

# 2010 Clean Energy Investments

Project Summaries





# 2010 Clean Energy Investments

Project Summaries

June 2011

Asian Development Bank

© 2011 Asian Development Bank

All rights reserved. Published in 2011.  
Printed in the Philippines

ISBN 978-92-9092-397-8  
Publication Stock No. RPT113684

Cataloging-In-Publication Data

Asian Development Bank

2010 Clean energy investments.  
Mandaluyong City, Philippines: Asian Development Bank, 2011.

1. Clean Energy    2. Renewable Energy    3. Energy Efficiency.    I. Asian Development Bank.

The views expressed in this publication are those of the authors and do not necessarily reflect the views and policies of the Asian Development Bank (ADB), its Board of Governors, or the governments they represent.

ADB does not guarantee the accuracy of the data included in this publication and accepts no responsibility for any consequence of their use.

By making any designation of or reference to a particular territory or geographic area, or by using the term "country" in this document, ADB does not intend to make any judgments as to the legal or other status of any territory or area.

ADB encourages printing or copying information exclusively for personal and noncommercial use with proper acknowledgment of ADB. Users are restricted from reselling, redistributing, or creating derivative works for commercial purposes without the express, written consent of ADB.

All data as of 31 December 2010.

Note:

In this report, "\$" refers to US dollars.

Asian Development Bank  
6 ADB Avenue, Mandaluyong City  
1550 Metro Manila, Philippines  
Tel +63 2 632 4444  
Fax +63 2 636 2444  
www.adb.org

For orders, please contact:  
Department of External Relations  
Fax +63 2 636 2648  
adbpub@adb.org

Compiled and edited by  
Sustainable Infrastructure Division, Regional and  
Sustainable Development Department

 Printed on recycled paper

---

# Contents

---

List of Figures	iv
Executive Summary	v
Abbreviations	vi
Introduction	1
Central and West Asia Department	5
East Asia Department	19
Pacific Department	27
Private Sector Operations Department	33
South Asia Department	51
Southeast Asia Department	67
Appendixes	
1 2010 Clean Energy Grants-Financed Projects	71
2 2010 Sovereign and Nonsovereign Projects with Clean Energy Components	72

---

# Figures

---

1	Progress Toward ADB's \$2 Billion Clean Energy Investments Target	1
2	Clean Energy Investments—Public versus Private Sector, 2010	2
3	Clean Energy Investments by Clean Energy Project Type, 2010	3
4	Clean Energy Investments by Sector, 2010	3
5	Indicators for Clean Energy Investments, 2010	4

---

# Executive Summary

---

The Asia and the Pacific region is using energy at a phenomenal rate, and this use—as well as the continuing demand for more energy—is expected to have far-reaching consequences. Meeting energy demand, protecting energy security, and taking these measures while responding to the threat of climate change are among the region’s greatest development challenges.

Asia and the Pacific’s demand for energy must be met in a socially, economically, and environmentally sustainable manner. The Energy Policy of the Asian Development Bank (ADB) seeks to emphasize energy security, provide widespread support for energy efficiency and renewable energy to facilitate the transition to a low-carbon economy, maximize access to energy for all, and promote energy sector reforms toward inclusive development and a region free of poverty. The ADB Clean Energy Program, which embodies the Energy Policy, is an umbrella program that covers efforts to lower carbon emissions and to accelerate the adoption and use of low-carbon technologies in the region.

The demand for clean energy in the region has not abated, and developing member countries, pushing forward on green growth pathways, will continue to seek ADB assistance with clean energy development. As such, ADB support for clean energy has surpassed \$1 billion in investments per year since 2008. With continued support from its regional departments, ADB can achieve its target of \$2 billion per year in clean energy investments by 2013.

In 2010, the Clean Energy Program came close to this \$2 billion target. The Clean Energy Program team reviewed 2010 energy-related reports and recommendations of the President and found that 29 projects with a total value of \$3.39 billion included clean energy components. The total clean energy investment was \$1.76 billion, and their project summaries are compiled and edited in this report.

