

SREP FUNDING PROPOSAL			
Project Approval Request			
1. Country/Region:	<i>Nepal</i>	2. CIF Project ID#:	(Trustee will assign ID)
3. Program Title:	South Asia Sub-regional Economic Cooperation Power System Expansion Project: <i>Rural Electrification Through Renewable Energy</i>		
4. Type of SREP Investment	<i>Private:</i>	<i>Public: X</i>	<i>Mixed:</i>
5. Funding Request (in US million total) for Project:	<i>Grant: USD 11,200,000</i>	<i>Loan:</i>	
6. Approved Preparation Grant	<i>Amount (USD): 580,000¹</i>	<i>Date: 22 April 2014</i>	
7. Implementing MDB:	<i>Asian Development Bank (ADB)</i>		
8. Other MDB Involvement	<i>MDB: n/a</i>	<i>Type of Involvement:</i>	
9. National Project Focal Point:	<i>Mr. Bhuban Karki, Under Secretary, Ministry of Finance Mr. Som Lal Subedi, Secretary, Ministry of Science, Technology and Environment (MoSTE)</i>		
10. National Implementing Agency² for project:	<i>Alternative Energy Promotion Center (AEPC)</i>		
11. MDB SREP Focal Point and Project Task Team Leader (TTL):	<i>HQ-SREP Focal Point for ADB: Mr. Jiwan ACHARYA (jacharya@adb.org)</i>	<i>TTL for ADB: Mr. ZHANG Lei (zlei@adb.org)</i>	
12. Project Description:			
<u>Summary of the Project</u>			
<p>This proposal is for Component II, Mini and Micro Initiatives: off-grid electricity, of Nepal's Investment Plan (IP), which was endorsed by the SREP sub-committee on November 1, 2011.³ The ADB Country Partnership Strategy (CPS) with Nepal has a strong focus on support for sustainable energy to facilitate economic development. ADB's CPS, consistent with programs of the World Bank and other donors, includes large-scale energy infrastructure (hydropower, grid expansion and efficiency improvements) as well as small-scale off-grid and mini-grid renewable energy (RE) solutions such as stand-alone solar power systems; mini, micro, and pico hydropower (MMH); and solar and wind mini-grids (SWM). Separately, several complementary advisory service activities are under active consideration and/or implementation in Nepal's energy sector and electric power subsector.</p> <p>The proposed South Asia Sub-regional Economic Cooperation Power System Expansion Project comprises four outputs: (i) transmission system expansion and upgrade, (ii) distribution system expansion and upgrades, (iii) off-grid renewable energy development, and (iv) capacity building. The Nepal Electricity Authority (NEA) will be the executing agency (EA) for outputs 1 and 2 (the on-grid components); the Alternative Energy Promotion Center (AEPC) will be the</p>			

¹ A grant of \$300,000 was previously utilized for preparation of the Nepal SREP Investment Plan.

² Can be Government agency or private sector firm

³ The IP was revised in March 2012, shifting some financial resources from extended biogas to off-grid electricity. As per the endorsed Investment Plan (IP) the off-grid projects will utilize SREP grant funding.

EA for output 3; and both NEA and AEPC will be EAs for output 4. The AEPC-executed outputs comprise the “Project” for proposed SREP funding. The Project will (i) scale up electricity access using RE-based mini-grids systems, and (ii) ensure sustainable operations through capacity development. The Project will provide access to electricity and facilitate productive end uses of energy at the “bottom of the pyramid” in rural locations which are well beyond the “last mile” of the grid.

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)⁴, 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. As the CREF is still in the initial stage of incorporation and start-up, and its operational date is uncertain, the Project will be implemented in parallel with the NRREP as a virtual window of the CREF.⁵ 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).

The Project will finance enabling RE infrastructure for productive energy end-uses, which is a necessary condition for equitable growth and poverty reduction in off-grid areas. The SREP funds will support:

- (i) Mini-grid based renewable energy systems in off-grid, rural communities, including installation of up to 4.3 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, through the provision of (a) a credit line of \$5 million from ADB’s Special Funds to user communities or developers for mini hydro and (b) a \$10 million grant⁶ from the SREP Strategic Climate Fund (SCF) administered by ADB, and
- (ii) Capacity development support to AEPC. The physical investments will be reinforced and supplemented by capacity building support to AEPC, including project management support, institutional capacity enhancement and parallel livelihood development activities in the project area.

