



# 2014 CLEAN ENERGY INVESTMENTS

## PROJECT SUMMARIES

2014  
CLEAN ENERGY  
INVESTMENTS  
PROJECT SUMMARIES



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# Abbreviations

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ADB	-	Asian Development Bank
ADF	-	Asian Development Fund
AFD	-	Agence Française de Développement
BRT	-	bus rapid transit
CAREC	-	Central Asia Regional Economic Cooperation Program
CCFPSA	-	Canadian Climate Fund for Private Sector in Asia
CCGT	-	combined-cycle gas turbine
CCS	-	carbon capture and storage
CEF	-	Clean Energy Fund
CEFPF	-	Clean Energy Financing Partnership Facility
CNG	-	compressed natural gas
COSO	-	Central Operations Services Office
CSP	-	concentrated solar thermal power
CTF	-	Clean Technology Fund
CWRD	-	Central and West Asia Department
EARD	-	East Asia Department
GEF	-	Global Environment Facility
GMS	-	Greater Mekong Subregion
GWh	-	gigawatt-hour
HCMC	-	Ho Chi Minh City
IGCC	-	integrated gasification combined-cycle
IMAR	-	Inner Mongolia Autonomous Region
IREDA	-	Indian Renewable Energy Development Agency
kg	-	kilogram
km	-	kilometer
kV	-	kilovolt
Lao PDR	-	Lao People's Democratic Republic
LNG	-	liquefied natural gas
LPG	-	liquefied petroleum gas
m <sup>3</sup>	-	cubic meter
MFF	-	multitranches financing facility
MW	-	megawatt
NMT	-	nonmotorized transport
OCO	-	Office of Cofinancing Operations
OCR	-	ordinary capital resources
OGC	-	Office of the General Counsel
OSFMD	-	Operations Services and Financial Management Department

PARD	- Pacific Department
PLN	- Perusahaan Listrik Negara (State Electricity Corporation)
PNG	- Papua New Guinea
PPL	- PNG Power Limited
PPP	- public-private partnership
PRC	- People's Republic of China
PRCM	- PRC Resident Mission
PSOD	- Private Sector Operations Department
SARD	- South Asia Department
SDCC	- Sustainable Development and Climate Change Department
SCF	- Strategic Climate Fund
SERD	- Southeast Asia Department
SREP	- Scaling Up Renewable Energy Program
TA	- technical assistance
tCO <sub>2</sub> e	- ton of carbon dioxide equivalent
TJ	- terajoule

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# Executive Summary

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In 2014, the Asian Development Bank (ADB) achieved clean energy investments of \$2.4 billion, continuing to meet its annual target of investing at least \$2 billion in clean energy projects. Not only is this the highest level of clean energy investment ADB has recorded, it is also the fourth year in a row that ADB's clean energy investments have surpassed \$2 billion. The demand for clean energy among the developing countries of Asia and the Pacific remains high, and ADB is fully committed to assist the continued development of clean energy in the region.

Globally, the clean energy sector saw impressive investment results. After 3 years of decline, clean energy investments rebounded in 2014 with \$270 billion invested globally, and a record 95 gigawatts of renewable energy capacity installed. As the technology costs for renewable energy have decreased, especially in the case of solar, their installed capacity has grown by leaps and bounds. This is particularly relevant for developing countries where renewables were once seen as untenable due to their high cost compared to traditional, fossil fuel-based generation.

The report "*Global Trends in Renewable Energy Investment 2015*"<sup>1</sup> stated that 2014 was a watershed year for renewable energy in developing markets, with investment recorded at \$131.3 billion, compared to developed economies at \$138.9 billion. In Asia, the People's Republic of China (PRC) and Japan invested a combined amount of \$74.9 billion in solar energy. The PRC also remained the top overall destination for clean energy investment, attracting \$83.3 billion of investments, thanks to its dedicated policy commitment to renewable energy development.

In developing Asia, Indonesia attracted more than a billion dollars of investment in renewables, and the renewable energy sectors of the Philippines and Myanmar saw investments in the \$500 million range.

Even more remarkable is that these investments in clean energy occurred during a time of low oil prices. While developing Asian countries are benefiting from falling oil prices, they are also aware that this cannot last forever, and a future spike in oil prices could easily upset their economies. The investment in clean energy shows a continuing shift away from oil toward sustainable sources of energy.

Renewables, including solar, wind, biomass, geothermal and other sources, also grew their share in world electricity generation to 9.1% in 2014, up from 8.5% in 2013. The Frankfurt School-UNEP Center states that this 0.6% growth is the equivalent to saving 1.3 gigatonnes of carbon dioxide (CO<sub>2</sub>) as a result of the new installed renewable energy capacity.

In 2014, ADB continued to innovate on ways to help develop and deploy clean energy in the Asia and the Pacific. Among the projects supported by ADB is a new service to match buyers and sellers of low-carbon technologies to speed up the rate of technology transfer to developing Asia. Called the IPEX Cleantech Asia, this first-of-its-kind technology exchange will broker technology transfers from developed countries to developing Asia and between developing Asian nations. The pilot service will initially focus on clean energy and energy efficiency technologies with expected average transaction size ranging between \$2 to 5 million.

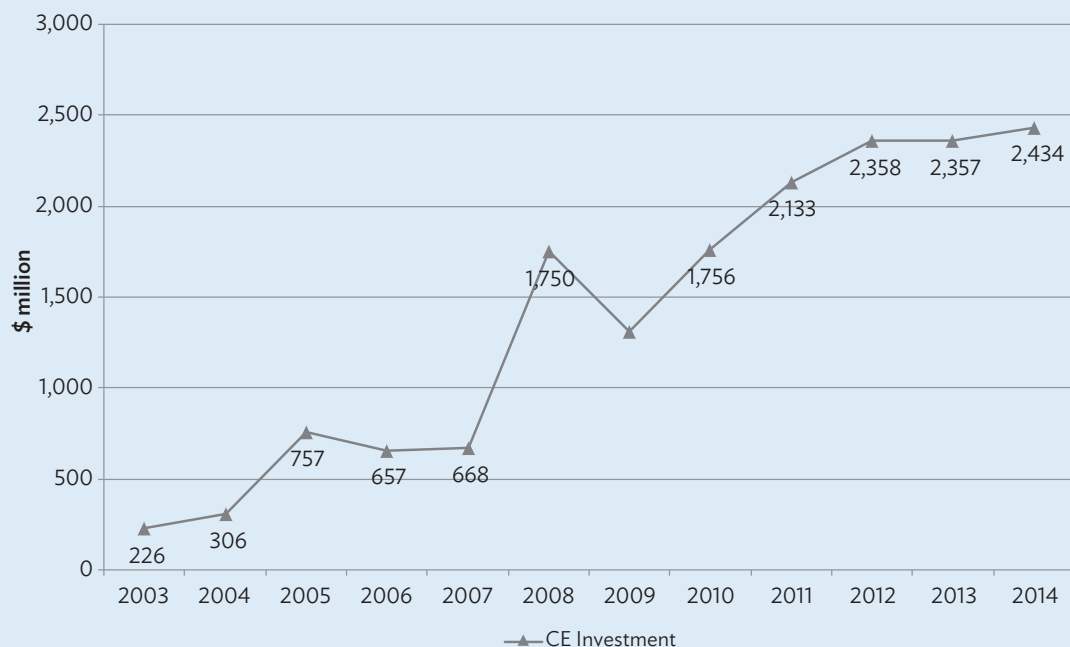
Continuing price drops in equipment and the operation and maintenance costs have made wind and solar technologies much easier for developing countries to embrace.

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<sup>1</sup> Frankfurt School-UNEP Centre/Bloomberg New Energy Finance. 2015. *Global Trends in Renewable Energy Investment 2015*. [http://fs-unep-centre.org/sites/default/files/attachments/key\\_findings.pdf](http://fs-unep-centre.org/sites/default/files/attachments/key_findings.pdf)



**Figure 1: Progress Toward ADB's \$2 Billion Clean Energy Investments Target**



In 2014, ADB's clean energy investments reached a total of \$2.434 billion. The solid gray line in the figure above tracks ADB's annual clean energy investments.

Source: ADB Database 2014.

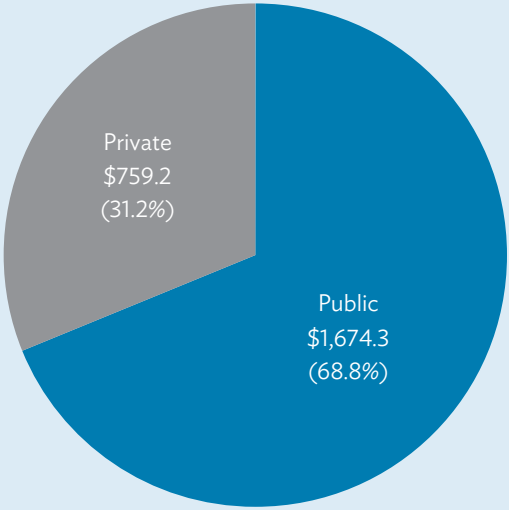
ADB's investment record supports this conclusion. Tried and true clean energy technologies continue to be supported, as countries are now better equipped to tap into their indigenous solar, wind and small hydro resources. ADB also supported innovative and new technologies, such as advancements in sustainable transport including a bus rapid transit system, as well as large scale energy efficiency projects that had crossover in the water and agriculture sectors.

Out of ADB's total clean energy investment of \$2.4 billion, the majority (69%) was in the public sector through sovereign loans and grants worth more than \$1.67 billion, with the remaining \$0.76 billion (31%) in private sector investments, almost \$100 million higher compared to 2013.

In terms of clean energy by project type, ADB's renewable energy investments make up the largest share, as can be seen in Figure 3. Investments in renewables amounted to \$1.35 billion in 2014, with energy efficiency investments at \$0.90 billion. ADB's higher investment in cleaner fuels this year went to projects in the PRC, which is prioritizing cleaner burning sources of energy in order to combat air pollution caused by the use of coal.

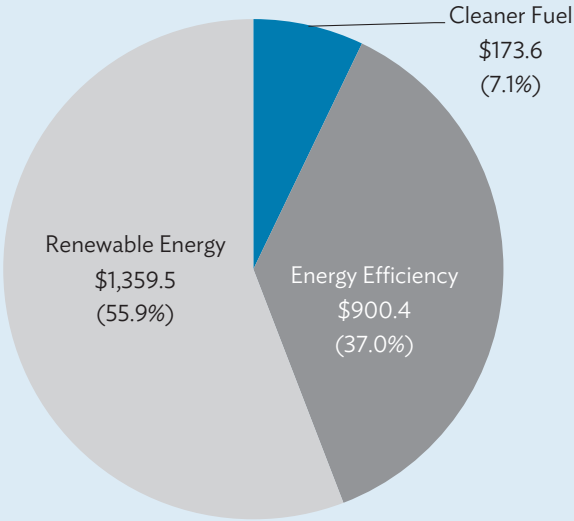
Energy sector specific investments continue to draw the bulk of investment with \$1.97 billion, and the remainder of \$0.46 billion was invested mainly in transport projects, with some support to increased energy efficiency in the water sector.

Figure 2: Clean Energy Investments—Public versus Private Sector, 2014  
(\$ million)



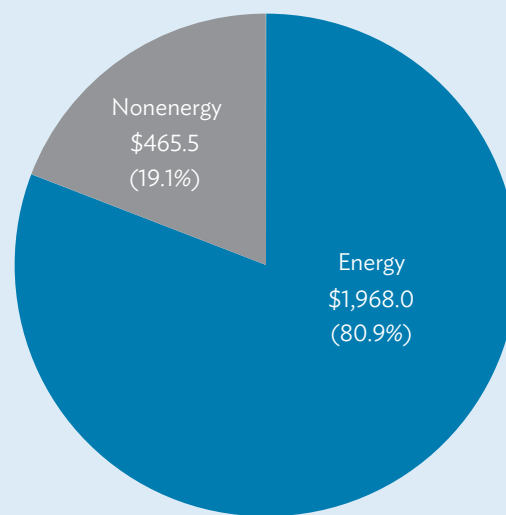
Source: ADB Database 2014.

Figure 3: Clean Energy Investment by Clean Energy Project Type, 2014  
(\$ million)



Source: ADB Database 2014.

**Figure 4: Clean Energy Investment by Sector, 2014**  
(\$ million)



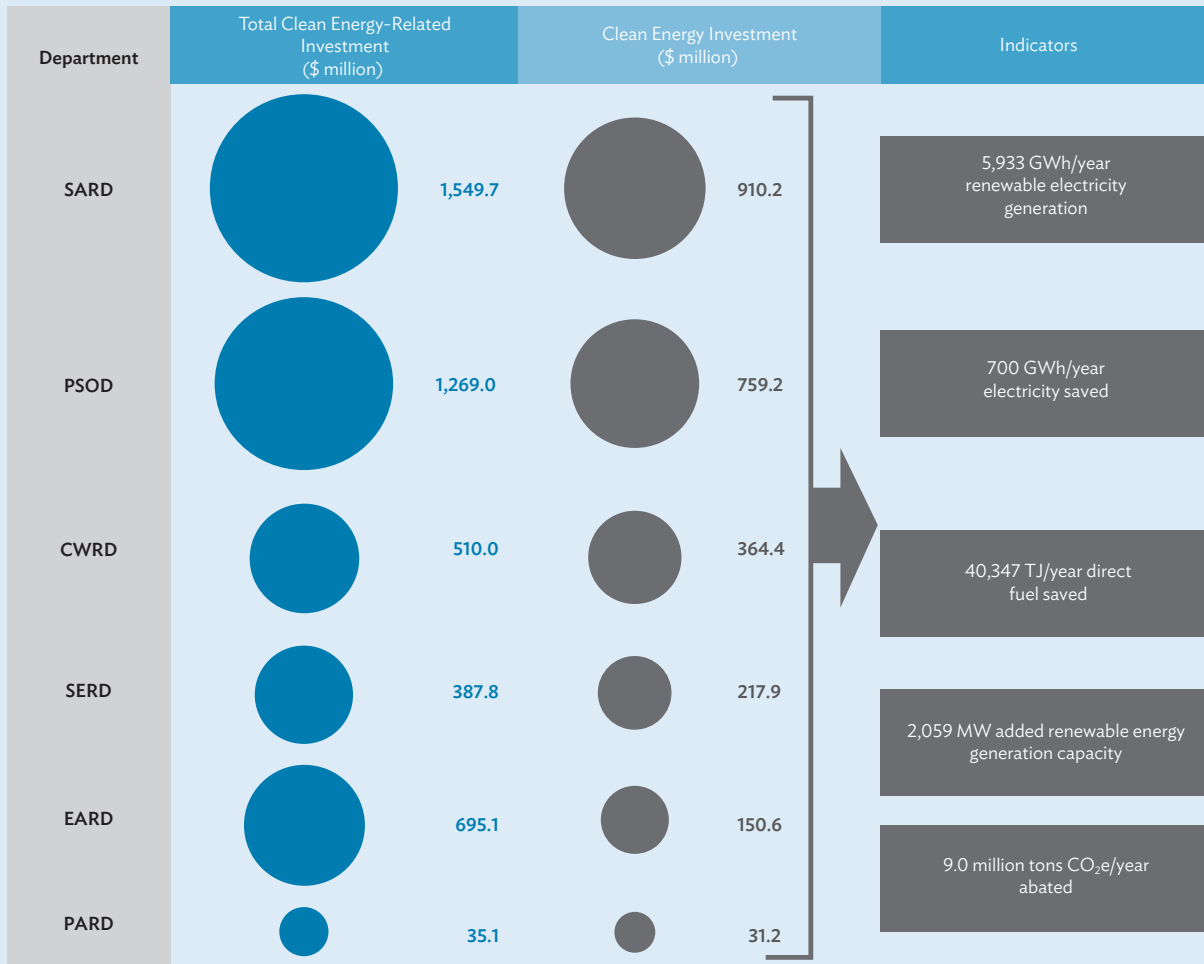
Source: ADB Database 2014.

An analysis of clean energy investment by operations department at ADB shows that the South Asia Department was the source of a leading share (37%) of investment at \$910 million. This reflects high investment levels in India, though the subregion as a whole received investment with projects in Bangladesh, Bhutan, the Maldives and Nepal. The Private Sector Operations Department claimed the second greatest share (31%) of investment at \$759 million, followed by the Central and West Asia Department at \$364 million (15%), the Southeast Asia Department with \$218 million (9%), the East Asia Department with \$151 million (6%) and finally the Pacific Department at \$31 million (1%).

