

# 2011

## Clean Energy Investments

Project Summaries





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June 2012

Asian Development Bank

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Printed in the Philippines

ISBN 978-92-9092-678-8 (Print), 978-92-9092-679-5 (PDF)  
Publication Stock No. RPT124641

#### Cataloging-In-Publication Data

Asian Development Bank

2011 Clean energy investments: Project summaries.  
Mandaluyong City, Philippines: Asian Development Bank, 2012.

1. Clean energy. 2. Renewable energy. 3. Energy efficiency. I. Asian Development Bank.

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All data as of 31 December 2011.

#### Note:

In this report, “\$” refers to US dollars.

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# Abbreviations

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ADB	–	Asian Development Bank
CAREC	–	Central Asia Regional Economic Cooperation Program
CCGT	–	combined-cycle gas turbine
COSO	–	Central Operations Services Office
CWRD	–	Central and West Asia Department
EARD	–	East Asia Department
IGCC	–	integrated gasification combined-cycle
IMAR	–	Inner Mongolia Autonomous Region
kg	–	kilogram
LPG	–	liquefied petroleum gas
OCO	–	Office of Cofinancing Operations
OGC	–	Office of the General Counsel
PARD	–	Pacific Department
PLN	–	PT Perusahaan Listrik Negara (State Electricity Corporation)
PRC	–	People's Republic of China
PSOD	–	Private Sector Operations Department
RSDD	–	Regional and Sustainable Development Department
SARD	–	South Asia Department
SERD	–	Southeast Asia Department
tCO <sub>2</sub> e	–	ton of carbon dioxide equivalent



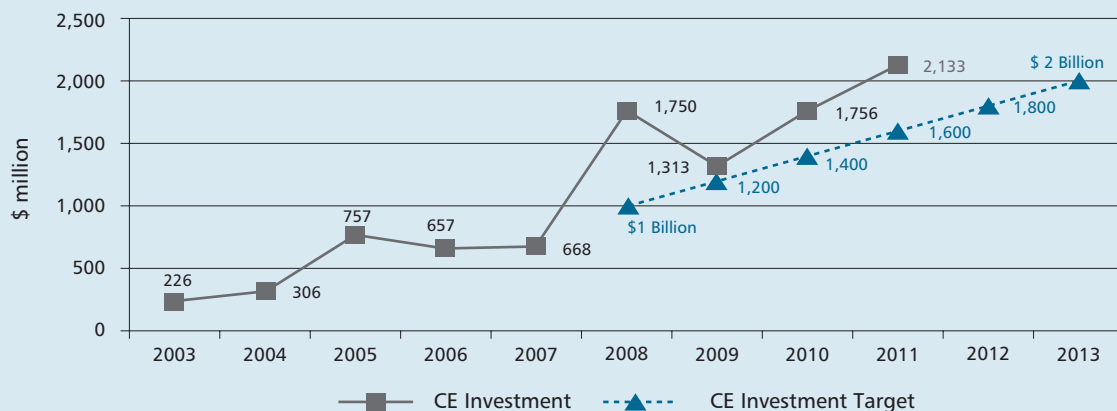
# Executive Summary

In 2011, the Asian Development Bank (ADB) achieved clean energy investments of \$2.1 billion, meeting its investment target of \$2 billion annually by 2013, two years ahead of schedule. When ADB committed to this target in 2009, it also formalized its policy to support clean energy in as many sectors and ways as possible.

The 2009 Energy Policy has proven to have correctly anticipated the high interest and enormous appetite for clean energy among the developing countries of Asia and the Pacific. While meeting the target early is welcome and to be celebrated, it is not entirely unexpected nor is it without precedent.

In 2008, based on the successes of its then current energy efficiency initiative, ADB originally targeted raising clean energy investments to \$1 billion annually in the span between 2008 and 2012. This target was reached immediately, with investments of \$1.75 billion in 2008, leading to the setting of a target of \$2 billion.

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



In 2011, ADB's clean energy investments reached a total of \$2.13 billion. The solid gray line in the figure above tracks ADB's annual clean energy investments, while the dotted blue line marks ADB's target of \$1 billion from 2008 to 2012, and its \$2 billion target starting in 2013. Source: ADB Database 2011.

While industry experts working in renewables such as solar and wind described 2011 as a challenging year due to continuing economic turbulence, they remain optimistic with good reason. Globally, investment in solar power surged to \$136 billion in 2011 and the total amount of wind power in the world increased by 41,000 MW in 2011.<sup>1</sup> These contributed to a new high in global clean energy investment of \$260 billion.<sup>2</sup> Clean energy has found fertile ground in the energy hungry Asia and the Pacific, led primarily by enormous investment in the People's Republic of China and India.

<sup>1</sup> Global Wind Energy Council, <http://bit.ly/l6wEFV>, 2011.

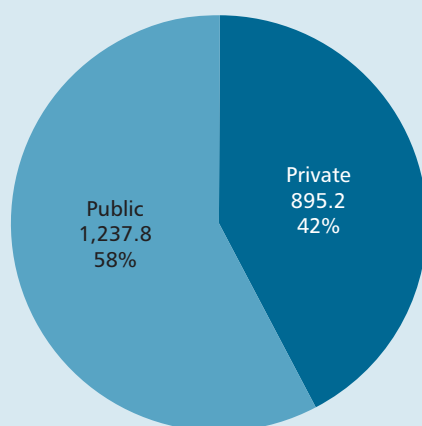
<sup>2</sup> Bloomberg New Energy Finance <http://bnef.com/PressReleases/view/180>, 2011.



ADB entered 2011 aiming to capitalize on the evolution of our Clean Energy Program into an overarching framework supporting projects in renewables and energy efficiency in the energy sector and in non-energy sectors as well. We exit 2011 with expanded support for solar energy through the Asia Solar Energy Initiative, the approval of the Quantum Leap in Wind Power technical assistance for the priority countries of Mongolia, the Philippines, Viet Nam and Sri Lanka, and new support for venture capital firms focusing on bringing climate change related technologies to market.

Of ADB's total clean energy investment of \$2.1 billion, the majority (58%) are public sector or sovereign loans totaling \$1.2 billion, while the remaining \$895 million (42%) went to the private sector. Private sector investments rose by almost \$300 million compared to 2010 investments, while public sector investments rose by around \$100 million.

**Figure 2 Clean Energy Investments—Public versus Private Sector, 2011**  
(\$ million)



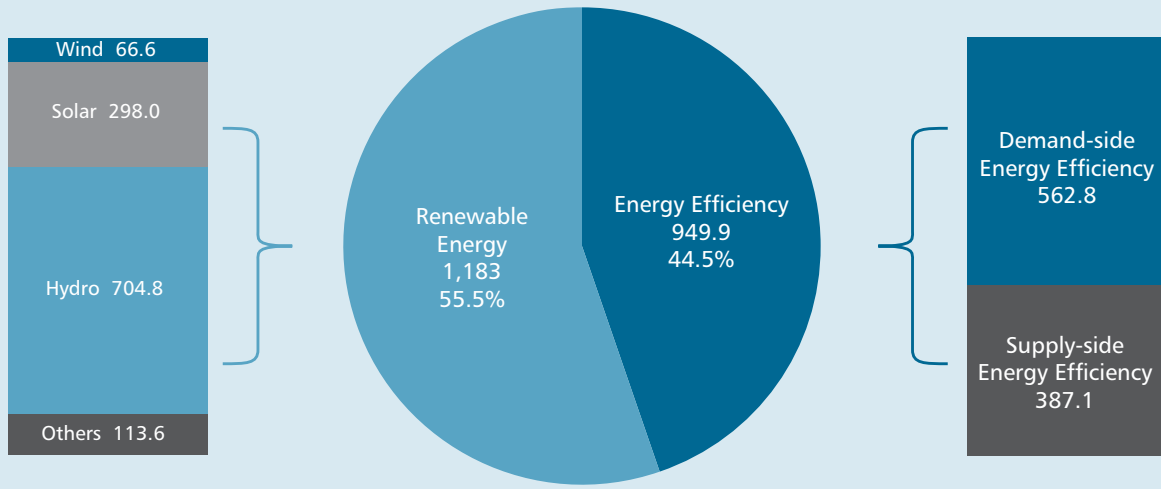
Source: ADB Database 2011.

By clean energy project type, ADB's renewable energy investments make up the largest share. (See Figure 3). Investments in renewables amounted to \$1.18 billion in 2011. Energy efficiency investments expanded greatly in 2011, with \$950 million invested, compared to \$340 million in 2010.

As shown in Figure 4, out of ADB's total clean energy investments, \$1.7 billion was invested in the energy sector, while \$400 million was invested in projects in non-energy sectors including transport and water.

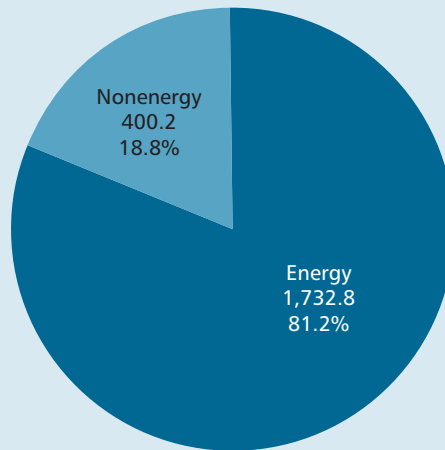
ADB's \$2.1 billion in clean energy investments in 2011 is expected to result in significant energy savings from energy efficiency, a total of 3.3 Terawatt hours per year of clean power from renewable sources such as solar, wind and hydro; 3.3 Terawatt hours per year of electricity savings from energy efficiency; more than 91,000 terajoules per year from avoided consumption of direct fuel; the abatement of 13.7 million tons of carbon dioxide equivalent (tCO<sub>2</sub>e) per year; and installation of 875 megawatts of renewable energy generation capacity. (Figure 5)

**Figure 3 Clean Energy Investments by Clean Energy Project Type, 2011**  
(\$ million)



"Others" refers to investments mainly in clean energy financing guarantee, equity, and biomass.  
Source: ADB Database 2011.

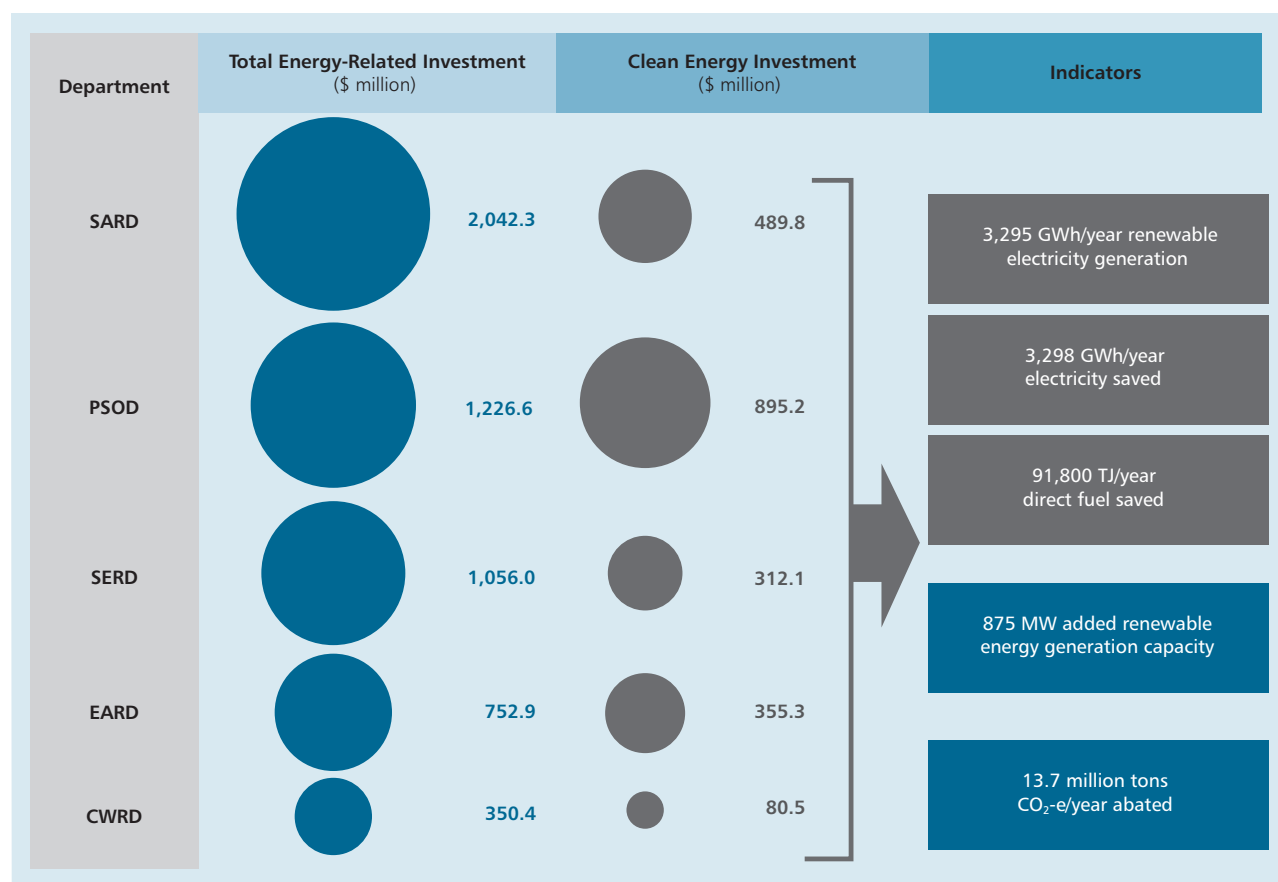
**Figure 4 Clean Energy Investments by Sector, 2011**  
(\$ million)



Source: ADB Database 2011.

An analysis of clean energy investments by operations department shows that most of 2011's investments came from the Private Sector Operations Department (42% of investment) whose work supports projects all across the region. This was closely followed by South Asia Department with \$490 million (23%), the East Asia Department \$355 million (16.6%), the Southeast Asia Department with \$312 million (14.6%) and finally the Central and West Asia Department with \$80 million (3%).

Figure 5 Indicators for Clean Energy Investments, 2011  
(\$ million)



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

Source: ADB Database 2011.

Of ADB's total clean energy investments in 2011, there were two grant financed investments totalling \$30.72 million. A \$75.4 million grant was extended to Afghanistan to improve the delivery of electricity services in the country, with \$27.42 million of that amount supporting the rehabilitation and upgrade of a hydropower plant. The second grant of \$3.3 million was for a public-private infrastructure development facility in Bangladesh which will support the development of the household solar energy market. For more details on these two grants, see Appendix 1.

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# Central and West Asia Department

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**Grant numbers:** 0280/0281/0282-AFG  
**Project numbers:** 42094-04/42094-09  
MFF—Energy Sector Development Investment  
Program Project 3 (formerly MFF—Energy Sector  
Enhancement Investment Program Project III)

## Rationale

The access to reliable power supply is severely limited in Gereshk, Afghanistan. Of the 7,500 households within the 6 km radius of the town center in Gereshk District, only 2,500 have connections to the local electricity distribution system. Even for those connected to the electricity network experience chronic power outages during morning and evening peak hours. Power shortage is a critical impediment in promoting licit private sector development, ensuring quality public services, and improving living conditions in Gereshk.

The limited access to reliable power is attributed to the power infrastructure deficiency. Gereshk relies on an island electrical grid with power generated predominantly by an old and damaged run-of-river type hydro power plant. The hydro power plant has an installed capacity of 3.2 MW, but operates sub-optimally with 2 MW. The peak demand is estimated at 8 MW. The distribution network consists of a combination of 40 kV and 3.3 kV system, which is not efficient and not capable of distributing any increase in the generated output. Further, the distribution network is in a poor state of repair with problems on support structures, transformers, substations and low voltage customer connections. Da Afghanistan Breshna Sherkat (DABS) does not have the capacity nor resources to rehabilitate the infrastructure on its own.

## Description

The project will rehabilitate the Gereshk Hydropower Plant and upgrade the distribution network. The project will also connect more end-users to the power grid in the Gereshk town center with more efficient distribution network.