This report was also crafted in acknowledgment of the work that ADB regional departments have achieved and will continue in the clean energy sector. It presents ADB clean energy projects for 2010 and illustrates the Clean Energy Program’s multipronged approach that seeks to increase efficiency in the energy, transport, and urban sectors; adopt renewable energy sources; and improve access to energy for the poor. Information about ADB clean energy projects is presented in this report in an accessible, easy-to-reference manner, condensing information that is found in project databases and formal reports.

---

# Abbreviations

---

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

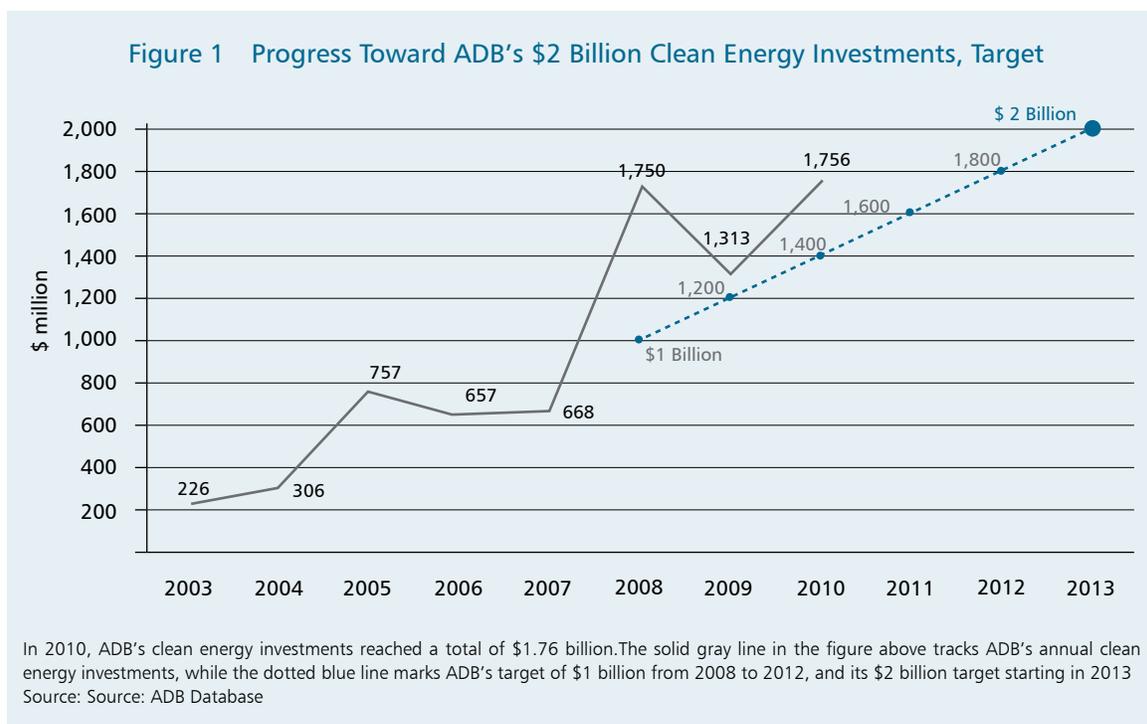
tCO<sub>2</sub>e – ton of carbon dioxide equivalent

# Introduction

The year 2010 was remarkable for clean energy and the Asia and Pacific region. The region became a preferred destination for clean energy financing, with the People's Republic of China (PRC) and India achieving great progress in clean energy development. Both countries installed wind power at levels that place them among the top five wind power-producing countries in the world. Earlier in the year, Pew Charitable Trusts announced that the PRC had surpassed the United States in clean energy investment.<sup>1</sup> However, while the region is poised to be a global leader in clean energy development, much needs to be done to propel clean energy into the mainstream of the entire region.

Expansion, acceleration, and evolution were the clean energy watchwords of the Asian Development Bank (ADB) for 2010. ADB's Energy Efficiency Initiative, established to push ADB clean energy investment to \$1 billion a year, evolved into the Clean Energy Program, which now focuses on supporting clean energy in smaller developing member countries and facilitating the adoption of low-carbon technologies throughout the region. ADB's new technology-focused clean energy-related initiatives marked ADB's expansion into a new area beyond its usual specialties of finance and policy support.