Access to Energy and Potential Energy Resources

Nepal is a low income country with more than 80% of the population living in rural areas. As of 2013, only about 65% of the total population (56% of households) had access to electricity, including through off-grid solutions, and the per capita electricity consumption was around 102 kilowatt hours (kWh) per year, one of the lowest in the world. Electrification is uneven across the country: 93% of the urban households enjoy access to electricity while the grid access rate drops to 49% in the rural areas⁷. Disparity in access to infrastructure including electricity has been

⁴ 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.

⁵ 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 As endorsed, the SREP IP includes \$20 million to be provided as grant to the Government, to be utilized for public sector-led activities including the proposed off-grid Project.

⁷ Central Bureau of Statistics of Nepal. 2011. *Nepal Labor Force Survey 2008*, Kathmandu.

identified as the one of the critical constraints to Nepal's inclusive growth⁸. The households without access to electricity depend largely on kerosene for lighting; some consumers utilize diesel- or gasoline-fired generator sets for electricity. Using diesel, gasoline, and kerosene is not only expensive and polluting but also worsens Nepal's balance of payments situation as all fossil fuels must be imported. Doubling of diesel prices over the past 3 years also seriously hurts household income and businesses⁹. The country and sector context is shown in Figure 1.

The limited area served by the national grid, increasing demand for rural electrification, appropriateness of decentralized energy systems in sparsely populated rural areas, availability of off-grid RE resources¹⁰, and the need to respond to climate change are some key drivers for promotion of RE deployment in rural Nepal. Off-grid RE including both household and village scale systems has become a priority program of Government of Nepal (GoN) as a cost-effective solution to remote, sparsely populated areas unviable for grid extension, while being clean, safe and environmentally friendly¹¹.

In addition to hydropower -- which remains largely undeveloped relative to estimated potential -- solar and wind resources appear to be substantial, yet are largely overlooked due to the higher upfront development costs. Technical solar photovoltaic (PV) potential has been estimated at about 2100 MW, which could produce 2759 gigawatt-hours per year (GWh/y) assuming 15% load factor. Technical wind potential is estimated at 3000 MW, which could produce 7884 GWh/y assuming 30% load factor. This combined solar and wind potential represents approximately 195% of 2012-13 demand of 5446 GWh.¹²

Inadequate supply of electricity has been a major constraint for economic development and poverty alleviation in Nepal, which demonstrates a significant need and clear opportunity for the development of Nepal's RE resources. Despite the apparent economy of scale, large hydropower development has been largely unsuccessful due to several factors including weak governance and institutional structures, lack of institutional arrangements to mobilize the private sector, limited availability of domestic/foreign funds, relatively low retail tariffs, high technical and commercial losses in the transmission and distribution network, a financially stressed public sector utility, and inadequate human resource capacity. As a result, today there is less than 1000 MW of grid-connected hydropower capacity, and less than 1000 MW under construction, out of more than 40,000 MW which is considered to be economically viable. Private sector development of grid-connected small hydropower (1MW - 10 MW per project) is being supported by SREP through a joint program of the ADB Private Sector Operations Department (ADB-PSOD) and the International Finance Corporation (IFC).¹³

In parallel with the grid-connected hydropower development, the Alternative Energy Promotion Center (AEPC), with support of various development partners, has a successful track record of

⁸ Asian Development Bank, United Kingdom Department for International Development, and International Labor Organization. 2009. *Country Diagnostic Studies – Highlights of Nepal: Critical Development Constraints*. Manila London, and Geneva.

⁹ Diesel imports averaged 300 million liters a year in 2001–2007, but increased to 600 million liters by 2010. Diesel prices rose from NRs53/liter to NRs97/liter.

