small Hydropower Finance Program* (USD 10 million with ADB private sector and USD 10 million with IFC);
- b) Reallocating the cancelled USD 20 million in SREP funding to the *Public and Private Partnership for Solar Development* to be developed and implemented by ADB public sector.

The SREP Sub-Committee endorses the proposed revisions as a basis for the further development of the proposed activities for SREP funding. The Sub-Committee requests ADB to work closely with the Government of Nepal to expedite the development of the new program for submission to the Sub-Committee for funding approval by the fourth quarter of 2015.

**SCALING UP RENEWABLE ENERGY PROGRAM
REVISED INVESTMENT PLAN FOR NEPAL**

March 2015

[Review draft for Submittal to SREP Sub-committee]

ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
ADB PSOD	Asian Development Bank Private Sector Operations Department
AEPC	Alternative Energy Promotion Center
GHG	Greenhouse Gas
GoN	Government of Nepal
GWh	Gigawatt-hours
IBRD	International Bank for Reconstruction and Development
IFC	International Finance Corporation
IP	Investment Plan
MOSTE	Ministry of Science, Technology, and Environment
MtCO ₂ e	Million tons of carbon dioxide equivalent
MW	megawatts
MWh	megawatt-hours
NEA	Nepal Electricity Authority
NRREP	National Rural Renewable Energy Program
RE	renewable energy
SHP	small hydropower
tCO ₂ e	tons carbon dioxide equivalent
\$ M	million US dollars

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EXECUTIVE SUMMARY

The Government of Nepal (GoN) has informed the Asian Development Bank (ADB), the International Bank for Reconstruction and Development (IBRD), and International Finance Corporation (IFC), of its interest to revise the Scaling Up Renewable Energy Programme for low-income countries (SREP) Investment Plan (IP). The SREP Sub-Committee endorsed the Nepal SREP IP in November 2011 and confirmed its endorsement together with the Note on Proposed Revision to the Investment Plan for Nepal in March 2012. Table ES1 summarizes the indicative financing plan and implementation status as of January 2015. Table ES2 presents the proposed changes to the IP.

Table ES-1: Nepal SREP IP Projects Status as of January 2015

Components	Projects	Sector	SREP Fund	Sub-Committee Approval	MDB Approval	MDB
Component 1: Small hydropower development	On-grid small hydropower development	Private	10.0	Oct 2012	--	ADB-PSOD
		Private	10.0	Oct 2012	--	IFC
Component 2: Mini and micro initiatives	Off grid Rural Electrification Through Renewable Energy	Public	11.2	May 2014	Jul 2014	ADB
	Extended Biogas Program	Public	7.9	Feb 2014	Aug 2014	IBRD

Source: Joint Mission, January 2015.

Table ES2: Indicative Financing Plan March 2015 (\$million)

Components	Projects	Sector	SREP Fund	Sub-Committee Approval	MDB Approval	MDB
Component 1: On-grid Utility-scale Solar Development	Public Private Partnership for Solar Development	Public	20	Q3 2015	Q4 2015	ADB
Component 2: Mini and micro initiatives	Off grid Rural Electrification Through Renewable Energy	Public	11.2	May 2014	Jul 2014	ADB
	Extended Biogas Program	Public	7.9	Feb 2014	Aug 2014	IBRD

Source: Joint Mission, January 2015.

The overall context and objectives of the IP are the same as the original IP and are consistent with the GON climate change policy and economic development framework. The major change is to shift funds from private sector on-grid small hydropower (SHP) to a public private partnership for solar power development. The shift in funds represents a change in renewable resource and technology development, and shifting funds from IFC and the ADB Private Sector Operations Department (PSOD) to ADB's public sector window. The updated IP is focused on achievable success in the next 12 to 18 months. Details of the proposed changes are described in the following sections.

I. INTRODUCTION

1. The Scaling Up Renewable Energy Programme for low-income countries (SREP) Investment Plan (IP) for Nepal was endorsed by the SREP Sub-Committee in November 2011. The Sub-Committee re-confirmed its endorsement together with the Note on Proposed Revision to the Investment Plan for Nepal in March 2012. The IP presented the following strategic uses for SREP: (i) private sector on-grid small hydropower (SHP) development; and (ii) public sector mini and micro energy development.

2. The proposed changes will retain and reprogram the funds from the original allocation for private sector SHP investments to other renewable energy (RE) development. The original allocation for SHP development led by Asian Development Bank (ADB) Private Sector Operations Department (ADB-PSOD) and the International Finance Corporation (IFC) will be applied to a public-private partnership for on-grid utility scale solar power development. This document is organized as follows:

- Section II -- Review of implementation status;
- Section III -- Explanation of the circumstances and rationale for revising the investment plan and making changes to the projects or programs included;
- Section IV -- Description of the proposed changes, and
- Section V -- Assessment of the potential impact of the proposed changes on achieving the objectives and targets of the original investment plan.

3. The overall context and objectives of the IP are consistent with the original IP and the Government of Nepal's (GoN) evolving energy development and climate change policy framework. The updated IP is focused on achievable success in the next 12 to 18 months.