Total grant amount: \$43 million (ADF)/\$20 million (UK)/\$12.4 million (Denmark)

Clean energy investment: \$27.42 million

Project category: Renewable Energy

Renewable energy generation: 18.92 gigawatt-hours/year

Greenhouse gas emissions reduction: 15,289 tCO<sub>2</sub>/year

Board approval: 22 Dec 2011

Project life: 30 years

Grant numbers: 0280/0281/0282-AFG    Project numbers: 42094-04/42094-09

**Impact**    Better power supply in areas south of Kabul.

**Outcome**    Increase in hydropower generation capacity in Gereshk.

**Outputs**

- Gereshk power supply system rehabilitated and improved
- End-user connections increased with improved distribution facilities
- DABS operational capacity increased

**Division**    Energy Division, CWRD

#### Program team

**Team leader**    K. Mitsuhashi, Energy Specialist, CWRD

**Team members**

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- R. Sanda, Energy Specialist (Investment), CWRD
- I. Setyawati, Social Development Specialist (Resettlement) CWRD

**Executing agency**    Da Afghanistan Breshna Sherkat (DABS)

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**Loan number:** 2737-TKM  
**Project number:** 43441-01  
North–South Railway Project

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## Rationale

The Government of Turkmenistan signed a multilateral agreement in October 2007, with Kazakhstan and Iran to construct new railway tracks to develop the North-South railway corridor. This is the region's key route for transporting bulky goods, such as oil and oil products, mineral resources, agricultural products and textiles. The north–south railway line will promote regional trade, cooperation, and integration. The project will reduce transport costs, cut travel time and improve accessibility to rural areas of the country. This will generate benefits beyond savings in railway transport costs and time.

## Description

The north-south railway line will improve Turkmenistan's accessibility to Kazakhstan, the Persian Gulf countries, the Russian Federation, and South Asia. It will also increase regional trade. The project will contribute to sustainable economic growth in Turkmenistan and the development of an integrated and efficient railway system in the region.

**Total loan amount:** \$125 million (OCR)  
**Clean energy investment:** \$25 million  
**Project category:** Demand side energy efficiency  
**Energy savings:** 15.82 gigawatt-hours/year  
**Greenhouse gas emissions reduction:** 10,200 tCO<sub>2</sub>/year  
**Board approval:** 15 Mar 2011  
**Project life:** 40 years

Loan number: 2737-TKM Project number: 43441-01

**Impact** Increased trade between Turkmenistan and other countries in the region.

**Outcome** An efficient, safe, and reliable railway transport network developed and operated in Turkmenistan with better connectivity with neighboring countries.

**Outputs**

- Safe and efficient movement of trains with the installation of signaling, power, and telecommunication system between Bereket and Buzkhun
- Tracks are well maintained and kept safe
- Support provided for project management and MRT's institutional capacity improvement

**Division** Transport and Communications Division, CWRD

#### Project team

**Team leader** S. Khan, Head, Project Administration Unit, CWRD

**Team members**

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- B. Konysbayev, Senior Counsel, Office of the General Counsel
- M. Rehman, Senior Transport Specialist, CWRD
- S. Roth, Gender Specialist, CWRD
- I. Setyawati, Social Development Specialist, CWRD

**Executing agency** Ministry of Railway Transport of Turkmenistan



**Loan number:** 2779-UZB

**Project number:** 43151-01

**Advanced Electricity Metering Project**  
(formerly Automated Metering System)

## Rationale

Uzbekistan power sector has high transmission and distribution losses. The state joint stock company Uzbekenergo, a vertically integrated utility fully owned by the government, estimates total system losses of up to nearly 20%: 2%–4% in transmission and 13%–15% in distribution. This is nearly four times the 5% losses experienced in advanced countries, and actual losses are thought to be higher, with commercial losses in the range of 25%–35%. Uzbekistan’s electrification rate is almost 100%. All connections are metered and billed according to tariffs set for consumer categories. But the electricity meters being used—electromechanical devices that were manufactured during 1960–1990—are generally old and unreliable. They are still in service well beyond their designed economic life without recalibration for accuracy, making it difficult for Uzbekenergo to account accurately for actual electricity use. They are also easy to tamper with. Because there is a shortage of meter-reading personnel, not all meters are regularly read. Customers read their meters themselves but sometimes underreport their consumption. Meter readers (or controllers) are often unable to read the meters and collect revenue, as most meters are installed inside the house. Controllers can decide to either disconnect the customers immediately for past unpaid consumption or overlook the excess consumption and enter into the system a reading lower than the actual one.

Advanced electricity metering (AEM), or “smart metering” with digital meters, allows two-way communication between the utility and consumers. AEM enables the utility to remotely monitor and disconnect supply without sending reading personnel to the site. It provides consumers with power usage information more frequently. AEM can help identify losses, reduce commercial losses, and improve tariff collection. The AEM system will accommodate both pre- and post-payment. Uzbekenergo expects to use AEM technology to increase energy efficiency through loss reduction and, potentially, demand-side management.

## Description

The Advanced Electricity Metering Project will install an AEM system, with modern, accurate, and theft-proof revenue meters for about one million residential and commercial entity customers in Samarkand, Bukhara, and Jizzakh regions. AEM will allow appropriate accounting for every unit of power consumed, which is essential for minimizing commercial losses and identifying upgrades that would result in a lower technical loss. The project will contribute to improving energy efficiency, and will help reduce commercial losses and improve collection efficiency of electricity revenue.

**Total loan amount:** \$150 million (OCR)

**Clean energy investment:** \$28.13 million

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

**Energy savings:** 104 gigawatt hours/year

**Greenhouse gas emissions reduction:** 64,000 tCO<sub>2</sub>/year

**Board approval:** 19 Sep 2011

**Project life:** 20 years

Loan number: 2779-UZB    Project number: 43151-01

<b>Impact</b>	Improved financial viability of the power sector.
<b>Outcome</b>	Substantially reduced commercial and tariff collection losses for residential and small business entity customers in Bukhara, Jizzakh, and Samarkand.
<b>Outputs</b>	<ul style="list-style-type: none"> <li>• Advanced meters installed and associated data communication equipment functional</li> <li>• Data management system developed and operational</li> <li>• Customer services for end users improved</li> </ul>
<b>Division</b>	Energy Division, CWRD
<b>Project team</b>	
<b>Team leader</b>	K. Mitsuhashi, Energy Specialist, CWRD
<b>Team members</b>	<p>J. Hwang, Project Management Specialist, CWRD  M. Khudayberdiyeva, Senior Social Development Officer (Gender), CWRD  R. Nadyrshin, Senior Portfolio Management Officer, CWRD  J. Ngai, Counsel, Office of the General Counsel  S. Roth, Social Development Specialist (Gender and Development), CWRD  R. Sanda, Energy Specialist (Investment), CWRD  D. Utami, Principal Safeguards Specialist, CWRD  Y. Xu, Energy Specialist, CWRD</p>
<b>Executing agency</b>	Uzbekenergo



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# East Asia Department

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**Loan number:** 2771-PRC

**Project number:** 40524-01

Shandong Energy Efficiency and Emission  
Reduction Project

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## Rationale

The industry sector is the main energy consumer in Shandong, consuming more than three-quarters of total energy supply in 2009. Moreover, the energy supply in Shandong is heavily dependent on high carbon fossil fuels—coal (77%) and oil (21.2%)—causing large emissions. Despite improving the energy intensity, the underinvestment in energy efficiency and the existence of many energy-intensive industries in the province provide significant opportunities for further energy intensity reductions through targeted investment.

The existing industrial energy efficiency financing mechanisms in Shandong benefit small projects. A large financing gap exists for medium and large-sized energy efficiency projects that involve all or part of an industrial manufacturing process for an industry. Three key barriers have impeded investment: (i) lack of familiarity with the latest energy efficient technologies, combined with the enterprises' perception of production interruptions and/or loss of revenues; (ii) difficulties for commercial banks to assess cash flow benefits and forgo collateral for such investment projects which do not generate additional revenues; and (iii) lack of capacity for evaluation and risk assignments for energy conservation investments by commercial banks. Limited market-based incentive mechanisms to reward investors for reducing emissions through energy efficiency also discourage investors. These market imperfections warrant targeted public interventions.

## Description

The project proposes to finance the reduction of energy intensity and emissions from energy-intensive industries in Shandong Province through a financial intermediation loan (FIL). The aim of the project is to promote energy efficiency and emission reduction measures in the provinces industry sector, develop energy service companies (ESCOs), and enhance institutional capacity to identify and manage energy efficiency and emission reduction projects.

**Total loan amount:** \$100 million (OCR)

**Clean energy investment:** \$100 million

**Project category:** Renewable Energy/Demand side energy efficiency

**Energy savings:** 4,627 terajoules/year

**Greenhouse gas emissions reduction:** 822,297 tCO<sub>2</sub>/year

**Board approval:** 18 Aug 2011

**Project life:** 20 years

Loan number: 2771-PRC Project number: 40524-01

**Impact** Reduced industrial energy intensity and emissions in Shandong Province.

**Outcome** Expanded energy efficiency investments in energy intensive industries of Shandong Province.

**Outputs**

- Priority energy efficiency and emission reduction projects implemented in selected energy-intensive industries;
- Capacity developed for government and financial institutions in planning, investments, and management of energy efficiency projects.

**Division** Energy Division, EARD

#### Project team

**Team leader** S. Yamamura, Energy Specialist, EARD  
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J. Laude, Private Sector Development Specialist, EARD  
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G. Santos-Nave, Associate Project Analyst, EARD  
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M. Pajarillo, Senior Finance Specialist, EARD  
T. Ueda, Natural Resources Economist, EARD

**Executing agency** Shandong Provincial Government

**Loan number:** 2773-PRC

**Project number:** 39653-04

**Guangdong Energy Efficiency and Environment  
Improvement Project—Tranche 3**

## Rationale

The gross domestic product (GDP) of Guangdong in 2005 was CNY2.24 trillion (\$280 billion) which was more than 12% of People's Republic of China's (PRC) GDP and the highest among the provinces and municipalities. The annual electricity consumption (267 TWh in 2005) has been rapidly growing at nearly 15% since 2000. Since 2001, Guangdong has suffered severe power shortages. The power shortage was about 5,000 MW in the summer of 2006. Guangdong also has significant acid rain problems: in 2005, acid rain frequency was about 55%, and 18 cities covering about 85% of the areas in the province, experienced acid rain. Since 2000, most of Guangdong's large cities have an increase in the number of days a year when the ambient air quality fails to meet the national air quality standards. The power shortage and environmental problems, if not resolved quickly, would hinder the economic growth of the province.

To address the power shortage and environmental problems, both the PRC and Guangdong Provincial Governments have given the highest priority to energy efficiency. Controlling the demand side of energy of the energy system will offset the need to increase supply due to increasing economic output.

## Description

Tranche 3 of the Investment Program consists of five sub borrowers:

- (i) SGIS Songshan Co. Ltd: The company will enhance efficiency of waste energy recovery by upgrading energy management and monitoring system, including installation of computers, sensors, and telecommunication cables in the existing boilers and production lines.
- (ii) Guangdong Chengya Energy Service Co.: The company will (a) retrofit air conditioning station at mobile phone base stations and (b) monitor digitalized power plant control system in existing power plants.
- (iii) Guangdong Rizhao New Technology Co.: The company will replace existing inefficient generatrix with energy-efficient composite copper-tube generatrix in converting stations and production lines.
- (iv) Guangzhou Zhiguang Energy Conservation Co.: The company will fit variable-frequency motor control system to improve motor's operational efficiency.
- (v) Guangzhou Bosch Machinery Co. Ltd.: The company will replace existing inefficient plastic injection molding machine with energy-efficient automatic plastic injection molding machine.

**Total loan amount:** \$42.94 million (OCR)

**Clean energy investment:** \$42.94 million

**Project category:** Demand side energy efficiency

**Energy savings:** 1,323 terajoules/year; 192.65 gigawatt-hours/year

**Greenhouse gas emissions reduction:** 256,953 tCO<sub>2</sub>/year

**Board approval:** 30 Aug 2011

**Project life:** 20 years

Loan number: 2773-PRC    Project number: 39653-04

**Impact** Improved energy intensity and reduced emissions in Guangdong Province.

**Outcome** Improved energy efficiency in selected industrial and commercial sectors in Guangdong province.

**Outputs**

- energy efficiency projects in Tranche 3 implemented
- Energy service company (ESCO) sector developed in Guangdong
- capacity developed for promotion and assessment of energy efficiency projects

**Division** Energy Division, EARD

#### Project team

**Team leaders** H. Yang, Energy Specialist, EARD

**Team members**

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- X. Liu, Senior Project Officer (Energy), PRC Resident Mission, EARD
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- M. Pajarillo, Senior Finance Specialist (Energy), EARD
- R. Sabur, Energy Specialist, EARD

**Executing agency** Guangdong Provincial Government



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**Loan number:** 2835-PRC

**Project number:** 44012-02

Hebei Energy Efficiency Improvement and Emission  
Reduction Project

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## Rationale

Hebei Province ranks second in energy consumption among all the provinces, with a total energy consumption of 267 metric tons of coal equivalent in 2010, or 8.7% of the national consumption. During the Eleventh plan, Hebei's energy intensity reduced by 20.11% to 1.58 tce, which is still much higher than the national average of 1.034 tce. This is mainly due to the presence of many energy-intensive industries, such as iron and steel, electricity and heat production, cement, and petroleum and petrochemical. Most of these industrial plants operate at much lower energy efficiency levels than international best practice as a result of underinvestment in energy efficiency. Hebei has set a target of a further 17% energy intensity reduction during the Twelfth plan, which will be challenging unless targeted investments are significantly scaled up in these energy-intensive industrial plants.

The key barriers for energy efficiency investments are (i) lack of familiarity with the latest energy efficient technologies, combined with the enterprises perception of production interruptions and/or loss of revenues; (ii) difficulties for commercial banks to assess cash flow benefits and forgo collateral for such investment projects, which do not generate additional revenues; and (iii) lack of capacity for evaluation and risk assignments for energy conservation investments by commercial banks, thereby limiting debt financing. Limited market-based incentive mechanisms to reward investors for reducing emissions through energy efficiency also discourage investors. These market imperfections warrant targeted public interventions.

The energy service companies (ESCOs) have been developing slowly since 2000 in Hebei Province. Most of the existing ESCOs in Hebei Province have limited registered capital, assets, and employees. The ESCOs are unable to obtain commercial debt financing because of the banks perception of risks and the lack of meaningful collateral, which limits their involvement to only small-scale energy efficiency projects with limited investment and short paybacks. The proposed project addresses this barrier by including an ESCO in the project design.

## Description

The project is designed to provide a suitable financing mechanism and finance energy efficiency projects in selected energy-intensive industries and ESCOs. The Hebei provincial government, through Hebei Provincial Finance Bureau, will establish a revolving escrow fund (REF) account at the selected financial intermediary to finance eligible energy efficiency subprojects. The subprojects are expected to have a loan repayment period of 5 years including the grace period. The repayment of subloans, from these subprojects, will be revolved by relending to future batches of energy efficiency subprojects through the REF. It is expected that the REF will be fully revolved two times before ADB's loan is repaid.

**Total loan amount:** \$100 million (OCR)

**Clean energy investment:** \$100 million

**Project category:** Demand side energy efficiency

**Energy savings:** 7,799 terajoules/year

**Greenhouse gas emissions reduction:** 668,669 tCO<sub>2</sub>/year

**Board approval:** 14 Dec 2011

**Project life:** 20 years

Loan number: 2835-PRC    Project number: 44012-02

**Impact** Improved energy efficiency and emission reduction in Hebei Province.

**Outcome** Increased investments in energy efficiency in Hebei Province.

**Outputs**

- Industrial energy efficiency projects implemented
- ESCO projects implemented

**Division** Energy Division, EARD

#### Project team

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**Executing agency** Hebei Provincial Government

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**Loan number:** 2765-PRC

**Project number:** 43332-04

Railway Energy Efficiency and Safety

Enhancement Investment Program—Tranche III

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## Rationale

Ministry of Railways will implement a plan for railway development (2009–2016) at a cost of about \$25 billion for capacity expansion over the southwestern region of the People's Republic of China (PRC). The railway development plan will support railway construction or capacity expansion as has been done in the past and energy efficiency, environmental sustainability, and safety, which are critically important areas for PRC railway sector.

The investment program will be implemented in the southwestern PRC, a relatively poor area. The region is largely mountainous with abundant natural reserves of coal, and other nonferrous materials; and famous tourist sites. In spite of abundant natural resources, many people are poor and the economic growth necessary to reduce rural poverty has failed to develop because of inadequate transport services and high costs.

