Cover Page for Project/Program Approval Request			
1. **Country/Region**:	Nepal	2. **CIF Project ID#**:	(Trustee will assign ID)
3. **Source of Funding:**	☐ FIP	☐ PPCR	☒ SREP
4. **Project/Program Title:**	*South Asia Subregional Economic Cooperation Power System Expansion Project - Additional Cofinancing*		
5. **Type of CIF Investment:**	☒ *Public*	☐ Private	☐ Mixed
6. **Funding Request in million USD equivalent:**	*Grant: $20 million*	*Non-Grant:*	
7. **Implementing MDB(s):**	*Asian Development Bank*		
8. **National Implementing Agency:**	*Nepal Electricity Authority*		
9. **MDB Focal Point and Project/Program Task Team Leader (TTL)**:	*Headquarters- Focal Point:* *Mr. Jiwan Acharya* *(jacharya@adb.org)*	*TTL:* *Mr. Aiming Zhou* *(azhou@adb.org)*	

10. **Project/Program Description** (including objectives and expected outcomes)**:**

This proposal refers to the Component I On-grid utility scale solar development – public private partnership for solar development of the revised Nepal SREP Investment Plan (IP) endorsed by the SREP Subcommittee (SC) in April 2015. The 2015 revised Nepal IP reprogrammed $20 million from private sector small hydropower development projects led by the Asian Development Bank - Private Sector Operations Department (ADB-PSOD) and the International Finance Corporation (IFC) to a public-private partnership for on-grid utility scale solar power development.

The Government of Nepal requested the $20 million SREP grant fund be mobilized as additional financing to the South Asia Subregional Economic Cooperation (SASEC) Power System Expansion Project and expand its scope to include the utility scale solar power development. The on-going project has an estimated total financing of $440.00 million approved by the SREP SC and ADB Board of Directors on 09 May 2014 and 04 July 2014, respectively. It was made effective on 15 January 2015 and targets completion by 30 June 2022. The project aims to assist Nepal's energy sector development by facilitating (i) expansion of domestic power transmission capacity, (ii) power exchange with India, (iii) augmentation and expansion of the distribution networks, and (iv) mini-grid-based renewable energy access in rural areas. It has four outputs: (1) increased power transmission capacity; (2) improved and expanded power distribution network; (3) increased mini-grid-based renewable energy systems in remote areas; and (4) enhanced capacity development support to Nepal Electricity Authority (NEA) and Alternative Energy Promotion Center (AEPC).

SREP is currently supporting output 3 - the mini-grid based renewable energy systems in off-grid, rural communities, which covers installation of up to 4.8 megawatt (MW) of aggregated mini hydro-electric power plants and up to 0.5 MW of aggregated mini-grid based solar or solar/wind hybrid systems; and output 4 - capacity development support to AEPC, including project management support, institutional capacity enhancement, and parallel livelihood development

activities in the project area.

The proposed *SASEC Power System Expansion Project – Additional Financing* will help finance a new output complemented by technical assistance:

(1) Development and installation of utility-scale solar power across multiple sites, with aggregate capacity of at least 25 MW by 2018 (Output 5). Candidate sites are commercial and industrial estates or corridors, NEA sites with available land, active and abandoned airports[1], and sites secured by independent power producers (IPP) and Renewable Energy Service Companies (RESCOs). Various types of installations and business models will be considered: (i) captive generation at commercial and industrial estates, reducing diesel-based generation; this could include aggregated ground-mounted and large-scale rooftop system; (ii) semi-captive generation, with surplus power delivered to the grid; and (iii) conventional IPP installations delivering power directly to the grid.

Solar installations will be developed through a competitive tendering procedure, with Power Purchase Agreements (PPAs) awarded on the basis of best offtake price, which will be the basis for viability gap financing (VGF) payments. The project will support installations that can be constructed and commissioned as fast as possible, preferably by second quarter of 2018.