II. IMPLEMENTATION STATUS

ADB Rural Electrification Through Renewable Energy Project

4. **Description:** The Project is part of the Government's National Rural and Renewable Energy Program (NRREP) which has three components: (i) the new Central Renewable Energy Fund (CREF)¹, a successor to the existing Renewable Energy Fund; (ii) technical support for extended biogas, solar, and community electrification; and (iii) productive end use of energy by households and micro-, small-, and medium-scale enterprises. The Project is being implemented in parallel with the NRREP as a virtual window of the CREF.² Based on successful experience of the Micro Hydro Debt Fund managed by two commercial banks, Himalayan Bank Limited (HBL) and Clean Energy Development Bank (CEDB), ADB will provide a credit line of \$ 5 million to be channeled through these two banks (or CREF when it is operational).

5. **Rationale:** The rationale and expected impacts are as envisioned in the original IP. The project is replicable and scalable.

¹ As outlined by the Rural Energy Policy 2006, the CREF is envisaged to be a vehicle to mobilize both grant (subsidy) and credit funds for renewable energy sector.

² ADB and other donors have discussed participation in the CREF during prior consultation missions; the Project will utilize the sector loan modality, with funding flows in parallel to CREF. The overall objectives of the proposed Project are fully consistent with the SREP IP objectives and CREF operational design.

6. **Progress:** The ADB Board of Directors approved the project in July 2014. AEPC has recruited consultants for implementation support. The project is progressing reasonably well.

IBRD Extended Biogas Program

7. **Description:** The SREP Extended Biogas project is designed to contribute to the effective development of a commercially viable biogas sector. The proposed project will have a very important Technical Assistance (TA) component (\$1m) to strengthen the capacity of diverse stakeholders involved in the nascent large-scale biogas sector in Nepal. It will also have an investment component (\$6.9m) to be reimbursed by the Alternative Energy Promotion Center (AEPC), the implementing agency for the project, for capital-cost buy-down support provided under GoN policy, and this SREP investment support will be paid only for plants that are independently verified to be working after commissioning. In a nutshell, SREP funds will support the competitive identification of investors and will enhance the capacity of Nepali companies whose proposals are competitively selected. The financial support will be only up-front, but the preceding capacity building (throughout the sector) is designed to ensure that there is no need for further ongoing support, as the projects will be screened at the beginning for reliable commercial viability.

8. **Rationale:** Large biogas plants and associated mature technological upgrades in rates of recovery, enrichment to improve methane content, and efficient storage of biogas are all common in Nepal's neighboring countries (India, China, Bangladesh), but have not yet been introduced to Nepal. In an environment where private enterprises, as well as municipalities, continue to struggle with the high costs of imported fossil fuels while toiling to manage their waste in a responsible manner, the SREP Extended Biogas project will expand the size, product and customer range of the country's biogas program, delivering savings in avoided purchases of commercial fuels and generating positive externalities from reduced pollution of the land, air and water by recycling of waste into biogas.

9. **Progress:** The GoN and the World Bank successfully concluded Negotiations for the SREP Extended Biogas project on June 6, 2014. The World Bank's Board subsequently approved the Grant Agreement for the project on August 27, 2014, and it was executed by the Government of Nepal and the World Bank on November 24, 2014. In parallel, AEPC has developed a set of robust protocols and guidelines, encapsulated in the Project Operational Manual, to ensure that transparency and inclusion are paramount in the financing of sub-projects. The public launch event for the project was held on February 3, 2015; about 20 sub-projects are at varying stages of readiness (e.g. feasibility study completed) along with another 40-50 expressions of interest already in the pipeline.

Private Sector On-grid Small Hydropower Development

10. **Description:** SREP funds were to be utilized to develop a SHP investment structure which would crowd-in financing activities of pre-selected Nepalese credit institutions ("Partner Banks"). The investment structure was designed to mitigate financial barriers faced by the Partner Banks by deploying innovative capital and risk-sharing solutions including but not limited to: Credit Facilities, Risk-Sharing Facilities/Guarantees, and Foreign Exchange and Interest Rate Risk Coverage.

11. **Rationale:** The significant demand/supply imbalance for long term financing has been a major barrier to scaling-up SHP development in Nepal. The global financial crisis has led to limited liquidity and ability by local Commercial Banks to provide long-term financing for SHP projects. The SREP co-financed SHP Investment Structure was intended to build financing

capacity and to mobilize private sector funding sources to bring innovative financing solutions to the SHP sector, facilitating development and scaling-up of the SHP sub-sector in Nepal.

12. **Progress:** The SHP program was approved conditionally by the SREP Sub-Committee in November 2012 with a final confirmation in March 2013. At the time the Program was proposed, liquidity in Nepal's financial sector was very tight and banks were unable provide long-term financing for SHP projects. Liquidity in the banking system has improved considerably over the last two years, the Nepal Rashtra Bank has begun to provide re-financing for SHPs, and some Nepali commercial banks have moved into renewable energy financing including for small hydropower. As a result, it appears that there is limited value addition to be provided by SREP funds through the ADB-PSOD and IFC SHP financing program, and both teams have decided not to pursue the program further.