These initiatives, under the new target of \$2 billion a year in clean energy investments from 2013, as announced in 2009, have ambitious goals (Figure 1). The Asia Solar Energy Initiative aims to increase the amount of solar power generated in the region by 3 gigawatts by 2013, the Quantum Leap in Wind aims to install an additional

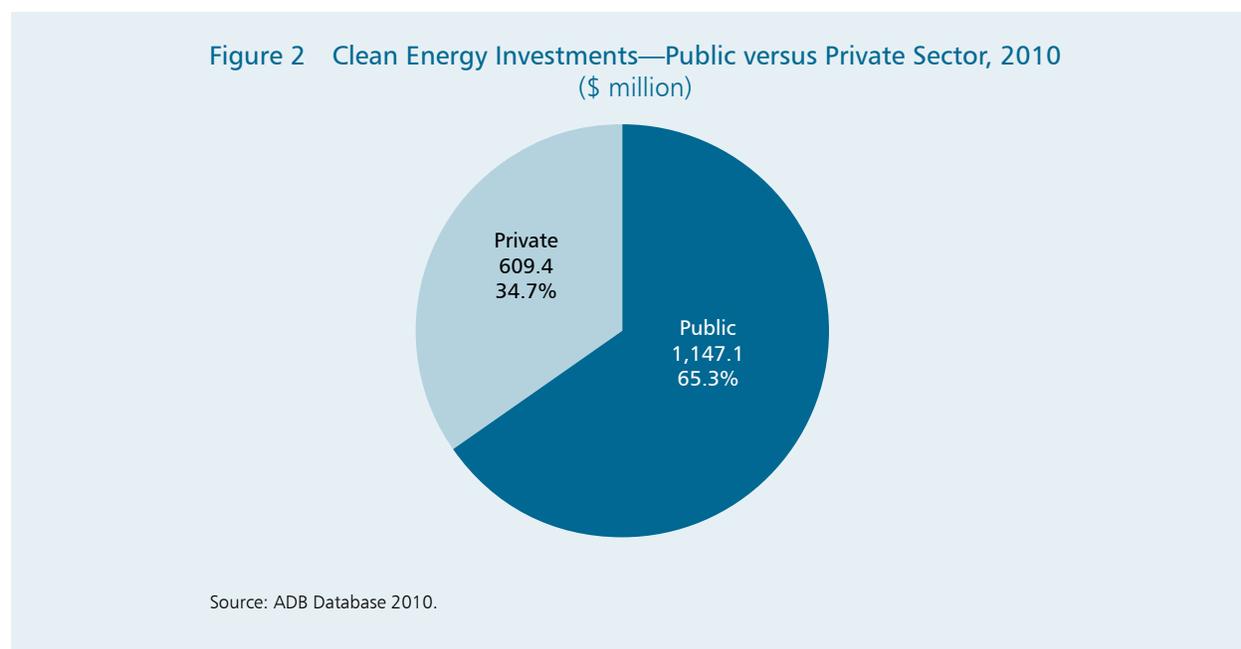


<sup>1</sup> Pew Charitable Trusts. 2010. Who's Winning the Clean Energy Race? [http://www.pewtrusts.org/our\\_work\\_report\\_detail.aspx?id=57969](http://www.pewtrusts.org/our_work_report_detail.aspx?id=57969)

1 gigawatt of wind power across priority developing member countries (e.g., Mongolia, Philippines, Sri Lanka, and Viet Nam) within a few years, and other initiatives hope to accelerate the transfer of low-carbon technology into the region through private-sector led, ADB-backed market models. Still others aim to incentivize the use of renewable power through flexible market-based methods and to support the involvement of venture capital funds in the region's clean energy sector.