Out of ADB's overall clean energy portfolio in 2014, there were thirteen grant-financed investments totaling \$148 million. These grants largely were in support of clean energy in small island nations, including the Cook Islands, the Maldives, Nauru, and the Solomon Islands. ADB also channeled a grant from the Global Environment Fund to the PRC to support a sustainable public transport project. For more details on these grants, see Appendix 1.

In 2014, ADB's \$2.4 billion clean energy investment is expected to produce the following significant gains: a total of 5.9 terawatt hours per year of clean electricity from renewable sources such as solar, wind and hydro; 700 gigawatt-hours of electricity savings from energy efficiency gains; more than 40,000 terajoules per year saved from the avoided consumption of direct fuel; the abatement of 9 million tons of carbon dioxide equivalent (tCO<sub>2</sub>e) per year; and the installation of 2 gigawatts of renewable energy generation capacity (see Figure 5).

**Figure 5: Indicators for Clean Energy Investments, 2014**  
(\$ million)



CO<sub>2</sub>e = carbon dioxide equivalent, CWRD = Central and West Asia Department, EARD = East Asia Department, GWh = gigawatt-hour, MW = megawatt, PARD = Pacific Department, PSOD = Private Sector Operations Department, SARD = South Asia Department, SERD = Southeast Asia Department, TJ = terajoule.  
Source: ADB Database 2014.



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# Central and West Asia Department

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**Loan/Grant Numbers:** 3212-KGZ and 0419-KGZ  
**Project Number:** 46348-003  
**Toktogul Rehabilitation Phase 2 Project**

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## Rationale

The Kyrgyz Republic power sector is characterized by ageing assets, high commercial losses, below-cost tariffs, and poor performance of sector companies. Power sector assets are over 30 years old and approaching the end of their economic life. This results in reduced reliability and high system technical losses (15% of net supply). The sector also suffers from high commercial losses (15% of net supply), poor financial management and performance, and tariffs that are below cost recovery. Following exceptionally high growth in domestic demand (50% from 2009 to 2013), there is a critical need for major rehabilitation, replacement, and augmentation of sector assets.

Toktogul hydroelectric power plant (HPP) is the country's largest and most important power plant, with installed capacity of 1,200 MW. It produces 40% of the country's average electricity output, and is critical both as a domestic power source and for power export; it also provides frequency regulator services to the Central Asian power system. Toktogul HPP was placed into service in 1975, and has undergone no significant rehabilitation. Critical equipment components are failing, resulting in availability dropping to 80%; a continued decline in availability is expected in the absence of rehabilitation. An assessment concluded that all the HPPs on the Naryn Cascade require rehabilitation; rehabilitation of Toktogul HPP was identified as the highest priority. Failure of Toktogul HPP would affect the stability of the Central Asian power system and be catastrophic for the Kyrgyz Republic's electricity supply.

The complete rehabilitation of Toktogul HPP is planned over a three-phase program. The project constitutes the second phase, and will rehabilitate two of the four turbine and generator units. The project is included in the Asian Development Bank's (ADB) country operations business plan for the Kyrgyz Republic, 2014–2016.

## Description

The project will replace turbine and generator units 2 and 4 and all associated auxiliary and control equipment and repair the existing hydraulic steel structures. The project benefits will include (i) increasing unit power output from the existing 300 MW to 360 MW, (ii) increasing unit efficiency by 2.5 percentage points from 90.0% to 92.5%, and (iii) improving availability from 80% to 95%. Life expectancy of the rehabilitated units will be 35 years.

**Total Loan Amount:** \$65.5 million (ADF)  
\$100 million (Euroasian Development Bank)  
**Total Grant Amount:** \$44.5 million (ADF)  
**Clean Energy Investment:** \$ 201.10 million  
**Project Category:** Renewable Energy  
**Renewable Energy Generation:** 115 gigawatt-hours/year  
**Greenhouse Gas Emission Reduction:** 85,000 tCO<sub>2</sub>e/year  
**Board Approval:** 2 December 2014  
**Project Life:** 35 years

**Impact** Increased reliability of national and regional power systems

**Outcome** Improved operational performance of the Open Joint-Stock Company Electric Power Plants, the main generation company in the Kyrgyz Republic

**Outputs**

- Toktogul HPP rehabilitated
- Asset inventory and revaluation prepared
- Kyrgyz Republic power sector master plan developed
- Open Joint-Stock Company Electric Power Plants business process improved

**Division** Energy Division, CWRD

**Project Team**

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**Executing Agencies** Ministry of Energy and Industry  
State Property Fund  
Open Joint-Stock Company Electric Power Plants



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**Loan Number:** 3141-UZB  
**Project Number:** 45306-001  
**Takhiatash Power Plant Efficiency Improvement Project**

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## Rationale

Uzbekistan's power generation plants are generally old and inefficient, requiring urgent modernization. The aging power plants are a result of underinvestment in power infrastructure after the collapse of the Soviet Union. More than 75% of the power plant units are over 30 years old, reaching or exceeding their economic life. The thermal efficiency averages 31%, while that of energy-efficient combined-cycle gas turbines exceeds 50%. Although the country is endowed with abundant proven natural gas reserves and potential gas reserves are being explored, natural gas is not infinite. The reserve to production ratio for the country's natural gas is estimated at about 25–30 years. Replacing existing power generation assets with energy-efficient equipment is a key strategy for saving energy, securing reliable power supply, and reducing greenhouse gas emission.

The Takhiatash thermal power plant (TPP) is the main source of power supply in the Karakalpakstan and Khorezm regions. In 2012, power consumption in these regions was 2,293 GWh with maximum load of 466 MW. By 2020, the power consumption is expected to exceed 3,620 GWh, with maximum load of 620 MW. With 730 MW of installed capacity, the Takhiatash TPP now comprises five gas-fired steam turbine generation units. Three units totaling 310 MW have passed their designed economic life, and have been operating with derated capacity (130 MW), low thermal efficiency (23.7%), and limited plant availability (25%). The other two units, totaling 420 MW, are 26 years old or less. However, their capacity is derated by 15%, the efficiency is low at 31%, and they are over utilized to meet demand, which prevents regular maintenance.

## Description

The project will construct two combined-cycle gas turbine units (230–280 MW each) with at least 52% thermal efficiency at the existing Takhiatash TPP. Three existing units (Nos. 1–3) will be decommissioned and two (Nos. 7–8) will be kept for backup power generation, while underutilized structures (blocks 1 and 2) will be demolished and the land will be remediated.

The project will develop Uzbekenergo's capacity for becoming a commercially bankable utility. It will also build a community social service center that will not only create jobs but will also help improve the community's welfare and foster gender equality.

**Total Loan Amount:** \$300 million (OCR)  
**Clean Energy Investment:** \$163.27 million  
**Project Category:** Supply side energy efficiency  
**Energy Savings:** 11,200 terajoules/year  
**Greenhouse Gas Emission Reduction:** 418,000 tCO<sub>2</sub>e/year  
**Board Approval:** 15 July 2014  
**Project Life:** 30 years

**Impact** More reliable power supply in Uzbekistan

**Outcome** Increased energy-efficient power supply in the Karakalpakstan and Khorezm regions

**Output**

- Energy-efficient power generators operational in Takhiatash TPP
- Developed Uzbekenergo's capacity to become commercially bankable
- Community social service center becomes operational

**Division** Energy Division, CWRD

#### Project Team

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**Executing Agency** Uzbekenergo



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# East Asia Department

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**Grant Number:** 0388-PRC  
**Project Number:** 44007-013  
**Jiangxi Fuzhou Urban Integrated Infrastructure  
Improvement – Additional Financing**

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## Rationale

The Global Environment Facility (GEF) provides grants for projects that support climate change mitigation by reducing greenhouse gas (GHG) emissions. The Asian Sustainable Transport and Urban Development (ASTUD) program was submitted to GEF by the Asian Development Bank (ADB) and approved by the GEF Council in November 2011. ASTUD includes GEF funding for projects in Jiangxi Fuzhou of US\$2.75 million, to be implemented in conjunction with the ADB financed Jiangxi Fuzhou Urban Integrated Infrastructure Improvement Project. The aim of the GEF funded activities is to build on the planned improvements in public transport in Fuzhou to produce additional savings in GHG emissions.

The proposed GEF-financed component design is based on discussions between ADB and leaders of the Fuzhou Municipal Government, Finance Bureau, Development and Reform Commission, Fuzhou Investment and Development, Planning Bureau, Transport Bureau, Environment Bureau, Traffic Police Detachment, Fuzhou Bus, and Jiangxi Urban and Rural Planning and Design Institute. The discussions concluded that the available GEF funds could be best used by focusing on the objective of improving the energy efficiency of bus operations in Fuzhou. This will deliver savings in GHG emissions, and will also contribute to improved local air quality and savings in bus operating costs.

The additional financing is directly related to output 1 (bus rapid transit [BRT] system) of the main ADB project.

## Description

The additional financing will fund (i) the additional cost of purchasing advanced technology compressed natural gas buses for the BRT (approximately 51 vehicles) instead of diesel, (ii) the full cost of approximately 10 new buses to replace older vehicles operating on two existing routes that will link with the BRT, (iii) international BRT technical assistance to the project's team that is responsible for the detailed operations plan and detailed infrastructure design to improve BRT system operational efficiency, (iv) maintenance training, (v) drivers' training.

**Total Grant Amount:** \$2.55 million (GEF)  
**Clean Energy Investment:** \$2.55 million  
**Project Category:** Demand-side energy efficiency  
**Energy Savings:** no data  
**Greenhouse Gas Emission Reduction:** no data  
**Board Approval:** 14 May 2014  
**Project Life:** 12 years

**Impact** An efficient, inclusive, and sustainable urban transport system in Jiangxi Fuzhou

**Outcome** Efficient multimodal access to the new main railway station

- Outputs**
- BRT system
  - Urban transport hub
  - Fenggang River greenway
  - Station access roads
  - Institutional strengthening and capacity building

**Division** Transport and Communications Division, EARD

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**Executing Agency** Fuzhou Municipal Government

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**Loan Number:** 3114-PRC  
**Project Number:** 46079-002  
**Guangdong Chaonan Water Resources Development  
and Protection Demonstration Project**

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## Rationale

Chaonan District is a county-level administrative division of Shantou Municipality in Guangdong Province. The total annual water resources of the district are about 580 million cubic meters, equivalent to only about 450 cubic meters (m<sup>3</sup>) per capita per year, which is internationally considered as absolute water scarcity.

Chaonan District faces a great challenge of ensuring water security for its social and economic development due to (i) lack of adequate water treatment and supply facilities, (ii) weak institutional capacity for managing water resources and providing water services, and (iii) water pollution in rivers and other water bodies around the towns and villages in the plain area. Current water supply capacity, including the three major water supply systems of Jinxi, Longxi, and Qiufeng, is about 135,000 m<sup>3</sup>/day, which is far from meeting both the current and future demand for domestic and industrial uses in the district. Water demand is estimated to reach 288,800 m<sup>3</sup>/day by 2020 and 331,423 m<sup>3</sup>/day by 2025. The current water supply systems serve about 70% of the district population, but cannot guarantee 7-day, 24-hour services. The three water supply systems are independent from each other and cannot supplement each other if one system is facing water shortage. Due to low technical standards, aging of the pipes, and lack of maintenance, nonrevenue water (NRW) of the current district supply systems are as high as 50% (40% leakage, 10% nonpayment), resulting in serious water and energy losses, high water tariffs, and limited service coverage.

## Description

The project will strengthen the Chaonan Water Supply, the major implementing agency and the operator of the water supply system under the project. The project will upgrade the skills of operational staff, improve operational performance and viability, establish water quality monitoring and control centers, and reduce operating losses. The current water supply systems' NRW is particularly high, and an assessment was carried out during project preparation to determine improvement measures. The project incorporates such measures to reduce NRW with an agreed target.

**Total Loan Amount:** \$100 million (OCR)  
**Clean Energy Investment:** \$9.98 million  
**Project Category:** Demand-side energy efficiency  
**Energy Savings:** 4.87 gigawatt-hours/year  
**Greenhouse Gas Emission Reduction:** 4,314 tCO<sub>2</sub>e/year  
**Board Approval:** 28 February 2014  
**Project Life:** 25 years

**Impact** Better health and quality of life in Chaonan District

**Outcome** Improved and equitable water supply services to urban and rural residents in Chaonan District

- Outputs**
- Improved water resources protection
  - Improved water supply infrastructure
  - Strengthened institutional and staff capacity

**Division** Environment, Natural Resources, and Agriculture Division, EARD

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**Executing Agency** Chaonan District Government



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**Loan/Grant Numbers:** 3216-PRC and 0420-PRC  
**Project Number:** 45022-002  
**Jiangxi Ji'an Sustainable Urban Transport Project**

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## Rationale

Ji'an is located in central Jiangxi Province, along the Ganjiang River. The city is a provincial-level municipality of 4.9 million people of which 41.6% are urban residents. The existing public transport system in Ji'an is inadequate to serve the needs of a developing city, and will require substantial investment to improve its efficiency and services. Buses are not given priority, resulting in relatively slow and unreliable service. Public transport services in the city center are affected by increasing traffic resulting in declining operating speeds and longer travel times. Traffic signals are manually controlled and uncoordinated resulting in added delays on heavily traveled roads. Bus stops and multimodal connections at existing transport facilities are inadequate, poorly designed, and inconvenient for passengers. The multimodal connection to the Ji'an Railway Station is unorganized and poorly accessible.

## Description

The project will provide efficient multimodal access to major activity centers in Ji'an. Through the project, the planned high-speed railway station and surrounding new development area will be linked to the existing city with well-designed multimodal transport infrastructure, greenway development, and integrated public transport services. The existing public transport network will be improved through a prioritized bus rapid transit (BRT) system and upgraded multimodal connections.

A grant provided by Global Environment Facility (GEF) will support environmental improvement by maximizing the energy efficiency of bus operations on the BRT and feeder services. The GEF grant will fund three activities: (i) fuel-efficient bus operations using 12 diesel hybrid electric buses (output 1); (ii) evaluation and monitoring of hybrid bus performance under BRT and normal operating conditions (output 4); and (iii) development of an integrated transport and land use plan (output 4). The GEF-financed activities are designed to reduce the carbon intensity of the transport system in Ji'an and provide a low-carbon blueprint for future urban development.

**Total Loan Amount:** \$120 million (OCR)  
**Total Grant Amount:** \$2.55 million (GEF)  
**Clean Energy Investment:** \$5.26 million  
**Project Category:** Demand-side energy efficiency  
**Energy Savings:** 1,653 terajoules/year  
**Greenhouse Gas Emission Reduction:** 122,500 tCO<sub>2</sub>e/year  
**Board Approval:** 9 December 2014  
**Project Life:** 12 years

**Impact** An efficient, inclusive, and sustainable urban transport system in Ji'an

**Outcome** Efficient multimodal access to major activity centers in Ji'an

- Outputs**
- Public transport improved
  - Yudai River and greenway rehabilitated
  - Traffic management and urban roads developed
  - Institutional capacity developed

**Division** Transport and Communications Division, EARD

**Project Team**

**Team Leader** K. J. Kim, Senior Transport Specialist, EARD

**Team Members** A. Banez, Operations Assistant, EARD  
T. Bisht, Social Development Specialist, EARD  
X. Chen, Transport Specialist (Railways), EARD  
C. Chu, Senior Portfolio Management Officer, EARD  
F. Connell, Principal Counsel, OGC  
S. Lewis-Workman, Senior Transport Economist, EARD  
R. Mamatkulov, Senior Transport Specialist, EARD  
G. O'Farrell, Environment Specialist, EARD  
G. Nave-Santos, Project Analyst, EARD  
J. Sluijter, Transport Economist, EARD

**Executing Agency** Ji'an Municipal Government

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**Loan Number:** 3211-PRC  
**Project Number:** 46048-002  
**Jilin Urban Development**

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## Rationale

Development in Jilin Province is centered in the cities of Changchun and Jilin, and improvements barely reach the remote, less-developed prefectures in the southeast and northwest, where Baishan (480,000 residents) and Baicheng (330,000 residents) cities, respectively, are located.

Critical infrastructure gaps that prevent sustainable development of Baicheng and Baishan cities have been identified. Residential areas in western Baicheng—the Baicheng Economic Development Zone—have grown without proper access to central municipal services such as wastewater treatment plants, municipal solid waste management system and effective water supply services.

Baishan’s water supply has reached its full capacity and cannot ensure 24-hour water services. Currently, 30% of the population (144,000 people) lacks full-time access to water. The recent decline in the quality and quantity of the main water source (Dayangcha River) in Jianguyuan district combined with the growing population of Hunjiang district are putting Baishan’s water supply safety at significant risk. Previously inadequate technical standards, aging pipes, and poor water supply dispatching efficiency have resulted in nonrevenue water in Baishan reaching 65%; this in turn has caused inefficient water use, loss of income, and excessive energy consumption.