The investment program is a key intervention in the railway sector, with many technical, operational, safety, and economic benefits. The investment program seeks to introduce modern technology for enhanced energy efficiency, environmental sustainability, and safety on a network basis; increase throughput; and improve reliability—all of which will lead to a more affordable, faster, cheap, safe, energy-efficient, and more environment-friendly mode of transport in the PRC.

## Description

Tranche 3 of Investment Program will finance procurement of energy efficient, environmental protection, and safety equipment that will result in energy savings, environmental protection, and enhanced safety. Physical components of Tranche 3 are (i) energy efficiency component: (a) railway electrification equipment, and (b) electric power supply system; (ii) environmental protection component: (a) noise barrier; and (iii) railway safety enhancement component: (a) enhanced railway fasteners and switches, (b) railway telecommunications system, (c) railway signaling system, (d) advanced railway inspection equipment, and (e) emergency rescue equipment, and any other equipment as agreed between PRC and ADB. This equipment has significant energy efficiency, environmental, and safety benefits compared to what is used currently on the PRC railways. Integrating this equipment into the southwestern PRC railway network will help optimize performance, ensure reliability, and enhance safety.

**Total loan amount:** \$250 million (OCR)

**Clean energy investment:** \$50 million

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

**Energy savings:** 298.33 terajoules/year

**Greenhouse gas emissions reduction:** 22,106 tCO<sub>2</sub>/year

**Board approval:** 20 Jul 2011

**Project life:** 40 years

Loan number: 2765-PRC    Project number: 43332-04

**Impact** Improved transport system in the Southwestern region of the PRC that supports sustainable socio economic development and the western region development strategy.

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

**Outputs**

- Investment program implemented by installing energy efficiency, environmental protection, and safety enhancement equipment
- A safety audit of a nominated railway administration completed
- Capacity building provided

**Division** Transport and Communications Division, EARD

#### Project team

**Team leader** Y. Ono, Transport Specialist, EARD

**Team members** X. Chen, Transport Specialist (Railways), EARD  
P. Clos, Counsel, Office of the General Counsel  
S. Saxena, Senior Transport Specialist, EARD  
L. Afafe-Limqueco, Assistant Project Analyst, EARD

**Executing agency** Ministry of Railways

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**Loan number:** 2759-PRC

**Project number:** 43024-01

**Xinjiang Altay Urban Infrastructure  
and Environment Improvement Project**

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## Rationale

The development of Xinjiang Uygur Autonomous Region (XUAR) is a top priority for the People's Republic of China (PRC). XUAR is one of the poorest and most remote regions in the northwest with a large ethnic minority population. Altay is the northernmost area in XUAR. It comprises one city (Altay City) and six counties and shares a border with Kazakhstan, Mongolia, and the Russian Federation. The XUAR and Altay Prefecture governments have accorded high priority to infrastructure improvement.

Across Altay, infrastructure facilities are inadequate to meet existing demand and hinder the expansion of local economies. Road surfaces are severely damaged by winter freezing and traffic, and the road network is incomplete. Utilities are either nonexistent or are old, fragile, and mostly insufficient, resulting in frequent service failures and environmental pollution. Water supply capacity is restricted by inadequate infrastructure and water quality is compromised by high seasonal turbidity. Most of the county areas lack sewers, and wastewater treatment capacity is marginal. Refuse collection and disposal are poorly managed, and most landfills resemble unregulated dumping grounds. Decentralized heating plants have low-efficiency, coal-fired boilers while hot water distribution has limited coverage, thus creating serious pollution problems in urban areas. All of these threaten human health, pollute the environment, and constrain necessary improvements in living standards. Therefore, comprehensive urban infrastructure improvements are needed urgently.

## Description

The project will improve urban infrastructure facilities and the environment in five border counties of Altay Prefecture in the XUAR, which will help upgrade urban living conditions and rehabilitate the environment. Improving urban infrastructure in project counties will contribute to long-term poverty reduction and improve quality of life. The project's components comprise (i) construction and/or upgrading of roads, (ii) improved water supply system, (iii) new wastewater treatment facilities, (iv) new landfills, (v) new or upgraded central heating systems, (vi) new construction of infrastructure for White Birch Forest Scenic Area, and (vii) project implementation support and targeted capacity building for the project's implementing entities in county governments.

**Total loan amount:** \$100 million (OCR)

**Clean energy investment:** \$4.75 million

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

**Energy savings:** 5,724 terajoules/year

**Greenhouse gas emissions reduction:** 550,000 tCO<sub>2</sub>/year

**Board approval:** 23 Jun 2011

**Project life:** 30 years

Loan number: 2759-PRC Project number: 43024-01

<b>Impact</b>	Better living standards and conditions in the project counties.
<b>Outcome</b>	Integrated and more efficient municipal services in the project counties of Altay.
<b>Outputs</b>	<ul style="list-style-type: none"> <li>• Road components in Buerjin, Fuhai, Habahe, and Jimunai counties operational</li> <li>• Water supply components in Buerjin, Fuhai, Habahe, Jimunai and Qinghe counties operational</li> <li>• Wastewater components in Buerjin, Fuhai, Habahe, Jimunai and Qinghe counties operational</li> <li>• Heating components in Buerjin, Fuhai, Habahe, Jimunai and Qinghe counties operational</li> <li>• New construction of infrastructure in White Birch Forest Scenic Area in place</li> <li>• Capacity to deliver municipal services enhanced</li> </ul>
<b>Division</b>	Urban and Social Sectors Division, EARD
<b>Project team</b>	
<b>Team leader</b>	J. Huang, Urban Development Specialist, EARD
<b>Team members</b>	<p>I. Ahsan, Counsel, Office of the General Counsel</p> <p>M. Gupta, Senior Safeguards Specialist (Resettlement), EARD</p> <p>X. Ma, Lead Safeguards Specialist, Regional and Sustainable Development Department</p> <p>A. Morel, Environment Specialist, EARD</p> <p>B. Reid, Senior Finance Specialist, EARD</p> <p>P. Vandenberg, Economist, Economics and Research Department</p> <p>W. Walker, Senior Social Development Specialist, EARD</p> <p>J. Wang, Senior Project Officer (Urban Development &amp; Water Supply), PRC Resident Mission (PRCM), EARD</p> <p>L. Wang, Senior Project Officer (Urban Development), PRCM, EARD</p>
<b>Executing agency</b>	Altay Prefecture Government

**Loan number:** 2760-PRC

**Project number:** 43025-01

**Gansu Tianshui Urban Infrastructure Development**

## Rationale

Gansu province has the People's Republic of China's (PRC) second-lowest gross domestic product per capita—Tianshui municipality's 3.6 million inhabitants include 640,000 urban dwellers in Qinzhou and Maiji districts with an estimated urban poverty rate of 13.5% (2009). Development barriers include poor infrastructure and Gansu's remote inland location. Although positioned as an economically developed, environment-friendly, and livable city, Tianshui faces urban development challenges. These include (i) poor district heating and air quality, (ii) seasonal flooding, and (iii) inadequate urban transport. The many small-scale boilers of Tianshui's Qinzhou district are energy inefficient. During winter, pollutants from these coal-fired boilers and single-family heating stoves lessen air quality. Beyond air pollution challenges, the Xi and Wei rivers converge in Tianshui and flood seasonally. Tianshui's urban population grows by over 4% annually. Inadequate facilities for public transport and nonmotorized transport (NMT), and poor traffic management and traffic safety worsen slow urban road development. The rationale for the project is addressing these urban development challenges and so enabling Tianshui to meet urbanization pressures and maximize Guanzhong-Tianshui Economic Zone (GTEZ)-related benefits.

## Description

The project aims to promote balanced and environmentally sustainable urbanization, and to improve living conditions in Tianshui, a second-tier city in Gansu province, PRC. It will support the restructuring and expansion of the Qinzhou district heating network; construction of urban roads and bridges, and related services such as better flood control; and stronger urban management capacity.

**Total loan amount:** \$100 million (OCR)

**Clean energy investment:** \$12.25 million

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

**Energy savings:** 4,452 terajoules/year

**Greenhouse gas emissions reduction:** 427,800 tCO<sub>2</sub>/year

**Board approval:** 29 Jun 2011

**Project life:** 30 years

Loan number: 2760-PRC    Project number: 43025-01

**Impact** Better living conditions in Tianshui municipality.

**Outcome** Improved heating, transport and flood control services in Tianshui municipality.

**Outputs**

- Qinzhou district's upgraded heating network is operating
- Chengji road and flood control facilities are operating
- Wastewater components in Buerjin, Fuhai, Habahe, Jimunai and Qinghe counties operational
- Urban roads and bridges are opened to traffic and related services are operating
- Capacity developed and institutions strengthened

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

#### Project team

**Team leader** B. Reid, Senior Finance Specialist, EARD

**Team members**

- L. Apagalang, Project Analyst, EARD
- M. Gupta, Senior Safeguards Specialist (Resettlement), EARD
- M. Guzon, Operations Assistant, EARD
- S. Kawazu, Counsel, Office of the General Counsel
- A. Morel, Environment Specialist, EARD
- W. Walker, Senior Social Development Specialist, EARD

**Executing agency** Municipal Government of Tianshui



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**Loan number:** 2738-PRC

**Project number:** 42016-01

**Qinghai Rural Water Resources Management Project**

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## Rationale

Reducing poverty and increasing rural incomes remain daunting challenges in the People's Republic of China (PRC) though national economic growth has been more than 9% annually during the past two decades. Agriculture remains an important sector in Qinghai where irrigation water management is essential to sustain agriculture throughout the year. Meeting water needs and improving irrigation water management has become the major priority of agriculture development in this province.

There is considerable potential to increase irrigation water use efficiency and agricultural productivity by improving irrigation management and agronomic practices, which would allow farmers to grow cash crops in addition to subsistence crops, and thus increase their incomes.

## Description

The proposed Project will help to (i) convert the existing lift irrigation schemes to gravity irrigation by making use of the two existing reservoirs in the area; and (ii) improve agricultural extension services and institutional capacity, and empower farmer associations for irrigated agricultural service and management. The Project will increase water-use efficiency and is in line with ADB's water policy in improving and expanding the delivery of water services, fostering water conservation and increasing system efficiency.

**Total loan amount:** \$60 million (OCR)

**Clean energy investment:** \$45.32 million

**Project category:** Renewable Energy/Demand-side energy efficiency

**Energy savings:** 50 gigawatt-hours/year

**Greenhouse gas emissions reduction:** 48,730 tCO<sub>2</sub>/year

**Board approval:** 17 Mar 2011

**Project life:** 50 years

Loan number: 2738-PRC Project number: 42016-01

**Impact** Increased farmers' income and reduced poverty in the counties of Hualong, Jianzha, and Xunhua in Qinghai Province

**Outcome** Increased agricultural productivity and irrigation water use efficiency in the project area

**Outputs**

- Climate-resilient irrigation infrastructure, including conversion of the existing lift irrigation schemes to gravity irrigation using two existing reservoirs in the area
- Participatory irrigation management
- Improved project management
- Strengthened agricultural service support

**Division** Environment, Natural Resources & Agricultural Division, EARD

#### Project team

**Team leader** Y. Zhou, Water Resources Specialist, EARD

**Team members**

- I. Ahsan, Counsel, Office of the General Counsel
- S. Ferguson, Principal Social Development Specialist (Safeguards), EARD
- T. Lin, Natural Resources Economist, EARD
- L. Medina, Project Officer, EARD
- F. Radstake, Senior Environment Specialist, EARD
- M. Vorpahl, Social Development Specialist, EARD
- F. Wang, Senior Project Officer (Financial Management), EARD
- W. Zhu, Senior Safeguards Officer (Resettlement), EARD

**Executing agency** Qinghai Provincial Government (QPG)



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# Private Sector Operations Department

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**Loan numbers:** 7349/2844-BAN

**Project number:** 45916-01

Industrial and Infrastructure Development Finance  
Company (IIDFC)

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## Rationale

Bangladesh suffers from a chronic shortage of energy. Gas, the main source of energy, is insufficient to meet demand. Power supply is 29% short of demand. Energy shortages are undermining the country's competitiveness, causing an estimated two percentage point loss in gross domestic product growth potential. The situation is not expected to improve soon as production from existing gas fields is forecast to decline from 2019. Securing new sources of energy (e.g., coal, liquefied natural gas) locally or abroad will take time because of the need for policy decisions to bring energy tariffs up to full cost recovery at market levels.

Energy efficiency provides a cost-effective response to energy shortages. On the supply side, existing gas-fired power plants can be made more efficient, and transmission and distribution losses can be reduced. On the demand side, the Government of Bangladesh has initiated efficiency measures in the commercial and residential sectors. Industries should also be a key focus for energy efficiency initiatives: directly and indirectly, industries consume about 50% of Bangladesh's gas. They also consume oil and coal, so energy efficiency in industry can help reduce the country's carbon emissions.

The proposed finance program will promote energy efficiency investments in industry through a loan facility to selected financial institutions. These financial institutions will onlend the proceeds to eligible energy efficiency projects in seven industries: brick making, textiles, steel, cement, ceramics, chemicals, and agri-industries. These industries have large energy saving potential and energy efficiency improvement technologies are readily identifiable (either retrofits of existing systems or new systems).

## Description

The finance program will promote energy efficiency investments in target industries through a \$30 million loan facility to selected participating financial institutions in Bangladesh. The participating financial institutions will onlend the facility amount to eligible energy efficiency projects in seven target industries: brick making, textiles, steel, cement, ceramics, chemicals, and agri-industries. The finance program will initially target the brick making sector by promoting brick kilns that are 50% more energy efficient than existing kilns. The finance program will also identify bankable projects in the other target industries through a \$1.5 million project preparatory technical assistance.

**Total loan amount:** \$30 million (OCR)

**Clean energy investment:** \$30 million

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

**Energy savings:** 350 gigawatt-hours/year

**Greenhouse gas emissions reduction:** 150,000 tCO<sub>2</sub>/year

**Board approval:** 07 Jul 2011

**Project life:** 20 years

Loan numbers: 7349/2844-BAN    Project number: 45916-01

- Impacts**
- energy savings contributing to reducing Bangladesh’s energy supply–demand gap and mitigating climate change
  - demonstration that industrial energy efficiency solutions are commercially viable
  - development of local energy efficiency expertise within the finance sector and among technical consultants and energy efficiency solution providers

**Outcome**    Greater efficiency of the financed industrial projects, resulting in energy savings and carbon emissions reduction.

- Outputs**
- Completion of industrial energy efficiency projects
  - Implementation of an environmental and social management system by all participating financial institutions

**Division**    Infrastructure Finance Division 1

#### Project team

**Team leader**    M. Lemoine, Investment Specialist, PSOD

**Team members**    F. Connell, Counsel, Office of the General Counsel  
 M. Jensen, Investment Specialist, PSOD  
 J. Leusink, Investment Specialist, PSOD  
 V. Medina, Safeguards Officer, PSOD  
 M. Pascua, Senior Safeguards Officer, PSOD

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**Loan number:** 7336-PRC

**Project number:** 44916-01

**Sino–Green Climate Investment Fund**

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## Rationale

The Fund seeks to promote resource conservation and environmental protection by investing in companies and projects in sectors related to climate change in the People's Republic of China (PRC), and to provide fund investors with stable, long-term capital gains.

The PRC is one of the largest energy consuming and greenhouse gas (GHG) emitting countries in the world. Its status as such has led to increasing concern about energy security and growing public demand for reducing energy costs and addressing climate change in the country. This in turn has resulted in a convergence of social, political, economic, environmental, and entrepreneurial forces that is collectively driving the creation of vast opportunities for businesses to benefit as early movers in climate change and environmental technologies and to capitalize on the substantial policy support that exists in the PRC for the country to transition to low-carbon and climate-resilient growth. Equity investment is in high demand to finance sustainable growth of those companies focusing on improving energy efficiency, developing renewable energy, conserving resources, abating pollution, and reducing carbon dioxide (CO<sub>2</sub>) and other GHG emissions.

## Description

The Fund is an equity investment of up to CNY162.5 million (approx \$25 million) in Sino-green Climate Investment Fund L.P. (SCIF), not exceeding a 25% stake, whichever is less, and not resulting in ADB being the largest Fund investor.