¹⁰ Off-grid Renewable energy includes mini-micro hydropower (5 kW – 1 MW), pico hydropower (less than 5 kW), solar, wind, biogas and biomass. Micro-hydro power, solar and wind potential has been estimated at about 100 MW, 2100 MW and 3000 MW, respectively, which could theoretically meet all of current electricity demand.

¹¹ Government of Nepal. 2011. *Scaling-up Renewable Energy Program Investment Plan for Nepal*. Kathmandu.

¹² Solar and wind potentials are from UNEP/GEF. 2008. *Solar Wind Energy Resource Assessment*. This report also noted that an additional 1800 MW may be developed using concentrating solar thermal power technologies.

¹³ This program was approved by the SREP Trust Fund Committee on 31 October 2012.

delivering off-grid RE solutions including biogas, mini and micro hydropower, and solar PV systems. To demonstrate the potential contribution of wind power, an innovative solar-wind hybrid prototype has been operating since 2011. The proposed Project will pursue scaling up of mini-grid based RE for underserved, bottom-of-the-pyramid communities.

Consistency with Key SREP Investment Criteria

Increased RE capacity and increased access to energy via RE: The Project will directly finance mini-grid development with approximately 4.3 MW of MMH and 0.5 MW of solar and/or wind¹⁴. The physical components will scale-up RE as the MMH installations will generally be 80 kW or larger (vs. the typical 5 – 80 kW previously installed), solar installations will generally be 10 kW or larger (vs. current home systems of 20 watts), and solar-wind hybrid systems will be introduced at a scale of 10 kW or larger.

The introduction of small-scale wind power is a first step in developing Nepal's wind resources at successively larger scales. As the large hydropower experience has shown, the classic economy-of-scale approach has had limited success translating potential into actual electricity output. Rather than attempting to develop utility-scale wind farms (a “big bang” approach), the project will establish a “walk before running” learning trajectory.¹⁵

The larger scale of MMH and solar and solar-wind systems are quantum advances on current technology and experience base. The RE mini-grid scale will be tailored to community needs and ability for development and ownership. Successful experience operating mini-grids in excess of 80 kW capacity will lead toward larger mini-grid RE development, eventually achieving 1 – 10 MW scale. The mini-grids' designs and technical specifications will be compatible with future connection to the national grid. The Project will directly facilitate mini-grid installations to reach more than 30,500 households with total RE capacity of 4.8 MW.

Low-emissions development: Nepal does not have any commercially viable fossil fuel resources, and refined petroleum products such as diesel, gasoline, and kerosene are all imported. As such, Nepal has a potential competitive and comparative advantage in low-emissions development through technological leap-frogging. The Project will contribute to realizing these advantages by scaling up off-grid RE systems. The RE-based mini-grids will displace diesel and gasoline use in generator sets, kerosene for lighting, and traditional biomass. The greenhouse gas reductions are estimated at 18,000 tons carbon dioxide equivalent per year (tCO₂e/y) and substantial co-benefits will be realized from avoided use of biomass and fossil fuels for cooking and lighting (including gender co-benefits).

Affordability and competitiveness of RE: The 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. RE-based electricity is competitive with diesel- and gasoline-fired generator sets on a levelized cost of electricity (LCOE) or life-cycle basis: at current market prices, electricity from diesel or gasoline generator sets costs at least \$0.31 per kWh, which is higher than the LCOE of every form of commercially available RE system today. However, the LCOE does not reflect all of the costs for electricity service delivery, e.g., the

¹⁴ The actual installed capacities will depend on local conditions in the villages requesting support. The SREP-supported investments will be leveraged by the broader investment program under the NRREP.

¹⁵ The solar and wind component is a variation on advanced market commitment, as the project will use bulk procurement to achieve a critical mass of capacity.

distribution lines, customer connections, meters, etc., and upfront capital costs remain a barrier to most communities and concessional funds are needed to scale up RE installations with respect to the size of RE-based mini-grids and the number of communities served.

Productive use of energy: The Project 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 the energy, mainly in sectors of agriculture, rural enterprise, health and education. The Project targets 20% of electricity generated being consumed by productive use of energy by 2018. The NRREP will have a leading role in expanding off-take for livelihood development, building on AEPC's experience base.