## Description

The project will promote people-centered urban transport in Baicheng. The provision of lanes dedicated to buses and nonmotorized traffic, supported by a capacity development program, will initiate change in the transport planning system and promote the extension of low-carbon transport.

The solid waste management systems in Baicheng and Baishan cities will be developed into integrated solid waste management systems through a plan that defines step-by-step solutions for each type of waste.

The establishment of a resource-efficient and safe water supply system in Baishan will be achieved by supporting (i) reduction of nonrevenue water from 65% to 35%, by addressing water leakage, unbilled uses, and commercial losses; (ii) improvements in operations and energy efficiency by addressing engineering, automation and monitoring, and operation and maintenance; (iii) water supply safety, through the implementation of a water safety plan based on water quality monitoring and assurance systems; (iv) financial sustainability through tariff reform to achieve full cost recovery; and (v) an education campaign to raise water conservation awareness.

**Total Loan Amount:** \$150 million (OCR)  
**Clean Energy Investment:** \$8.83 million  
**Project Category:** Demand side energy efficiency  
**Energy Savings:** 7.30 gigawatt-hours/year  
**Greenhouse Gas Emission Reduction:** 5,685 tCO<sub>2</sub>e/year  
**Board Approval:** 5 December 2014  
**Project Life:** 25 years

**Impact** Improved economic growth, resource efficiency, and quality of life in Baicheng and Baishan cities

**Outcome** Improved delivery and efficiency of municipal services in Baicheng and Baishan cities

**Outputs**

- Improved urban infrastructure in Baicheng
- Integrated solid waste management system in Baicheng
- Integrated solid waste management system in Baishan
- Improved water supply management in Baishan

**Division** Urban and Social Sectors Division, EARD

#### Project Team

**Team Leader** A. Heckmann, Urban Development Specialist, EARD

**Team Members** M. Ancora, Urban Development Specialist, PRCM, EARD  
M. Gupta, Principal Safeguards Specialist (Resettlement), EARD  
M. Guzon, Operations Assistant, EARD  
A. Morel, Environment Specialist, EARD  
G. Tadevosyan, Safeguards Specialist, EARD  
W. Walker, Principal Social Development Specialist, EARD  
S. Zaidansyah, Senior Counsel, OGC  
L. Zou, Senior Financial Management Specialist, EARD

**Executing Agency** Jilin Provincial Government

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**Loan Number:** 3218-PRC  
**Project Number:** 47052-002  
**Low Carbon District Heating Supply in Hohhot  
in Inner Mongolia Autonomous Region**

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## Rationale

The Inner Mongolia Autonomous Region (IMAR) experiences subzero temperatures for 6 months of the year, and winter temperatures can drop to as low as  $-40^{\circ}\text{C}$ . Adequate heating is a basic human need and essential for socioeconomic activities. Coal has been the predominant fuel for heating in IMAR, contributing to indoor and outdoor air pollution and undermining human health. As rapid urbanization increases the demand for heating, heavy use of coal-based district heating will worsen air quality, especially in large urban areas such as Hohhot, home to about 10% of IMAR's total population. Switching to a low-emission fossil fuel, such as natural gas, and emission-free renewable energy is urgently needed.

IMAR has large reserves of natural gas and excellent solar and wind energy resources. The National Energy Administration in the PRC issued a policy notice in 2013 strongly encouraging the use of curtailed wind power for district heating, which requires high energy use at night during the winter. The proposed project will demonstrate a large-scale low emission and low-carbon district heating system using wind power and natural gas. Because of its easy access to sufficient natural gas and excess wind power, Hohhot is an appropriate choice to demonstrate such heating system.

## Description

The project will install (i) low-emission natural gas boilers, (ii) wind-powered electric boilers with zero emissions, (iii) energy-efficient heat exchange stations, (iv) insulated heating pipelines, and (v) a distribution control and data management system to optimize system operation. The project covers three heating zones (Jinqiao, Xinjiaying, and Haoqingying) in Saihan and Xincheng districts in the eastern part of Hohhot. About 61,000 households in these areas are currently connected to 50 small and inefficient coal-fired boilers (equivalent to 158 megawatts thermal), and more than 210,500 households are using coal-fired heating stoves without any emission control. After completion, the project will avoid 848,500 tons of standard coal, and will emit 60% less carbon dioxide, 82% less nitrogen oxides, negligible particulate matters, and 98% less sulfur dioxide compared with the existing heating supply. The project will achieve energy efficiency of 0.5 gigajoule/square meter, which is 17% more efficient than the average IMAR district heating system.

**Total Loan Amount:** \$150 million (OCR)  
**Clean Energy Investment:** \$64.27 million  
**Project Category:** Cleaner fuel/Renewable energy/Demand-side energy efficiency  
**Energy Savings:** 16,037 terajoules/year  
**Greenhouse Gas Emission Reduction:** 1,299,400 tCO<sub>2</sub>e/year  
**Board Approval:** 9 December 2014  
**Project Life:** 25 years

**Impact** Improved energy efficiency and cleaner environment in IMAR

**Outcome** Improved air quality and reduced greenhouse gas emissions in Hohhot

- Outputs**
- District heating coverage expanded
  - Low-carbon and highly efficient heat generation system installed
  - A new business model for wind-based district heating piloted

**Division** Energy Division, EARD

**Project Team**

**Team Leader** N. W. Kim, Environment Specialist, EARD

**Team Members** P. Dungca, Associate Project Analyst, EARD  
S. Kawazu, Senior Counsel, OGC  
L. Lu, Economics Officer, PRCM, EARD  
T. Oi, Senior Energy Specialist, EARD  
A. Seiler, Financial Specialist (Energy), EARD  
S. Yamamura, Senior Energy Specialist, EARD

**Executing Agency** Government of Inner Mongolia Autonomous Region

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**Loan Number:** 3109-PRC  
**Project Number:** 43332-054  
**Railway Energy Efficiency and Safety Enhancement  
Investment Program – Tranche 5**

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## Rationale

Rapid and sustained economic growth since 1978, when the open door policy and economic reforms were initiated in the People's Republic of China (PRC), was accompanied by rapid increases in the demand for transport. Railways have been playing an essential role in transportation and in promoting sustainable economic growth and social development due to their environment-friendliness, energy efficiency, reliability and affordability and lower land take.

The Government of the PRC (the government) has prioritized railway development and has emphasized railway development in the less-developed western region with a view to reducing disparities in regional economic development between the coastal and western areas. In its development plan, the government is aiming to expand the railway network from 91,000 kilometers (km) in 2010 to 120,000 km by 2015; and from 36,000 km to 50,000 km in the poor western region.

With railway network extension, ADB has been helping the PRC railway sector create awareness of railway energy efficiency, environmental sustainability and safety enhancement and has been encouraging the use of clean energy and energy-efficient technologies, safety enhancement, and environmental improvement in railway construction, operation, and maintenance through periodic policy dialogue with the China Railway, formerly the Ministry of Railway. The government has identified these three issues as key areas of sustainable development and included them in the Eleventh and Twelfth Five-Year Plans.

A multitranche financing facility (MFF) for the Railway Energy Efficiency and Safety Enhancement Investment Program (Investment Program) in the PRC was approved by ADB on 8 December 2009. The MFF will provide up to \$1.0 billion to the government from ADB's ordinary capital resources. It aims to support the development of a sustainable, energy-efficient, safe, reliable, affordable, and environment-friendly railway system in the PRC. The Framework Financing Agreement was signed between the PRC and ADB on 10 November 2009. This is the fifth tranche of this MFF.

## Description

Tranche 5 involves procurement and installation of railway electrification system, railway electric power supply system, track safety operation and maintenance equipment, enhanced railway fasteners, antiseismic bridge bearings, railway telecommunication system, and railway signaling system.

**Total Loan Amount:** \$170 million (OCR)  
**Clean Energy Investment:** \$59.68 million  
**Project Category:** Demand-side energy efficiency  
**Energy Savings:** 298.33 TJ/year  
**Greenhouse Gas Emission Reduction:** 22,106 tCO<sub>2</sub>e/year  
**Board Approval:** 7 February 2014  
**Project Life:** 40 years

**Impact** Improved transport system in the southwestern region that supports sustainable socioeconomic development and the western region development strategy

**Outcome** An energy-efficient, safe, reliable, and environment-friendly railway transport system developed in the region

**Outputs**

- Energy efficiency-related equipment installed
- Railway safety enhancement-related equipment installed

**Division** Transport and Communications Division, EARD

#### Project Team

**Team Leader** X. Chen, Senior Transport Specialist, EARD

**Team Members** T. Bisht, Safeguards Specialist, EARD  
F. Connell, Principal Counsel, OGC  
G. O'Farrell, Environment Specialist, EARD  
W. Zhang, Senior Transport Officer, PRCM  
L. Cuevas-Arce, Senior Operations Assistant, EARD  
M. Macrohon, Associate Project Analyst, EARD

**Executing Agency** China Railway





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# Pacific Department

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**Loan/Grant Numbers:** 3193-COO and 0415-COO  
**Project Number:** 46453-002  
**Renewable Energy Sector Project**

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## Rationale

The Cook Islands is a Pacific island country with an estimated total population of 18,600 people. The Cook Islands depends heavily on imported fuels, with a total fuel import bill in 2012 at \$29.8 million, or 25% of total imports and 9% of gross domestic product. The total installed power generation capacity in the Cook Islands is 11.75 megawatts, with more than 99% of households connected to the grid.

Electricity costs in the Cook Islands are among the highest in the Pacific with the average electricity tariff at \$0.63 per kilowatt-hour (kWh) in 2013. On the outer islands, due to limited affordability, the government subsidizes a part of the electricity generation cost so the average electricity tariff is \$0.57 per kWh. Both are above regional average tariffs.

Changing diesel-based power generation to renewable energy sources is expected to reduce the cost of generation by up to 40% and diesel consumption for power generation by up to 95%, and will contribute to sustainable social and economic development. Average annual solar irradiation of around 1,900 kWh per square meter constitutes a major renewable source for power generation.

## Description

The project will construct up to six solar photovoltaic power plants with a total installed capacity of about 3 megawatts-peak coupled with lithium-ion batteries and will rehabilitate the existing distribution network for core and noncore subprojects. The project will feature three core subprojects on Mangaia, Mauke, and Mitiaro and up to three noncore subprojects on Aitutaki, Atiu, and Rarotonga. Core subprojects are already designed, assessed as viable, and ready for implementation.

**Total Loan Amount:** \$11.19 million (OCR)  
**Total Grant Amount:** \$7.26 million (EU)  
**Clean Energy Investment:** \$18.45 million  
**Project Category:** Renewable energy  
**Renewable Energy Generation:** 4.87 gigawatt-hours/year  
**Greenhouse Gas Emission Reduction:** 2,930 tCO<sub>2</sub>e/year  
**Board Approval:** 21 November 2014  
**Project Life:** 25 years

**Impacts** Increased energy security in an environmentally sustainable manner

**Outcome** Increased access to a higher share of electricity generated from renewable energy sources

**Outputs**

- Solar photovoltaic power system development
- Institutional strengthening and project management support

**Division** Transport, Energy and Natural Resources Division, PARD

**Project Team**

**Team Leader** S. Yamamura, Senior Energy Specialist, EARD

**Team Members** C. Damandl, Senior Counsel, OGC  
A. Dizon, Associate Project Analyst, PARD  
S. Lee, Principal Social Development Specialist (Gender and Development), PARD  
W. Lee, Energy Specialist, PARD  
D. Ling, Transport Specialist, PARD  
M. Melei, Country Specialist, PARD  
N. Sapkota, Safeguards Specialist, PARD  
J. Williams, Senior Environment Specialist, PARD

**Executing Agency** Ministry of Finance and Economic Management

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**Grant Numbers:** 0414-NAU and 0424-NAU  
**Project Number:** 46455-002  
**Electricity Supply Security and Sustainability**

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## Rationale

Nauru is a Pacific island country with a total population of 10,000 people. Access to grid electricity is universal but the supply is unreliable because of underinvestment in, and poor maintenance of, generation and distribution assets. The cost of generation is also extremely high because of the poor condition and inefficiency of the Nauru Utilities Corporation's (NUC) generators. The powerhouse (physical structure) is also in poor condition, which represents a vulnerability to Nauru's electricity supply security.

Installed generation currently comprises eight units with a total nominal capacity of 12.90 megawatts (MW). However, Nauru's current available capacity is only 3.70 MW because two units are inoperable and the output of the remaining units is reduced because of their poor condition. Current peak load is 3.75 MW. Scheduled service outages are a constant feature of electricity service in Nauru. Unscheduled outages due to faults are frequent. Nauru will remain reliant on reliable and efficient thermal generation (i.e., diesel) for its base load, and for system stability and reliability, for the foreseeable future. Nauru's current diesel generation equipment is neither reliable nor efficient.

Addressing reliability and efficiency shortcomings in Nauru's current diesel generation equipment is of first-order priority to improve service reliability and mitigate the risk of catastrophic failure of the NUC's power generation. The NUC's investment priorities include introducing 3.0 MW of new diesel-fired generation under the project to replace existing generation, improve efficiency and reliability, and reduce fuel costs. The NUC estimates that this will result in a 20% improvement in generation efficiency from 3.4 kilowatt-hours (kWh) generated per liter of diesel consumed to 4.1 kWh.

## Description

The project involves (i) purchase and installation of new, medium-speed, 2.6–3.0 MW diesel generator complete with related auxiliary equipment and training of NUC personnel on its operation and maintenance (ii) repair and/or replacement of existing roof and structural reinforcements of NUC's powerhouse.

**Total Grant Amount:** \$2 million (ADF)  
\$2.7 million (EU)  
**Clean Energy Investment:** \$0.80 million  
**Project Category:** Supply-side energy efficiency  
**Energy Savings:** 54 terajoules/year  
**Greenhouse Gas Emission Reduction:** 3,900 tCO<sub>2</sub>e/year  
**Board Approval:** 7 November 2014  
**Project Life:** 20 years

**Impact** Increased economic activity

**Outcome** Increased reliability, lower cost, and greater sustainability of power generation in Nauru

**Outputs**

- New diesel-fired generation put into service
- Repair and/or replacement of existing roof and structural reinforcements of NUC's powerhouse
- Efficient project implementation

**Division** Transport, Energy and Natural Resources Division, PARD

**Project Team**

**Team Leader** M. Trainor, Energy Specialist, PARD

**Team Members** S. Lee, Principal Social Development Specialist, PARD  
M. Lucich, Senior Economics Officer, Pacific Coordination Liaison Office, PARD  
M. Sapkota, Safeguards Specialist, PARD  
Y. Seo, Counsel, OGC  
J. Williams, Senior Environment Specialist, PARD

**Executing Agency** Ministry of Finance

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**Loan/Grant Numbers:** 3127-SOL and 0386-SOL  
**Project Number:** 46014-002  
**Provincial Renewable Energy Project**

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## Rationale

Economic development and provision of infrastructure in Solomon Islands is concentrated in the national capital of Honiara, which has about 13% of the national population but 89% of the country's power generation capacity. In contrast, the province of Malaita, with a population of 137,596 (about 25% of the national population), has only about 2% of total generation capacity. Generation by Solomon Islands Electricity Authority (SIEA), the state-owned utility, provides power only to the main provincial center of Auki, entirely through diesel plants at high cost. Power tariffs in Solomon Islands are among the highest in the Pacific. Power provision is unreliable and marked by frequent outages due to diesel fuel supply and maintenance issues. Auki is SIEA's third-largest load center with 274 residential customers and 335 commercial customers.

Only about 3% of the population of Malaita has access to grid-connected power. More than three-quarters of households in Malaita use kerosene lamps as their main source of lighting and nearly all use wood for cooking. Other sources of energy include small home solar systems, mini hydropower, portable generators, and gas. The main reasons for the low access rates are (i) the high cost of diesel power generation in the provincial centers, which gives the corporatized SIEA little incentive to expand the distribution network (where generation and supply costs exceed the national tariff); (ii) lack of government community service obligation funding for grid extensions; (iii) a difficult geography and small, dispersed pockets of population, and (iv) low capacity to pay in some areas. Significant unmet demand means that people resort to self-generation but would connect to the grid if sufficient capacity were available. The high cost of electricity and the limited reach of the distribution grid are slowing economic growth in the provincial centers, including Auki, and curb agriculture and tourism in particular.