III. CIRCUMSTANCES AND RATIONALE FOR INVESTMENT PLAN UPDATE

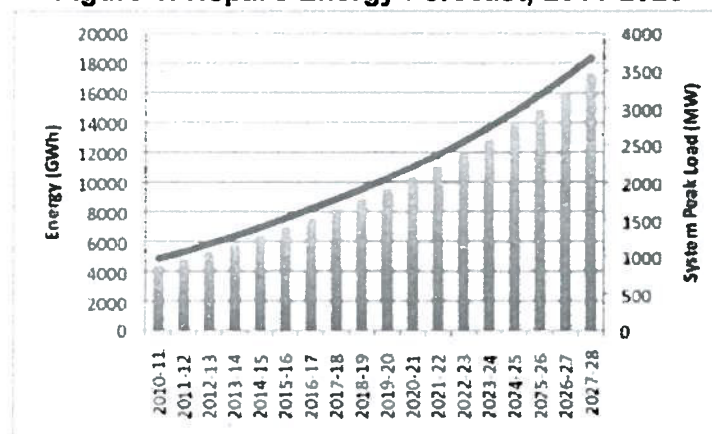
13. Energy demand in Nepal continues to grow at about 10% per year, outpacing new electric power capacity additions and energy output. Installed generation capacity is 782 megawatt (MW), versus peak demand of 1200 MW in late 2014; the energy demand-supply gap is summarized in Table 1. More than 1300 MW of new hydropower capacity is under construction, and by 2017-18 a wet-season power surplus is expected. However, power deficits during the dry season are projected to persist, with a shortage of up to 600 MW in 2022-23. Electricity demand is forecast to reach about 3,866 MW in year 2027-28 (medium growth scenario) which is an increase of some 2,665 MW from current peak demand. The energy forecast indicates energy output of 18,086 Gigawatt-hours (GWh) by 2027-28, as shown in Figure 1. The national electricity shortage will become more severe if energy demand is not addressed in a timely and effective manner.

Table 1: Electricity Gap, 2013

Annual Peak Demand	1201 MW
Dry Season Generation	675 MW
Deficit (Gap)	526 MW
Annual Total Energy Demand	5,909 GWh
Generated Energy from Available Source	3,559 GWh
Annual Energy Gap	2,350 GWh

GWh=Gigawatt-hours, MW=megawatt

Figure 1: Nepal's Energy Forecast, 2011-2028



14. The investment requirements for new hydropower development remain substantial as a mix of run-of-river and storage projects are necessary to build up a year-round daily surplus: total investment required is on the order of several billions of dollars over the next 15-20 years. ADB and the World Bank Group, including IFC, are supporting large-scale hydropower development, grid expansion and upgrades, and other efficiency improvements. **GoN recognizes that RE resources other than hydropower are underdeveloped relative to potential and has requested ADB to support utility-scale solar development.**

15. RE development remains a priority program of the GoN. The low coverage of the national grid, increasing demand for rural electrification, appropriateness of decentralized energy systems in sparsely populated rural areas, availability of alternative energy resources, and the need to respond to climate change are some of the key drivers for increasing investment in the RE sector. GoN's goal for the next 20 years is to increase the share of RE from less than 3% to 10% of the total energy supply, and to increase the access to electricity from alternative energy sources from 10% to 30%. The policy and sector frameworks that supports RE development as discussed in the original IP remain in effect. Policy framework and cross-sectoral measures include the following key documents:

- RE Plans as Part of National Plans since 1985
- Rural Energy Policy 2006
- Subsidy Policy for Renewable (Rural) Energy 2013
- Subsidy Delivery Mechanism 2013
- Hydro-Power Development Policy 2001
- Electricity Act 1992 of Nepal
- Other relevant energy sector policies include: Water Resources Strategy 2002 and National Water Plan 2005; National Electricity Crisis Resolution Action Plan 2008; Reports of the Task Force for Generating 10,000 MW Hydropower in 10 Years (2011-2020) and 25,000 MW Hydropower in 20 Years (2011-2030); and National Energy Strategy 2009 (*draft*)

16. In order to address energy shortages, investment in other RE resources needs to be expanded and accelerated in parallel with hydropower development. The proposed changes to the SREP IP will support broader RE resource development, specifically solar power.

IV. PROPOSED CHANGES TO THE INVESTMENT PLAN

17. The IP presented the following strategic uses for SREP: (i) private sector on-grid small hydropower (SHP) development; and (ii) public sector mini and micro energy development. The components and SREP allocations as of January 2015 are presented in Table 2. The strategic rationale for SREP intervention in the energy sector remains the same as the original IP: energy supply and access to energy remain as critical constraints to inclusive growth, and both on- and off-grid energy systems are required.

18. The proposed changes will retain and reprogram the funds from the original allocation for private sector SHP investments to a public-private partnership for on-grid utility scale solar power development. The proposed reallocations are shown in Table 3, and the revised plan is presented in Table 4. The financing plan endorsed in March 2012 is presented in Table 5, and the revised plan is presented in Table 6.