The SCIF will primarily invest in companies at the expansion stage in energy efficiency, renewable energy, resource recycling and conservation, and environment protection. The SCIF's portfolio companies are expected to have (i) attained preliminary success in technology or commercial operations; (ii) exhibited strong business fundamentals and sustainable growth trends; (iii) committed to fully meet domestic environmental and social regulations and requirements, and to comply with all applicable safeguard and social policies of ADB as well as the anti-money laundering and know-your-client requirements; and (iv) agreed on a clear business development strategy and exit path with the fund manager.

**Total line of equity:** \$25 million (Equity-OCR)

**Clean energy investment:** \$25 million

**Project category:** Renewable Energy

**Renewable energy generation:** No data

**Greenhouse gas emissions reduction:** No data

**Board approval:** 29 Aug 2011

**Project life:** No data

Loan number: 7336-PRC    Project number: 44916-01

- Impacts**
- Sustainable low-carbon growth and accelerated private sector development in the clean energy and environment sectors in the PRC
  - Development of domestic (onshore) private equity fund market in the PRC with an improved legal and regulatory framework

**Outcome** Increased number of well-managed clean technology projects and companies (e.g., those in energy efficiency improvement, renewable energy development, and environmental protection).

**Output** The SCIF is established and investing in clean technology companies and projects

**Division** Capital Markets and Financial Sectors Division

#### Project team

**Team leaders** B. Huang, Investment Specialist, PSOD  
K. Zheng, Senior Investment Specialist, PSOD

**Team members** P. Bailet, Counsel, Office of the General Counsel  
S.J. Brett, Investment Specialist, PSOD



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**Loan numbers:** 7329/2748-IND

**Project number:** 43912-01

Bangalore Metro Rail Corporation Limited (BMRC)

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## Rationale

The lack of a public transport system that efficiently and economically services all parts of the city seriously impacts the poor. While those using personal vehicles (such as cars and two wheelers) are also affected, the proportionate impact on urban poor people is possibly far higher due to their not having access to personal vehicles. While public buses are generally available, travel by buses through congested urban areas takes more time and is also not comfortable over longer distances, given the fact that most of the buses are not air-conditioned.

While a metro system cannot by itself address all of these severe problems, it will provide a high-capacity transport corridor along specific arteries of the city, which will draw a large proportion of users from the roads. A well-planned intermodal transit system combining buses and rail-based systems will also need to be built across the city; generally the rail-based systems cater to the higher traffic density corridors, while the buses act in the proximate areas as feeders to the rail system.

One reason why many cities in developing countries have not built metro systems has been the high initial cost. There is a clear opportunity and growing desire for commercial finance to step in and bridge some of the gap.

## Description

The project is the development and operation of an urban metro rail transit system in Bangalore city (also known as Bengaluru) comprising two intersecting corridors (north–south and east–west). The project includes the development of 42.3 kilometers (km) of metro rail corridors, 40 stations (1 at-grade, 32 elevated, and 7 underground stations), 2 station depots, signaling, electromechanical system, and all ancillary facilities and rolling stock.

Total loan amount: \$250 million

Clean energy investment: \$50 million

Project category: Demand-side energy efficiency

Energy savings: No data

Greenhouse gas emissions reduction: No data

Board approval: 31 March 2011

Project life: 40 years

Loan numbers: 7329/2748-IND    Project number: 43912-01

- Impacts**
- Improved urban infrastructure supports economic growth in urban centers through better connectivity and access
  - Crowding-in of private sector investment and commercial nonrecourse finance into large urban transport projects

**Outcome**    Efficient, well-used, environmentally friendly, and financially stable urban rail transport system is developed for Bangalore City.

- Outputs**
- Infrastructure for phase I is completed
  - Well functioning institutional and operation arrangements for managing the MRT system
  - Financially bankable structure is developed and implemented

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

#### Project team

**Team leaders**    H. Hoshi, Investment Specialist, PSOD  
A. Mehta, Senior Finance Specialist (Infrastructure), SARD

**Team members**    R. Barba, Safeguards Specialist, SARD  
M. Greenhow, Counsel, Office of the General Counsel  
E. Gregori, Unit Head, Project Administration, PSOD  
S. Gupta, Principal Investment Specialist, PSOD  
A. Huang, Finance Specialist, SARD  
M. Mahurkar, Principal Treasury Specialist, Treasury Department  
J. Perera, Principal Safeguards Specialist, SARD  
R. Peri, Principal Private Sector Development Specialist, SARD  
A. Sharma, Senior Director, Office of Regional Economic Integration

**Approval number:** 7331-IND

**Project number:** 44941-01

Solar Power Generation

## Rationale

The Government of India announced the formulation and implementation of India's National Solar Mission (NSM) in January 2010. The NSM is an initiative of the central and state governments to promote ecologically sustainable energy growth while addressing India's energy security challenge. It will constitute a major contribution by India to the global effort to meet the challenges of climate change. The objective of the NSM is to establish India as a global leader in solar energy by creating the policy conditions for rapid diffusion of technology and investment across the country.

Solar energy is abundant in India, with high insolation measured at about 300 sunny days on average per year and estimated to be 5 billion megawatt-hours (MWh) per year of energy over India's land area. Most regions receive 4–7 kilowatt-hours (kWh) per square meter (m<sup>2</sup>) per day; the national average is 4.5 kWh/m<sup>2</sup>/day. This rate of insolation is among the highest in the world. Effective unlocking of this huge potential, through photovoltaic or concentrating solar thermal power development, provides the ability to generate power on a distributed basis and enables rapid capacity addition with relatively short lead times (e.g., less than 1 year).

India's NSM intends to commission 20,000 megawatts (MW) in grid-connected solar power generation by 2022 to help fill persistent energy shortages with diversified low-carbon power generation, secure its energy independence using indigenous resources, and become a manufacturing hub for the solar energy industry in Asia.

## Description

A partial credit guarantee facility (the Facility) whereby ADB will issue partial credit guarantees (PCGs) in amounts, in aggregate, of up to \$150 million of principal (or its equivalent in Rupees or other foreign currency acceptable to ADB), in favor of foreign and local commercial banks lending to solar power generation subprojects in India. The Facility will support multiple subprojects up to a maximum size of 25 MW under a solar power program with the central or state government. Under the Facility, ADB will issue PCGs to guarantee scheduled payments of principal and interest under loans to be provided by foreign or local commercial banks. The PCGs will be provided without government counter-guarantee.

The Guarantee Facility will be accompanied by a \$1.25 million parallel technical assistance (TA) program funded jointly by ADB and the Clean Energy Financing Partnership Facility (CEFPF) to commercial banks, which will help build their capacity and expertise in solar technology and technical risk assessment in the context of India's operating environment.

**Partial credit guarantee:** \$150 million (OCR)

**Clean energy investment:** \$150 million

**Project category:** Renewable Energy

**Renewable energy generation:** 205 gigawatt-hours/year

**Greenhouse gas emissions reduction:** 176,000 tCO<sub>2</sub>/year

**Board approval:** 19 Apr 2011

**Project life:** 25 years

Approval number: 7331-IND    Project number: 44941-01

- Impacts**
- Successful implementation of phase 1 of NSM
  - Increased foreign direct investment by the private sector in the solar power industry
  - Long-term reduction in levelized cost for solar energy in India

**Outcome** Solar power generation facilities under the NSM and state power schemes, installed and deliver energy to the grid.

- Outputs**
- Supported financing of solar projects
  - Solar project-related technical due diligence and capacity building provided to partner and local commercial banks
  - Mobilization of affordable debt and equity from domestic and international investors for renewable energy power plants

**Division** Infrastructure Finance Division 1

#### Project team

**Team leader** D. Purka, Senior Investment Specialist, PSOD

**Team members**

- C. Gin, Senior Counsel, Office of the General Counsel
- S. Gupta, Principal Investment Specialist and Unit Head, Private Sector Operations, India Resident Mission, PSOD
- V. Medina, Safeguards Officer, PSOD
- J. Munsayac, Social Development Specialist, PSOD
- A. Patil, Investment Specialist, PSOD
- A. Porras, Safeguards Officer, PSOD
- B. Raemaekers, Senior Financing Partnership Specialist (Guarantees and Syndications), Office of Cofinancing Operations

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**Loan numbers:** 7340/2798-IND

**Project number:** 45915-01

Dahanu Solar Power Project

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## Rationale

The Project addresses to promote sustainable economic growth by increasing the supply of clean energy to reduce the energy deficit in India. In addition, the building of the project will help prove the feasibility of utility scale solar power projects in India and the operational performance in a location (Rajasthan) where substantial development in the solar power sector is planned for the next 5 years.

## Description

The Project involves the construction and operation of a 40MW solar photo-voltaic (PV) power plant in Dhursar, Jaisalmer district, Rajasthan (India). The Project will use fixed-tilt cadmium telluride (CdTe) thin film solar photo-voltaic (PV) modules.

**Total loan amount:** \$48 million

**Clean energy investment:** \$48 million

**Project category:** Renewable Energy

**Renewable energy generation:** 56.16 gigawatt-hours/year

**Greenhouse gas emissions reduction:** 41,000 tCO<sub>2</sub>/year

**Board approval:** 02 Nov 2011

**Project life:** 25 years

Loan numbers: 7340/2798-IND    Project number: 45915-01

- Impact**
- Diversified energy mix through the addition of renewable energy capacity.
  - Replication of utility scale (>25 MW) solar power generation projects

**Outcome** Demonstrated profitability and sustainability of utility-scale private solar power generation project.

**Output** Construction and operation of India's first utility-scale solar photovoltaic power generation facility

**Division** Infrastructure Finance Division 1

#### Project team

**Team leader** A. Patil, Investment Specialist, PSOD

**Team members** P. Bailet, Counsel, Office of the General Counsel  
 S. Gupta, Principal Investment Specialist, PSOD  
 V. Medina, Safeguards Officer, PSOD  
 J. Munsayac, Safeguards Specialist, PSOD  
 M. Pascua, Senior Safeguards Officer, PSOD  
 D. Purka, Principal Investment Specialist, PSOD  
 M. Tsuji, Principal Safeguards Specialist, PSOD

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**Loan numbers:** 7341/2799-LAO

**Project number:** 40906-01

**Nam Ngum 3 Hydropower Project**

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## Rationale

Hydropower is the major source of electricity in the Lao PDR, providing stable and inexpensive supplies. The government has signed memoranda of understanding with Thailand and Viet Nam to export to each of these countries up to 7 gigawatts and 5 gigawatts respectively. The government has decided to hold minority equity stakes in export-oriented projects to enhance the revenues it receives and allow it to ensure that any adverse social and environmental impacts of projects are mitigated effectively and sustainably.

The Thailand Power Development Plan, 2010, which runs from 2010 to 2030, estimates that the country will need an additional 21,564 MW of electricity-generating capacity by 2020 to maintain economic growth. The plan envisions sourcing more than 5 GW from neighboring countries. The proposed Nam Ngum 3 is one of the hydropower sources from which Thailand intends to import electricity starting in January 2017.

The project will provide low-cost and renewable energy to meet rising electricity demand in Thailand, and contribute to the foreign exchange revenues of the Lao PDR, which will provide funds needed to meet its poverty-reduction goals.

## Description

The Project involves the construction and operation of a 440 MW hydropower plant in Lao PDR. It will operate under a concession agreement with the Government of Lao PDR (GOL). All of the power generated by the Project will be sold to Thailand under a power purchase agreement (PPA) with the Electricity Generating Authority of Thailand (EGAT). The main features include an underground power station, a 220 meter high dam, and about 105 km long, 500 kV transmission line.

**Total loan amount:** \$350 million (OCR)

**Clean energy investment:** \$350 million

**Project category:** Renewable Energy: see GMS Nam Ngum 3 (SERD)

**Renewable energy generation:** see GMS Nam Ngum 3 (SERD)

**Greenhouse gas emissions reduction:** see GMS Nam Ngum 3 (SERD)

**Board approval:** 03 Nov 2011

**Project life:** see GMS Nam Ngum 3 (SERD)

Loan numbers: 7341/2799-LAO    Project number: 40906-01

<b>Impact</b>	<ul style="list-style-type: none"> <li>Increased private sector investment in hydropower in Lao PDR</li> <li>Increased reliability of power supply in Thailand</li> </ul>
<b>Outcome</b>	Increased regional cooperation between the Lao PDR and Thailand through the trade of clean energy.
<b>Outputs</b>	<ul style="list-style-type: none"> <li>construction of the NN3 and the associated 500 kilovolt transmission line in the Lao PDR as a PPP executed in an environmentally sustainable and socially inclusive manner;</li> <li>Economic benefits to Lao PDR in the form of increased government revenues, employment opportunities for Lao nationals and economic activity in the Lao PDR</li> </ul>
<b>Division</b>	Infrastructure Finance Division 2
<b>Project team</b>	
<b>Team leader</b>	C. Uy, Investment Specialist, PSOD
<b>Team members</b>	E. Baardsen, Principal Infrastructure Specialist, Southeast Asia Regional Department (SERD) S. Hashizume, Investment Specialist, PSOD I. Makin, Principal Water Resources Specialist, SERD M. Manabat, Senior Investment Officer, PSOD N. Moller, Counsel, Office of the General Counsel J. Munsayac, Safeguards Specialist, PSOD A. Porras, Safeguards Officer, PSOD B. Raemaekers, Senior Guarantees and Syndications Specialist, PSOD S. Tu, Senior Safeguards Specialist, PSOD C. Wensley, Lead Water Specialist, SERD



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**Loan numbers:** 7339/2732-PAK

**Project number:** 44914-01

Star Hydro Power Limited

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## Rationale

The Project addresses Pakistan's growing energy deficit by adding 147 MW power generation capacity and promote more efficient use of indigenous and renewable energy resources. The Project will also promote private sector participation in the country's hydropower sector under the Power Policy 2002. In addition, the Project stimulates local employment and economic activities.

## Description

The Project involves construction and operation of a 147 MW run-of-the-river hydroelectric power generation facility between the Kunhar and Jhelum rivers near Muzaffarabad on a build-own-operate-transfer basis for a period of 30 years from the commercial operations date.

Total loan amount: \$97 million

Clean energy investment: \$97 million

Project category: Renewable Energy

Energy savings: 632.6 gigawatt-hours/year

Greenhouse gas emissions reduction: 280,000 tCO<sub>2</sub>/year

Board approval: 11 Oct 2011

Project life: 50 years

Loan numbers: 7339/2732-PAK    Project number: 44914-01

- Impacts**
- Economic growth in Pakistan is less constrained by deficient power supply
  - Increased investments by the private sector in power generation projects in Pakistan

**Outcome**    Production of lower cost, carbon efficient power.

**Output**    A 147 MW hydropower project financed, built and commissioned by the private sector

**Division**    Infrastructure Finance Division 1

#### Project team

**Team leader**    T. Koike, Senior Investment Specialist, PSOD

**Team members**    M. Hashimi, Investment Officer, Pakistan Resident Mission, Central and West Asia Department  
 A. Hirose, Assistant General Counsel, Office of General Counsel  
 M. Manabat, Senior Investment Officer, PSOD  
 V. Medina, Social Development Officer, PSOD  
 J. Munsayac, Social Development Specialist, PSOD  
 M. Pascua, Environment Officer, PSOD  
 M. Pateguana, Young Professional, PSOD  
 S. Tu, Senior Environment Specialist, PSOD

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**Loan number:** 7348-PAK

**Project numbers:** 49505-01/02

Foundation Wind Energy I and II Projects

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## Rationale

As in many developing countries, energy deficit is a major constraint on efficient economic growth in Pakistan. To ensure a sustainable supply of energy, the Government of Pakistan launched a number of initiatives to promote private sector participation in the country's energy infrastructure, including the power sector.

The two wind projects will help Pakistan meet the electrical capacity shortfall in the country. The sponsors requested that all financing for the two projects be obtained in compliance with Islamic Shariah principles. Islamic Development Bank and local banks are raising financing on this basis. To meet the needs of the client, ADB will make innovative use of partial credit guarantee, allowing the project companies to raise all financing in line with Shariah. In the event the PCG structure is implemented, this will be the first time ADB participates in a debt financing that is entirely compliant with Shariah.