## Description

The project involves (i) constructing a 750-kilowatt Fiu River Hydropower Plant, a run-of-river hydropower plant including intake structure, headrace canal, powerhouse and transmission lines, (ii) extending the electricity distribution grid in Auki including installation of step-down transformers, distribution lines, household connections and minimum supply kits with prepayment meters to connect approximately 250 new household customers to the distribution grid, (iii) training SIEA staff in the operation of hydropower plants through a 3-year outsourced operation and maintenance contract and training newly connected households on options for electricity-based income generation, electricity safety, and household budget management, and (iv) establishing a project management unit that will provide efficient technical design, management, and supervision services.

**Total Loan Amount:** \$6.00 million (ADF)  
**Total Grant Amount:** \$6.00 million (ADF)  
**Clean Energy Investment:** \$12.00 million  
**Project Category:** Renewable energy  
**Renewable Energy Generation:** 2.04 gigawatt-hours/year  
**Greenhouse Gas Emission Reduction:** 1,623 tCO<sub>2</sub>e/year  
**Board Approval:** 12 May 2014  
**Project Life:** 40 years

**Impact** Increased economic activity in Auki, Malaita Province

**Outcome** SIEA has increased supply of more reliable and cleaner power to Auki, Malaita Province

- Outputs**
- Fiu River hydropower plant put into operation by SIEA
  - Extension of distribution grid by SIEA
  - Capacity building undertaken for implementing agency and project beneficiaries
  - The project management unit renders efficient project management services

**Division** Transport, Energy and Natural Resources Division, PARD

**Project Team**

**Team Leader** A. Maxwell, Senior Energy Specialist, PARD

**Team Members** S. Lee, Principal Social Development Specialist (Gender and Development), PARD  
N. Sapkota, Safeguards Specialist, PARD  
M. Tonizzo, Investment Specialist, PSOD  
J. Versantvoort, Principal Counsel, OGC  
J. Williams, Senior Environment Specialist, PARD

**Executing Agency** Ministry of Mines, Energy and Rural Electrification





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# Private Sector Operations Department

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**Investment Number:** 7436/3236-BAN  
**Project Number:** 44951-014  
**Summit Bibiyana II Power**  
**(Bibiyana II Gas Power Project)**

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## Rationale

In Bangladesh, about 62% of the population had access to electricity as of May 2014. Many industrial and commercial establishments depend on expensive and inefficient captive power generation (burning diesel or heavy oil) during power interruptions. Bangladesh faces the challenge of increasing access to electricity and removing power-related constraints on economic development. The government has embarked on a program of fast-track measures to develop power generation capacity, including developing new gas supply facilities and dual-fuel and coal-based power plants to generate 15 gigawatts of power capacity by 2016.

The consortium of Summit Industrial & Mercantile and GE Energy was awarded the Bibiyana II project in November 2010. After being formally awarded the project, the consortium approached ADB to discuss financing for the project, given ADB's pioneering role and experience in financing the Meghnaghat gas power independent power producer project, one of the first major private sector independent power producer projects in Bangladesh, and its strong support for the power sector through sovereign lending.

## Description

The project involves design, engineering, construction, and operation of a 341 megawatt combined-cycle, gas-fired power plant to be located on the south bank of the Khushiyara River about 180 kilometers (km) northeast of Dhaka and 30 km southwest of the town of Sylhet in the district of Habiganj. The project comprises one combined-cycle equipment train and utilizes a single General Electric 9FA combustion turbine generator, coupled to a heat recovery steam generator and a single steam turbine generator, as well as other plant and equipment. Gas will be supplied to the project through an 8.8 km long, 50.8-centimeter high-pressure pipeline from the existing Bibiyana gas field. Power will be evacuated from the power plant by means of 230 kilovolt or 400 kilovolt transmission lines.

**Total Loan Amount:** \$75.00 million (OCR)  
**Clean Energy Investment:** \$22.83 million  
**Project Category:** Supply-side energy efficiency  
**Energy Savings:** 7,799 terajoules/year  
**Greenhouse Gas Emission Reduction:** 437,500 tCO<sub>2</sub>e/year  
**Board Approval:** 5 December 2014  
**Project Life:** 30 years

- Impacts**
- Improved access to electricity in Bangladesh
  - Increased investments by the private sector in power generation in Bangladesh

**Outcome** Increased combined cycle power generation

**Output** Construction and operation of a power plant running on indigenous gas

**Division** Infrastructure Finance Division 1, PSOD

**Project Team**

**Team Leader** H. Hoshi, Senior Investment Specialist, PSOD

**Team Members**

- I. Chauche, Investment Specialist, PSOD
- E. David, Associate Investment Officer, PSOD
- J. Gomez, Safeguards Officer, PSOD
- M. Greenhow, Senior Counsel, OGC
- S. Noda, Senior Safeguards Specialist, PSOD
- B. Quang, Safeguards Specialist, PSOD
- S. Rahman, Project Officer, Bangladesh Resident Mission, SARD
- R. Samiano, Safeguards Officer, PSOD
- K. Taniguchi, Senior Economist, PSOD

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**Investment Number:** 7407/3130-GEO  
**Project Number:** 47919-014  
Adjaristsqali Georgia  
(Adjaristsqali Hydropower Project)

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## Rationale

Georgia has made significant progress in its energy sector, going from chronic power shortages and poor financial condition of electricity and gas companies to becoming an electricity exporter in 2007 thanks to the Government of Georgia's effort to increase the generation capacity of hydropower plants. While Georgia imports electricity in winter when supply is low, it has significant excess generation in summer, and the volume of exports is increasing each year. In view of its rich but underdeveloped hydro resources, Georgia has set a strategic goal to become a regional energy hub by trading energy with neighboring countries. The proposed project is the second private hydropower plant designed for energy export and the first to be financed on a limited recourse basis.

In March 2013, Tata Power and Clean Energy Invest (CEI and, collectively with Tata Power, the sponsors), approached the Asian Development Bank (ADB) to request a loan for the project. Such request was made based on ADB's long partnership history with Tata Power and the International Finance Corporation, and ADB's experience in financing private hydropower projects. The project team also had a preliminary discussion with the European Bank for Reconstruction and Development, which was also approached by the sponsors. Through these initial discussions, the Private Sector Operations Department believed that the project possesses sound fundamentals, ADB's participation will bring significant developmental benefits and demonstration impact, financing from ADB is absolutely necessary to make the project happen, and the success of the project will send an important signal to the market and help build confidence for private sector participation in Georgia's hydropower development and cross-border energy trade.

## Description

The project involves the construction, operation, and maintenance of two separate run-of-river hydropower plants operating in a cascade with a total capacity of 185 megawatts. The main hydropower plant will be constructed on the Adjaristsqali River near Shuakhevi village utilizing water collected from the Chirukhistsqali, Skhalta, and Adjaristsqali rivers; and a small hydropower plant will be constructed at Skhalta village utilizing water diverted from the Chirukhistsqali River.

**Total Loan Amount:** \$75.00 million (OCR)  
\$15.00 million (CCFP/SA/CEFPF)  
**Clean Energy Investment:** \$90.00 million  
**Project Category:** Renewable energy  
**Renewable Energy Generation:** 450 gigawatt-hours/year  
**Greenhouse Gas Emission Reduction:** 200,000 tCO<sub>2</sub>e/year  
**Board Approval:** 19 May 2014  
**Project Life:** 40 years

- Impacts**
- Georgia’s hydropower sector development
  - Private sector participation in Georgia’s hydropower increased
  - Cross-border energy trade as a means of regional cooperation and integration promoted

- Outcome**
- Increased production and export of hydropower

- Output**
- Hydropower plant developed and commissioned

**Division** Infrastructure Finance Division 1, PSOD

#### Project Team

- Team Leaders**
- I. Aoki, Investment Specialist, PSOD
  - T. Koike, Principal Investment Specialist, PSOD
- Team Members**
- E. David, Associate Investment Officer, PSOD
  - S. Durrani-Jamal, Senior Economist, PSOD
  - C. Gin, Principal Counsel, OGC
  - J. Gomez, Safeguards Officer (Environment), PSOD
  - A. Hashimi, Investment Specialist, PSOD
  - G. Kiziria, Senior Country Coordination Officer, Georgia Resident Mission, CWRD
  - M. Manabat, Senior Investment Officer, PSOD
  - M. Principe, Senior Social Development Officer, PSOD
  - D. Purka, Principal Investment Specialist, PSOD
  - B. Quang, Safeguards Specialist, PSOD
  - M. Tsuji, Principal Safeguards Specialist, PSOD

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**Investment Number:** 7406-IND

**Project Number:** 47926-014

**ReNew Power Ventures**

**(ReNew Power Investment Project)**

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## Rationale

India is in chronic need of additional power generation capacity. The Government of India's Eleventh Five Year Plan, 2007–2012 targeted the creation of 79 gigawatts (GW) of additional conventional power capacity. However, actual realization was no more than 55 GW. The government in its Twelfth Five Year Plan, 2012–2017, has set a larger target of 100 GW including 24 GW of capacity which should have been completed in the previous plan. India also needs to diversify its energy mix, not only to combat climate change but also to ensure the country's energy security. The availability of indigenous conventional fuels is diminishing and India has to import increasing quantities of expensive coal and liquefied natural gas. The share of renewable power—including hydropower—in total installed capacity has declined from 44% in 1970 to 31% in 2011. The government intends to stop this decline and has set a goal of maintaining the proportion of renewable power at its current level (31%) until 2023.

The project team has sought to identify renewable energy developers suitable for financing support from the Asian Development Bank (ADB), which can make a material impact in alleviation of the power shortage in the country. ReNew Power Ventures (ReNew) was identified as one such developer. The company and ADB initiated a dialogue in April 2013 and ReNew proposed an ADB equity investment of the Indian rupee equivalent of \$50 million to help finance the company's growing pipeline of wind projects.

ReNew combines the presence of a credible sponsor, a proven track record, a strong project pipeline, and a high-quality management team, which position the company to become one of the leading renewable energy players in India. The project is consistent with Private Sector Operations Department's strategy of supporting high-potential private renewable energy developers in India through growth capital. ADB's assistance will improve ReNew's ability to attract other investors and enable the company to achieve its target of at least 1,000 megawatts of operating renewable power projects in India by 2015. Supporting a developer at the holding level instead of at a single project level will leverage ADB's funds and create greater development impact in terms of renewable energy capacity addition (more megawatts per ADB dollar invested).

## Description

The project will develop and commission at least 560 megawatts of additional wind power capacity by 2015.

**Total Equity Amount:** \$50.00 million (OCR)

**Clean Energy Investment:** \$50.00 million

**Project Category:** Renewable Energy

**Renewable Energy Generation:** 1,226 gigawatt-hours/year

**Greenhouse Gas Emission Reduction:** 956,280 tCO<sub>2</sub>e/year

**Board Approval:** 16 May 2014

**Project Life:** 25 years

- Impacts**
- Continued development of renewable energy in India
  - Greater private sector participation in the Indian renewable energy sector

**Outcome** Increased production of renewable energy

**Output** Wind power projects developed and commissioned

**Division** Infrastructure Finance Division 1, PSOD

**Project Team**

**Team Leaders** I. Aoki, Investment Specialist, PSOD  
S. Shah, Principal Investment Specialist, PSOD

**Team Members** Q. Bui, Safeguards Specialist, PSOD  
H. Cruda, Senior Safeguards Specialist, PSOD  
A. Hashimi, Investment Specialist, PSOD  
J. Gomez, Safeguards Officer, PSOD  
M. Manabat, Senior Investment Officer, PSOD  
K. Taniguchi, Senior Economist, PSOD



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**Investment Numbers:** 7416/3175-IND to 7421/3180-IND  
**Project Number:** 48209-001  
**ACME-EDF Solar Power Project**

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## Rationale

The ACME group is a pioneer in solar power development in India. In 2009, it commissioned the first pilot solar thermal power project based on tower technology in India with a capacity of 2.5 megawatts (MW). Since then it has developed 65 MW of solar photovoltaic projects. In October 2013 EDF Energies Nouvelles (EDF EN) and EREN, two leading renewable energy developers from France, took a combined equity stake of 50% in ACME Solar Energy (ASEPL), the solar subsidiary of ACME. With these new investors and a solid pipeline, ASEPL is expected to significantly contribute to the goal of the Jawaharlal Nehru National Solar Mission (JNNSM), which aims to achieve an installed capacity of 22,000 MW of solar power in India by 2022. In February 2014, ASEPL won 100 MW of solar photovoltaic power projects under the JNNSM phase 2 tender.

It will be ADB's first direct support to solar photovoltaic projects developed under the JNNSM. ADB's assistance is required to support decreasing solar tariffs through long-tenor fixed-rate loans. ADB's assistance will also support the entry of foreign renewable energy developers into the Indian solar sector, catalyzing much-needed foreign direct investment and expertise into this key sector.

## Description

The project involves the financing and implementation of 200 MW of solar photovoltaic projects by ASEPL during 2014–2017. ADB will provide debt financing to the 100 MW already awarded under JNNSM phase 2, as well as to 100 MW of projects to be identified after approval by the ADB Board of Directors.

The 100 MW of capacity awarded under the JNNSM phase 2 encompasses five individual projects of 20 MW each that will be developed by five different special purpose vehicles: ACME Gurgaon Power, ACME Mumbai Power, ACME Rajdhani Power, Medha Energy, and Ranji Solar Energy. The annual global horizontal irradiance at the project site is estimated to be 1,996 kilowatt-hours per square meter on average, one of the highest in the country. Commissioning of the five projects is expected by 28 April 2015.

The additional 100 MW of projects to be financed by ADB will be selected by ADB and structured on standard terms and conditions similar to the first five projects. To ensure full utilization of the proposed loans within a reasonable time after Board approval, the additional 100 MW of projects will need to be financed by December 2016.

**Total Loan Amount:** \$100.00 million (OCR)

**Clean Energy Investment:** \$100.00 million

**Project Category:** Renewable energy

**Renewable Energy Generation:** 380 gigawatt-hours/year

**Greenhouse Gas Emission Reduction:** 353,400 tCO<sub>2</sub>e/year

**Board Approval:** 16 October 2014

**Project Life:** 25 years

- Impacts**
- Continued development of renewable energy in India
  - Greater private sector participation in the Indian renewable energy sector

- Outcome**
- Increased solar power supply by the private sector

- Output**
- Development and commissioning of a portfolio of solar power projects in India

**Division** Infrastructure Finance Division 1, PSOD

**Project Team**

**Team Leaders** I. Chauche, Investment Specialist, PSOD  
M. Lemoine, Senior Investment Specialist, PSOD

**Team Members** P. Bailet, Senior Counsel, OGC  
E. David, Associate Investment Officer, PSOD  
J. Gomez, Safeguards Officer (Environment), PSOD  
S. Noda, Senior Safeguards Specialist, PSOD  
M. Principe, Senior Social Development Officer, PSOD  
V. Ramasubramanian, Safeguards Specialist, PSOD

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**Investment Number:** 7409-INO  
**Project Number:** 47937-014  
**Supreme Energy Rantau Dedap**  
**(Rantau Dedap Geothermal Development Project Phase 1)**

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## Rationale

The Government of Indonesia recognizes the economic imperative of sustainable growth and aims to increase the share of renewable energy in the country's primary energy supply from 5% in 2010 to 25% by 2025 and achieve a reduction in GHG emissions of 41% by 2020. Geothermal energy is particularly suited to support Indonesia's more sustainable future, as the country has over 29,000 megawatts (MW) of geothermal resources, which is equivalent to 40% of the global geothermal resource base. Power generation costs of large geothermal power plants in Java and Sumatra are less than the country's average power generation cost. Geothermal sector development can therefore help improve the long-term financial health of Perusahaan Listrik Negara, the national electricity utility, while reducing Indonesia's reliance on fossil fuels.

The highest level of risk for a geothermal developer is during early project development and exploration, when the renewable energy resource has not yet been proven. Experienced developers in Indonesia are challenged to justify their investments when faced with full exposure to the high upfront costs of a drilling program and the inequitable risk-reward framework in the geothermal sector. The lack of an early-stage risk sharing mechanism remains a fundamental obstacle to geothermal power expansion in Indonesia and around the world. For ADB to effectively kick-start the Indonesian geothermal sector, it must not only facilitate the availability of long-term commercial financing, but also clear the way for new project development by initially sharing and mitigating some development risk.

## Description

The 240 MW Rantau Dedap Geothermal Development Project (Phase 1) is an ideal opportunity for ADB and CTF to play an instrumental role in developing the next generation of greenfield geothermal projects in Indonesia through pilot-testing of an innovative, early-stage financing product. The project is located about 225 kilometers southwest of Palembang in South Sumatera, Indonesia. Phase 1 constitutes the initial geothermal resource exploration, involving the drilling of five wells to better ascertain steam reservoir characteristics and capacity. A separate Phase 2 project will follow to complete drilling of production and injection wells, and power plant construction. Phase 2 will be financed through a traditional limited-recourse, long-term financing structure.