Table 2: Investment Plan Components as of January 2015 (US\$ million)

Components	Projects	Sector	SREP Fund	Sub-Committee Approval	MDB Approval	MDB
Component 1: Small hydropower development	On-grid small hydropower development	Private	10.0	Oct 2012	--	ADB-PSOD
		Private	10.0	Oct 2012	--	IFC
Component 2: Mini and micro initiatives	Off grid Rural Electrification Through Renewable Energy	Public	11.2	May 2014	Jul 2014	ADB
	Extended Biogas Program	Public	7.9	Feb 2014	Aug 2014	IBRD

Source: Joint Mission, January 2015.

ADB=Asian Development Bank, ADB-PSOD=Asian Development Bank Private Sector Operations Department, IBRD=International Bank for Reconstruction and Development, IFC=International Finance Corporation, MDB=multi-lateral development bank

Table 3: Proposed Reallocation of SREP Resources (US\$ million)

MDB / Program	SREP Funding (March 2012)	SREP Funding Reallocation			SREP Funding (Revised IP 2015)
		IBRD	ADB	IFC	
ADB Off grid Rural Electrification Through Renewable Energy	12				12
IBRD Extended Biogas Program	8				8
IFC On-grid hydropower development	10			(-) 10	0
ADB-PSOD On-grid small hydropower development	10		(-) 10		0
ADB On-grid Solar Power Program	n/a		(+) 20		20
Total	40		0		40

Source: MDB Joint Mission, January 2015

ADB=Asian Development Bank, ADB-PSOD=Asian Development Bank Private Sector Operations Department, IBRD=International Bank for Reconstruction and Development, IFC=International Finance Corporation, IP=Investment Plan

Table 4: Updated Investment Plan Components March 2015 (US\$ million)

Components	Projects	Sector	SREP Fund	Sub-Committee Approval	MDB Approval	MDB
Component 1: On-grid Utility-scale Solar Development	Public Private Partnership for Solar Development	Public	20	Q3 2015	Q4 2015	ADB
Component 2: Mini and micro initiatives	Off grid Rural Electrification Through Renewable Energy	Public	11.2	May 2014	Jul 2014	ADB
	Extended Biogas Program	Public	7.9	Feb 2014	Aug 2014	IBRD

Source: Joint Mission, January 2015.

ADB=Asian Development Bank, IBRD=International Bank for Reconstruction and Development, MDB=multi-lateral development bank, Q3=third quarter, Q4=fourth quarter

Table 5: Financing Plan Endorsed March 2012 (US\$ 000)

Investment	GoN	SREP Initial Allocation	RREP	Other	Private Sector Equity	Total	% of Total
Small hydro power		20,000		58,750	33,750	112,500	22
Mini & micro hydro	20,000	7,000	60,401	21,265	26,667	135,333	26
Solar home systems	18,750	5,000	56,395	19,855	25,000	125,000	24
Biogas	20,000	8,000	56,703	19,963	26,667	131,333	26
Other RETs	1,500		6,500		2,000	10,000	2
Total	60,250	40,000	179,999	119,833	114,084	514,166	100

Source: Nepal SREP Investment Plan endorsed in March 2012.

GoN=Government of Nepal, RREP=Rural and Renewable Energy Program, RETs= renewable energy technologies, SREP=Scaling Up Renewable Energy Programme for low-income countries

Table 6: Financing Plan – Revised March 2015 (US\$ 000)

Investment	GoN	SREP Allocation	RREP	Other / MDB	Private Sector Equity	Total	% of Total
Mini & micro hydro	20,000	5,000	60,401	21,265	26,667	133,333	27
Solar home systems	18,750	5,000	56,395	19,855	25,000	125,000	25
Biogas	20,000	10,000	56,703	19,963	26,667	133,333	27
Other RETs	1,500		6,500		2,000	10,000	2
On-grid solar	5,000	20,000		70,000 ^a	5,000	100,000	20
Total	65,250	40,000	179,999	131,083	85,334	501,666	100

Notes: ^a Includes ADB program loan of \$50 million and other cofinancing of \$20 million.

GoN=Government of Nepal, RREP=Rural and Renewable Energy Program, RETs= renewable energy technologies, SREP=Scaling Up Renewable Energy Programme for low-income countries

V. POTENTIAL IMPACTS OF PROPOSED CHANGES ON INVESTMENT PLAN OBJECTIVES

19. The proposed changes will preserve the integrity of the IP, while acknowledging the macro-economic challenges and operational constraints in the financial sector, the SHP subsector, other RE development prospects, recent cost reductions in solar power systems, and the expanding solar supply chain in Nepal and neighboring countries. The updated IP takes a more realistic view of sustainable energy prospects over the next 12 – 18 months. The assessment of potential impact of the proposed changes on achieving the objectives and targets of the original IP are summarized in Table 7. Results indicators are summarized in Table 8. Risks and mitigation measures of the updated IP are summarized in Table 9.