(2) Technical Assistance (TA) to facilitate project implementation comprising capacity development support to NEA and creation of solar project transaction facilitation. The TA will improve the financial sustainability and capacity of NEA. The transaction facilitation team composed of international and national experts (i.e. solar power engineer, procurement specialists, project management expert, environment and social experts, and financial experts) will assist in preparing "ready-to-build" projects tendered on an off-take tariff basis. The team will ensure that the subprojects are feasible and meet all environmental and social safeguards requirements set by the government and ADB.

Table 1 below shows the financing plan of the on-going project and the proposed SREP additional financing.

Table 1: Proposed Financing Plan

Source	**On-going**	**Additional Financing**	**Total**
ADB	180.00	0.0	180.00
SCF-SREP	11.20	20.0	31.20
Government of Norway	60.00	0.0	60.00
European Investment Bank	120.00	0.0	120.00
Government of Nepal	60.34	0.0	60.34
Communities	8.46	0.0	8.46
Total	**440.00**	**20.00**	**460.00**

[1] These sites are desirable as land is already cleared and relatively flat, no resettlement is required, and grid connections are available. NEA will contact the relevant aviation authorities to identify possible airport sites. These types of installations will avoid land acquisition and resettlement, minimizing upfront development time and transaction costs.

The expected project outcome and impact of the on-going project and the additional financing will be the same. Outcome would be increased capacity of the national power grid and enhanced renewable energy development, and the impact would be increased electricity access and improved power exchange across the border.

The proposed additional financing project is aligned with 2013-2017 ADB Country Partnership Strategy (CPS) for Nepal which emphasizes the importance of higher capital investments among priority sectors including the energy infrastructure as one of the key strategies to achieve economic growth. Energy sector's central theme of achieving energy security at home and developing energy exports calls for improvement of rural electrification and structural reforms to encourage private sector investment. The 2016–2018 ADB Country Operations Business Plan (COBP) for Nepal highlights sector objective of developing sustainable energy sources and transmission systems to promote access to and use of energy services. The project is prioritized as part of the South Asia Subregional Economic Cooperation Program's Power Generation and Transmission Master Plan and Regional Cooperation Business Plan, 2014–2016.

11. **Consistency with Investment Criteria[2]:**

Increased RE capacity and increased access to energy via RE: Currently, Nepal is experiencing a severe energy crisis. The annual peak power demand of the integrated Nepal power system in 2013 was estimated to be 1,095 megawatts (MW), but the system was unable to meet about 375 MW needed during the winter peak. Energy demand was estimated at 5,446 gigawatt-hours, out of which only 4,218 gigawatt-hours were supplied.[3] This gap between demand and supply cannot be reduced without addition of significant generation capacity and augmentation of transmission capacity in the integrated power system. Access to electricity is low with only 65% of the country's households having access to electricity (56% through the national grid and 9% through off-grid solutions) and per capita electricity consumption is 102 kilowatt-hours (KWh) per year, one of the lowest in the world.

The implementation of the proposed additional financing project component will help address the chronic power and fuel supply deficits in the country by further diversifying energy resource mix. The increased share of solar energy will provide a more sustainable energy mix, supporting and complimenting the existing hydropower generation, particularly during low flow seasons (i.e. dry and winter seasons).

The $20 million SREP grant fund will facilitate the installation of solar power generation projects of at least 25 MW grid-connected capacity across multiple sites with 32,850 MWh per year output, assuming 15% capacity factor. Using the World Bank methodology[4] for calculating inferred access to electricity for residential use from power generation projects, the proposed project will be able to support and improve access to electricity for an estimated of 267,000

[2] Please provide the information in the cover page or indicate page numbers in the accompanying project/program document where such information can be found.

[3] Nepal Electrical Authority. 2013. *A Year In Review: Fiscal Year 2012/2013*. Kathmandu.

[4] https://www.openknowledge.worldbank.org/bitstream/handle/10986/17370/853760BRI0ADD00for0collection0title.pdf?sequence=1

people, of which half of this are new customers and the other half are existing customers. This is about 53,400 household beneficiaries[5].