Developments in clean energy continue to be fast moving in 2011. Green growth, the low-carbon development strategy to create green economies that are sustainable and resilient against climate change, is being widely adopted, as countries seek a low-carbon future. The commitments to a global financing and technology mechanism for climate change mitigation and adaptation that were made at the 16th Conference of the Parties in Cancun, Mexico in 2010 will be made operational in 2011. ADB's programs and initiatives focusing on low-carbon technologies will continue to evolve in 2011.

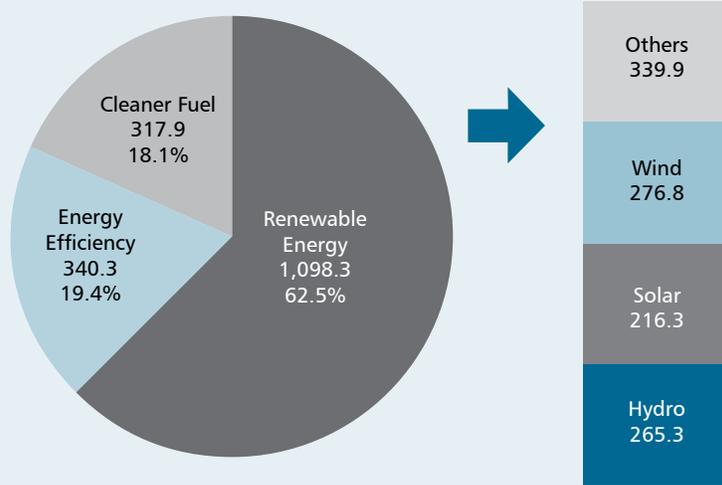
As shown in Figure 2, out of ADB's total clean energy investment of \$1.76 billion in 2010, \$1,147.1 million (65.3%) are public sector loans, while those from private sector operations totaled \$609.4 million (34.7%).



As shown in Figure 3, in terms of clean energy project type, ADB's renewable energy investments make up the largest share, amounting to \$1,098.3 million (62.5%). Energy efficiency investments comprise the next-largest share with \$340.3 million (demand-side at \$43.6 million, supply-side at \$296.7 million), then cleaner fuels at \$317.9 million (18.1%).

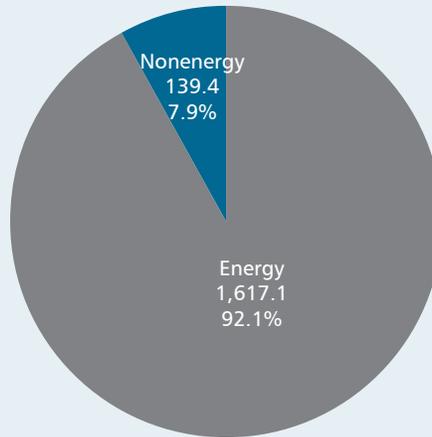
As shown in Figure 4, out of ADB's total clean energy investments, \$1,651.8 million (94.0%) were from the energy sector, and \$104.6 million (6.0%) came from nonenergy sectors.

**Figure 3 Clean Energy Investments by Clean Energy Project Type, 2010**  
(\$ million)



Others here refers to investments mainly in clean energy financing guarantee, equity, and biomass.  
Source: ADB Database 2010.