Table 7: Assessment of Proposed Changes

SREP Investment Criteria	Original Investment Plan	Revised Investment Plan 2015
Increased RE capacity and increased access to energy via RE	Strategic focus on (i) mini and micro energy systems for off-grid applications, and (ii) private sector grid-connected small hydropower development. Aggregate RE capacity of 90 MW and energy output of 335 GWh/y directly supported by SREP.	Strategic focus on (i) mini and micro energy systems for off-grid applications, and (ii) public-private partnership for on-grid utility-scale solar power. Aggregate RE capacity of at least 30 MW and energy output of 82 GWh/y directly supported by SREP.
Low-emissions development	Nepal has a potential competitive and comparative advantage in low-emissions development through technological leap-	Scope of RE development will be expanded to include solar energy resources. This will strengthen Nepal's

SREP Investment Criteria	Original Investment Plan	Revised Investment Plan 2015
	frogging.	opportunities for technological leap-frogging, reducing the need for conventional fossil fuels.
Affordability and competitiveness of RE	Off-grid subprojects will be developed by rural communities based on their ability and willingness to pay, in line with the available incentives provided through the NRREP. On-grid private sector SHP provides electricity at a cost of supply above the average grid mix but lower than back-up diesel generation.	No changes to the mini and micro energy components. New solar power will offset fuel consumption by back-up generation units. Possible higher off-take costs will be offset by complementary investments in grid efficiency improvements and system loss reductions.
Productive use of energy	The off-grid investments will finance directly the enabling energy infrastructure to expand productive end-use of energy. The productive energy use activities are to enhance income and welfare of rural communities by utilization of energy, mainly in agriculture, rural enterprise, health and education. New on-grid capacity provides additional energy for all grid-connected consumers; benefits accrue through direct consumption and reduction of load-shedding.	No direct changes for off-grid consumers, however, longer-term benefits may be realized through reduced cost of delivering off-grid solar capacity as the supply chain expands. On-grid solar output will alleviate the demand-supply gap, improving reliability of electricity supplies and expanding output for productive end uses.
Economic, social, and environmental development impact	Economic benefits will accrue from access to energy for residential and commercial uses, especially for new enterprises using RE. Social benefits will flow from access to electricity for lighting, refrigeration, and other uses as noted above. Environmental benefits will accrue from reduced use of fossil fuels (mainly diesel and kerosene) and reduced reliance on traditional biomass (agricultural waste, dung, and wood) for cooking.	New solar output will ultimately reduce consumption of petroleum fuels for back-up generation. Direct economic benefits result from reduced foreign exchange outflow for petroleum fuel purchases. Environmental and public health benefits will also accrue from reduced petroleum fuel combustion, especially from black carbon and PM2.5 emissions.
Economic and financial viability	The off-grid subprojects will be economically viable based on avoided costs of fossil fuel and traditional biomass energy supplies. On-grid SHPs to be commercially viable with credit enhancements provided by concessional finance.	New solar projects will be developed on a commercial basis.
Leveraging of other financing	In addition to the MDB financing, government counterpart funds, and community contributions, the off-grid sub-projects complement funding of the NRREP, and leverage will be expanded via the CREF when it becomes operational.	Leveraging of SREP funds is expected to increase compared to the original IP.
Gender	Off-grid subprojects are mostly effective gender mainstreaming in nature; benefits will accrue mainly to women, who are typically responsible for cooking and gathering of traditional biomass for fuel.	Potential gender benefits to be assessed during development of new projects.
Co-benefits	Co-benefits will be realized from reduced indoor air pollution and reduced stress on forest resources.	Co-benefits will be expanded via new solar projects, mainly in form of reduced air emissions from back-up diesel generation.

Source: Joint MDB mission, January 2015

CREF=Central Renewable Energy Fund, GWh=Gigawatt-hours, MDB=multilateral development bank, MW=megawatt, NRREP= National Rural Renewable Energy Program, RE=renewable energy, SHP=small hydropower, SREP= Scaling Up Renewable Energy Programme for low-income countries

Table 8: Results Framework

Results	Indicators	Baseline	Targets	Means of Verification
SREP Transformative Impacts				
Support low carbon development pathways by reducing energy poverty and/or increasing energy security	Electricity access rate	65% in 2013 ^a	92% in 2025 ^a	AEPC and NEA annual reports
	RE capacity (MW) and annual electricity output (GWh/y)	Capacity: 113 MW ^b Output: 452 GWh/y ^b	Capacity: 130 MW ^c Output: 281 GWh/y ^c	AEPC and NEA annual reports
	Increased annual public and private investments (USD) in targeted subsector(s)	> \$ 25 million ^d	\$ 377 million ^e	AEPC and NEA annual reports
SREP Program Outcomes				
1. Increased supply of renewable energy	Annual electricity output from RE as a result of SREP interventions (GWh)	144 GWh/y ^f	82 GWh/y ^g	AEPC Annual Reports
2. Increased access to modern energy services	Number of women and men, businesses and community services benefiting from SREP interventions	> 220,000 households with biogas and/or solar ^h	200,000 people accessing biogas energy services, mini-micro energy systems, and on-grid solar energy ^g	AEPC Annual Reports

Notes:

^a Values from ADB SASEC Project, Report and Recommendation of the President, 2004

^b Installed capacities: SHP 76.7 MW, mini- & micro-hydro 29.7 MW, solar home systems 6.4 MW; energy output assumes 4000 hours/year operation at rated capacity

^c Total capacity assumes SREP supported investments are replicated for a total of (a) 30 MW from micro-/mini-energy investments, and (b) 100 MW of solar PV. Energy outputs assumes (a) 120 GWh/y from micro-/mini-energy, (b) 131 GWh/y from ADB solar project (100 MW x 8760 h/y x 0.15 = 131.4 GWh/y), and (c) 30 GWh/y from World Bank biogas project.