The methodology and assumptions used for the inferred access: Solar capacity of 25 MW with 32,850 MWh[6] expected annual energy output. Based on the pattern from International Energy Agency's (IEA) Energy Balance Database for 2013 report[7], Nepal's residential consumption was 83% and non-residential use was 17%. Using these patterns, the disaggregated amount of electricity generated for non-residential use (i.e. industries, businesses, transport and agriculture) is 5,584.5 MWh/year; while residential consumption is 27,265.5 MWh/year. Nepal's access to electricity and per capita consumption are lower than the 2010 average global access rate of 83% and average global consumption per capita of 685 KWh; given these, it was assumed that new electricity generated for residential use will be allocated equally between new and existing consumers. As a result, the 27,265.5 MWh/year would benefit approximately 267,000 new and existing consumers. Using latest sex ratio (male per 100 female) of 94.2, the project will benefit 129,495 males and 137,505 females.

Low-emissions development: The project supports the implementation of the country's Low Carbon Economic Development Strategy which encompasses promotion and adoption of clean energy technologies to boost economic development in a sustainable manner. The strategy is part of the government's continued efforts towards achieving the low-carbon development path.

At present, diesel has been used as an alternative energy to generate electricity especially during load-shedding. Daily load shedding occurs for up to 14 hours per day in the dry season and six hours per day in the wet season, mainly attributed to increasing demand, low rainfall, no significant addition of new generation and poor utilization of available resources (NEA, 2013). The Nepal Oil Corporation (NOC) reported that the country has been generating around 531 MW of electricity through the use of diesel. Out of the 65,000 kilolitres (kl) total demand for diesel in the domestic market, Nepal utilizes around 26,000 kl diesel for electricity, i.e., about 40% of the diesel is used for electricity generation. [8]

The proposed utility-scale solar development will help reduce greenhouse gas (GHG) emissions which otherwise will be emitted from diesel power generation. Assuming 0.8ton CO2/MWh from diesel generation set, the expected avoided emissions from the solar power generation would be around 26,280 tons carbon dioxide equivalent (tCO2e) annually, this will be in addition to the 18,000[9] tCO2e annually from the on-going mini-grid output.

Affordability and competitiveness of RE: The country has good solar resources. There are 300 sunny days per year with average solar radiation varying from 3.6 to 6.2 kilowatt-hours per meter square (kWh/m2) per day with approximately 4.5 kWh/m2 per day energy intensity. The estimated commercial potential of grid-connected solar power is about 2,100 MW. Compared to

[5] Average number of household members in Nepal is 5.
[6] Power from the solar systems will be used by the users nearby; therefore, T&D was treated as zero loss.
7 International Energy Agency. 2015. Energy Balances of Non-OECD Countries.
[8] http://www.ktm2day.com/2012/05/07/diesel-provides-531-mw-of-electricity/
[9] For the on-grid and mini-grid components of the on-going project, expected emission savings would be 20,000 tCOe annually.

hydropower projects, solar systems can be quickly installed near load centers. Solar radiation is relatively steady year-round and is therefore one of the ideal resources to complement hydropower output during the low-flow season. Grid-connected solar power generation is technically proven worldwide and 640 kW of photovoltaic (PV) capacity is already in operation in Nepal. Under the ongoing project, 0.5 MW of mini-grid-based solar and solar and wind hybrid systems in selected rural communities will be developed.

Nepal has the opportunity to rapidly expand in-country solar supply chains and energy services expertise given its location between India and China with large and growing solar technology and service supply chains. Installed solar PV system costs continue to decline, while installed costs for large hydropower remain relatively stable. Solar PV prices have fallen by 80% since 2008 and are expected to keep dropping (IRENA, 2014). Based on other solar project experiences, the operating and maintenance costs for utility scale solar projects are estimated at $20/kW/year, which covers replacement of balance of system, panel cleaning and maintenance etc. Using these trends, solar PV is expected to reach price parity with conventional hydropower in the foreseeable future.