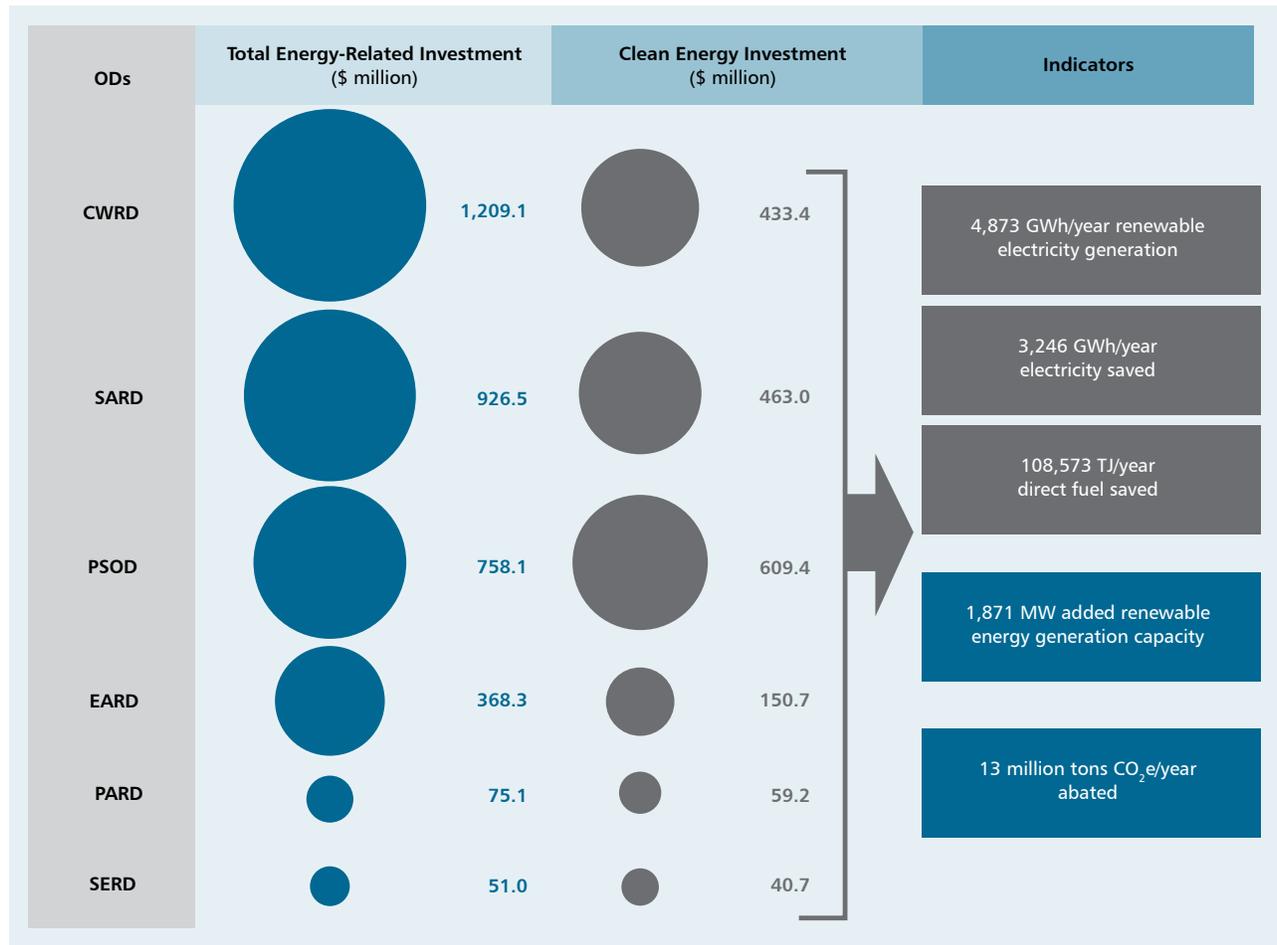
**Figure 4 Clean Energy Investments by Sector, 2010**  
(\$ million)



Source: ADB Database 2010.

In 2010, ADB's \$1.76 billion in clean energy investments is expected to result in significant energy savings from energy efficiency; a total of 4.9 terawatt-hours per year of clean power from renewable sources such as hydro, wind, and solar; 3.3 terawatt-hours of electricity savings from energy efficiency; 108,573 terajoules per year from avoided consumption of direct fuel; abatement of 13 million tons of carbon dioxide equivalent (tCO<sub>2</sub>e) per year; and installation of 1,871 megawatts of renewable energy generation capacity (Figure 5).

Figure 5 Indicators for Clean Energy Investments, 2010  
(\$ million)



CO<sub>2</sub>e = carbon dioxide equivalent, CWRD = Central and West Asia Department, EARD = East Asia Department, GWh = gigawatt hours, MW = megawatt, ODs = ADB's Operations Departments, PARD = Pacific Department, PSOD = Public Sector Operations Department, SARD = South Asia Department, SERD = Southeast Asia Department, TJ = terajoule  
Source: ADB Database 2010.