## Description

The two projects will encompass engineering, design, procurement, construction, turbine erection, grid tie-in, commissioning, and operation and maintenance (O&M) for two 50 MW wind power plants. They will be located in the Gharo wind corridor 54 kilometers southeast of Karachi, Pakistan's industrial and commercial hub. The projects will be constructed under a date-certain, lump-sum, fixed-price engineering, procurement and construction contract. Power evacuation from both projects to the national grid will be through a 132-kilovolt line to be built and operated by the National Transmission and Despatch Company (NTDC), the national grid operator. Power offtake arrangements will be through a 20-year take-or-pay energy purchase agreement (EPA) signed by each project company and NTDC through its Central Power Purchasing Agency.

**PCG amount:** \$66.61 million

**Clean energy investment:** \$66.61 million

**Project category:** Renewable Energy

**Renewable energy generation:** 287 gigawatt-hours/year

**Greenhouse gas emissions reduction:** 136,250 tCO<sub>2</sub>/year

**Board approval:** 8-Dec-2011

**Project life:** 20 years

Loan number: 7348-PAK    Project numbers: 49505-01/02

- Impacts**
- Economic growth in Pakistan less constrained by deficient power supply
  - Increased investment by the private sector in power generation projects in Pakistan

**Outcome**    Production of lower-cost, carbon-efficient power from wind energy.

**Outputs**    Two 50 MW wind power projects in Pakistan installed and commissioned

**Division**    Infrastructure Finance Division 1

#### Project team

**Team leader**    S. Shah, Senior Investment Specialist, PSOD  
M. Hashimi, Senior Investment Officer, Central and West Asia Department

**Team members**    I. Aoki, Investment Specialist, PSOD  
P. Bailet, Counsel, Office of the General Counsel (OGC)  
M. Manabat, Senior Investment Officer, PSOD  
V. Medina, Safeguards Officer, PSOD  
A. Mohammed, Assistant General Counsel, OGC and Practice Leader, Islamic Finance  
A. Porras, Safeguards Officer, PSOD  
B. Raemaekers, Senior Guarantees and Syndications Specialist, PSOD

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**Loan numbers:** 7335/2762-THA

**Project number:** 44946-01

Gulf JP NS Company Limited

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## Rationale

The Project will help (i) provide reliable and least-cost power to fuel economic growth and prevent supply shortfalls; (ii) promote efficient combined cycle technology and baseload alternatives to coal-fired generation; (iii) support public-private partnerships that enhance efficiency in the sector.

## Description

The Project entails the construction of a 1,600-megawatt combined cycle power plant in Nong Saeng district, Saraburi Province, 120 km north of Bangkok. The Project will be developed and implemented under a 25-year power purchase agreement (PPA) with the Electricity Generation Authority of Thailand (EGAT), and a 25-year gas supply agreement (GSA) with PTT Public Company Limited (PTT). Project costs and fuel are passed through the offtake agreement. The Project is a public-private partnership (PPP) under the Independent Power Producers (IPP) program, that utilizes commercial energy from power plants with capacities greater than 90 MW. An interconnecting pipeline from the plant will connect to PTT's existing Wangnoi-Kaengkoi transmission pipeline 20 kilometers away. A new transmission line will also be constructed to connect to EGAT's system 1.5 kilometers away.

**Total loan amount:** \$170 million (OCR)

**Clean energy investment:** \$38.58 million

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

**Energy savings:** 36,550 terajoules/year

**Greenhouse gas emissions reduction:** 5,700,000 tCO<sub>2</sub>/year

**Board approval:** 07 Jul 2011

**Project life:** 20 years

Loan numbers: 7335/2762-THA    Project number: 44946-01

- Impacts**
- Long-term sustainable and inclusive economic growth in Thailand is supported by efficient power supply
  - Independent Power Producer's combined-cycle generation is replicated

**Outcome** Consumers received competitively priced cleaner power generated from technically and financially stable gas-fired generation.

- Outputs**
- First Thai public– private partnership of over \$1 billion to reach financial close and the first IPP producing over 1,000 MW to be brought online since the global credit crisis
  - Large IPP compliant with ADB safeguards and other social requirements

**Division** Infrastructure Finance Division 2

#### Project team

**Team leader** D. Wiedmer, Investment Specialist, PSOD

**Team members**

- O. Jetwattana, Private Sector Economics Officer, Thailand Resident Mission, Southeast Asia Department
- R. Lockhart, Young Professional, PSOD
- M. Manabat, Senior Investment Officer, PSOD
- V. Medina, Social Development Officer, PSOD
- N. Moller, Counsel, Office of the General Counsel
- M. Pascua, Environment Officer, PSOD
- A. Porras, Safeguards Officer, PSOD
- B. Raemaekers, Senior Guarantees and Syndications Specialist, Office of Cofinancing Operations
- S. Tu, Senior Environment Specialist, PSOD

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**Loan numbers:** 7332/7334-REG

**Project number:** 44945

Climatech Venture Capital Funds

Aloe Environment Fund III (Regional)

VenturEast Life Fund III (India)

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## Rationale

Energy consumption in many of ADB's DMCs is growing extremely rapidly, raising concerns about the region's vulnerability to resulting environmental degradation and fluctuations in energy prices, both of which often hurt the poor the most. An important means of assisting developing countries in mitigating climate change and enhancing energy security is to improve the availability and affordability of new low-carbon technologies. For this to happen, however, financing must be made available for climate change-related innovation. This entails a need to mobilize private capital, as public resources will be insufficient to finance innovation on the required scale. To that end, venture capital is one form of financing that could play a vital role in meeting this need for investment, however it also is undercapitalized. In view of this, ADB has launched the equity component of the initiative. It aims to invest equity into multiple funds to accelerate the transfer and diffusion of climate change and environmental technologies via the investments the funds will make into climatech portfolio companies.

## Description

The proposed equity investments comprise the equity component of ADB's Asia Climate Change and Clean Energy Venture Capital Initiative, which seeks to enhance the availability and affordability of technologies that address climate change mitigation and adaptation, and environmental protection, as well as energy security, in Asia. Through this initiative, ADB proposes to invest \$40 million of equity in aggregate in two venture capital funds, which were selected through a competitive process. These funds will target early-stage climatech ventures operating in ADB's developing member countries (DMCs). The initiative will help to facilitate technology innovation, transfer, and diffusion, which is identified as one of the key building blocks to effecting the international climate change agenda as reflected in the Kyoto Protocol, 2007 Bali Action Plan, the Copenhagen Accord, and subsequent agreements. The initiative is also expected to establish (through separate Board approval) a technical assistance (TA) program to provide knowledge support to various funds in ADB's DMCs (potentially including these two) on emerging market opportunities, technological competence and growth potential of investee companies, and intellectual property rights issues, so that they can allocate more of their fund resources to early-stage companies that lack access to capital, and to those technologies that contribute greatly to climate change mitigation and adaptation.

The two funds (Aloe Environment Fund III, VenturEast Life Fund III) proposed for investment will primarily target the markets of the People's Republic of China and India.

Total equity amount: \$40 million

Clean energy investment: \$40 million

Project category: Renewable Energy

Renewable energy generation: No data

Greenhouse gas emissions reduction: No data

Board approval: 20 May 2011

Project life: No data

Loan numbers: 7332/7334-REG    Project number: 44945

**Impact**    Accelerated innovation and diffusion of climate change mitigation and adaptation, and environmental improvement and protection technologies (making them more competitive and affordable in developing Asia).

**Outcomes**    Increased access to finance and expertise in climatech companies and projects in the target regions (primarily the People's Republic of China and India).

**Output**    The Funds are established and funded as planned

**Division**    Capital Market and Finance Division

#### Project team

**Team leaders**    S. Kim, Investment Specialist, PSCM, PSOD  
J. Klein, Investment Specialist, PSCM, PSOD

**Team members**    S. J. Brett, Investment Specialist, PSCM, PSOD  
F. Connell, Senior Counsel, Office of the General Counsel  
T. Kubo, Principal Climate Change Specialist, RSDD  
A. Zhou, Energy Specialist, RSDD  
M. A. Dato, Climate Change Officer, RSDD





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# South Asia Department

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**Grant numbers:** 0253/4-BAN

**Project numbers:** 40517-02/40517-04

Public–Private Infrastructure Development Facility  
(Supplementary)

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## Rationale

The main rationale for the proposed supplementary grants is to increase the financing available to the rural poor for the purchase of solar home systems (SHS) which is in line with the provision of grant money already done by other donors. The funds will subsidize SHSs and other renewable energy applications in order to make them more affordable to end-users, thereby guaranteeing increased SHS installation rates and the successful implementation of alternative energy generation in off-grid areas. This will assist the government in implementing its vision of universal electricity access by 2020.

## Description

The proposed supplementary grant will complement the Asian Development Fund funding of \$33 million equivalent under component C of the Project. The \$2 million allocation under the Clean Energy Financing Partnership Facility will be used to provide a \$25 buy-down grant per individual SHS. This will enable 80,000 low- and middle-income households and micro and small enterprises in Infrastructure Development Company Limited's (IDCOL) solar energy program to benefit from a reduced SHS price.

The remaining grant amount under the Climate Change Fund will be provided to IDCOL to pay for expenses related to the administration and monitoring of the renewable energy program such as:

- (i) \$357,000 as program support administration cost of IDCOL for the management and monitoring on the use of the refinancing loans and grant component);
- (ii) \$233,000 as an institutional development fund for the training of PO staff and their customers to widen their outreach capacities in rural areas. Thanks to the expanding network of supply and maintenance outlets maintenance, services and spare parts are available in reasonable vicinity (around 10 kilometers) of the SHSs customers;
- (iii) \$30,000 earmarked to carry out technical inspections;
- (iv) \$60,000 for annual technical audits carried out by an audit firm for 2 consecutive years; and
- (v) \$40,000 for appointing independent engineers to conduct feasibility studies, appraise and monitor renewable energy projects.

**Total grant amount:** \$1.3 million (CCF); \$2 million (ACEF/CEFPF)

**Clean energy investment:** \$3.3 million

**Project category:** Renewable Energy

**Renewable energy generation:** 5.84 gigawatt-hours/year

**Greenhouse gas emissions reduction:** 27,600 tCO<sub>2</sub>/year

**Board approval:** 17 May 2011

**Project life:** 25 years

Grant numbers: 0253/4-BAN    Project numbers: 40517-02/40517-04

<b>Impact</b>	Improved per capita infrastructure availability.
<b>Outcome</b>	Enhanced private sector participation in infrastructure development.
<b>Outputs</b>	<ul style="list-style-type: none"> <li>• Improved lending terms of IDCOL for infrastructure subprojects</li> <li>• Improved ability of IDCOL to mobilize long-term capital</li> <li>• Enhanced governance at IDCOL</li> <li>• Enhanced capacity for application of environmental and social safeguards standards</li> <li>• Enhanced efficiency of IDCOL in developing and financing infrastructure subprojects</li> </ul>
<b>Division</b>	Public Management, Financial Sector, & Trade Division, SARD
<b>Project team</b>	
<b>Team leader</b>	P. Marro, Principal Financial Sector Development Specialist, SARD
<b>Team members</b>	N. Bertsch, Young Professional, SARD J. Ghimire, Counsel, Office of the General Counsel
<b>Executing agency</b>	Ministry of Finance

**Loan number:** 2769-BAN

**Project number:** 37113-01

**Power System Efficiency Improvement Project**

## Rationale

Energy shortage is the most critical infrastructure constraint on Bangladesh's economic growth. In 2011, the maximum demand for electricity is 6,000 MW, which is expected to rise to 7,000 MW by 2013. But the maximum available generation is 4,500–4,750 MW (from an installed capacity of 5,719 MW), leaving a significant supply gap. The main causes for the supply shortage are (i) the poor operational efficiency of thermal power plants and inefficient use of energy; (ii) inadequate supplies of natural gas, which is the primary source of energy for electricity generation; (iii) slow progress on cross-border energy cooperation; and (iv) lack of diversification in energy supply, including inadequate exploitation of renewable energy. These issues were highlighted in the Asian Development Bank (ADB) 2009 Bangladesh energy sector assistance program evaluation (SAPE).

## Description

The Project consists of the following components:

*Part A: Generation Efficiency Improvement*

- i. Replacement of old steam and gas turbine power plants with a total capacity of 260 MW at the Ashuganj Power Station Company Ltd. (APSCL) complex with an efficient combined-cycle power plant of 450 MW capacity

*Part B: Increased Renewable Energy Use*

- i. Installation of a 5MW solar PV based grid-connected power generation plant at Kaptai Hydropower Plant site
- ii. Installation of an off-grid wind-solar-diesel hybrid system in Hatiya Island (1 MW solar PV, 1 MW wind energy, and 5.5 MW existing diesel generator)
- iii. Installation and retrofitting of about 1,000 km of street lighting based on solar PV and LED-based technology in six cities across the country

**Total loan amount:** \$300 million (OCR)

**Clean energy investment:** \$101.86 million

**Project category:** Renewable energy/Supply-side energy efficiency

**Renewable energy generation:** 7.42 gigawatt-hours/year

**Energy savings:** 18,534 terajoules/year

**Greenhouse gas emissions reduction:** 323,500 tCO<sub>2</sub>/year

**Board approval:** 11 Aug 2011

**Project life:** 30 years

Loan number: 2769-BAN    Project number: 37113-01

Impact	Increased provision of better access to electricity
Outcome	Increased generating capacity
Outputs	<ul style="list-style-type: none"> <li>• Improved energy efficiency</li> <li>• Increased renewable energy use</li> <li>• Capacity developed in executing agencies and surrounding communities</li> </ul>
Division	Energy Division, SARD
Project team	
Team leader	P. Wijayatunga, Senior Energy Specialist, SARD
Team members	A. M. Faisal, Project Officer (Environment), SARD L. George, Energy Specialist, SARD J. Ghimire, Counsel, Office of the General Counsel G. Hauber, Principal Private Sector Development Specialist, SARD Z. Lei, Energy Specialist, SARD R. Murshed, Senior Project Officer (Energy), SARD S. Parwez, Senior Programs Officer, SARD F. Sultana, Social Development and Gender Officer, SARD P. Van Houten-Castillo, Social Safeguard Specialist, SARD
Executing agencies	Power Div-Min of Power, Energy & Mineral Resources Ashuganj Power Station Company Bangladesh Power Development Board

**Loan number:** 2764-IND

**Project number:** 43467-03

**Madhya Pradesh Energy Efficiency Improvement  
Investment Program—Tranche 1**

## Rationale

Madhya Pradesh (MP) is an agrarian state with 70% rural population, and inadequate power supply in rural areas is one of the major obstacles affecting the economic growth and development. At present, rural power feeders feed mixed agriculture and domestic/village loads approximately for 8–10 hours. Agricultural pumps are provided with three-phase supply for 6–8 hours. During the rest of the period, single-phase supply on the high voltage line is made available, intended for use in households and small businesses. Farmers use phase splitters and run their water pumps for extended hours resulting in power interruptions, abnormal loading of feeders and failures of distribution transformers. The currently inefficient system results in households not getting power round the clock, leads to unbalanced loading of transformers and defeating the purpose of load shedding. Moreover, the current system of common supply to households and water pumps makes it difficult to locate and reduce commercial losses. The Government of Madhya Pradesh (GoMP) has undertaken a feeder separation program to resolve these issues. The first phase is already under implementation and the proposed ADB assistance plans to finance the second phase of the MP feeder separation program.

## Description

The objective of the Investment Program and the Project is to improve operational efficiency of electricity distribution in rural areas of the State. The Project shall consist of subprojects under the following components:

- A. **Feeder Separation**, comprising (i) construction of new 11 kV lines and (ii) rehabilitation and upgrades of existing 11 kV lines, so as to separate power supply to irrigation pumps and households;
- B. **Installation of HVDS**, comprising (i) installation of new distribution transformers and (ii) conversion of bare conductor LV lines to aerial bundled cables;
- C. **Supply Quality Improvements and Metering**, comprising mapping of distribution assets and associated global positioning system (GPS) surveys, installation of meters, network management improvements of systems at 11 kV and below.

Total loan amount: \$200 million (OCR)

Clean energy investment: \$51.85 million

Project category: Supply-side energy efficiency

Energy savings: 465 gigawatt-hours/year

Greenhouse gas emissions reduction: 323,000 tCO<sub>2</sub>/year

Board approval: 15 Jul 2011

Project life: 25 years

Loan number: 2764-IND Project number: 43467-03

**Impact** Continuous and higher quality supply of electricity to rural household in Madhya Pradesh.

**Outcome** Improved operational efficiency of electricity distribution in rural areas of Madhya Pradesh benefiting 1.4 million households.