^d Prior investment mainly via World Bank and other donors through AEPC

^e Includes SREP funds of \$40 million plus expected total leverage of \$131.4 million for ADB micro-/mini-energy project, \$126.4 million for World Bank biogas project, and \$80 million for new ADB solar project

^f RE output only from mini-/micro- energy and solar home systems: 36.1 MW @ 4000 h/y = 144 GWh/y

^g Assumes output only from SREP-financed facilities: micro-/mini-energy systems 4.8 MW @ 4000 h/y (19.2 GWh/y); 25 MW solar @ 15% output (32.85 GWh/y); and 30 GWh/y from biogas-based electricity. Total energy of 82 GWh/y @ 400 kWh/person/year = 205,000 people

^h Baseline from SREP IP endorsed in November 2011: 227,039 households using solar home systems and 238,587 domestic biogas installations

Table 9: New Program/Project Risks and Mitigation Measures

Risk	Mitigation Measure	Residual Risk
<p>Policy and regulatory framework: No formal policies are in place for on-grid solar</p>	<ul style="list-style-type: none"> • Different business models are being explored for solar installations. The initial sub-projects will be "inside-the fence" captive generation units which do not require a power purchase agreement or new policy directives. • Solar policy formulation will be driven in part by market development rather than vice versa. Policy evolution will be supported through agreed sector reforms under the program loan modality. 	M/L
<p>Technology: Limited experience with solar systems larger than 100 kW</p>	<ul style="list-style-type: none"> • Solar technology installation and maintenance know-how will be included in goods and supply contracts. • Solar installations will take advantage of existing supply chains and expertise in the region. 	L
<p>Development Impact: The scale of initial installations will be modest compared to current demand-supply gap.</p>	<ul style="list-style-type: none"> • The sector reform agenda will promote replication and scale up of solar installations to reduce the demand-supply gap; the ADB project will include complementary grid efficiency improvements and loss reductions which will help close the demand-supply gap. • Technical assistance will be provided to develop new business models to support rapid expansion of solar capacity and output. 	M/L
Overall risk after mitigation	Low	

L=Low, M=Medium

APPENDIX 1: PUBLIC PRIVATE PARTNERSHIP FOR SOLAR DEVELOPMENT (ADB)

Problem statement

1. Development of hydropower has not proceeded at a sufficient pace to meet demand growth, resulting in a power shortfall of about 500 MW at peak demand times.³ A wet-season power surplus is expected by 2017, but a dry season shortage of up to 600 MW is projected through year 2022-23. There are around 33,000 generator sets in Nepal, with aggregate capacity of about 500 - 800 MW.⁴

2. Of the potential renewable energy (RE) resources in Nepal, solar appears to be the most promising with respect to scale and location of potential applications, resource and technology risks, and speed of deployment.⁵ The technical solar energy potential is estimated at 2100 MW; at 15% output the energy produced would be 2759 gigawatt-hours per year (GWh/y), which represents 42% of projected electricity demand in 2014-15.⁶ Upfront capital costs, lack of commercial financing, grid interconnection issues, and perceived cost disadvantages pose critical obstacles for widespread solar deployment at megawatt (MW) scale.

Proposed contribution to initiating transformation

3. The Government has requested ADB to support 100 MW of on-grid solar capacity. The proposed project will accelerate solar energy development by facilitating at least 25 MW of utility-scale development. The project will support installations which can be constructed and commissioned as fast as possible to address the chronic power deficit: candidate sites are industrial estates, Nepal Electricity Authority (NEA) sites with available land, telecommunications towers, and other sites with sufficient land area such as airports (active and abandoned).⁷ At least three types of installations will be piloted: (i) captive generation at industrial estates, reducing diesel-based generation; (ii) semi-captive generation, with surplus power delivered to the grid; and, (iii) conventional installations delivering power directly to the grid. For captive generation, SREP funds would be utilized to take out up-front development risks; for installations selling power to the grid, SREP funds could cover part of the cost difference between solar output and NEA's average cost of supply.

4. The proposed project along with an ongoing project funded by the World Bank, comprise an advanced market commitment to develop at least 50 MW of grid-connected solar capacity. The project will include parallel investments in transmission and distribution system loss reductions and efficiency improvements, which will offset part of the cost difference between on-grid solar and the grid mix (which is about \$0.10/kWh). The SREP funds will cofinance a program loan from ADB, so that the physical investments are synergistic with energy sector reforms. The SREP funds will be deployed as output-based aid, i.e., disbursed based on achievement of solar development milestones. The program loan modality will support policy evolution and capacity development for instruments such as feed-in tariffs, net metering regulations, new power purchase agreements, and other incentives; however, the initial solar installations will be captive generation units that do not require these policy interventions in order to proceed and succeed.

Implementation readiness

5. The ADB Country Operations Business Plan 2014-16 includes an energy sector program loan for 2016, which will be advanced for Board approval in the fourth quarter of 2015. SREP funding approval is expected by the third quarter of calendar year 2015.