Analysis of clean energy investments by operations department shows that most come from the Private Sector Operations Department (PSOD) with \$609.4 million (34.7%), followed by the South Asia Department (SARD) with \$463.0 million (26.4%), Central and West Asia Department (CWRD) with \$433.4 million (24.7%), East Asia Department (EARD) with \$150.7 million, Pacific Department (PARD) with \$59.2 million, and the Southeast Asia Department (SERD) with \$40.7 million (2.3%).

Of ADB's total clean energy investments in 2010, \$43.4 million are grant-financed. Most are in the energy sector with around \$29.0 million (67.3%), followed by multisector investments at around \$12.0 million (28.1%), and transport sector investments at \$2.0 million (4.6%). Much of these clean energy grant investments are in South Asia, with around \$24.0 million (54.3%). Clean energy grant investments in East Asia follow with around \$14.0 million (31.2%), Southeast Asia with around \$8 million (6.2%), and the Pacific with \$1.1 million (2.4%). In terms of clean energy project type, renewable energy grant investments comprise the largest share, amounting to \$35.8 million (82.4%). Energy efficiency investments take the next largest with around \$6.6 million at 15.2% (demand-side at \$2.0 million, supply-side at \$4.6 million), then cleaner fuels at around \$1.1 million (2.4%). For a detailed breakdown, see Appendix 1.

---

# Central and West Asia Department

---

---

**Loan numbers:** 2629 and 2630-UZB(SF)

**Project number:** 43151-02

Talimarjan Power Project in Uzbekistan

---

## Rationale

Energy security underpins all aspects of economic growth in Uzbekistan, and energy-efficiency options are an underlying theme in achieving energy security and mitigating the impact of climate change. The government's strategy has shifted to adopting clean technology to increase supply and to reduce greenhouse gas emissions, and to enhancing trade. In the short to medium term (2009–2014), power generation capacity will need to increase considerably to match electricity demand growth of 3.1%–5.4% per year. The construction of new, more efficient combined-cycle gas turbine (CCGT) plants fits this strategy. Other initiatives include expanding renewable energy and energy-efficiency programs, replacing or rehabilitating old and obsolete thermal power plants, and promoting regional energy trade. Further, as an active member of the Central Asia Regional Economic Cooperation Program (CAREC), Uzbekistan signed a framework action plan to expand the regional power network as a means to increase trade in power. It was under CAREC that Uzbekistan started exporting power to Afghanistan in 2009. These exports will soon rise from 150 megawatts to 300 megawatts.

## Description

The project involves the construction of two CCGT units (370–450 megawatts each) at the Talimarjan thermal power plant. Each unit will include (i) a gas turbine with electrical generator; (ii) heat recovery steam generator; (iii) steam turbine with electrical generator; (iv) deaerator unit; (v) steam condenser; and (vi) ancillary equipment including a generator transformer; systems for control; electrical switching; oil, water and gas treatment; cooling water; and all other plant auxiliaries. The first unit will be commissioned in March 2014, and the second unit in December 2014. The project also has a special capacity development component that will support the improvement of Uzbekenergo's management, financial, and operational performance.