**Outputs**

- Separate feeders for agricultural pumps and households and installed high voltage distribution system (HVDS)
- Installed meters, new household connections
- Access to business development services improved for women-headed micro enterprises
- Built capacity of women self help groups

**Division** Energy Division, SARD

#### Project team

**Team leader** H. Gunatilake, Principal Energy Economist, SARD

**Team members** H. Kobayashi, Senior Energy Specialist, SARD  
P. van Houten-Castillo, Social Development Specialist, SARD  
J. Versantvoort, Counsel, Office of the General Counsel  
P. Wijayatunga, Senior Energy Specialist, SARD

**Executing agency** Madhya Pradesh Poorv Kshetra Vidyut Vitaran Co. Ltd.



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**Loan number:** 2778-IND

**Project number:** 44431-01

Gujarat Solar Power Transmission Project

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## Rationale

India is bestowed with solar irradiation ranging from 4 to 7 kWh/square meter/day across the country, with western and southern regions having higher solar incidence. With rapid growing electricity demand, availability of land and increasing reliance on imported sources of fossil fuel, India has initiated steps to tap into and develop the large potential for solar energy based power generation. The transition to mainstreaming solar energy could be appropriately scaled up through capacity development of all the stakeholders related to issues of technology, finance, project management and policy development.

The government of Gujarat (GOG), taking advantage of the favorable policy regimes and high solar irradiation in the state, launched the Solar Power Policy in 2009 and proposes to establish a number of large scale solar parks starting with the Charanka solar park in Patan district in the sparsely populated northern part of the state. The development of solar parks will streamline the project development timeline by letting government agencies undertake land acquisition and necessary permits, and provide dedicated common infrastructure for setting up solar power generation plants largely in the private sector. Common infrastructure for the solar park include site preparation and leveling, power evacuation, availability of water, access roads, security and services.

Gujarat Power Corporation Limited (GPCL) is the responsible agency for developing the solar park of 500 megawatts and will lease the lands to the project developers to generate solar power. Gujarat Energy Transmission Corporation Limited (GETCO), with the mandate to develop transmission infrastructure in Gujarat is one of the Executing Agencies for the Project and will develop the transmission evacuation from the identified interconnection points with the solar developer. ADB funds to Government of India will be on-lent to GETCO. Connection from the solar power plant to the interconnection point would be funded by the developer.

Through development of the power evacuation line from the solar park, ADB will facilitate private sector participation and develop a model that can be replicated to scale up solar power in a significant manner in India.

## Description

The proposed project will develop the transmission infrastructure for evacuation of power in a reliable manner from the solar power generation plants to be located in the 2,500 hectares Charanka solar park located in Patan district of Gujarat. The solar park will site over 500 MW of both solar photovoltaic (PV) and concentrated solar power (CSP) plants.

Total loan amount: \$100 million (OCR)  
Clean energy investment: \$100 million  
Project category: Renewable Energy  
Renewable energy generation: Not applicable  
Greenhouse gas emissions reduction: Not applicable  
Board approval: 12 Sep 2011  
Project life: 40 years

Loan number: 2778-IND Project number: 44431-01

<b>Impact</b>	Large-scale development of reliable solar power projects in a cost-effective manner in India.
<b>Outcome</b>	Development of reliable solar power transmission infrastructure for the successful operation of the solar park.
<b>Outputs</b>	<ul style="list-style-type: none"> <li>• The procurement, installation and commissioning of the transmission system and associated facilities for the Charanka Solar Park</li> <li>• Vocational training for skilled employment</li> <li>• Energy-based livelihood enhancement</li> </ul>
<b>Division</b>	Energy Division, SARD
<b>Project team</b>	
<b>Team leader</b>	N. Sakai, Senior Climate Change Specialist, SARD
<b>Team members</b>	<p>J. Acharya, Climate Change Specialist (Clean Energy), Regional and Sustainable Development Department</p> <p>S. Fukushima, Energy Specialist, SARD</p> <p>L. George, Energy Specialist, SARD</p> <p>H. Gunatilake, Principal Energy Economist, SARD</p> <p>V. Karbar, Senior Project Officer (Energy), India Resident Mission, SARD</p> <p>C. Roque, Project Officer, SARD</p> <p>A. Syed, Counsel, Office of the General Counsel</p> <p>P. van Houten-Castillo, Social Development Specialist, SARD</p>
<b>Executing agencies</b>	Gujarat Energy Transmission Corporation Limited Government of Gujarat

**Loan numbers:** 2787-IND/2788-IND  
**Project numbers:** 44426-02/44917-01  
National Grid Improvement Project

## Rationale

The Indian power sector has a history of growing demand for and chronic shortages of electricity. The country is in constant need of additional power supply and the power sector suffers the shortfalls in both generation and transmission capacity. Achieving efficient delivery of all the power that the growing economy needs is a national priority and critical to sustaining India's long-term development.

To alleviate the country's acute power shortage, the Government of India has traditionally focused on increasing power generation. Investment in transmission facilities has lagged behind. With increasing generation capacity, commensurate improvements in the transmission system expansion are urgently needed.

## Description

To optimize transnational power supply and promote country-wide power transfer in an efficient manner, the Government aims to integrate regional power grid network systems, which comprise five interconnected electrical regions including northern, northeastern, eastern, western, and southern regions. Each electrical region attempts to connect and synchronize power system of neighboring states within the region, but interregional power transfer capacity has still been limited. Since natural energy resources are unevenly distributed and concentrated in certain locations, surplus power from some regions can be transferred to other regions in power deficit only when creating transmission super highways among the regions. While the existing interregional transmission capacity stands at 22,400 MW, the Government targets to increase this capacity to 27,950 MW by 2012, growing to 57,000 MW by 2015, and 75,000 MW by 2017 under the 12th Five Year Plan. Such interregional transmission strengthening will create a backbone to sustain open power supply and investment in both generation and distribution.

**Total loan amount:** \$500 million (OCR-Sovereign); \$250 million (Nonsovereign)  
**Clean energy investment:** \$15.45 million (Sovereign); \$7.72 million (Nonsovereign)  
**Project category:** Supply-side energy efficiency  
**Energy savings:** 725 gigawatt-hours/year  
**Greenhouse gas emissions reduction:** 536,000 tCO<sub>2</sub>/year  
**Board approval:** 30 Sep 2011  
**Project life:** 40 years

Loan numbers: 2778-IND/2788-IND Project numbers: 44426-02/44917-01

**Impact** Accelerated development of the interregional grid system for increased power supply.

**Outcome** Increase reliable power supply from private IPPs and public utilities within the interconnected grid network.

**Outputs**

- Procurement, installation and commissioning of a strengthened interregional transmission network between the northern and western grid regions
- Improvements to POWERGRID's corporate credit. Access to nonsovereign borrowing and risk management

**Division** Energy Division, SARD

#### Project team

**Team leader** K. Ogino, Senior Energy Specialist, SARD

**Team members**

- S. Fukushima, Energy Specialist, SARD
- C. Galarpe, Operations Assistant, SARD
- G. Hauber, Principal Private Sector Development Specialist, SARD
- S. Janardanam, Finance Specialist (Energy), SARD
- T. Limbu, Energy Economist, SARD
- M. Mahurkar, Principal Treasury Specialist, Treasury Department (TD)
- R. Nagpal, Senior Counsel, Office of the General Counsel
- B. Raemaekers, Senior Guarantees and Syndications Specialist, Private Sector Operations Department
- M. C. Santos, Senior Operations Assistant, SARD
- M. S. Sriram, Senior Financial Control Officer, SARD
- D. Taneja, Senior Treasury Specialist, TD
- P. van Houten-Castillo, Social Development Specialist, SARD

**Executing agency** Power Grid Corporation of India Limited

**Loan number:** 2793-IND

**Project number:** 36330-013

**Railway Sector Investment Program—Tranche 1**

## Rationale

India's transport infrastructure needs further investment to meet the country's growth demand. The Government of India's Eleventh Five Year Plan (FY2007/08–FY2011/12) highlights the need for an efficient transportation system to effectively increase productivity and competitiveness in the world market. Railways make up a significant part of India's transport sector.

One of the most widespread constraints facing railway operations is the capacity of high density railway routes. The railway trunk routes comprise just 16% of the network but carry more than 50% of the traffic. Accidents per million train-km have been steadily reduced. The operating ratio as well as the critical efficiency parameters have improved. However, there is still room for further improvement.

## Description

The proposed financing under the requested periodic financial request (the tranche) covers the following components:

**Railway improvement component.** This component comprises civil works, electrification, supply of rails and switches, and other related services and works for (i) doubling about 840 km of (a) the Daund-Gulbarga section (224 km); (b) the Sambalpur-Titlagarh section (182 km); (c) the Raipur-Titlagarh section (203 km); and (d) the Hospet-Taniaghat section (201 km) and (ii) electrification of the Pune-Wadi Guntakal section (641km). The general consultant will be engaged for overall project management and the project management consultants will be engaged as the Engineer for all projects.

**Efficiency enhancement component.** The efficiency enhancement component will provide equipment and implementation support to implement part of the institution strengthening action plan, especially focusing on implementation of the new accounting architecture.

**Clean development mechanism (CDM) component.** The component will provide implementation support to the Ministry of Railways for mitigation and carbon credits activities.

Total loan amount: \$150 million (OCR)

Clean energy investment: \$27.27 million

Project category: Demand-side energy efficiency

Energy savings: 67.42 gigawatt-hours/year

Greenhouse gas emissions reduction: 60,000 tCO<sub>2</sub>/year

Board approval: 18 Oct. 2011

Project life: 60 years

Loan number: 2793-IND Project number: 36330-013

<b>Impact</b>	Improved transport system and greater mobility.
<b>Outcome</b>	An energy-efficient, safe, reliable, affordable and environment-friendly railway system developed.
<b>Outputs</b>	<ul style="list-style-type: none"> <li>• Expanded physical infrastructure and enhanced efficiency of infrastructure use</li> <li>• Improved operations efficiency</li> <li>• Clean development mechanism (CDM) application and implementation for the investment program</li> </ul>
<b>Division</b>	Transport and Communications Division, SARD
<b>Project team</b>	
<b>Team leader</b>	H. Yamaguchi, Principal Transport Specialist, SARD
<b>Team members</b>	M. Ajmera, Social Development Specialist, SARD P. Dutt, Principal Transport Specialist, SARD S. Janardanam, Financial Management Specialist, SARD A. Motwani, Senior Project Implementation Officer, SARD R. Nagpal, Senior Counsel, Office of the General Counsel R. V. Peri, Principal Private Sector Development Specialist, SARD M. Roesner, Senior Transport Specialist, SARD L. M. Tai, Transport Specialist, SARD K. Yangzom, Environment Specialist, SARD S. Zhao, Social Development Specialist, SARD
<b>Executing agency</b>	Ministry of Railways (MOR)

**Loan number:** 2794-IND

**Project number:** 43464-06

Himachal Pradesh Clean Energy Transmission  
Investment Program—Tranche 1

## Rationale

The hydropower generation potential of the state of Himachal Pradesh is about 23,000 megawatts (MW)—about one-fourth of the total hydropower potential of India.

As a subset of the state's overall power sector road map, and with support from ADB, Himachal Pradesh Power Transmission Corporation Limited (HPPTCL) has prepared a power system master plan to articulate a transmission network expansion plan for Himachal Pradesh. This plan, endorsed by India's Central Electricity Authority (CEA), provides a sound basis for investment in transmission facilities, and is expected to engender confidence among existing and potential private hydropower developers that sufficient transmission capacity will be available to evacuate power from hydropower facilities to markets outside of Himachal Pradesh.

## Description

The investment program thus consists of transmission system investments required through 2016, and a capacity development program for HPPTCL to help corporatize the state transmission utility as a stand-alone entity—a requirement of the Electricity Act, 2003. The Project proposed for financing under the requested PFR consists of:

1. New Transmission System Assets
  - A. Transmission Line Construction
    - i. Approximately 28 km, 220 kV double circuit transmission line from Hatkoti to Pragati Nagar, District Shimla.
  - B. Construction of SubStations
    - i. 66/220/400 kV gas insulated switchgear (GIS) substation at Wangtoo, District Kinnaur, and connecting 400 kV double circuit transmission line, (i.e. loop-in loop-out or LILO) from Wangtoo to Abdullahpur
    - ii. 220/400 kV GIS substation near Pragati Nagar, District Shimla, plus connection line by LILO of 400 kV D/C line from Jhakri to Addullahpur
    - iii. 66/220 kV GIS substation at Bhoktoo, District Kinnaur plus connection line (LILO) of 220 kV D/C line from Kashang to Bhaba
2. Capacity Development
  - i. Computerized enterprise resource planning solution design and installation
  - ii. Additional computer and engineering design equipment
  - iii. Training program

**Total loan amount:** \$113 million (OCR)

**Clean energy investment:** \$113 million

**Project category:** Renewable Energy

**Renewable energy generation:** Not applicable

**Greenhouse gas emissions reduction:** Not applicable

**Board approval:** 18 Oct 2011

**Project life:** 40 years

Loan number: 2794-IND Project number: 43464-06

**Impact** Himachal Pradesh Power Transmission Corporation Ltd (HPPTCL) has sufficient assets and capacity to support its mandate as the state transmission utility company.

**Outcome** HPPTCL has increased its asset base and its capacity.

**Outputs**

- New transmission systems assets are operational
- HPPTCL's management capacity enhanced

**Division** Energy Division, SARD

#### Project team

**Team leader** A. Jeffries, Senior Energy Specialist, SARD

**Team members** H. Kobayashi, Principal Portfolio Management Specialist, SARD  
P. Van-Houten Castillo, Social Development Specialist, SARD  
J. Versantvoort, Senior Counsel, Office of the General Counsel

**Executing agency** Himachal Pradesh Power Transmission Corp. Ltd.



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**Loan number:** 2800-IND

**Project number:** 41614-05

Assam Power Sector Enhancement  
Investment Program—Tranche 3

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## Rationale

Assam's peak power demand is forecasted to grow to 1,883 MW by 2014 with an annual increase of 14.2%. To meet the rapid growth, new power plants will be constructed and commissioned by 2014 with sufficient additional capacity. While generation capacity is expected to soon catch up with expected demand, limited capacity of the Assam state transmission and distribution system can continue to constrain delivery of power to consumers. For example, a serious bottleneck of 38 MW from Lakwa natural gas and heat recovery power plant to Guwahati (capital of Assam) prevents full operation of the clean power plant at peak hours. The current physical constraints in the transmission system mean that Assam residents are unable to fully access clean power, missing the opportunity to reduce greenhouse gas emissions. The system master-plan study indicates an imminent need for significant investment in transmission to ensure that capacity addition in generation results in power that is available for input into the distribution system.

The distribution network in Assam is characterized by overloaded transformers and long distribution feeders, thereby increasing distribution losses to 55%–60% in some areas. The challenge for the T&D systems is the inadequate infrastructure and capabilities to accurately measure and monitor losses at each point. Furthermore, while many distribution transformers are metered, micro energy accounting is not possible because of the lack of consumer indexing and linkage with the distribution transformers. Under the Assam Power Sector Development Plan, 370,000 units of intelligent and downloadable meters with tamper-proof boxes were installed across the state. However, the magnitude of the impact of such meter replacement has been limited as meter reading is still undertaken manually. Also, certain special features of these meters that can reduce human interference in meter reading have not been fully activated because of the absence of information technology systems in distribution utilities. Addressing such capacity and training requirements in distribution utilities will have a significant impact on commercial loss reduction.

## Description

The third Periodic Financing Request for an amount of \$50 million will be the last tranche under the MFF. Tranche 3 proposes to finance a set of projects for (i) access to power in distribution, and (ii) energy efficiency enhancement and distribution loss reduction. Tranche 3 of the MFF investments will provide sustainable state power sector with increased distribution capacity to support inclusive and low carbon economic growth by (i) increasing the in-state power sales to match growing demand relative to 2008 baseline of 2,650 GWh meeting the demand increase as per the estimate for 2014, and (ii) improving the State Gross Domestic Product per capita relative to baseline of 2009 (Rs. 18,598 /capita).