**Total Loan Amount:** \$50.00 million (CTF)  
**Clean Energy Investment:** \$50.00 million  
**Project Category:** Renewable energy  
**Renewable Energy Generation:** Not applicable  
**Greenhouse Gas Emission Reduction:** Not applicable  
**Board Approval:** 4 June 2014

- Impacts**
- Successful financing of a private sector geothermal power generation project in South Sumatra
  - Early-stage financing solutions available for geothermal project exploration and development across Indonesia

- Outcome**
- Confirmation of geothermal resources in South Sumatra

- Output**
- Completion of exploration phase

**Division** Infrastructure Finance Division 2, PSOD

#### Project Team

**Team Leader** L. Rahman, Investment Specialist, PSOD

**Team Members** S. Durrani-Jamal, Senior Economist, PSOD

C. Gin, Principal Counsel, OGC

M. Manabat, Senior Investment Officer, PSOD

N. Peters, Safeguards Specialist, PSOD

M. Principe, Senior Social Development Officer, PSOD

D. Purka, Principal Investment Specialist, PSOD

V. Ramasubramaniam, Safeguards Specialist, PSOD

N. Soewarno, Senior Investment Officer, Indonesia Resident Mission, SERD

J. Surtani, Senior Investment Specialist, PSOD

R. Tabanao, Project Analyst, PSOD

M. Tonizzo, Investment Specialist, PSOD

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**Investment Number:** 7408/3137-MYA  
**Project Number:** 47913-014  
**Yangon Urban Renewal and District Cooling Project**

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## Rationale

Myanmar is experiencing a rapid influx of business and tourism as the country opens as an appealing new destination for investment and attractions. However, the steady increase of international visitors is currently overwhelming Yangon, the country's largest commercial city and transit hub.

The concentration of business and tourism activity in Yangon places increasing pressure on public utilities and the environment. Yangon has a hot tropical monsoon climate in which daytime temperatures hover around 30°C. Accordingly, air conditioning is an expensive necessity for businesses and tourism, and accounts for a significant percentage of electricity consumption, especially during peak periods. The project will include the country's first district cooling plant, which will provide sustainable, efficient, reliable, and essential cooling services. The plant will use state-of-the-art technology to significantly reduce electricity consumption for cooling compared with conventional air conditioning. The plant will help reduce the strain on Yangon's electrical grid, reduce power plant fuel consumption, provide cost savings to end users, and reduce greenhouse gas emissions.

## Description

The project will revitalize approximately 4 hectares of downtown Yangon into an emerging central business district located next to the central railway station. The overall development comprises a hotel with serviced apartments, two office towers, a retail podium, a residential tower, a restored heritage building, and a district cooling plant. The project will be developed under a 50-year build-operate-transfer lease with the Ministry of Rail Transportation with two consecutive 10-year extensions (for a total of 70 years). The project will help alleviate the acute supply shortage in the city, stimulate tourism and commercial activity, and promote energy efficiency. The district cooling plant will generate cool water and distribute it through a network of piping systems to individual buildings in the district. The plant is expected to avoid 10,000 megawatt-hours of electricity and 3,000 tons of carbon dioxide equivalent emissions annually.

**Total Loan Amount:** \$50.00 million (OCR)  
\$30.00 million (B-Loan)

**Total Equity:** \$20.00 million (OCR)

**Total Guarantees:** \$20.00 million

**Clean Energy Investment:** \$3.00 million

**Project Category:** Demand-side energy efficiency

**Energy Savings:** 10 gigawatt-hours/year

**Greenhouse Gas Emission Reduction:** 3,000 tCO<sub>2</sub>e/year

**Board Approval:** 26 June 2014

**Project Life:** 25 years

**Impacts** Increase in business and tourism activity in Myanmar, while preserving and protecting its heritage

**Outcome** Sustainable tourism and business growth in Yangon

**Outputs**

- 3.9 hectares of integrated urban renewal development in central Yangon
- An energy efficient district cooling system

**Division** Infrastructure Finance Division 2, PSOD

**Project Team**

**Team Leader** D. Wiedmer, Senior Investment Specialist, PSOD

**Team Members**

- S. Durrani-Jamal, Senior Economist, PSOD
- S. Hashizume, Investment Specialist, PSOD
- R. Lockhart, Investment Specialist, PSOD
- N. Moller, Senior Counsel, OGC
- K. Paocharoen, Investment Officer, PSOD
- A. Porras, Safeguards Officer, PSOD
- B. Raemaekers, Senior Guarantees and Syndication Specialist, PSOD
- V. Ramasubramanian, Safeguards Specialist, PSOD
- R. Tabanao, Project Analyst, PSOD
- K. Taniguchi, Senior Economist, PSOD

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**Investment Number:** 7432/3206-PRC  
**Project Number:** 48281-001  
China Gas Holdings  
(Natural Gas for Land and River Transportation Project)

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## Rationale

Air pollution continues to be a major environmental challenge in the People's Republic of China (PRC). Less than 1% of the 500 main cities in the PRC meet the air quality standards recommended by the World Health Organization. Although industrial emissions have stabilized in the past few years, a rapid increase in vehicular traffic volumes has created a new threat in the form of vehicle and vessel emissions. This has created renewed interest in the application of both compressed natural gas (CNG) and liquefied natural gas (LNG) in the transport sector. Heavily polluting fuels such as diesel can be replaced with natural gas. Natural gas produces no particulate matter, 25% less carbon dioxide, less than one-third as much nitrogen oxides, and 99% less sulfur dioxide than conventional fuel.

The government is actively trying to increase natural gas usage as a part of the PRC's overall energy mix, and specifically encourages its use in land and water transportation. While gas supply—both from domestic and international sources—has increased, natural gas demand still remains unmet, largely because of a lack of distribution and refueling infrastructure, particularly in long-distance transport corridors which cross municipal and provincial boundaries.

## Description

Through continuous project screening and discussion with private sector gas operators, the Asian Development Bank selected China Gas Holdings (CGH) as the ideal partner to develop natural gas distribution infrastructure targeted at the transportation sector. CGH distinguished itself from its peers by having (i) greater geographical coverage, including in least-developed rural areas; (ii) substantial technical expertise in small-sized LNG refilling stations; and (iii) a clear strategy for gas distribution in IWT.

The project is designed to facilitate the use of natural gas as a transportation fuel by building compressed natural gas (CNG) and LNG refueling stations along long-distance land transportation corridors and IWT networks in the PRC that cross municipal and provincial boundaries. With the proposed facility, CGH plans to build and operate 600 CNG and 200 LNG filling stations for land-based vehicle use and another 20 liquefied natural gas (LNG) filling stations for IWT vessel use during 2015–2018.

**Total Loan Amount:** \$150.00 million (OCR)  
\$300.00 million (B-Loan)  
**Clean Energy Investment:** \$109.35 million  
**Project Category:** Cleaner Fuel  
**Greenhouse Gas Emission Reduction:** 2,000,000 tCO<sub>2</sub>e/year  
**Board Approval:** 4 December 2014  
**Project Life:** 15 years

- Impacts**
- Energy mix in the PRC is diversified through increased use of natural gas
  - Increased availability of natural gas as a transportation fuel

**Outcome** A commercially viable CNG and LNG low-carbon transport fuel system developed for inland and water transport

- Outputs**
- Increased availability of CNG and LNG stations meeting safeguard standards
  - Creation of job opportunities

**Division** Infrastructure Finance Division 2, PSOD

#### Project Team

**Team Leader** H. Kimura, Principal Investment Specialist, PSOD

**Team Members**

- S. Durrani-Jamal, Senior Economist, PSOD
- C. Gin, Principal Counsel, OGC
- S. Hashizume, Investment Specialist, PSOD
- A. Manabat, Senior Investment Officer, PSOD
- K. Moss, Investment Specialist, PSOD
- S. Noda, Senior Safeguards Specialist, PSOD
- J. Qi, Investment Officer, PSOD
- B. Quang, Safeguards Specialist, PSOD
- D. Song, Senior Guarantees and Syndications Specialist, PSOD
- Y. Wang, Investment Officer, PRCM



**Investment Numbers:** 7414/3153-LAO and 7414/3154-LAO

**Project Number:** 41924-014

**Nam Ngiep 1 Power**

**(Nam Ngiep 1 Hydropower Project)**

## Rationale

Hydropower resources in the Greater Mekong Subregion (GMS) are extensive, with an estimated potential capacity of 30,000 megawatts (MW). However, they are unevenly distributed. Thailand, which has a large and growing power requirement, has limited hydropower potential and is dependent on natural gas which is depleting over time. The Lao People's Democratic Republic (Lao PDR), on the other hand, has the largest hydropower potential in the region at 20,000 MW, but the smallest domestic demand. The GMS countries are thus promoting power trading to enable complementary access to cost-efficient energy resources. The Lao PDR plans to export up to 7,000 MW of hydropower to Thailand and up to 5,000 MW to Viet Nam.

## Description

The project involves construction and operation, on a build–operate–transfer basis, of a 290 MW hydroelectric power generation facility, on the Nam Ngiep River, in the provinces of Bolikhamxay and Xaysomboun. The dam site is 145 kilometers northeast of Vientiane. It has three major components:

- (i) A main power station (272 MW) with a concrete gravity dam (height 148 meters) and a reservoir (surface area 67 square kilometers), with effective storage capacity of 1.2 billion cubic meters; electricity produced will be exported to Thailand;
- (ii) A reregulation power station (18 MW) with a concrete gravity dam (height 21 meters) and a reregulating reservoir (surface area 1.3 square kilometers), with effective storage capacity of 4.6 million cubic meters; electricity produced will be supplied within the Lao PDR; and
- (iii) A 125 km 230-kilovolt transmission line to connect the main power station to the Nabong substation near Vientiane.

**Total Loan Amount:** \$144.00 million (OCR)  
\$77.00 million (B-Loan)

**Clean Energy Investment:** \$221.00 million

**Project Category:** Renewable Energy

**Renewable Energy Generation:** 1,500 gigawatt-hours/year

**Greenhouse Gas Emission Reduction:** 500,000 tCO<sub>2</sub>e/year

**Board Approval:** 14 August 2014

**Project Life:** 40 years

- Impacts**
- Increased regional cooperation between the Lao PDR and Thailand
  - Increased electrification rate in the Lao PDR
  - Increased private sector investment in hydropower in the Lao PDR in an environmentally and socially sustainable manner

- Outcome**
- Increased private sector provision of reliable and clean power in Thailand and the Lao PDR

- Outputs**
- Completion of a 290-MW hydropower plant in an environmentally and socially sustainable manner.
  - Economic benefits to the Lao PDR
  - Capacity development of local government in environment and social protection.

**Division** Infrastructure Finance Division 2, PSOD

**Project Team**

**Team Leader** K. Fukaya, Lead Investment Specialist, PSOD

**Team Members** B. Dunn, Senior Environment Specialist, SDCC  
S. Durrani-Jamal, Senior Economist, PSOD  
C. Gin, Principal Counsel, OGC  
M. Manabat, Senior Investment Officer, PSOD  
J. Munsayac, Safeguards Specialist, PSOD  
S. Noda, Senior Safeguards Specialist, PSOD  
A. Porras, Safeguards Officer, PSOD  
M. Principe, Senior Social Development Officer, PSOD  
S. Roberts, Investment Specialist, PSOD  
R. Samiano, Safeguards Officer, PSOD  
D. C. Song, Senior Guarantees and Syndications Specialist, PSOD

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**Investment Number:** 7435/3219-THA

**Project Number:** 48233-001

**Chaiphum Wind Farm  
(Subyai Wind Power Project)**

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## Rationale

Thailand's electricity production depends heavily on conventional fuels, with 65% produced using natural gas and 21% coal and lignite. Natural gas has traditionally provided Thailand with a reliable and low-cost source of energy, but growing demand and dwindling natural gas reserves from the Gulf of Thailand mean the country must diversify and secure alternative fuel sources for power generation. Fortunately, Thailand has abundant renewable energy sources—biomass, biogas, mini-hydro, solar, and wind. Using these domestic sources of renewable energy can boost Thailand's energy security, save foreign exchange, and protect the country from global price fluctuations.

To complement its renewable energy strategy, the Ministry of Energy advocates decentralized power generation through the country's small power producer (SPP) program. The program allows private developers to build, own, and operate 10–90 MW power projects and enter into a power purchase agreement (PPA) with the Electricity Generating Authority of Thailand (EGAT). Renewable energy SPPs are also eligible for an “adder” incentive in addition to the wholesale electricity price. Government support through the SPP program and the adder incentive is essential for the viability and sustainability of the proposed project.

The 81-megawatt (MW) Subyai Wind Power Project is part of the long-term growth strategy of the Electricity Generating Public Company, which emphasizes expanding investments into renewable energy to strengthen its business in independent power generation in Thailand.

## Description

The project entails the construction and operation of an 81.0 MW power plant, comprising 32 wind turbines, each with 2.5 MW capacity, in Chaiphum Province, approximately 300 kilometers northeast of Bangkok. The project will enter into a PPA with EGAT for up to 90 MW under the SPP program. The PPA is automatically renewable every 5 years. In addition to the wholesale tariff, the PPA includes an adder incentive of B3.5 per kilowatt-hour applicable for 10 years from the date of commercial operation. The PPA is automatically renewable every 5 years. In addition to the wholesale tariff, the PPA includes an adder incentive of B3.5 per kilowatt-hour applicable for 10 years from the date of commercial operation. The project will be constructed under a fixed-price, date-certain, turnkey engineering, procurement, construction arrangement on a joint and several basis. The scheduled commercial operation date under the PPA is December 2016.

**Total Loan Amount:** \$53.00 million (OCR)  
\$30.00 million (CTF)

**Clean Energy Investment:** \$83.00 million

**Project Category:** Renewable Energy

**Renewable Energy Generation:** 128.95 gigawatt-hours/year

**Greenhouse Gas Emission Reduction:** 65,000 tCO<sub>2</sub>e/year

**Board Approval:** 4 December 2014

**Project Life:** 25 years

- Impacts**
- Diversified energy mix through the addition of renewable energy capacity
  - Increased private sector participation in wind power production

**Outcome** Demonstrated viability and sustainability of utility-scale private sector wind power project

**Output** Installation and operation of 81 MW utility-scale wind power plant

**Division** Private Sector Infrastructure 2, PSOD

**Project Team**

**Team Leader** R. Lockhart, Investment Specialist, PSOD

**Project Advisor** D. Wiedmer, Senior Investment Specialist, PSOD

**Team Members** J. Acharya, Senior Climate Change Specialist, SDCC  
I. Aguilar, Safeguards Officer, PSOD  
S. Durrani-Jamal, Senior Economist, PSOD  
S. Hashizume, Investment Specialist, PSOD  
M. Manabat, Senior Investment Officer, PSOD  
N. Moller, Senior Counsel, OGC  
K. Paocharoen, Investment Officer, PSOD  
A. Porras, Safeguards Officer, PSOD  
R. Samiano, Safeguards Officer, PSOD



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# South Asia Department

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**Loan Numbers:** 3169-BAN and 3170-BAN  
**Project Number:** 46168-001  
**South Asia Subregional Economic Cooperation Railway  
Connectivity: Akhaura-Laksam Double Track**

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## Rationale

Bangladesh has the potential to become a transport and transshipment center for the South Asia subregion. It borders India and Myanmar and is close to the landlocked countries of Bhutan and Nepal. Together with the Bhangabandhu Bridge over River Jamuna (the Jamuna Multipurpose Bridge) and the provision of access to Chittagong Port, the Dhaka–Chittagong corridor can facilitate trade between Bangladesh and the northeastern states of India, the Indian state of West Bengal, Bhutan, and Nepal, creating the potential to attract more foreign and domestic investments to the country. However, the market share of the railway in the subregional transport is low due to congestion in main domestic railway corridors, which limits additional trains for domestic and international traffic.

Bangladesh Railway's market share has declined to less than 10%; it cannot maintain its market share mainly because of the capacity constraints in the Dhaka–Chittagong corridor, which limits the number of container trains between Chittagong Port and the Dhaka Inland Container Depot to two daily trains. About 203 kilometers (km) out of the 321 km Dhaka–Chittagong railway line is still only single track, constraining the demand to increase the number of trains in the corridor. There are projects funded by Asian Development Bank, Japan International Cooperation Agency, and Indian government that double track the railway lines and build the needed bridges. However, these projects do not cover the remaining 72 km single track section between Akhaura and Laksam which will become the critical bottleneck for domestic and subregional traffic in this corridor.