**Total loan amount:** \$350.00 million of which \$120.02 million is clean energy investment

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

**Energy savings:** 21,390 terajoules in direct fuel savings per year

**Greenhouse gas emissions reduction:** 1.2 million tCO<sub>2</sub>e per year

**Board approval:** 20 April 2010

**Project life:** 30 years

<b>Impacts</b>	The project will help Uzbekistan achieve energy security and facilitate regional energy trade.
<b>Outcomes</b>	Energy efficiency is improved; regional connectivity is enhanced; and customers receive reliable, quality power supply.
<b>Outputs</b>	<ul style="list-style-type: none"><li>• Two CCGT units in Talimarjan thermal power plant commissioned</li><li>• Uzbekenergo corporate management and performance improved</li><li>• Community service center operational</li></ul>
<b>Clean energy indicator</b>	Greenhouse gas emissions reduced by 1.2 million tCO <sub>2</sub> e annually by 2014 from the baseline of 3.5 million tCO <sub>2</sub> e annually in 2009.
<b>Division</b>	Energy Division
<b>Project team</b>	
<b>Team leader</b>	B. Byambasaikhan, energy specialist, Central and West Asia Department (CWRD)
<b>Team members</b>	B. Konybayev, counsel, Office of the General Counsel (OGC) M. Kunzer, senior environmental specialist, CWRD J. Liston, principal energy specialist, CWRD K. Mitsuhashi, energy specialist, CWRD R. Nadyrshin, portfolio management officer, CWRD S. Roth, social development specialist, CWRD I. Setyawati, social development specialist, CWRD
<b>Executing agency</b>	SJSC Uzbekenergo

---

**Loan number:** 2633-UZB(SF)

**Project number:** 42489-03

**Water Supply and Sanitation Services  
Investment Program in Uzbekistan**

---

## Rationale

Uzbekistan has a poverty reduction and welfare improvement strategy, which identifies access to safe water and sanitation as a means for economic development and poverty reduction. The government's intention is to reach 100% service coverage in urban areas and 85% in rural areas within the next decade. These targets are backed by a policy framework and a sector investment plan amounting to \$1.2 billion by 2012 and \$2.9 billion by 2020. The policy framework calls for greater institutional effectiveness, better service performance and management, improved operational and commercial efficiencies, higher cost recovery rates, and tighter financial controls. This paves the way for piloting a variety of public-private partnership contracts for bulk water supply and performance-based service contracts for small town vodokanals (water supply and sanitation agencies). Through this policy framework, water quality and continuity are added to the service targets. In addition, the government anticipates the merger of vodokanals and the introduction of performance benchmarking for water supply and sanitation operations.

## Description

The investment program is improving water supply and sanitation services in provincial cities and secondary towns across eight provinces. Physical investments include rehabilitation and expansion of the water supply, sanitation, and sewerage systems. Nonphysical investments include sector planning; policy adjustments (e.g., tariff setting and regime); project management (e.g., procurement, contract management, scheduling, and progress reporting); and service company management (e.g., training to improve operations and maintenance, as well as commercial and financial aspects of the business). ADB approved the first tranche of the multitranche financing facility in the amount of \$60 million on 8 October 2009. For the second tranche, the government requested that ADB finance rehabilitation and expansion of water supply and wastewater management systems in the cities of Andijan and Kokand, and urban water supply systems in Fergana, Margilan, and Rishtan. The immediate rehabilitation and/or reconstruction of water supply and sanitation systems, and the development of vodokanal operational capacity, are needed to prevent the systems from further deterioration and to provide acceptable services to about 1.1 million residents in these cities.

**Total loan amount:** \$140.00 million of which \$1.64 million is clean energy investment

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

**Electricity savings:** 4.67 gigawatt-hours per year

**Greenhouse gas emissions reduction:** 2,879 tCO<sub>2</sub>e per year

**Board approval:** 16 April 2010

**Project life:** 15 years

<b>Impact</b>	The investment program will improve living standards, the environment, and public health in urban centers in Uzbekistan.
<b>Outcome</b>	Water supply and sanitation services are safe, reliable and sustainable, and hygiene is improved in project cities.
<b>Outputs</b>	<ul style="list-style-type: none"><li>• Water supply and sanitation systems rehabilitated and improved</li><li>• Management structure and capacity for water supply and sanitation operation improved</li><li>• Effective support provided to program implementation</li></ul>
<b>Clean energy indicators</b>	System leakage reduced to less than 30% from current 50% (the cost estimate for nonrevenue water reduction is taken as the energy-efficiency investment. In this program, each cubic meter of water saved represents a certain amount of electricity saved in pumping and other production processes).
<b>Division</b>	Urban Development and Water Division
<b>Program team</b>	
<b>Team leader</b>	Y. Ye, senior urban economist, CWRD
<b>Team members</b>	M. Davila, urban development specialist, CWRD R. Galeos-Raymundo, administrative assistant, CWRD C. Png, counsel, Office of the General Counsel I . Setyawati, social development specialist, CWRD N. Talipova, associate project analyst, Uzbekistan Resident Mission, CWRD L. Zheng, principal urban development specialist, CWRD
<b>Executing agency</b>	Uzbekistan Communal Services Agency (Uzkommunhizmat)