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); these benefits will accrue mainly to women, who are typically responsible for cooking as well as gathering of fuelwood and other traditional biomass.

Economic and financial viability: The subprojects will be economically viable based on avoided costs of fossil fuel and traditional biomass energy supplies, but are expected to be financially sub-commercial based on current upfront capital costs. Solar-based mini-grids may become commercially viable in the foreseeable future (i.e., within the next 5 – 10 years if not sooner). Capital costs of wind are also expected to decline as manufacturing capacity of small-scale wind systems expands. Bulk procurement will be employed for the solar and solar/wind hybrid based mini-grid component to reduce capital costs to the extent possible. Based on the calculations of the sample subprojects, the EIRR is 17.11% for mini-micro hydro and 14.22% for solar and solar/wind hybrid. The operation and maintenance costs, including replacement cost of batteries, can be recovered through an affordable tariff paid by end users.¹⁶

Leveraging of other financing: The project will use ADB's sector loan modality which allows flexibility during implementation to achieve additional leverage. In addition to the ADB financing, government counterpart funds, and community contributions, the Project complements funding of the NRREP, and leverage will be expanded via the CREF when it becomes operational. Project funds can be blended with credit lines of CREF and the existing micro-hydropower debt fund established with financing from GIZ.

Gender: The Project is classified by ADB as Effective Gender Mainstreaming, and includes a Gender Equity and Social Inclusion plan. Detailed information is presented in the draft Report and Recommendation of the President (for sake of brevity, these details are not repeated here). Gender mainstreaming activities will be further developed during implementation.¹⁷

Co-benefits: Co-benefits will be realized mainly from avoided use of fossil fuels and traditional biomass. The greatest co-benefits will arise from reduced indoor air pollution. The second greatest co-benefits will arrive from reduced stress on forest resources, which will be demonstrated in one of the initial sub-projects located in Gaurishankar Conservation Area.

¹⁶ The mini grid will be financed by communities, and the power generation installations including electrical/mechanical equipment and civil works will be financed by ADF and SCF.

¹⁷ The sector loan modality provides flexibility for further development going forward.

The Project includes \$1.2 million for capacity development including support for project implementation and training. This capacity development component will facilitate the overall expansion of mini-grid installations as well as scaling up the average size of installations. The scope of capacity development will be tailored to project implementation needs, and will include procurement assistance, training in operation and maintenance (O&M) for RE operators, and building awareness and engagement of communities to be served by these investments. Promotion of productive energy end-use activities will be financed directly by AEPC via the NRREP.

13. Objective

To increase RE capacity and access to sustainable energy on a programmatic basis.

14. Expected Outcomes:

- Increase in renewable energy produced by mini and micro energy projects
- Increase in number of villages, households, and people with access to clean/renewable electricity

15. Key Results and Indicators for Success (consistent with SREP results framework):

The performance indicators outlined below are derived from the SREP Results Measurement Framework. These indicators will be tracked at least annually. Suggested performance indicators for the project include:

Result	Indicator
(a) Increase in RE capacity	4.8 MW of new capacity
(b) Increase in RE output	25,228 MWh energy produced annually
(c) Increase in access to clean energy	30,500 households and around 143,350 people ¹⁸ with increased access to electricity Number of businesses/community services benefiting from improved access Electricity access rate

16. Budget:

Expenditures ¹⁹	Amount (USD) – estimates [SREP funds only]
1. Capacity Development	1,200,000
Project Implementation - Consulting services	800,000
Social mobilizer (NGO)	400,000
2. Investment Components	10,000,000
Mini- micro hydro mini-grids	7,000,000
Solar / wind mini-grids	3,000,000
Total Cost	11,200,000

¹⁸ Based on 2011 census, the average number of household in Nepal is 4.7. Sex ratio is 94.4% (0.94 male: 1 female); the gender dis-aggregated beneficiaries are estimated at 67,661 males and 75,689 females.

¹⁹ These expenditure categories may be adjusted during project implementation according to emerging needs. The amounts listed are for SREP funds only; a detailed breakdown of the financing plan is presented in the draft Report and Recommendation of the President.