**Total loan amount:** \$50 million (OCR)

**Clean energy investment:** \$3.51 million

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

**Energy savings:** 236 gigawatt-hours/year

**Greenhouse gas emissions reduction:** 212,446 tCO<sub>2</sub>/year

**Board approval:** 04 Nov 2011

**Project life:** 30 years

Loan number: 2800-IND Project number: 41614-05

**Impact** Enhanced quality and expanded service delivery of electricity in Assam.

**Outcome** Assam Power Distribution Company Limited becomes sustainable company with increased efficiency and distribution network capacity.

**Outputs**

- Constructed and augmented distribution lines and substations and conclusion of electrification programs
- Renovated and modernized distribution substations

**Division** Energy Division, SARD

#### Project team

**Team leader** Tika Limbu, Energy Economist, SARD

**Team members** Paola Van Houten-Castillo, Social Development Specialist, SARD  
V. S. Rekha, Principal Counsel, Office of the General Counsel  
Srinivasan Janardanam, Finance Specialist (Energy), SARD

**Executing agency** Assam State Electricity Board

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**Loan number:** 2830-IND

**Project number:** 43467-05

Madhya Pradesh Energy Efficiency Improvement  
Investment Program—Tranche 2

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## Rationale

One of the major obstacles affecting the economic growth and development in the rural areas of Madhya Pradesh is inadequate power supply. To ensure better power supply in the rural areas, which would require strengthening of the existing infrastructure and construction of new infrastructure, the Government of Madhya Pradesh has requested the Asian Development Bank (ADB) through the Government of India (GOI) for a Multitranche Financing Facility (MFF) to finance the feeder separation program (or the distribution improvement program). The first phase of this feeder separation program was approved by ADB in 2007. The current MFF is now financing the second phase.

## Description

Similar to Tranche 1, the project components for Tranche 2 are as follows:

### **Component 1 Feeder separation**

This will involve additional new 11 kV bays at existing primary substations and construction of new 11 kV lines. Currently, the 11 kV line construction work does not identify whether the work is associated with a new agricultural feeder or a new village feeder. New transformers associated with agricultural feeders, and all 11 kV rehabilitation and upgrades are included in the component.

### **Component 2 HVDS and associated low voltage (LV) lines**

This component will cover the village feeders and the associated works such as movement of existing distribution substations to a more convenient, new location closer to the village, and installation of new transformers in the HVDS as required. Associated LV works under the HVDS is also included in this component.

### **Component 3 Quality improvement and metering**

This will involve asset mapping, associated global positioning system (GPS) survey, improvements to the metering system, and overall improvement of the network management at 33 kV and below.

### **Component 4 Upstream 33 kV network strengthening**

This component will have upstream improvements in the 33 kV network, including the new 33 kV lines, 33 kV/11 kV substations, upgrading and additional transformers at existing substations.

Total loan amount: \$200 million (OCR)

Clean energy investment: \$51.85 million

Project category: Supply-side energy efficiency

Energy savings: 635 gigawatt-hours/year

Greenhouse gas emissions reduction: 597,000 tCO<sub>2</sub>/year

Board approval: 14 Dec 2011

Project life: 25 years

Loan number: 2830-IND    Project number: 43467-05

<b>Impact</b>	Improved operational efficiency of electricity distribution in rural areas of Madhya Pradesh.
<b>Outcome</b>	Efficient electricity distribution expanded in 15 project districts in Madhya Pradesh.
<b>Outputs</b>	<ul style="list-style-type: none"> <li>• Separate feeders for agricultural pumps and households</li> <li>• Installed High Voltage Distribution Systems (HVDS)</li> <li>• Installed meters and improved supply quality</li> <li>• Strengthened 33 kV network</li> </ul>
<b>Division</b>	Energy Division, SARD
<b>Project team</b>	
<b>Team leader</b>	H. Gunatilake, Principal Energy Economist, SARD
<b>Team members</b>	H. Kobayashi, Senior Energy Specialist, SARD P. van Houten-Castillo, Social Development Specialist, SARD J. Versantvoort, Counsel, Office of the General Counsel P. Wijayatunga, Senior Energy Specialist, SARD
<b>Executing agency</b>	Madhya Pradesh Poorv Kshetra Vidyut Vitaran Co. Ltd.

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**Loan number:** 2808-NEP

**Project number:** 41155-01

Electricity Transmission Expansion and Supply  
Improvement Project

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## Rationale

Limited transmission capacity in western region of Nepal has restricted additional electricity imports through the western border with India. The first large-scale cross-border transmission line with India between Dhalkebar (Nepal) and Muzaffarpur (India), with a capacity of 1,000 MW, is at an advanced stage of preparation. This will enable Nepal to import electricity from India initially and later facilitate hydropower export. However, the full benefits of this critical regional connection can be harnessed only when adequate strengthening of the related transmission infrastructure within Nepal is undertaken.

The project targets the strengthening and expansion of transmission and distribution systems, and enables Nepal to make further use of its abundant hydropower resources. Transmission network strengthening, in conjunction with current hydropower development, is a precondition to reducing load shedding and technical losses and increased cross-border electricity trade. The project is designed to address these needs of Nepal's power system.

## Description

The project is critical for reliability of energy supply in Nepal and its capacity for power import and export across the border. It will address three key areas in the electricity supply industry which suffers from years of under investment: (i) electricity transmission capacity expansion including facilitation of increased cross-border power flows, which include second circuit stringing of Kohalpur-Mahendranagar 132 kV transmission line, construction of Tamakoshi (Kimthi)—Kathmandu 220 kV/400 kV transmission line and expansion of Chappali grid substation; (ii) strengthening of the distribution system in both DCS East and DCS West regions and along the Tamakoshi (Kimthi)—Kathmandu transmission line; and (iii) rehabilitation of Tinau (1 MW) and Sundarijal (640 kW) small-hydro power plants.

**Total loan amount:** \$56 million (ADF):

**Clean energy investment:** \$2.3 million

**Project category:** Renewable energy

**Renewable energy generation:** 4.2 gigawatt-hours/year

**Greenhouse gas emissions reduction:** 2,500 tCO<sub>2</sub>/year

**Board approval:** 15 Nov 2011

**Project life:** 30 years

Loan number: 2808-NEP    Project number: 41155-01

**Impacts** Increased access to reliable supply of electricity

**Outcome** Improved electricity supply

**Outputs**

- Increased electricity transmission
- Expanded electricity distribution
- Enhanced electricity generation
- Efficient project management

**Division** Energy Division, SARD

#### Project team

**Team leaders** P. Wijayatunga, Senior Energy Specialist, SARD

**Team members** M. Davidovski, Senior Counsel, Office of the General Counsel  
 L. George, Energy Specialist, SARD  
 Z. Lei, Energy Specialist, SARD  
 S. Parwez, Senior Programs Officer, SARD  
 F. Tornieri, Senior Social Development Specialist, SARD  
 P. van Houten-Castillo, Social Safeguard Specialist, SARD

**Executing agency** Nepal Electricity Authority

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**Loan numbers:** 2733/2734-SRI

**Project number:** 39415-01

**Sustainable Power Sector Support Project**

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## Rationale

Sri Lanka's power sector struggles to meet the growing demand for electricity at sufficiently low cost and acceptable reliability. The share of thermal energy in the generation mix has increased from 6% in 1995 to 61% in 2010 as demand growth has been generally met by oil-fired thermal generation. This type of power generation makes electricity expensive because of high fuel prices, and poses a serious threat to the country's energy security and the environment. The transmission system is too weak to meet the growing demand in the regions. Substantial investments are required to strengthen the transmission network and improve its reliability. About 15% of households—primarily those in rural areas—do not have access to electricity despite the government's intensive investment program to expand the rural distribution network. The electrification ratio of 67.3% in Eastern Province is the lowest among all of Sri Lanka's provinces and is well below the average national electrification ratio of 85.4% in 2009. There is an urgent need to develop clean energy and indigenous renewable energy sources, reduce losses, and improve energy efficiency.

## Description

The project will have the following components: (i) transmission system strengthening to further improve its energy efficiency and reliability and enable rural electrification in the Eastern, North Central, Southern and Uva provinces of Sri Lanka; (ii) rural electrification and distribution system improvement in the Eastern and Uva provinces of the country to expand access for the poor and rural households; and (iii) energy efficiency and renewable energy.

**Total loan amount:** \$110 million (OCR); \$10 million (ADF)

**Clean energy investment:** \$11.73 million

**Project category:** Energy Efficiency/Renewable Energy

**Renewable energy generation:** 5.53 gigawatt-hours/year

**Greenhouse gas emissions reduction:** 505,672 tCO<sub>2</sub>/year

**Board approval:** 27 Jan 2011

**Project life:** 30 years

Loan numbers: 2733/2734-SRI    Project number: 39415-01

<b>Impact</b>	Reliable, adequate, and affordable power supply for sustainable economic growth and poverty reduction.
<b>Outcome</b>	Improved coverage, efficiency and reliability in service delivery.
<b>Outputs</b>	<ul style="list-style-type: none"> <li>• Strengthened transmission network</li> <li>• Expanded and improved distribution network in rural areas of Eastern and Uva provinces</li> <li>• Energy efficiency improved and additional renewable energy developed</li> </ul>
<b>Division</b>	Energy Division, SARD
<b>Project team</b>	
<b>Team leader</b>	M. Khamudkhanov, Senior Energy Specialist, SARD
<b>Team members</b>	R. Nagpal, Senior Counsel, Office of the General Counsel J. Peththawadu, Project Implementation Officer, Sri Lanka Resident Mission, SARD S. Sasaki, Environment Specialist, SARD P. van Houten-Castillo, Social Development Specialist, SARD P. Wijayatunga, Senior Energy Specialist, SARD
<b>Executing agency</b>	Ministry of Power and Energy (MOPE) Ceylon Electricity Board Sustainable Energy Authority





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# Southeast Asia Department

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**Loan numbers:** 7327/2740-INO

**Project number:** 44906

Indonesia Eximbank

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## Rationale

In Indonesia, the availability of long term, affordable US dollar-denominated loans, vital for exporters to expand and create jobs, has been sharply curtailed by the global financial crisis. Producers looking to upgrade plants and purchase energy efficiency services and energy efficient equipment to make energy cost savings and meet new international energy management standards are unable to source funds. ADB estimates show that energy efficiency improvements by exporters could cut peak electricity demand by around 2,500 megawatts—equivalent to the current power shortfall faced by Indonesia's state electricity company.

## Description

The investment is expected to mitigate the foreign currency financing gap constraining Indonesian exporters, as term US dollar trade finance is limited, firms seeking to import capital equipment for manufacturing exports are restricted in their access to overseas technologies for energy efficiency that are denominated in US dollars. The nonsovereign loan will pioneer energy efficiency finance through the \$30-million tranche under the A-loan. The pilot investment will address existing exporter demand for manufacturing retrofits to comply with advanced processing standards in overseas markets. The remaining \$70-million under the A-loan will be used to facilitate access to Indonesian Exim Bank's existing and new clients in term US dollar trade finance, working capital and refinancing which include shortening the maturity of the high interest loans taken during the financial crisis. Similarly the B-loan will help Indonesia Eximbank overcome its financing gap for US dollar term lending and meet exporters' demand for term trade finance and working capital.

**Total loan amount:** \$200 million

**Clean energy investment:** \$30 million

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

**Energy savings:** 628 terajoules/year

**Greenhouse gas emissions reduction:** 92,000 tCO<sub>2</sub>/year

**Board approval:** 25 March 2011

**Project life:** 10 years

Loan numbers: 7327/2740-INO    Project number: 44906

<b>Impact</b>	Indonesia Eximbank's trade and energy efficiency financing increases.
<b>Outcome</b>	Improved access to energy efficiency and export credit agency finance with insurance for exporting corporations and small and medium enterprises.
<b>Outputs</b>	<ul style="list-style-type: none"> <li>Indonesia Eximbank expanding its export credit and insurance products and initiating energy efficiency finance</li> <li>Risk sharing agreements undertaken with 3–5 major commercial banks</li> <li>Indonesia Eximbank initiating a plan of accession to the Berne union of international credit insurers</li> </ul>
<b>Division</b>	Energy division, SERD
<b>Project team</b>	
<b>Team leader</b>	M. Varkay, Senior Private Sector Development Specialist, SERD
<b>Team members</b>	F. Barot, Operations Assistant, SERD M. Montelibano, Private Sector Development Specialist, SERD D. Song, Senior Financing Partnerships Specialist, Office of Co-financing Operations S. Zaidansyah, Counsel, Office of the General Counsel
<b>Executing agency</b>	Indonesia Exim Bank

**Loan numbers:** 2818/2819-LA0  
**Project numbers:** 41385-01/41385-02  
Greater Mekong Subregion Nam Ngum 3  
Hydropower Project

## Rationale

Hydropower is the major source of electricity in the Lao PDR, providing stable and inexpensive supplies. The government has signed memoranda of understanding with Thailand and Viet Nam to export to each of these countries up to 7 gigawatts and 5 gigawatts respectively. The government has decided to hold minority equity stakes in export-oriented projects to enhance the revenues it receives and allow it to ensure that any adverse social and environmental impacts of projects are mitigated effectively and sustainably.

The Thailand Power Development Plan 2010, which runs from 2010 to 2030, estimates that the country will need an additional 21,564 MW of electricity-generating capacity by 2020 to maintain economic growth. The plan envisions sourcing more than 5 GW from neighboring countries. The proposed Nam Ngum 3 is one of the hydropower sources from which Thailand intends to import electricity starting in January 2017.

The project will provide low-cost and renewable energy to meet rising electricity demand in Thailand, and contribute to the foreign exchange revenues of the Lao PDR, which will provide funds needed to meet its poverty-reduction goals.

## Description

The Project involves the construction and operation of a 440 MW hydropower plant in Lao. It will operate under a concession agreement with the Government of Lao PDR (GOL). All of the power generated by the Project will be sold to Thailand under a power purchase agreement (PPA) with the Electricity Generating Authority of Thailand (EGAT). The main features include an underground power station, a 220 meter high dam, and about 105 km long, 500 kV transmission line.

**Total loan amount:** \$98.2 million (OCR); \$16.92 million (ADF)  
**Clean energy investment:** \$115.12 million  
**Project category:** Renewable Energy  
**Renewable energy generation:** 2,072 gigawatt-hours/year  
**Greenhouse gas emissions reduction:** 1,000,000 tCO<sub>2</sub>/year  
**Board approval:** 03 Nov 2011  
**Project life:** 60 years

Loan numbers: 2818/2819-LAO    Project numbers: 41385-01/41385-02

<b>Impacts</b>	<ul style="list-style-type: none"> <li>Increased private sector investment in hydropower in Lao PDR</li> <li>Increased reliability of power supply in Thailand</li> </ul>
<b>Outcome</b>	Increased regional cooperation between the Lao PDR and Thailand through the trade of clean energy.
<b>Outputs</b>	<ul style="list-style-type: none"> <li>Construction of the NN3 hydropower plant and associated transmission lines in Lao PDR</li> <li>Economic benefits to the Lao PDR in the form of increased government revenues, employment opportunities for the Lao nationals, and economic activity in the Lao PDR</li> </ul>
<b>Division</b>	Energy Division, SERD
<b>Project team</b>	
<b>Team leaders</b>	E. Baardsen, Principal Infrastructure Specialist, SERD
<b>Team members</b>	D. T. Bui, Senior Energy Economist, SERD A. Fernando, Project Analyst, SERD S. Hashizume, Investment Specialist, Private Sector Operations Department (PSOD) P. Jena, Senior Public Management Specialist, SERD S. Kawazu, Senior Counsel, Office of the General Counsel J. Munsayac, Safeguards Specialist, PSOD M. Paterno, Finance Specialist, SERD G. Peralta, Senior Safeguards Specialist (Environment), SERD P. Phommachanh, Project Officer, Lao Resident Mission A. Porras, Safeguards Officer, PSOD D. Schmidt, Energy Economist, SERD M. Sultana, Social Development Specialist, SERD S. L. Tu, Senior Safeguards Specialist, PSOD C. Uy, Investment Specialist, PSOD
<b>Executing agency</b>	Lao Holding State Enterprise (LHSE)

**Loan number:** 2741-VIE  
**Project number:** 40080-01  
Hanoi Metro Rail System—Line 3

## Rationale

Ha Noi is Viet Nam's capital and the second-largest city in Viet Nam; the population of the greater urban area is about 6 million, and is expected to reach almost 8 million by 2025. Private vehicles dominate transportation, with about 90% of transport modal share. Inadequate road infrastructure results in heavy congestion during peak hours, and this will worsen when motorbike riders switch to cars as their household incomes improve. While the road network is expanding slowly, the growth cannot meet the expected increase in demand, and most inner city areas face space limitations on road capacity expansion. Private transport is not sustainable as the principal transportation mode. A well-integrated high capacity public urban transport system is essential to meet the demands of Ha Noi, and a metro rail system is the most appropriate solution for densely populated inner city areas. Without investment in major public transport infrastructure to support a significant modal shift to public transport, economic growth will be severely constrained and the urban environment will deteriorate due to high logistics costs and severe congestion. Ha Noi is at an early stage of adoption of private motorization, so investment in major public transport infrastructure represents an effective means to reduce future urban congestion.