The government's Sixth Five-Year Plan, 2011–2015, therefore, assigns the highest priority to increasing the capacity of the Dhaka–Chittagong corridor by completing double tracking on the entire corridor, which accounts for more than 40% of all passenger journeys by railway in Bangladesh.

## Description

The project involves upgrading railway infrastructure by (i) double-tracking 72 km of railway lines including the construction of the new second track and upgrading and reconstruction of the existing track in accordance with the requirements of the Trans Asia Railways network for future conversion to broad gauge; (ii) installing modern signaling and interlocking equipment to enhance the safety of railway operation; and (iii) reconstructing 11 stations with integrated design features for the elderly, women, children and disabled. It will also support Bangladesh Railway in project management and implementation and will help provide capacity development for the permanent project management unit to be established in Bangladesh Railway and for accessing climate mitigation funding.

**Total Loan Amount:** \$400.00 million (OCR)  
\$105.00 million (ADF)

**Clean Energy Investment:** \$287.28 million

**Project Category:** Demand-side energy efficiency

**Energy Savings:** 2,148 terajoules/year

**Greenhouse Gas Emission Reduction:** 145,000 tCO<sub>2</sub>e/year

**Board Approval:** 30 September 2014

**Project Life:** years

**Impact** Improved domestic and subregional trade-flow and passenger movement in Bangladesh

**Outcome** Improved railway transport system in Bangladesh

- Outputs**
- Upgraded railway infrastructure
  - Improved capacity of Bangladesh Railway in project management and implementation
  - Improved project implementation unit in Bangladesh Railway

**Division** Transport and Communications Division, SARD

**Project Team**

**Team Leader** M. Roesner, Senior Transport Specialist, SARD

**Team Members** R. Elfving, Senior Financing Partnership Specialist, OCO  
K. Emzita, Principal Counsel, OGC  
E. Fluet, Social Development Specialist, SARD  
T. Kawabata, Transport Specialist, SARD  
S. Tanaka, Senior Transport Specialist, SARD  
K. Yangzom, Environment Specialist, SARD  
S. Zhao, Social Development Specialist, SARD

**Executing Agency** Bangladesh Railway



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**Loan/Grant Numbers:** 3225-BHU, 3226-BHU, and 0421-BHU  
**Project Number:** 44444-013  
**Second Green Power Development Project**

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## Rationale

Bhutan is currently the only South Asian country with a surplus of power for export. Hydropower generation contributes to one-fifth of the country's gross domestic product. Power exports account for one-third of government revenue, and are the primary source for government spending on socioeconomic development for social services such as health, education, and rural development. Hydropower development thus forms the foundation of the economy and social system in Bhutan.

In Bhutan, domestic power supplies are subsidized by hydropower exports. The government uses the energy royalty from hydropower generation to reduce the domestic retail tariffs of the Bhutan Power, national transmission and distribution utility. The benefits from power exports are thus redistributed to domestic electricity users through the regulatory tariff systems. However, electricity demand has been growing at around 10% per year since 2004, and is expected to double from 2013 to 2020. Continued hydropower development will be critical to contribute to export earnings and sustain the major government revenue, while keeping affordable electricity prices for households, businesses, and industries.

In developing hydropower projects, the Eleventh Five Year Plan (2013–2018) requires optimizing approaches to enhance local development, private sector participation, employment opportunities, and alignment of the project's corporate social responsibilities with local community needs. The government intends to use hydropower to promote inclusive development rather than simply generate electricity and revenue.

## Description

The project will finance the run-of-the-river Nikachhu hydropower plant, with 118 megawatt capacity. It is located on the Nikachhu River in Trongsa district in the central region of Bhutan. The project aims to export power to India through a public-private partnership and Clean Development Mechanism. Its design follows the successful model of the Dagachhu hydropower development, which was financed by the Asian Development Bank in 2008 under the Green Power Development Project.

**Total Loan Amount:** \$70.00 million (OCR)  
\$25.25 million (ADF)  
**Total Grant Amount:** \$25.25 million (ADF)  
**Clean Energy Investment:** \$111.92 million  
**Project Category:** Renewable energy  
**Renewable Energy Generation:** 491.52 gigawatt-hours/year  
**Greenhouse Gas Emission Reduction:** 459,734 tCO<sub>2</sub>e/year  
**Board Approval:** 15 December 2014  
**Project Life:** 40 years

**Impact** Expanded cross-border power trading

**Outcome** Increased clean hydropower generation in Bhutan

- Outputs**
- Hydropower plant constructed
  - Druk Green Power and Tangsibji Hydro Energy project management and implementation capacity enhanced
  - Hydropower development and trading framework improved

**Division** Energy Division, SARD

**Project Team**

**Team Leader** K. Ogino, Principal Energy Specialist, SARD

**Team Members** M. Ajmera, Social Development Specialist, SARD  
H. Austria, Project Officer, SARD  
C. Galarpe, Senior Operations Assistant, SARD  
L. George, Energy Specialist, SARD  
J. Ghimire, Counsel, OGC  
H. Kobayashi, Principal Portfolio Management Specialist, SARD  
T. Norbu, Senior Country Coordination Officer, SARD  
P. Wijayatunga, Principal Energy Specialist, SARD  
N. Yoneda, Energy Specialist, SARD

**Executing Agencies** Druk Green Power  
Tangsibji Hydro Energy

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**Loan Number:** 3186-IND  
**Project Number:** 46268-002  
**Clean Energy Finance Investment Program – Tranche 1**

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## Rationale

India has undergone a rapid economic transformation, with an average annual gross domestic product growth rate of 6.8% during 2008–2013. However, more rapid economic growth has been marked by chronic electricity shortages, high energy poverty especially in the countryside and an increasing dependence on fossil fuels. To balance the conflicting objectives among growth, climate change, and energy security, India is scaling up renewable energy investment.

A major challenge to sustaining high levels of renewable energy deployment in India is the lack of sufficient long-term debt financing for project lending. Due to the relatively high upfront cost of renewable energy projects, loan tenors of 12 or more years are usually required to make projects financially viable. However, such long-term funds are scarce in the Indian market. The implementation of Basel III capital regulations in India creates even stricter conditions on capital adequacy and asset liability management. These factors are expected to lead to rising long-term funding costs and constrained project lending capacity.

Under the administrative oversight of the Ministry of New and Renewable Energy, Indian Renewable Energy Development Agency (IREDA) is a wholly government-owned nonbank financial institution established in 1987 to promote renewable energy investment. IREDA is well capitalized with increasing profitability, and its lending constitutes about 11% of total renewable energy lending in India. IREDA's ability to fund renewable energy projects on the merits of their cash flows and risk profiles enables it to fund good projects from smaller, less capitalized sponsors. This widens the pool of project developers and investable projects, leverages additional private capital, and facilitates renewable project development.

## Description

The project is part of a \$500-million multi-tranche financing facility (MFF) consisting of financial intermediation sovereign-guaranteed loans to IREDA. The Asian Development Bank funds will support IREDA's lending operation to eligible renewable energy subprojects in India. Technologies may include wind, biomass, hydropower, solar, and cogeneration. This MFF will leverage private capital to scale up sector lending in order to add more renewable energy capacities in India over the coming years. Tranche 1 outputs include at least 10 subprojects debt financed by IREDA, and institutional capacity initiatives.

**Total Loan Amount:** \$200.00 million (OCR)  
**Clean Energy Investment:** \$200.00 million  
**Project Category:** Renewable energy  
**Renewable Energy Generation:** 1,500 gigawatt-hours/year  
**Greenhouse Gas Emission Reduction:** 1,200,000 tCO<sub>2</sub>e/year  
**Board Approval:** 30 October 2014

**Impact** Increased renewable energy infrastructure

**Outcome** Facilitated investment in renewable energy

- Outputs**
- Enhanced availability of long term financing to support renewable energy projects
  - Improved institutional capacity of IREDA

**Division** Public Management, Financial Sector, and Trade Division, SARD

**Project Team**

**Team Leaders** A. Huang, Finance Specialist, SARD  
A. Jeffries, Principal Energy Specialist, SARD

**Team Members** M. Ajmera, Social Development Specialist, SARD  
S. Cowlin, Energy Specialist, SARD  
P. Gutierrez, Project Analyst, SARD  
S. Janardanam, Energy Specialist, SARD  
C. Kim, Lead Finance Specialist, SARD  
M. Panis, Senior Operations Assistant, SARD  
S. Sasaki, Environment Specialist, SARD  
A. Syed, Counsel, OGC

**Executing Agency** Indian Renewable Energy Development Agency Development Agency

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**Loan Number:** 3140-IND  
**Project Number:** 47101-002  
**Assam Power Sector Investment Program – Tranche 1**

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## Rationale

Assam's power sector faces serious challenges: about 37% of households have access to electricity with about 5–6 hours of power cuts per day. In fiscal year (FY) 2012, peak demand for power was 1,250 megawatts (MW) against available supply of 960 MW, indicating a shortfall of 23%. Only about 30% of the state's 700 tea gardens—one of the mainstays of the Assam economy—are supplied with grid electricity. The remainder use natural gas for tea manufacturing; the gas supply is erratic.

On the supply side, Assam is heavily dependent on power imports from other states, with only about 25% of demand currently met by in-state generation. During peak periods, Assam is forced to purchase as much as 15% of its power requirement from independent power producers at very high cost.

With assistance from the Asian Development Bank (ADB), the Government of Assam has prepared a power sector masterplan to solve power sector problems. The total investment requirement for Assam's power sector for FY2012–FY2022 is about \$3.5 billion. The Assam Power Sector Investment Program selected a portion of the total requirement, considering the priority needs. At \$430 million, the investment program represents approximately 12% of the overall investment requirement of the Assam power sector. The government has requested a multi-tranche financing facility (MFF) in an amount up to \$300 million from ADB's ordinary capital resources to help finance a part of the investment program. The MFF will comprise three tranches, subject to the government's submission of related periodic financing requests, execution of the related loan and project agreements for each tranche, and fulfillment of terms and conditions and undertakings set forth in the framework financing agreement.

## Description

Tranche 1 activities include physical and nonphysical investments. Physical investments includes replacement of 4 open gas cycle turbines in Lakwa Thermal Power Station with new internal combustion type gas engine generators of 70 MW capacity. Nonphysical investment has three major subcomponents: (i) project preparation and implementation support; (ii) enterprise resource planning (ERP) support; and (iii) capacity building and training. Project preparatory support will be provided for the development of tranche 3 of the MFF and implementation support is for the Lakwa gas power plant in tranche 1.

**Total Loan Amount:** \$50.00 million (OCR)  
**Clean Energy Investment:** \$32.27 million  
**Project Category:** Supply-side energy efficiency  
**Energy Savings:** 748.66 terajoules/year  
**Greenhouse Gas Emission Reduction:** 42,000 tCO<sub>2</sub>e/year  
**Board Approval:** 11 July 2014  
**Project Life:** 30 years

**Impact** Increased capacity and efficiency of energy generation systems in Assam

**Outcome** Increase capacity and efficiency in Lakwa power plant

**Outputs**

- Generation system upgraded and expanded
- Institutional capacity of Assam Power Generation and Assam Power Distribution strengthened.

**Division** Energy Division, SARD

**Project Team**

**Team Leaders** H. Gunatilake, Lead Economist, SARD  
T. Limbu, Energy Economist, SARD

**Team Members** M. Ajmera, Social Development Specialist, SARD  
J. Banerjee, Project Officer (Energy), SARD  
S. Sasaki, Environment Specialist, SARD  
Y. Seo, Counsel, OGC  
S. Shafiq, Financial Management Specialist, SARD  
P. Wijayatunga, Principal Energy Specialist, SARD  
A. Yusupov, Energy Specialist, SARD

**Executing Agencies** Assam Power Distribution  
Assam Power Generation  
State of Assam

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**Loan Number:** 3183-IND  
**Project Number:** 42267-026  
**Rajasthan Urban Sector Development Program**

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## Rationale

Urban centers have been driving economic growth in India, led by services and manufacturing, placing cities at the forefront of the country's economic transformation. According to recent estimates, the urban sector contributes about 63% of India's gross domestic product (2009–2010); this share is projected to increase to 75% by 2021. Similarly, while India's urban population currently constitutes about 31% of the total population, it is expected to grow to 43% by 2031. Rajasthan, with a population of 68.6 million and an area of 342,239 square kilometers, is the largest state in the country. About 25% of the population is urban, this percentage is increasing rapidly at 2.9% per annum.

Increasing urbanization has aggravated the already deficient urban infrastructure and poor services. The country partnership strategy, 2013–2017 of the Asian Development Bank for India identifies the urban infrastructure deficit as one of the most important binding constraints to inclusive growth.

## Description

The sector development program (SDP) fits well with the priorities identified in the strategy, and will address the country's urbanization challenge, including plans for urban renewal and development of smart cities. The SDP will complement past and ongoing efforts of the Government of Rajasthan to improve water supply and wastewater services to the residents of the state of Rajasthan. The SDP comprises (i) a program, financed by a policy-based loan, to support policy reforms, including institutional development and governance improvement in the urban sector in the state; and (ii) a project, financed by a project loan, to invest in the water distribution network in five project cities and sewerage systems in the six project cities.

The policy-based loan will provide financial support to the state government to implement reforms that will unlock the potential of various stakeholders, including municipal bodies, individual households, and private sector investors. The amount of the policy-based loan is based on the development financing needs of the state's urban sector, and the financial support required for reforms. The project loan will support catalytic investments that enhance productivity and leverage finances from various other sources in the project cities. The project will also introduce innovations in water supply and wastewater management, such as continuous water supply, and long-term operation and maintenance embedded construction contracts for nonrevenue water reduction and sustainability of operations.

**Total Loan Amount:** \$250.00 million (OCR)  
**Clean Energy Investment:** \$30.77 million  
**Project Category:** Demand-side energy efficiency  
**Energy Savings:** 6.74 gigawatt-hours/year  
**Greenhouse Gas Emission Reduction:** 6,609 tCO<sub>2</sub>e/year  
**Board Approval:** 24 October 2014  
**Project Life:** 40 years

**Impact** Sustainable urban development in Rajasthan

**Outcome** Improved urban service delivery in Rajasthan

- Outputs**
- Urban institutions strengthened
  - Urban governance improved
  - Water supply system rehabilitated and expanded in five project cities
  - Wastewater system rehabilitated and expanded in six project cities
  - Capacity building and efficient program management implemented

**Division** Urban Development and Water Division, SARD

**Project Team**

**Team Leader** M. Sharma, Senior Urban Development Specialist, SARD

**Team Members** M. Barrogo, Associate Project Analyst, SARD  
A. Cervantes, Operations Assistant, SARD  
Y. Seo, Counsel, OGC  
I. Setyawati, Safeguards Specialist, SARD  
S. Shafiq, Financial Management Specialist, SARD  
R. Slangen, Urban Development Specialist, SARD  
P. Srivastava, Senior Project Officer (Urban), SARD

**Executing Agency** Government of Rajasthan



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**Grant Numbers:** 0409-MLD and 0410-MLD

**Project Number:** 46122-003

**Preparing Outer Islands for Sustainable Energy  
Development Project**

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## Rationale

The Maldives is an archipelago 750 kilometers southwest of Sri Lanka with 26 atolls and a total land area of about 300 square kilometers. About half the country's population lives on the outer islands. The Maldives has about 141 megawatts (MW) of installed diesel-based generation capacity on the inhabited islands and another 105 MW on the resort islands. While the Maldives has the unique distinction of being the first and only country in South Asia with 100% access to electricity, this achievement has come at a cost. Given the geographic spread, each island is electrified with its own diesel-powered grid system, resulting in expensive and not very reliable supply. The cost of diesel power is unaffordable at 30–70 cents per kilowatt-hour (depending on the island) and requires government subsidies in excess of \$40 million annually. In 2012, the Maldives spent over \$470 million on oil imports, a large share of it being fuel for electricity generation. The 100% diesel dependence of the Maldives also makes its carbon emissions per unit of electricity among the highest in the region.

The Maldives has significant renewable energy resources, i.e., the potential to generate solar power and, in some pockets, wind power. Energy sector studies show that the cost of energy generation from hybrid (renewable energy and fossil fuel) systems would be significantly lower than the existing options. The government's effort to increase electricity production from indigenous sources, including solar and wind, to enhance energy security will reduce the pressure on the balance of payments and improve the fiscal position.

## Description

The project on the outer islands would transform the existing grids through physical investments in renewable energy, energy management and control systems, energy storage, and improvements in distribution networks, and significantly reduce the need for diesel to generate electricity. Private sector investments to support solar photovoltaic interventions on larger islands (initially planned for the State Electricity Company) are under consideration outside, and complementary to, the project.