Co-Financing ²⁰ :	Amount:	Type of contribution:
• MDB: ADB	US\$ 5 million	ADF loan
• Other - community contributions	US\$ 8.47 million	Equity and in-kind
• Government / NRREP ²¹	US\$ 3.25 million	GON counterpart funds
• Other - Private Sector	(To be determined)	Central RE Fund
Co-Financing Total	US\$16.72 million	
17. Program Timeframe		
<p>For ADB Expected Board/MDB Management²² approval date: June 2014 Expected Mid-Term review date: Not applicable Expected Program closure²³ date: December 2021</p>		
18. Role of other Partners involved in program²⁴:		
<p>The project will be implemented as part of the Nepal NRREP, as noted above and described in the draft Report and Recommendation of the President.</p> <p>SREP is supporting a private sector financing facility for <u>grid-connected</u> small hydropower, which is being implemented by the ADB Private Sector Operations Department and IFC. The investments supported are complementary to the proposed Project.</p>		

²⁰ Cofinancing includes: in-kind contributions (monetary value), MDB loan or grant, parallel financing, etc. Possible private sector co-financing, in addition to community contributions, is not quantified herein, but is expected in the future, e.g., via supplier credit and new business models for delivering micro-energy systems.

²¹ The NRREP contribution is \$2 million grant.

²² In some cases activities will not require MDB Board approval.

²³ Financial closure date.

²⁴ Other local, national and international partners to be involved in implementation of the program.

19. Implementation Arrangements (incl. procurement of goods and services):

The AEPC will be the Executing Agency (EA), which will be responsible for the implementation of the Project. The existing NRREP Steering Committee chaired by Secretary of MoEST will serve as the Steering Committee for the Project. The Steering Committee will meet quarterly to provide overall guidance to the EA and review the overall progress of the Project. A two-tier implementation structure is being adopted. At AEPC level, a project implementation unit (PIU) including experienced staff headed by a Project Manager has been set up to be responsible for overall project implementation, including procurement, accounting, quality assurance, and safeguards. The PIU will be supported by project implementation consultants (PICs)²⁵ funded by the project. At the field level, District Energy and Environmental Sections (DEES), as the outreach arm of AEPC established in District Development Committees (DDC), have been set up in all districts across the country, which are responsible for coordination with district level stakeholders on off-grid renewable energy programs. The DEES will be supported by the Regional Service Centers (RSCs)²⁶, which are being engaged under NRREP as service providers covering all the rural areas of the country. The RSCs will assist the DEES to (i) identify subsequent subprojects in compliance with the criteria for selecting subprojects; (ii) prepare pre-feasibility studies for subsequent subprojects; (iii) supervise and monitor the construction and installation work of subprojects; (iv) coordinate and motivate target beneficiaries to contribute on subprojects implementation; (v) help target communities to develop and implement productive energy use plan; and (vi) conduct capacity building program. Any additional activity required to implement the Project will also be included from time to time by expanding the Terms of Reference (TOR) of present RSCs, engagement of new RSCs and recruitment of additional experts for these RSCs if needed. Further, social mobilizers are to be recruited under the project, which will coordinate closely with RSCs and complement their roles for supporting the implementation of the off-grid component at field level. Implementation arrangements are summarized in Table 1 (below).

ADB will follow ADB's policy on procurement. For more information, please refer to: <http://www.adb.org/sites/default/files/Guidelines-Procurement.pdf>

²⁵ The consultants include full time and short term experts, to help PIU on project procurement, technical supports, monitoring and evaluation. The consultants will have dual reporting function to both AEPC and ADB.

²⁶ NGO, cooperatives and private sector firms registered as legal entity in Nepal can apply as RSCs.