## Description

The Project will establish an integrated sustainable public transport system in five districts of Ha Noi by constructing 12.5 kilometers of a dual track rail metro line from Nhon to Ha Noi railway station. The Project will develop a new double track metro rail line in Ha Noi, which is one of four priority lines of a planned larger urban transportation system under the Ha Noi Urban Transport Master Plan (HUTMP). Metro line 3 will (i) facilitate public transport connectivity, (ii) greatly enhance access in five districts of Ha Noi, and (iii) be an important integral part of an improved public transport system, which aims to achieve increased public modal share through low-carbon transport that reduces greenhouse gas emissions.

**Total Loan Amount:** \$293 million (OCR)  
**Clean Energy Investment:** \$58.6 million  
**Project category:** Demand-side energy efficiency  
**Energy Savings:** 286 terajoules/year  
**Greenhouse gas emissions reduction:** 9,072 tCO<sub>2</sub>/year  
**Board approval:** 29 Mar 2011  
**Project life:** 60 years

Loan number: 2741-VIE Project number: 40080-01

Impacts	Establishment of an integrated sustainable public transport system in five districts of Ha Noi.
Outcome	Competitive metro rail services along the project corridor.
Outputs	<ul style="list-style-type: none"> <li>• Metro line 3 is operational</li> <li>• Improved implementation capacity of Ha Noi Metropolitan Rail Transport Project Board (HRB)</li> </ul>
Division	Transport and Communications Division, SERD
Project team	
Team leader	R. Valkovic, Principal Transport Specialist, SERD
Team members	I. Ahsan, Counsel, Office of the General Counsel P. Broch, Senior Transport Economist, SERD M. Buendia, Safeguards Specialist (Resettlement), SERD S. Hung, Social Development Specialist (Gender and Development), Regional and Sustainable Development Department (RSDD) A. Kunth, Infrastructure Specialist, SERD A. Samoza, Project Analyst, SERD S. Saxena, Climate Change Specialist, RSDD L. D. Thang, Senior Project (Transport) Officer, Viet Nam Resident Mission, SERD A. Velasquez, Safeguards Specialist (Environment), SERD
Executing agency	Ha Noi People's Committee



**Loan number:** 2754-VIE

**Project number:** 41456-02

Viet Nam Water Supply Sector Investment  
Program PFR 1

## Rationale

Ho Chi Minh City (HCMC) is Viet Nam's largest city and an important commercial and industrial center. Its population of 7.1 million is growing by 3.5% per annum and likely to surpass 10 million by 2020. While Viet Nam's gross domestic product is growing by more than 8% per annum, HCMC's gross domestic product is growing substantially faster, by 11%. This growth rate is seriously straining the city's infrastructure, including the water supply system.

The fundamental constraint on the water supply system is a shortfall in transmission capacity. Actual coverage is estimated at 82%, but large areas of HCMC, especially in the south, still suffer intermittent water supply because of low service pressure. HCMC's nonrevenue water (NRW) is estimated at 40% is still relatively high. The proposed investment program is in line with HCMC's draft master plan to be approved in 2011, whose objectives are to achieve universal coverage, continuous water supply, and drinking water quality in HCMC by 2025.

## Description

As a part of the Viet Nam Water Sector Investment Program, the Project aims to increase coverage of households in HCMC with reliable piped water supply and improve the efficiency of Saigon Water Corporation's (SAWACO) operations. The Project shall consist of:

- (i) Constructing 10 kilometers (km) of a 2,400 mm treated water pipeline to extend and strengthen transmission capacity to achieve reliable delivery of continuous water supply of adequate pressure;
- (ii) Repairing and replacing pipes to extend coverage and reduce nonrevenue water;
- (iii) Implementing an Information and Communication Technology program that encompasses the following:
  - a) Strengthen the operational management of SAWACO with integrated software and sustained training to improve billing; accounting systems; and other related financial information systems;
  - b) Human resources development;
  - c) Business and strategic planning and management information systems;
  - d) A supervisory control and data acquisition system / Distribution Control Centre and geographical information system in planning and operation for asset management and improved operation;
- (iv) Supporting SAWACO in developing climate change mitigation and disaster management plans and water conservancy plans; in achieving ISO Certification for performance benchmarking and continuous improvement process; and in implementing social development activities (Information Education Communication, Gender Action Plan);
- (v) Consulting services for detailed design and construction supervision.

**Total loan amount:** \$138 million (OCR)

**Clean energy investment:** \$32 million

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

**Energy savings:** 25 gigawatt-hours/year

**Greenhouse gas emissions reduction:** 18,889 tCO<sub>2</sub>/year

**Board approval:** 07 June 2011

**Project life:** 50 years

Loan number: 2754-VIE Project number: 41456-02

**Impacts** Sustainable provision of safe water in Viet Nam.

**Outcome** Improved efficiency in Viet Nam's water companies.

**Outputs**

- increased coverage
- Improved business planning, assets, and financial management
- Effective NRW reduction

**Division** Urban Development and Water Division, SERD

#### Project team

**Team leaders** H. Jenny, Principal Urban Development Specialist, SERD

**Team members**

- R. Butler, Resettlement Specialist, SERD
- V. T. Dien, Economics/Programs Officer, SERD
- E. Fischelis, Counsel, Office of General Counsel
- R. Frauendorfer, Principal Urban Development Specialist, SERD
- E. Gagnon, Senior Procurement Specialist, Central Operations Services Office
- U. Hoque, Social Development Specialist, SERD
- H. T. Khuc, Procurement Officer, SERD
- P. van Klaveren, Water Supply and Sanitation Specialist, SERD
- A. Mortell, Senior Project Officer, SERD
- M. Paterno, Financial Analysis Specialist, SERD
- G. Peralta, Environment Specialist, SERD
- M. Sultana, Senior Social Development Specialist, SERD

**Executing agency** Saigon Water Corporation

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**Loan number:** 2814-VIE

**Project number:** 43400-01

**O Mon 4 Combined Cycle Power Plant Project**

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## Rationale

Strong economic growth (about 8% a year during the past decade), rapid industrialization, an expansion of business and services, coupled with rising household consumptions have been the causes of the electricity demand growth. To meet this rapidly growing demand for electricity, the government plans to increase generating capacity by maximizing use of the country's energy resources. Despite construction of new generating capacity, power shortage still occurs in the country as electricity demand still outstrips supply. To address this deficit and improve the quality and reliability of the electricity supply to consumers, the government plans to increase generating capacity from 18,481 MW in 2010 to 35,000 MW in 2015 and 60,000 MW in 2020.

In the south, where natural gas is available, several gas-based power complexes have been built, one of which is the O Mon Power complex. The O Mon IV power plant is one of the four power plants to be developed at the O Mon power complex to meet the growing demand for electricity in southern Viet Nam.

## Description

The project will construct a 750-megawatt (MW) combined cycle gas turbine (CCGT) power plant at the O Mon thermal power complex. The project is in O Mon district in the city of Can Tho, about 250 kilometers south of Ho Chi Minh City. The project will help Viet Nam meet the fast-growing demand for electricity to foster socioeconomic development and industrialization in the south, particularly in the Mekong Delta. The project is part of the least-cost Seventh Master Power Development Plan approved by the Government of Viet Nam in 2011.

**Total loan amount:** \$309.89 million (OCR)

**Clean energy investment:** \$76.4 million

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

**Energy savings:** 10,695 terajoules/year

**Greenhouse gas emissions reduction:** 600,000 tCO<sub>2</sub>/year

**Board approval:** 24 Nov 2011

**Project life:** 30 years

Loan number: 2814-VIE    Project number: 43400-01

**Impact** Reliable supply of electricity to industrial, commercial, and residential consumers to enable socioeconomic development and industrialization, particularly in southern Viet Nam and the Mekong Delta.

**Outcome** Adequate generating capacity of the Viet Nam power system

**Outputs**

- 750 MW CCGT O Mon IV power plant operational
- Common facilities for O Mon IV and O Mon III power plants operational

**Division** Energy Division, SERD

#### Project team

**Team leader** D. T. Bui, Senior Energy Economist, SERD

**Team members**

- J. Acharya, Climate Change Specialist (Clean Energy), Regional and Sustainable Development Department
- E. Baardsen, Principal Infrastructure Specialist, SERD
- R. Butler, Safeguards Specialist (Resettlement), SERD
- K. Decker, Principal Financing Partnerships Specialist, Office of Cofinancing Operations
- M. Paterno, Finance Specialist, SERD
- G. Peralta, Senior Safeguards Specialist (Environment), SERD
- M. Sultana, Senior Social Development Specialist, SERD
- S. Zaidansyah, Senior Counsel, Office of the General Counsel

**Executing agency** Viet Nam Electricity



## Appendix 1 2011 Clean Energy Grant-Financed Projects

Grant Number	Country	Department and Division	Project Officer	Project Name	Sector and Clean Energy Category	Total Grant Amount (\$ million)	Clean Energy Investment (\$ million)	Funding Source
280	Afghanistan	CWRD Energy Division	K. Mitsuhashi	Energy Sector Development Investment Program-Tranche 3	Energy, Renewable Energy	43	15.64	ADF
281	Afghanistan	CWRD Energy Division	K. Mitsuhashi	Energy Sector Development Investment Program-Tranche 3	Energy, Renewable Energy	20	7.27	UK
282	Afghanistan	CWRD Energy Division	K. Mitsuhashi	Energy Sector Development Investment Program-Tranche 3	Energy, Renewable Energy	12.4	4.51	Denmark
253	Bangladesh	SARD Energy Division	P. Marro	Public-Private Infrastructure Development Facility	Energy, Renewable Energy	2	2	CCF
254	Bangladesh	SARD Energy Division	P. Marro	Public-Private Infrastructure Development Facility	Energy, Renewable Energy	1.3	1.30	CEFPF-ACEF

ACEF = Asian Clean Energy Fund, ADF = Asian Development Fund, CEFPF = Clean Energy Financing Partnership Facility, CWRD = Central and West Asia Department, SARD = South Asia Department, UK = United Kingdom.

## Appendix 2 2011 Sovereign and Nonsovereign Projects with Clean Energy Components

Country	Loan/ Investment No.	Project Title	Total Amount (\$ million) <sup>a</sup>	Clean Energy Investment (\$ million) <sup>a</sup>
<b>Sovereign Projects</b>				
<b>Energy Sector</b>				
Bangladesh	2769	Power System Efficiency Improvement Project	300.00	101.86
China, People's Republic of	2771	Shandong Energy Efficiency and Emission Reduction Project	100.00	100.00
China, People's Republic of	2773	Guangdong Energy Efficiency and Environment Improvement Investment Program—Tranche 3	42.94	42.94
China, People's Republic of	2835	Hebei Energy Efficiency Improvement and Emission Reduction Project	100.00	100.00
India	2764	Madhya Pradesh Energy Efficiency Improvement Investment Program—Tranche 1	200.00	51.85
India	2830	Madhya Pradesh Energy Efficiency Improvement Investment Program—Tranche 2	200.00	51.85
India	2800	Assam Power Sector Enhancement Investment Program—Tranche 3	50.00	3.51
India	2778	Gujarat Solar Power Transmission Project	100.00	100.00
India	2794	Himachal Pradesh Clean Energy Transmission investment Program—Tranche 1	113.00	113.00
India	2787	National Grid Improvement Project	500.00	15.45
Lao People's Democratic Republic	2818/2819	GMS Nam Ngum 3 Hydropower Project	115.12	115.12
Nepal	2808	Electricity Transmission Expansion and Supply Improvement Project	56.00	2.30
Sri Lanka	2733/2734	Sustainable Power Sector Support Project	120.00	11.73
Uzbekistan	2779	Advanced Electricity Metering Project	150.00	28.12
Viet Nam	2814	O Mon IV combined Cycle Power Plant Project	309.89	76.40
<b>Nonenergy Sector</b>				
China, People's Republic of	2738	Qinghai Rural Water Resources Management	60.00	45.32
China, People's Republic of	2759	Xinjiang Altay Urban Infrastructure & Environ- ment Improvement Project	100.00	4.75
China, People's Republic of	2760	Gansu Tianshui Urban Infrastructure Development Project	100.00	12.25
China, People's Republic of	2765	Railway Energy Efficiency and Safety Enhance- ment Investment Program—Tranche 3	250.00	50.00
India	2793	Railway Sector Investment Program—Tranche 1	150.00	27.27
Turkmenistan	2737	North-South Railway project	125.00	25.00
Viet Nam	2741	Hanoi Metro Rail System Project-Line 3	293.00	58.60
Viet Nam	2754	Water Sector Investment Program	138.00	32.00
<b>Subtotal</b>			<b>3,672.95</b>	<b>1,169.34</b>

*continued on next page*

Country	Loan/ Investment No.	Project Title	Total Amount (\$ million) <sup>a</sup>	Clean Energy Investment (\$ million) <sup>a</sup>
<b>Nonsovereign Projects</b>				
<b>Energy Sector</b>				
Bangladesh	7349/2844	Industrial Energy Efficiency Program (Industrial and Infrastructure Development Finance company)	30.00	30.00
India	7331	Solar Power Generation	150.00	150.00
India	7338/2788	Power Grid	250.00	7.72
India	7340/2798	Dahanu Solar Power Private Limited	48.00	48.00
Lao People's Democratic Republic	7341/2799	Nam Ngum 3 Power Company	350.00	350.00
Pakistan	7339/2792	Star Hydro Power Limited (Patrind Hydropower Project)	97.00	97.00
Pakistan	7348	Foundation Wind Energy Project I	33.43	33.43
Pakistan	7348	Foundation Wind Energy Project II	33.18	33.18
Thailand	7335/2762	Gulf JP NS Company Limited (Nong Saeng Natural Gas Power Project	170.00	38.58
<b>Nonenergy Sector</b>				
China, People's Republic of	7336	Sino-Green Climate Investment Fund	25.00	25.00
India	7339/2748	Bangalore Metro Rail System Project	250.00	50.00
Indonesia	7327/2740	Indonesia Exim Bank	200.00	30.00
Regional	7332/7333/ 7334	Equity Investment in Climatech Venture Capital Funds	40.00	40.00
<b>Subtotal</b>			<b>1,676.61</b>	<b>932.91</b>
<b>Grants</b>				
<b>Energy Sector</b>				
Afghanistan	0280/1/2	Energy Sector Development Investment Program—Tranche 3 (Gereshk Electricity Services Improvement project)	75.40	27.42
Bangladesh	0253/0254	Public–Private Infrastructure Development Facility	3.30	3.30
<b>Nonenergy Sector (No clean energy grant project in nonenergy sector in 2011)</b>				
<b>Subtotal</b>			<b>78.70</b>	<b>30.72</b>
<b>Total</b>			<b>5,428.26</b>	<b>2,132.97</b>

<sup>a</sup> Total investment includes loans from ADB's Ordinary Capital Resources and Asian Development Fund, grants and guarantees from Ordinary Capital Resources, Asian Development Fund, Global Environment Facility, and Clean Energy Financing Partnership Facility.



## 2011 Clean Energy Investments Project Summaries

This report summarizes the investments in clean energy of the Asian Development Bank (ADB) in 2011, 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 non-lending assistance, initiatives, and plan of action for sustainable growth in Asia and the Pacific.

### About the Asian Development Bank

ADB's vision is an Asia and Pacific region free of poverty. Its mission is to help its developing member countries reduce poverty and improve the quality of life of their people. Despite the region's many successes, it remains home to two-thirds of the world's poor: 1.8 billion people who live on less than \$2 a day, with 903 million struggling on less than \$1.25 a day. ADB is committed to reducing poverty through inclusive economic growth, environmentally sustainable growth, and regional integration.

Based in Manila, ADB is owned by 67 members, including 48 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.