³ NEA annual report, 2013.

⁴ Estimates are based on records of genset sales and anecdotal reports from various donors and Nepali companies.

⁵ Biomass, mini- and micro hydro power, off-grid solar, and wind are already being addressed under various programs supported by the National Rural Renewable Energy Program (NRREP) and SREP.

⁶ An additional 1800 MW may be developed using concentrating solar thermal power technologies. Wind potential is estimated at 3000 MW, which could produce 7884 GWh/y assuming 30% load factor. Solar and wind potentials are from UNEP/GEF. 2008. *Solar Wind Energy Resource Assessment*.

⁷ These types of installations will avoid land acquisition and resettlement, minimizing the upfront development time and transaction costs. Large-scale rooftop installations will also be considered, e.g., at industrial facilities, hotels, and office buildings (both private and public buildings).

Rationale for SREP financing

6. Upfront capital costs, technology risks, and off-take risks are major barriers to commercial solar development, which can be addressed with concessional financing. The project will directly support growth of the solar supply chain through renewable energy equipment and service providers, and facilitate removal of psychological barriers via price discovery while indirectly crowding-in private sector participation. The sector reforms will promote policy evolution to create a viable self-sustaining market for solar energy services. Table A1.1 presents performance and results indicators.

Table A1.1: Results Indicators and Targets

Results	Indicators	Baseline	Targets	Means of Verification
SREP Project Outcomes				
1. Increased supply of renewable energy	Installed capacity	0	>25 MW	Project review missions
	Design output	0	36.5 GW/h	
2. Increased access to modern energy services [on-grid solar power]	Number of women and men, businesses, and community services benefiting from SREP interventions	0	91,250 people ^a or around 19,400 households	
3. Increase in investments from private sector in renewable energy	USD\$ invested	0	US\$ 50 million by 2018	Annual reports of energy service companies, technology vendors
4. Greenhouse Gas emissions mitigated	CO2 emissions reduction	0	> 25,000 tCO ₂ e/year by 2020 ^b	MOSTE
SREP Inputs				
5. Capacity building activities	Workshops/training on solar installation, operations and maintenance for consumers, service providers, Nepal Electricity Authority	0	5 training workshops conducted by 2018	Project implementation reports and ADB review missions
	Workshops on solar development policy, tariff setting, feed-in tariff design, power purchase agreements, etc.		5 workshops conducted by 2018	

Notes: ^a Calculated based on 400 kWh per person per year consumption target.

^b Assumes 0.7 tCO₂e/MWh

Financing plan

Source	Amount (\$ million)
Government of Nepal	5
ADB (ADF loan)	50
European Union (grant) ^a	20
Other cofinancing / private sector	5
SREP	20
TOTAL	100

Note: ^a Grant cofinancing to be confirmed during project processing.

Project preparation timetable

Milestone	Date
SREP Updated IP Endorsement	Q1 / 2015
SREP funding approval	Q3 / 2015
ADB Board consideration	Q4 / 2015

APPENDIX 2: SUMMARY OF STAKEHOLDER OUTREACH

1. During the January 2015 Joint mission, two workshops were held to solicit feedback from all stakeholders (including civil-society representatives) to discuss the status and proposed changes to the IP (a list of participants is included in the Appendices). A separate meeting was also held with development partners. Some stakeholders expressed interest in a greater focus on energy access which is a core objective of Nepal's socio-economic development, suggesting that more investment in biogas (especially as a replacement for imported LPG for cooking) and improved cookstoves should be considered. Solar was noted as good for off-grid applications but problematic for on-grid energy supply, due in part to perceived cost disadvantages. As off-grid applications are already covered by the NRREP and ADB and IBRD projects, the possible value addition from increasing SREP support in these areas is not compelling. There were no specific objections voiced over the proposed changes. Discussions on the proposed changes with development partners (that included local representatives from some SREP Sub-Committee member countries) was also well-received.

2. A forum was held with the representatives from the Independent Power Producers Association of Nepal (IPPAN), financial institutions, solar technology and service providers, and consulting services enterprises. There is consensus on potential opportunities for solar development of at least 100 MW. There is a need for business models to complement the traditional on-grid Independent Power Producers (IPP) approach, e.g., captive solar generation at industrial facilities to reduce diesel fuel consumption, and there is a strong case for grant funds to overcome first-mover risks.