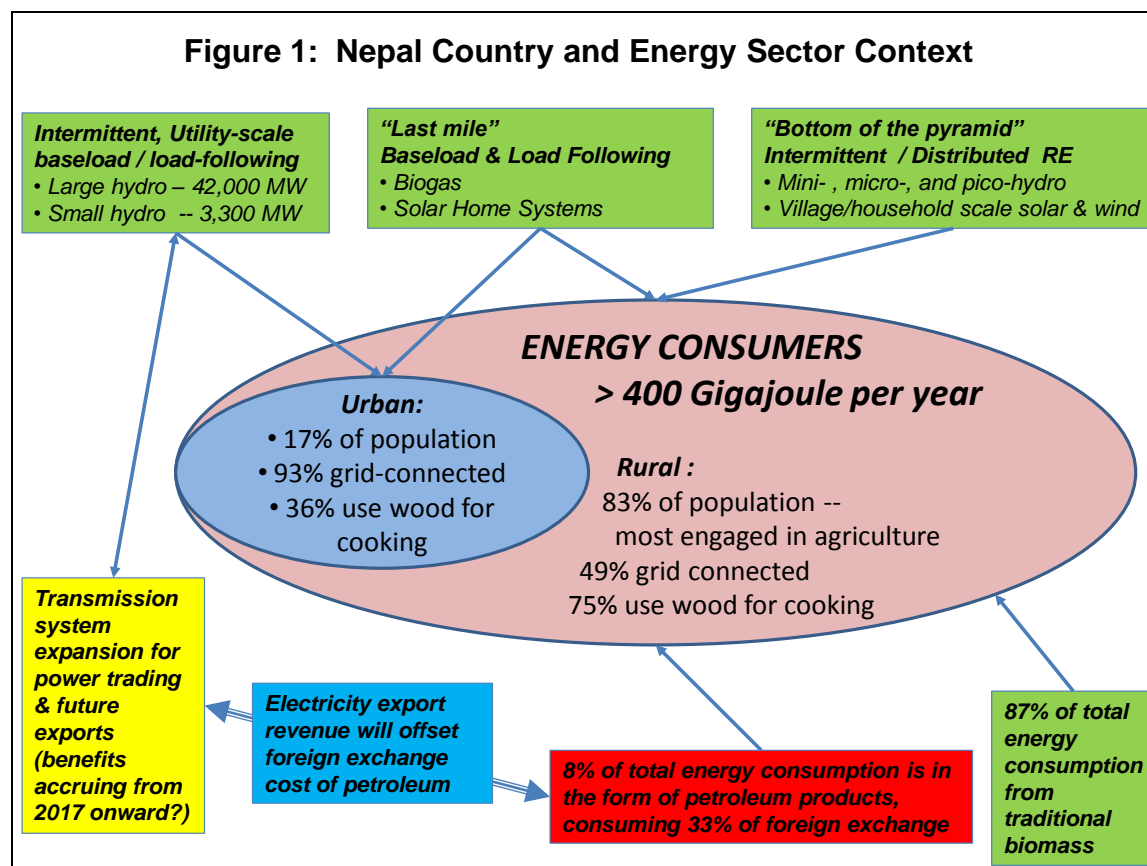


Table 1: Implementation Arrangements

Aspects	Arrangements		
Implementation period	1 January 2015–31 December 2021		
Estimated completion date	31 December 2021 (loan and grant closing on 30 June 2022)		
Management			
(i) Oversight body	Steering committee chaired by Secretary, Ministry of Energy, and co-chaired by Secretary, Ministry of Science, Technology and Environment		
(ii) Executing agencies	Nepal Electricity Authority (NEA) and Alternative Energy Promotion Centre (AEPC)		
(iii) Implementation units	Project Management Unit and Project Implementation Unit established in NEA and AEPC respectively, with 25 (NEA) and 8 (AEPC) professional staff and supporting staff.		
Procurement	International competitive bidding	6 packages	\$217.00 million
	National competitive bidding	16 packages	\$13.70 million
	Shopping	2 packages	\$0.20 million
Consulting services	Quality- and cost-based selection (90:10) for firms	300 person months	\$8.4 million
	Individual	80 person months	\$0.8 million
Advance contracting	All eligible contract packages and expenditures agreed between ADB and the government relating to all outputs		
Disbursement	The loan and grants (including ADB administered cofinancing) will be disbursed in accordance with ADB's <i>Loan Disbursement Handbook</i> (2012, as amended from time to time) and detailed arrangements agreed upon between ADB and the government.		

Source: Asian Development Bank.