Further, the proposed utility scale solar power generation will provide clean solutions for captive power generation to the customers. In Nepal, use of diesel generator sets with expensive diesel consumption among household residents and commercial entities is prevalent due to load shedding and poor reliability of grid-connected electricity. Based on a 2015 World Bank study, the levelized cost of electricity generation by diesel, in the absence of sufficient generation in the integrated Nepal power system is NRs 60.1 per kWh (US$ 0.56 per kWh). [10] Utility scale solar is expected to be well below the cost of diesel-based generation. As noted above, 30-40% of total diesel consumption in Nepal is for electricity generation. As supply of solar electricity will replace and reduce the use of imported petroleum fuels, the resulting foreign exchange savings could be used for other important imports.

Productive use of energy: The sustainable, affordable, and reliable power supply will promote productive energy use at the household and community levels. The solar power projects will generate and supply electricity directly to the grid improving the quality of electricity in the country. It will encourage more business and microenterprise development and improve supply to existing commercial consumers.

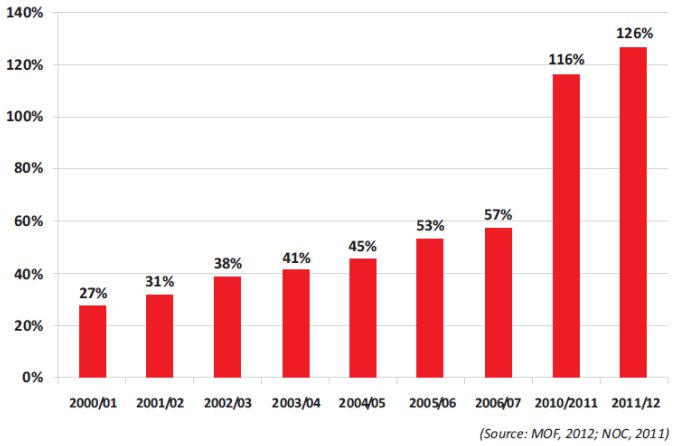
Economic, social, and environmental development impact:

Economic impact: Economic benefits will mainly accrue from the displacement of diesel use for power generation. Figure 1 below shows Nepal's expenditure on import of petroleum as against commodity exports. In 2011/12, expenditure on petroleum imports increased to 126% of export earnings. This means total commodity exports from Nepal are not sufficient to meet the rising demand of petroleum products (NPC, 2013). The additional solar energy capacity in the generation system will help improve the country's foreign exchange earnings by minimizing import of petroleum products.

[10] 2015. World Bank Publication: "Nepal: Scaling Up Electricity Access through Mini and Micro Hydropower Applications -A strategic stock-taking and developing a future roadmap".

The proposed solar development will stimulate domestic economic activities creating new opportunities such as access to markets, skills training, entrepreneurship, and employment.

Figure 1: Import of Petroleum Products Against Commodity Exports, 2000-2012



Social impact: The solar energy output will facilitate improved social services provisions such as hospitals and schools. Women and children, who usually consume considerable time in gathering fuel wood for cooking and heating, will benefit from the affordable and reliable electricity. Time spent in fuel collection can range from one to five hours per day. Electricity at night will give more time for children to study and women to perform other productive tasks. Moreover, it will also allow access to modern communications.

Environmental impact: Environmental benefits will accrue primarily from the reduced use of diesel for captive power generation. It will help improve air quality by avoiding conventional pollutant emissions, including GHG emissions from the use of fossil fuels.

Economic and financial viability: With additional cofinancing, the financial and economic viability of the ongoing project will further improve due to increased solar PV contribution in energy supply mix, reducing the need for high cost electricity from diesel generators. The economic evaluation of the utility-scale solar power project component indicates that the planned investment is economically viable, with an overall estimated economic internal rate of return (EIRR) of 24.4% against an assumed hurdle rate of 12%. The overall project remains viable under all sensitivities examined (i.e. increased capital costs, decreased benefits, and increased operation and maintenance costs) including a combined downside scenario.