Stakeholder Workshop Participants

1. Mr. Aananta Pandey, Energy Expert
2. Mr. Akhanda Sharma, Ministry of Science Technology and Environment
3. Ms. Anuja Shrestha, Winrock International
4. Mr. Ashish Shrestha, the World Bank
5. Mr. Bhuban Karki, Ministry of Finance
6. Mr. Balaram Shrestha, Biogas Support Program- Nepal
7. Ms. Barsha Pandey, the World Bank
8. Ms. Barsha Shrestha, Clean Energy Development Bank Limited
9. Ms. Bibhha Pradhan, Winrock International
10. Ms. Bobby Thapa, Winrock International
11. Mr. Bijaya Bahadur Pradhan, Energy Expert
12. Mr. Binod Shrestha, Winrock International
13. Mr. Dan Millison, Asian Development Bank (Consultant)
14. Mr. Devendra Adhikari, Asian Development Bank (Consultant)
15. Mr. Dilli Ghimire, Nepal Association of Community Electricity Users Nepal
16. Mr. Gopal Gurung, Japan International Cooperation Agency
17. Mr. Gyanendra Lal Pradhan, Federation of Nepalese Chamber of Commerce and Industries
18. Mr. Hari Gopal Gorkhali, Centre for Rural Technology
19. Ms. Itnuma Subba, Energy Development Council
20. Mr. Jan Eriksen, the Royal Norwegian Embassy
21. Mr. Jiwan Acharya, Asian Development Bank
22. Ms. Joyita Mukerjee, International Finance Corporation
23. Mr. Kailash Pradhan, Embassy of Japan
24. Mr. Kenichi Yokoyama, Asian Development Bank
25. Mr. Khadga Bisht, Independent Power Producers Association Nepal
26. Mr. Mahabir Pun, National Innovation Centre
27. Mr. Manu Binod Aryal, Central Renewable Energy Fund/ Alternative Energy Promotion Centre
28. Mr. Naba Raj Dhahal, Winrock International
29. Mr. Niraj Acharya, Energy Expert
30. Mr. Niraj Subedi, KfW

31. Mr. Prakash Aryal, Alternative Energy Promotion Centre
32. Ms. Preety Bhandari, Asian Development Bank
33. Mr. Prithvi Gyawali, Central Renewable Energy Fund
34. Mr. Priyantha Wijayatunga, Asian Development Bank
35. Mr. Pushkar Manandhar, Asian Development Bank
36. Mr. Rabin Shrestha, the World Bank
37. Mr. Raju Laudari, Alternative Energy Promotion Centre
38. Mr. Ram Manohar Shrestha, Profession, Asian Institute of Technology
39. Mr. Ram Prasad Dhital, Alternative Energy Promotion Centre
40. Mr. Ram Prasad Lamsal, Ministry of Science Technology and Environment
41. Ms. Ranjana Budhathoki, Winrock International
42. Mr. Rudra Khanal, Alternative Energy Promotion Centre
43. Ms. Salony Rajbhandari, Energy Expert
44. Mr. Samir Thapa, Alternative Energy Promotion Centre
45. Mr. Sandip Joshi, Winrock International
46. Mr. Sekhar K C, Korean International Cooperation Agency
47. Mr. Shanker Khagi, United States Agency for International Development
48. Mr. Sher Singh Lama, Winrock International
49. Mr. Shiva Timilsina, Energy Expert
50. Mr. Sopan Bishta, UNCDF/Alternative Energy Promotion Centre
51. Mr. Sourab Rana, Japan International Cooperation Agency
52. Ms. Sudipta Shrestha, Winrock International
53. Mr. Suman Basnet, United Nations Development Program
54. Mr. Surendra Rajbhandari, Nepal Electricity Authority
55. Mr. Suresh Kumar Dhungel, Renewable Energy Test Station/NAST
56. Mr. Suyog Shrestha, Ace Bank Limited
57. Mr. Toby Couture, E3 Analytics, National Renewable Energy Laboratory, USA
58. Ms. Ujin Shin, Korean International Cooperation Agency

Independent Power Producers (IPP) Round Table Forum Participants

1. Mr. Ashish Pradhan, Next Energy Venture
2. Mr. Binod Ghimire, Sunshine Energy Pvt. Limited
3. Mr. Binod Shrestha, Winrock International
4. Mr. Binod Thapa, Lasers Energy
5. Mr. Bishal Thapa, Lotus Energy
6. Ms. Bobby Thapa, Winrock International
7. Mr. Dan Millison, Asian Development Bank (consultant)
8. Mr. Devendra Adhikari, Asian Development Bank
9. Mr. Dipan Raghubanshi, LS Solar Pvt. Limited
10. Mr. Indra Khanal, Urja Ghar Private Limited
11. Mr. K R Khanal, Ultra Group Nepal
12. Mr. Kamal Kandel, Tourism Development Bank Limited
13. Mr. Kiran Gautam, Topsun Energy
14. Mr. Kumar Pandey, Independent Power Producers Association Nepal
15. Mr. Priyantha Wijayatunga, Asian Development Bank
16. Mr. Pushkar Manandhar, Asian Development Bank
17. Mr. Raj Kumar Thapa, Solar Solutions
18. Mr. Rajiv Poudel, Next Energy Venture
19. Mr. Ram Hari Shrestha, PSS Rev
20. Mr. Rudra Khanal, Alternative Energy Promotion Centre
21. Ms. Preety Bhandari, Asian Development Bank

22. Mr. Santosh Rai, Alternative Energy Promotion Centre
23. Mr. Sandip Joshi, Winrock International
24. Mr. Sun Nawbanja, ATTS Associates
25. Mr. Surendra Raj Bhandari, Nepal Electricity Authority
26. Mr. T P Adhikari
27. Mr. Uday Adhikari
28. Mr. Uma Kanta Khanal, Suryodaya Urja
29. Mr. Yub Raj Guragain, Civil Bank Limited
30. Mr. Zhang Lei, Asian Development Bank