The project outputs include the design and install solar–diesel hybrid grids on about 160 islands. It will also build the capacity of Ministry of Environment and Energy, State Electricity Company, and FENAKA on procurement, project management, technical and financial management, gender and safeguard support, and training.

**Total Grant Amount:** \$38.00 million (ADF)

\$12.00 million (SCF-SREP)

**Clean Energy Investment:** \$50.00 million

**Project Category:** Renewable energy

**Renewable Energy Generation:** 27.59 gigawatt-hours/year

**Energy Savings:** 242 TJ/year

**Greenhouse Gas Emission Reduction:** 40,000 tCO<sub>2</sub>e/year

**Board Approval:** 29 September 2014

**Project Life:** 25 years

**Impact** More sustainable energy sector based on renewable resources

**Outcome** Shift toward clean and cost-effective energy sources

- Outputs**
- Renewable energy-ready grid systems developed for outer islands and greater Male region
  - Enhanced capacity of Ministry of Environment and Energy, State Electricity, and FENAKA to implement renewable energy grid interventions

**Division** Energy Division, SARD

**Project Team**

**Team Leaders** P. Wijayatunga, Principal Energy Specialist, SARD  
L. George, Energy Specialist, SARD

**Team Members** J. Acharya, Senior Climate Change Specialist, SDCC  
M. Ajmera, Social Development Specialist, SARD  
K. Emzita, Principal Counsel, OGC  
A. Lopez, Energy Specialist, SARD  
S. Sasaki, Environment Specialist, SARD  
R. Sugimoto, Environment Specialist, SDCC

**Executing Agency** Ministry of Finance and Treasury

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**Grant Number:** 0383-NEP  
**Project Number:** 39399-034  
**South Asia Tourism Infrastructure Development  
Project-Additional Financing**

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## Rationale

The additional financing will support restructuring of the Nepal portion of the project to meet cost overrun as a result of price escalation and a change in scope of the Gautam Buddha Airport (GBA) from the originally designed regional international airport to a full international airport and safety improvements to provide unconstrained air connectivity for international tourists visiting the world heritage site at Lumbini. This is considered critical to achieving the objective of the original project, which was to develop Lumbini, the birth place of Lord Buddha, as an attractive cultural tourism destination and to upgrade GBA to link it with international tourist circuits in South Asia. Expanding the project scope—from an upgrade to regional international airport standard to a full international standard—will also enable GBA to serve as an alternate and backup international air transport point for Nepal in the event that poor weather conditions or a natural calamity shuts down Tribhuvan International Airport (TIA). TIA currently is the only airport in the country that can accommodate full-size aircrafts. Restructuring and completing the delayed project is expected to provide benefits that will outweigh the costs, and is preferred over downsizing or cancelling it by the Asian Development Bank (ADB) as the government has accorded it a high priority.

## Description

ADB's administration of a grant to be provided by ACEF for the additional financing will support the introduction of clean public transport services using electric vehicles for tourists and local residents in Lumbini area. This will help reduce noise and pollution from poorly maintained diesel and gasoline engine buses and add value to tourism experience.

**Total Grant Amount:** \$3.00 million (ACEF/CEFPF)  
**Clean Energy Investment:** \$3.00 million  
**Project Category:** Renewable energy  
**Renewable Energy Generation:** 0.84 gigawatt-hours/year  
**Greenhouse Gas Emission Reduction:** 156 tCO<sub>2</sub>e/year  
**Board Approval:** 28 March 2014  
**Project Life:** 12 years

**Impact** Enhanced contribution of tourism to sustainable and inclusive growth in the country

**Outcome** Nature- and culture-based tourism destinations improved

- Outputs**
- Enhanced connectivity to and from Lumbini
  - Improved community services and tourism facilities
  - Improved capacity in tourism development and project management

**Division** Nepal Resident Mission (NRM), SARD

**Project Team**

**Team Leader** G. Gewali, Senior Project Officer, NRM, SARD

**Team Members** Y. A. Kim, Counsel, OGC

D.K. Lee, Principal Transport Specialist, SARD

N. Pradhan, Project Officer, NRM, SARD

D. Singh, Senior Environment Officer, NRM, SARD

S. Subba, Senior Gender and Social Development Officer, NRM, SARD

L. Subedi, Senior Social Safeguard Officer, NRM, SARD

K. Tamaki, Senior Urban Development Specialist, SARD

**Executing Agencies** Ministry of Culture, Tourism and Civil Aviation

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**Loan/Grant Numbers:** 3139-NEP and 0398-NEP  
**Project Number:** 44219-014  
South Asia Subregional Economic Cooperation  
Power System Expansion Project

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## Rationale

Nepal is facing chronic power shortages. Only 65% of the country's households have access to electricity—56% through the national grid and 9% through off-grid solutions. Per capita electricity consumption is 102 kilowatt-hours per year, one of the lowest in the world. The installed capacity is 762 megawatts (MW), well below the peak demand of 1,095 MW. As a result, consumers connected to the national grid experience scheduled power cuts of 12 hours per day or more during the dry season. With the expected commissioning of six hydropower projects with a combined capacity of 732 MW in the next 3 to 6 years and more than 1,500 MW of additional capacity being developed, a wet season supply surplus is anticipated by 2018. However, the limited power transmission and distribution network is becoming a bottleneck for meeting domestic power demand, as well as power trade with neighboring countries.

## Description

The project will increase power transmission capacity and improve power distribution network by constructing/augmenting 400 kV, 220 kV, 33 kV, 11 kV and 400-volt lines and augmenting/replacing substations operating at different voltage levels. It will install up to 4.3 MW of mini hydroelectric power plants and up to 0.5 MW of mini-grid-based solar or solar and wind hybrid systems in selected rural communities. Furthermore, it will build the capacity of NEA and Alternative Energy Promotion Centre, on project management, preparation of a distribution system and rural electrification master plan, as well as a feasibility study of a large-scale wind farm; and parallel livelihood development activities in the project area.

**Total Loan Amount:** \$180.00 million (ADF)

**Total Grant Amount:** \$11.20 million (ADB SCF)

**Clean Energy Investment:** \$15.00 million

**Project Category:** Renewable energy

**Renewable Energy Generation:** 8 gigawatt-hours/year

**Greenhouse Gas Emission Reduction:** 20,000 tCO<sub>2</sub>e/year

**Board Approval:** 4 July 2014

**Project Life:** 40 years

**Impact** Increased electricity access in Nepal and improved power exchange across the border

**Outcome** Increased capacity of national power grid and enhanced renewable energy development

- Outputs**
- Power transmission capacity increased
  - Power distribution network improved
  - Mini-grid-based renewable energy systems in off-grid areas increased
  - Capacity development support to NEA and Alternative Energy Promotion Centre provided

**Division** Energy Division, SARD

#### Project Team

**Team Leader** L. Zhang, Energy Specialist, SARD

**Team Members** J. Acharya, Senior Climate Change Specialist, SDCC  
M. Ajmera, Social Development Specialist, SARD  
P. Manandhar, Project Officer (Energy), SARD  
S. Sasaki, Environment Specialist, SARD  
Y. Seo, Counsel, OGC  
D. Singh, Senior Environment Officer, SARD  
S. Subba, Senior Social Development Officer (Gender), SARD  
L. Subedi, Senior Social Development Officer (Safeguards), SARD  
P. Wijayatunga, Principal Energy Specialist, SARD  
H. Zhang, Finance Specialist (Energy), SARD

**Executing Agencies** Alternative Energy Promotion Center  
Nepal Electricity Authority

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**Loan Numbers:** 3146-SRI and 3147-SRI  
**Project Number:** 47037-004  
**Green Power Development and Energy Efficiency  
Improvement Investment Program – Tranche 1**

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## Rationale

Sri Lanka's efforts to develop the energy sector are reflected in the improved national electrification ratio: from 29% in 1990 to 94% by 2012. However, high dependence on expensive fossil fuel continues. Sector challenges include meeting growing demand for electricity at a low cost and acceptable reliability, and attaining long-term sustainability. The increase of the share of thermal oil-fired energy in power generation, from 6% in 1995 to 59% in 2012, creates a high cost base. The use of expensive oil-fired thermal plants to meet the growing demand is not a viable and sustainable solution for energy security and environment protection in the long term. Diversification of the generation mix primarily to renewable energy sources, improved network efficiency, reduced technical losses, and supply and demand-side management are needed. The transmission network needs to be expanded and modernized, particularly in former conflict-affected areas in Northern and Eastern provinces. Expansion of the 33-kilovolt (kV) medium-voltage network is required to provide power to rural areas where many households have poor reliability and inadequate supply.

## Description

Project 1 include the construction of (i) the 30-MW, run-of-river hydropower plant at Moragolla and associated transmission infrastructure; (ii) four new grid substations and associated lines at Kerewalapitiya (220/33 kV), Kappalurai (220/132/33 kV), Kalutara and Kesbewa (both 132/33 kV), and augmentation of Katunayake and old Anuradhapura 132/33 kV grid substations in Western, Eastern, and North Central provinces; (iii) 33 kV lines and gantries around Vavunativu and Madampe in Eastern and North Western provinces; and (iv) demand-side management pilot subprojects in Colombo. It also includes capacity building and project management for preparing future multi-tranche financing facility investments and supervising implementation of capital investments of project 1.

**Total Loan Amount:** \$121.00 million (OCR)  
\$29.00 million (ADF)  
\$30.00 million (AFD)

**Clean Energy Investment:** \$180.00 million

**Project Category:** Renewable energy/Demand-side energy efficiency/Supply-side energy efficiency

**Renewable Energy Generation:** 97.7 gigawatt-hours/year

**Energy Savings:** 8.706 gigawatt-hours/year

**Greenhouse Gas Emission Reduction:** 78,712 tCO<sub>2</sub>e/year

**Board Approval:** 29 July 2014

**Project Life:** Hydropower plant—40 years  
Transmission and distribution infrastructure—40 years  
Demand-side management subprojects—20 years

**Impact** Enhanced clean power generation, system efficiency and reliability

**Outcome** Increased hydropower generation capacity and transmission and medium voltage network efficiency

- Outputs**
- Hydropower generation developed in the Central Province
  - Transmission infrastructure capacity enhanced
  - Efficiency of medium voltage network improved
  - Demand-side management for energy efficiency improved
  - Capacity development support provided to Ceylon Electricity Board

**Division** Energy Division, SARD

**Project Team**

**Team Leader** M. Khamudkhanov, Principal Energy Specialist, SARD

**Team Members** M. Ajmera, Social Development Specialist, SARD  
H. Gunatilake, Lead Energy Economist, SARD  
S. Sasaki, Environment Specialist, SARD  
A. Syed, Counsel, OGC  
P. Wijayatunga, Principal Energy Specialist, SARD  
R. Wimalasena, Project Officer (Energy), Sri Lanka Resident Mission, SARD  
H. Zhang, Financial Specialist (Energy), SARD

**Executing Agency** Ministry of Power and Energy





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# Southeast Asia Department

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**Loan Numbers:** 3161-VIE and 8286-VIE  
**Project Number:** 46391-001  
Hanoi and Ho Chi Minh City Power Grid  
Development Sector Project

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## Rationale

Expanding the power system's capacity sustainably to meet the rapidly growing electricity demand is a key priority of the government of Viet Nam. According to the seventh power development plan, demand is expected to grow from 120 terawatt-hours (TWh) in 2012 to 330 TWh in 2020, and potentially to 700 TWh by 2030. Thus, generation capacity is to be strengthened from 26.5 gigawatts (GW) in 2012 to 70.5 GW in 2020, and over 8,000 kilometers of 500 kilovolt (kV) lines and 15,000 kilometers of 220 kV lines will be constructed to transmit the generated power to the load centers. The total investment needs for the power sector up to 2020 are estimated to be \$48.8 billion, of which \$16.3 billion is for grid expansion.

## Description

The project will strengthen the capacity and reliability of the power infrastructure in the two largest cities of Viet Nam—Ha Noi and HCMC—through rehabilitation, expansion and development of the 220 kV and 110 kV electricity power grids in the respective cities.

**Total Loan Amount:** \$172.70 million (OCR)  
\$100.00 million (ASEAN Infrastructure Fund)

**Clean Energy Investment:** \$159.73 million

**Project Category:** Supply-side energy efficiency

**Energy Savings:** 662.63 gigawatt-hours/year

**Greenhouse Gas Emission Reduction:** 460,000 tCO<sub>2</sub>e/year

**Board Approval:** 23 September 2014

**Project Life:** 40 years

**Impact** Growth in national electricity demand is met in a sustainable manner

**Outcome** Improved reliability and efficiency of electricity supply in Ha Noi and HCMC

- Outputs**
- Four core substation and transmission line subprojects in Ha Noi developed and/or rehabilitated
  - Four core substation and transmission line subprojects in HCMC developed and/or rehabilitated
  - Up to 20 noncore substation and transmission line subprojects in Ha Noi developed and/or rehabilitated
  - Up to nine noncore substation and transmission line subprojects in HCMC developed and/or rehabilitated

**Division** Energy Division, SERD

**Project Team**

**Team Leader** T. Kadono, Energy Specialist, SERD

**Team Members** M. T. Au, Senior Project Officer (Energy), SERD  
C. Jung, Energy Specialist, SERD  
B. Konysbayev, Senior Counsel, OGC  
H. Lee, Energy Economist, SERD  
H. B. Nguyen, Regional Cooperation Specialist, SERD  
M. Paterno, Finance Specialist, SERD  
G. Peralta, Senior Safeguards Specialist (Environment), SERD  
M. Suga, Social Development Specialist, SERD

**Executing Agencies** Hanoi Power  
Ho Chi Minh City Power

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**Grant Number:** 0384-VIE  
**Project Number:** 42182-013  
**Renewable Energy Development and Network  
Expansion and Rehabilitation for Remote Communes  
Sector – Additional Financing**

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## Rationale

The scope of expansion of the distribution networks under the ongoing project (Loan No. 2517) does not include the service connections (installation downstream the energy meter) to connect houses to the expanded networks. Approximately 50% of those households who will have access to electricity under the project are unable to afford the up-front service connection cost, estimated between \$50 and \$100 per household. In order to ensure poor and vulnerable households are connected to electricity network, during loan negotiation and loan inception mission in November 2009, Asian Development Bank project staff and executing agencies considered complementing the loan financing with grant subsidy to be implemented using output-based aid (OBA) mechanism.

Electricity supply will reduce the financial burden of poor households living in project areas, who cannot afford the up-front service connection costs, by decreasing their expenses on alternative energy sources such as expensive kerosene and batteries. Lighting is the primary energy need in these areas and switching from kerosene lamps to electric lamps is considered life changing including socioeconomic benefits such as improved indoor air quality, extended hours of productive activities and studies, lower fire hazard, enhanced security, recreation, access to information, and opportunities for income generating activities. Hence, the OBA activity will enhance the economic benefits of the ongoing project.

## Description

The additional financing will be used to pay the one-off upfront electricity service connection fee for a minimum of 48,333 poor households in the project areas.

**Total Grant Amount:** \$3.00 million (CEF under CEFPP)  
**Clean Energy Investment:** \$3.00 million  
**Project Category:** Renewable Energy  
**Renewable Energy Generation:** not applicable  
**Greenhouse Gas Emission Reduction:** 60,000 tCO<sub>2</sub>e/year  
**Board Approval:** 9 April 2014

**Impact** Promote pro-poor and balanced economic development of remote, mountainous and poor communes through sustainable use of electricity and renewable energy in an affordable manner.

**Outcome** Provision of reliable and affordable supply of electricity to remote, mountainous and poor communes

**Outputs**

- Installation of 5-10 mini hydro plants
- Electrification of 1,000 villages through grid expansion and rehabilitation
- Poor and vulnerable families in the project areas connected to the expanded electricity grid

**Division** Energy Division, SERD

#### Project Team

**Team Leader** E. Baardsen, Senior Infrastructure Specialist, SERD

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M. Buendia Social Development Specialist (Resettlement), SERD  
S. Kawazu, Counsel, OGC  
M. Sultana, Social Development Specialist, SERD  
Y. Tsujiki, Financial Analysis Specialist, SERD  
A. M. Tuan, Information Technology Officer, SERD

**Executing Agencies** Northern Power (Power Company 1)  
Central Power (Power Company 2)  
Southern Power (Power Company 3)

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**Loan Numbers:** 3113-VIE and 8279-VIE  
**Project Number:** 45200-002  
**Sustainable Urban Transport for Ho Chi Minh City  
Mass Rapid Transit Line 2**

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## Rationale

Ho Chi Minh City (HCMC) is the largest city in Viet Nam, with a greater urban area population of more than 9.0 million that is expected to grow to 13.8 million by 2025. Urban transportation is dominated by private vehicles, mostly motorcycles, which account for 85% of all vehicles. The dominance of private vehicle use, combined with an inadequate road system, creates severe congestion and peak hour travel speeds on many routes that average less than 10 kilometers per hour. Road safety is poor and the traffic accident rate high.