Leveraging of other financing: The SREP $20 million additional financing will accelerate development, installation, and operation of at least 25 MW of private sector owned grid-connected, utility-scale solar plants (defined as 1 MW or larger). The new project component is expected to leverage private sector equity and commercial debt estimated at around $70 million.[11]

[11] The economic cost of 1 MW installed solar power capacity in Nepal is about $2.79 million in terms of domestic price numeraire. Exact amount will be determined during the implementation stage.

The SREP fund will be used to cover the viability gap of average power cost of supply and the power purchase agreement price between NEA and the private project developers. It will lead to a benchmark of the solar feed in tariff scheme in the country, which has been proven as a successful policy in many countries. The proposed approach and business model can be replicated and scaled-up elsewhere in the country, resulting in accelerated growth of the solar energy services sector and ultimate delivery of electricity generated by solar PV systems at grid parity.

Moreover, the increased financial sustainability and capacity of NEA, including the expected positive impacts to poverty, environment and social aspects, will improve the enabling environment and encourage more investments in the energy sector from the public and private sectors, thus, further increasing SREP fund leverage.

Gender: *please see item # 13*

Co-benefits:

Energy security: The project will help achieve energy security in the country by diversifying energy sources, increasing capacity to meet electricity demand growth, and improving regional power trade.

Employment opportunities: The project will create direct and indirect job/employment opportunities. Jobs will be available during construction, operation and maintenance of the solar power projects. It is also expected to help build technical skills among locals to operate and maintain the solar power systems. Livelihood and microenterprise development will create more jobs available at the community level.

Improved health: At the household level, indoor air pollution can be avoided. Access to clean energy will have positive impact on health by avoiding fumes from the use of kerosene lamps for lighting, and toxic smoke from poorly functioning stoves which use traditional biomass (such as fuelwood, agricultural waste and dung) for cooking.

12. **Stakeholder engagement[12]:**

The proposed solar development activity was identified through stakeholder engagement, which will continue during project implementation. A series of consultations will be scheduled among project stakeholders particularly during site identification and project development. Stakeholders include private sector, local residents, civil society organizations, local government officials and other public agencies.

13. **Gender considerations[13]:**

The on-going project is classified by ADB as Effective Gender Mainstreaming. It includes a Gender Equity and Social Inclusion (GESI) Plan which details the activities, indicators and targets for each project output. The proposed additional component for utility-scale solar power development will also incorporate gender aspects during the development and implementation of

[12] Ibid.
[13] Ibid.

the projects.

The proposed project will ensure women's participation in all technical and skills training; and women and disadvantaged groups' participation during project consultations and development activities.

14. Indicators and Targets (consistent with results framework):

Core Indicator	On-going: mini-grid	Additional financing: utility-scale solar power development
(a) Installed capacity from renewable energy, as a result of SREP interventions	4.8 MW (4.3 MW of MMH and 0.5 MW of solar and/or wind)	25 MW of solar capacity
(b) Annual electricity output from renewable energy as a result of SREP interventions (GWh/yr)	25,228 MWh	32,850 MWh
(c) Number of women and men, businesses and community services benefitting from improved access to electricity and fuels, as a result of SREP interventions	About 30,500 households or 143,350 people	About 53,400 households or 267,000 people new and existing customers *(inferred access to electricity)* Male: 129,495 Female: 137,505
(d) GHG emissions avoided i. Annual ii. Lifetime (20 years)	 18,000 tCO2e 360,000 tCO2e	 26,280 tCO2e 525,600 tCO2e

Development indicator(s):
- Job opportunities during construction works, and operation and maintenance of the solar power projects

15. Co-Financing:

	Amount (in USD million):	*Type of contribution:*
• Government	n/a	In-kind contributions
• MDB		
• Private Sector (please specify) – IPPS and RESCOs	$70.00 *(exact amount to be determined)*	Equity and commercial debt
• Bilateral		
• Others: Community		

Co-Financing Total:	$70.00
16. Expected Board/MDB Management[14] approval date:	
Expected ADB board approval: March 2016	

FINAL Version
February 26, 2013

[14] In some cases activities will not require MDB Board approval.