The rapid growth of private vehicle traffic is partly due to HCMC's inadequate public transport system. It currently consists of a poorly integrated, inefficient bus network that cannot compete with transportation by motorcycles and cars. Poor institutional arrangements for establishing, allocating, and operating bus routes and providing reliable service limits ridership, which is part of the reason the system does not recover its operating costs. In addition, bus fares are kept low through heavy government subsidies. Planning, management, and control of traffic in the city are weak, and few policies or regulations exist that seek to reduce reliance on private vehicles or encourage the use of public transit.

## Description

The project will support the effective and sustainable use of the new Line 2 of the HCMC mass rapid transit (MRT) network now being developed with Asian Development Bank assistance. It will enhance the connectivity between the MRT Line 2 stations and other modes of public and private transport, and strengthen urban transport policies and regulations.

The project will provide infrastructure for improving accessibility to MRT2 stations, implement feeder bus links, integrated multi-modal stations with "park and ride" facilities where appropriate, infrastructure for improving accessibility to MRT2 stations as well as a parking plan for the city. Project management and institutional capacity building measures, together with expected policy and regulatory reforms, will also help achieve an improved public transport system and reduce greenhouse gas emissions. The project components, public transport services and other facilities will be designed to incorporate gender sensitive features that will compliment similar measures under the MRT2 project.

**Total Loan Amount:** \$10.00 million (ADF)  
\$48.95 million (CTF)

**Clean Energy Investment:** \$29.02 million

**Project Category:** Demand-side energy efficiency

**Energy Savings:** 54.32 terajoules/year

**Greenhouse Gas Emission Reduction:** 4,025 tCO<sub>2</sub>e/year

**Board Approval:** 20 February 2014

**Project Life:** 20 years

**Impact** Enhanced public transport system serving 6 districts in HCMC

**Outcome** Improved integration of MRT Line 2 stations with other modes of public and private transport

- Outputs**
- MRT Line 2 station access improved
  - Public transport information system established
  - Public transport policy and system developed

**Division** Transport and Communications Division, SERD

#### Project Team

**Team Leader** R. Valkovic, Principal Transport Specialist, SERD

**Team Members** J. Acharya, Senior Climate Change Specialist (Clean Energy), SDCC  
I. Ahsan, Counsel, OGC  
C. Clark, Safeguards Specialist (Resettlement), SERD  
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T. Mella, Operations Officer, SERD  
K. Sakamoto, Transport Economist, SDCC  
L. Thang, Senior Project Officer (Transport), Viet Nam Resident Mission  
A. Velasquez, Safeguards Specialist (Environment), SERD

**Executing Agency** Ho Chi Minh City People's Committee



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**Loan Numbers:** 3235-VIE and 8291-VIE

**Project Number:** 40080-024

**Strengthening Sustainable Urban Transport  
for Hanoi Metro Line 3**

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## Rationale

Ha Noi is at an early stage of urban transport development, having moved from heavy usage of bicycles to motorcycles and now increasingly to cars. Private vehicles dominate urban transportation, about 90% of which consists of motorcycles. Continued increasing car ownership, together with a significant increase in the number of motorcycles, has resulted in severe congestion during peak hours, resulting in degradation of the urban environment and a rise in traffic accidents. The situation is expected to worsen if the current traffic growth trend of 9% per year continues and more motorbike users convert to cars. The existing public transport system consists of an inadequate bus network that is becoming less competitive with private modes of transport.

The Ha Noi People's Committee plans to develop a city-wide mass transit system, and four metro lines and one bus rapid transit line are currently under development. Construction of phase 1 for metro line 3 commenced in October 2010 and it is expected to be operating in 2019. However, complementary measures building upon other sector reforms to improve public transport will need to be designed to ensure the emergence of an integrated public transport system that is attractive, accessible, and affordable. The proposed project will support a multimodal, integrated transport system to attract passengers from private vehicles to public transport services. This modal shift will promote inclusive low-carbon transport, thereby reducing greenhouse gas emissions and environmental pollution.

## Description

The project will directly support the integration of metro line 3 into the public transport network by providing infrastructure to improve connectivity to metro line 3 stations through feeder bus links. The project will develop integrated multimodal stations for metro line 3 with parking plans and park-and-ride facilities to improve station accessibility. The supporting infrastructure, public transport services, and other facilities will be designed to incorporate gender-sensitive features that will complement similar measures under the metro line 3 project. In addition, policy and regulatory measures developed will be fully inclusive by addressing the needs of all potential public transport users. The proposed institutional capacity building measures for metro agencies, together with expected policy and regulatory reforms, will also help achieve an improved public transport system and reduce greenhouse gas emissions.

**Total Loan Amount:** \$4.20 million (ADF)  
\$48.95 million (CTF)

**Clean Energy Investment:** \$26.17 million

**Project Category:** Demand-side energy efficiency

**Energy Savings:** 113.36 terajoules/year

**Greenhouse Gas Emission Reduction:** 8,400 tCO<sub>2</sub>e/year

**Board Approval:** 12 December 2014

**Project Life:** 20 years

**Impact** Enhanced public transport system serving six districts of Ha Noi

**Outcome** Improved integration of metro line 3 stations with other modes of public transport

- Outputs**
- Metro line 3 station access improved
  - Public transport system improved
  - Public transport policy developed

**Division** Transport and Communications Division, SERD

**Project Team**

**Team Leader** R. Valkovic, Principal Transport Specialist, SERD

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L. Thang, Senior Project Officer (Transport), Viet Nam Resident Mission, SERD  
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A. Veron-Okamoto, Transport Economist, SERD

**Executing Agency** Ha Noi People's Committee



## Appendix 1: 2014 Grant-Financed Clean Energy Projects

Grant Number	DMC	Department and Division	Project Officer	Project Name	Sector and Clean Energy Category	Total Amount (\$ million)	Clean Energy Investment (\$ million)	Funding Source
0421	BHU	Energy Division, SARD	Kaaru Ogino	Second Green Power Development Project	Energy/Renewable Energy	25.25	25.25	ADF
0415	COO	Transport, Energy and Natural Resources Division, PARD	Woo Lee	Renewable Energy Sector Project	Energy/Renewable Energy	7.26	7.26	European Union
0419	KGZ	Energy Division, CWRD	Sohail Hasnie	Toktogul Rehabilitation Phase 2 Project	Energy/Renewable Energy	44.50	37.36	ADF
0409	MLD	Energy Division, SARD	Len V. George	Preparing Outer Islands for Sustainable Energy Development Project	Energy/Renewable Energy	38.00	38.00	ADF
0410	MLD	Energy Division, SARD	Len V. George	Preparing Outer Islands for Sustainable Energy Development Project	Energy/Renewable Energy	12.00	12.00	SCF-SREP
0414	NAU	Transport, Energy and Natural Resources Division, PARD	J. Michael Trainor	Electricity Supply Security and Sustainability	Energy/Supply-side energy efficiency	2.00	0.34	ADF
0424	NAU	Transport, Energy and Natural Resources Division, PARD	J. Michael Trainor	Electricity Supply Security and Sustainability	Energy/Supply-side energy efficiency	2.70	0.46	European Union
0383	NEP	Nepal Resident Mission, SARD	Govinda P. Gewali	South Asia Tourism Infrastructure Development Project - Additional Financing	Transport/Renewable energy	3.00	3.00	ACEF/CEFPF
0398	NEP	Energy Division, SARD	Zhang Lei	South Asia Subregional Economic Cooperation Power System Expansion Project	Energy/Renewable Energy	11.20	10.00	SCF-SREP
0388	PRC	Transport and Communications Division, EARD	Ki-Joon Kim	Jiangxi Fuzhou Urban Integrated Infrastructure Improvement – Additional Financing	Transport/Demand-side energy efficiency	2.55	2.55	GEF
0420	PRC	Transport and Communications Division, EARD	Ki-Joon Kim	Jiangxi J'ian Sustainable Urban Transport Project	Transport/Demand-side energy efficiency	2.55	2.55	GEF
0386	SOL	Transport, Energy and Natural Resources Division, PARD	Anthony Maxwell	Provincial Renewable Energy Project	Energy/Renewable Energy	6.00	6.00	ADF
0384	VIE	Energy Division, SERD	Au Minh Tuan	Renewable Energy Development and Network Expansion and Rehabilitation for Remote Communes Sector - Additional Financing	Energy/Renewable Energy	3.00	3.00	CEF under CEFPF

ACEF = Asian Clean Energy Fund, ADF = Asian Development Fund, BHU = Bhutan, CEF = Clean Energy Fund, CEFPF = Clean Energy Financing Partnership Facility, COO = Cook Islands, CWRD = Central and West Asia Department, DMC = developing member country, EARD = East Asia Department, GEF = Global Environment Facility, KGZ = Kyrgyz Republic, MLD = Maldives, NAU = Nauru, NEP = Nepal, PARD = Pacific Department, PRC = People's Republic of China, SARD = South Asia Department, SCF = Strategic Climate Fund, SERD = Southeast Asia Department, SOL = Solomon Islands, SREP = Scaling Up Renewable Energy Program, VIE = Viet Nam.

## Appendix 2: 2014 Sovereign and Nonsovereign Projects with Clean Energy Components

Loans and Investments				
DMC	Loan/ Investment No.	Project Name	Total Amount (\$ million)	Clean Energy Investment (\$ million)
<b>Sovereign Projects</b>				
<b>Energy Sector</b>				
BHU	3225	Second Green Power Development Project	70.00	61.42
BHU	3226	Second Green Power Development Project	25.25	25.25
COO	3193	Renewable Energy Sector Project	11.19	11.19
IND	3140	Assam Power Sector Investment Program - Tranche 1	50.00	32.27
IND	3186	Clean Energy Finance Investment Program - Tranche 1	200.00	200.00
KGZ	3212	Toktogul Rehabilitation Phase 2 Project	165.50	163.74
NEP	3139	South Asia Subregional Economic Cooperation Power System Expansion Project	180.00	5.00
PRC	3218	Low Carbon District Heating Supply in Hohhot in Inner Mongolia Autonomous Region	150.00	64.27
SOL	3127	Provincial Renewable Energy Project	6.00	6.00
SRI	3147	Green Power Development and Energy Efficiency Improvement Investment Program - Tranche 1	121.00	121.00
SRI	3146	Green Power Development and Energy Efficiency Improvement Investment Program - Tranche 1	29.00	29.00
SRI		Green Power Development and Energy Efficiency Improvement Investment Program - Tranche 1	30.00	30.00
UZB	3141	Takhiatash Power Plant Efficiency Improvement Project	300.00	163.27
VIE	3161	Hanoi and Ho Chi Minh City Power Grid Development	172.70	101.16
VIE	8286	Hanoi and Ho Chi Minh City Power Grid Development	100.00	58.57
<b>Nonenergy Sectors</b>				
BAN	3169	South Asia Subregional Economic Cooperation Railway Connectivity: Akhaura-Laksam Double Track	400.00	227.55
BAN	3170	South Asia Subregional Economic Cooperation Railway Connectivity: Akhaura-Laksam Double Track	105.00	59.73
IND	3183	Rajasthan Urban Sector Development Program	250.00	30.77
PRC	3109	Railway Energy Efficiency and Safety Enhancement Investment Program - Tranche 5	170.00	59.68
PRC	3114	Guangdong Chaonan Water Resources Development and Protection Demonstration Project	100.00	9.98
PRC	3211	Jilin Urban Development	150.00	8.83
PRC	3216	Jiangxi Ji'an Sustainable Urban Transport Project	120.00	2.71
VIE	3113	Sustainable Urban Transport for Ho Chi Minh City Mass Rapid Transit Line 2 Project	10.00	4.92
VIE	8279	Sustainable Urban Transport for Ho Chi Minh City Mass Rapid Transit Line 2 Project	48.95	24.10
VIE	3235	Strengthening Sustainable Urban Transport for Hanoi Metro Line 3	4.20	2.07
VIE	8291	Strengthening Sustainable Urban Transport for Hanoi Metro Line 3	48.95	24.10
<b>Subtotal (Sovereign Projects)</b>			<b>3,017.74</b>	<b>1,526.56</b>

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Appendix 2 *continued*

Loans and Investments				
DMC	Loan/ Investment No.	Project Name	Total Amount (\$ million)	Clean Energy Investment (\$ million)
Nonsovereign Projects				
<b>Energy Sector</b>				
BAN	7436/3236	Summit Bibiyana II Power (Bibiyana II Gas Power Project)	75.00	22.83
GEO	7407/3130	Adjaristsqali Georgia (Adjaristsqali Hydropower Project)	90.00	90.00
IND	7406	ReNew Power Ventures (ReNew Power Investment Project)	50.00	50.00
IND	7416/3175	ACME EDF Solar Power Project	9.79	9.79
IND	7417/3176	ACME EDF Solar Power Project	9.81	9.81
IND	7418/3177	ACME EDF Solar Power Project	9.79	9.79
IND	7419/3178	ACME EDF Solar Power Project	9.81	9.81
IND	7420/3179	ACME EDF Solar Power Project	10.79	10.79
IND	7421/3180	ACME EDF Solar Power Project	50.00	50.00
INO	7409	Supreme Energy Rantau Dedap (Rantau Dedap Geothermal Development Project Phase 1)	50.00	50.00
LAO	7417/3153	Nam Ngiep 1 Power (Nam Ngiep 1 Hydropower Project)	127.00	127.00
LAO	7417/3154	Nam Ngiep 1 Power (Nam Ngiep 1 Hydropower Project)	94.00	94.00
PRC	7432/3206	China Gas Holdings (Natural Gas for Land and River Transportation Project)	450.00	109.35
REG	7430	Equity Investment in AEP II	30.00	30.00
THA	7435/3219	Chaiyaphum Wind Farm (Subyai Wind Power Project)	83.00	83.00
<b>Nonenergy Sector</b>				
MYA	7408/3137	Yangon Urban Renewal and District Cooling Project	120.00	3.00
<b>Subtotal (Nonsovereign Projects)</b>			<b>1,269.00</b>	<b>759.18</b>

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Appendix 2 *continued*

Grants				
DMC	Grant Number	Project Name	Total Amount (\$ million)	Clean Energy Investment (\$ million)
<b>Energy Sector</b>				
BHU	0421	Second Green Power Development Project	25.25	25.25
COO	0415	Renewable Energy Sector Project	7.26	7.26
KGZ	0419	Toktogul Rehabilitation Phase 2 Project	44.50	37.36
MLD	0409	Preparing Outer Islands for Sustainable Energy Development Project	38.00	38.00
MLD	0410	Preparing Outer Islands for Sustainable Energy Development Project	12.00	12.00
NAU	0414	Electricity Supply Security and Sustainability	2.00	0.34
NAU	0424	Electricity Supply Security and Sustainability	2.70	0.46
NEP	0398	South Asia Subregional Economic Cooperation Power System Expansion Project	11.20	10.00
SOL	0386	Provincial Renewable Energy Project	6.00	6.00
VIE	0384	Renewable Energy Development and Network Expansion and Rehabilitation for Remote Communes Sector - Additional Financing	3.00	3.00
<b>Nonenergy Sector</b>				
NEP	0383	South Asia Tourism Infrastructure Development Project - Additional Financing	3.00	3.00
PRC	0420	Jiangxi Ji'an Sustainable Urban Transport Project	2.55	2.55
PRC	0388	Jiangxi Fuzhou Urban Integrated Infrastructure Improvement - Additional Financing	2.55	2.55
<b>Subtotal (Grants)</b>			<b>160.01</b>	<b>147.77</b>
<b>Total</b>			<b>4,446.75</b>	<b>2,433.51</b>

BAN = Bangladesh, BHU = Bhutan, COO = Cook Islands, GEO = Georgia, IND = India, INO = Indonesia, KGZ = Kyrgyz Republic, LAO = Lao People's Democratic Republic, MLD = Maldives, MYA = Myanmar, NAU = Nauru, NEP = Nepal, PRC = People's Republic of China, REG = Regional, SOL = Solomon Islands, SRI = Sri Lanka, THA = Thailand, UZB = Uzbekistan, VIE = Viet Nam.

## **2014 Clean Energy Investments**

### *Project Summaries*

This report summarizes the investments in clean energy made by the operations departments of the Asian Development Bank (ADB) in 2014, condensing information from project databases and formal reports in an easy-to-reference format. This report was prepared by ADB's Clean Energy Program which provides the cohesive agenda that encompasses and guides ADB's lending and nonlending assistance, initiatives, and plan of action for sustainable growth in Asia and the Pacific.

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