---

**Loan number:** 2646-AZE

**Project number:** 43406-01

**Janub Gas-Fired Power Plant Project in Azerbaijan**

---

## Rationale

Despite the global economic crisis, Azerbaijan's gross domestic product increased by 10.8% in 2008, fueled by the export of new oil and gas production. Azerbaijan has abundant energy resources, with hydrocarbon reserves estimated at 7,000 billion barrels of oil equivalent. However, the poor quality and reliability of the electricity supply inhibits the expansion of industrial, agriculture, and commercial activities, which are needed for Azerbaijan to diversify its economy away from hydrocarbon-related sectors. Low power plant efficiency, combined with transmission and distribution losses, waste fossil fuels and nearly double greenhouse gas emissions and other pollutants that damage the environment. In the latest country strategy and program update, the government requested ADB support for energy within an expanded lending program, particularly for power transmission and distribution, climate change mitigation, and improving AzerEnergy's access to capital markets.

## Description

The project will construct a 780-megawatt combined-cycle power plant and auxiliary services with an average efficiency of 52% to replace the Shirvan thermal power plant, Azerbaijan's second-largest power plant, which is more than 40 years old and now inefficient. The project will have a significant carbon dioxide emissions reduction of 1.3 million tons by 2012 from a baseline of 39.8 million tCO<sub>2</sub>e in 2006. It will increase the stability of the power generation system in Azerbaijan and improve the reliability of the power supply in the country's industrial and economic hub in the Absheron Peninsula.

**Total loan amount:** \$232.32 million of which \$76.70 million is clean energy investment

**Project category:** Cleaner fuel and energy efficiency

**Energy savings:** 33,058 terajoules in direct fuel savings per year

**Greenhouse gas emissions reduction:** 1.3 million tCO<sub>2</sub>e per year

**Board approval:** 2 June 2010

**Project life:** 30 years

**Impact** Azerbaijan's power system provides the electricity needed for sustained economic growth.

**Outcome** AzerEnergy's capacity to provide efficient, reliable power to customers is increased.

**Output** 780-megawatt combined-cycle power plant and auxiliary services constructed

**Clean energy indicators** Fuel used to generate 1 kilowatt-hour is reduced from 386 grams of conventional fuels in 2008 to 260 grams by 2012, and emissions are reduced by 1.3 million tCO<sub>2</sub>e by 2012.

**Division** Energy Division

**Project team**

**Team leader** B. Byambasaikhan, energy specialist, CWRD

**Team members** B. Konybayev, counsel, OGC  
M. Kunzer, senior environmental specialist, CWRD  
J. Liston, principal energy specialist, CWRD  
K. Mitsuhashi, energy specialist, CWRD  
R. Nadyrshin, portfolio management officer, CWRD  
S. Roth, social development specialist, CWRD  
I . Setyawati, social development specialist, CWRD

**Executing agency** AzerEnergy

---

**Loan number:** 2671-KGZ(SF)

**Project number:** 43456-02

Power Sector Improvement Project in the  
Kyrgyz Republic

---

## Rationale

KyrgyzEnergo, a vertically integrated power utility, was unbundled in 2001 with the intention to bring efficiency and transparency to the sector. Although some improvements followed this move, the sector remains inefficient as represented by high electricity losses. In 2007, 5.9 terawatt-hours out of 12.2 terawatt-hours supplied domestically was unaccounted for; quasi-fiscal deficit amounted to 4.9% of the gross domestic product in 2007. A lack of proper metering is a major obstacle for loss reduction and adequate commercial operation. In addition, without budget for necessary maintenance, fuel purchase, rehabilitation, or new investment, the power sector is in dire condition.

## Description

This project seeks to improve the operational efficiency of the target power companies and reduce transmission losses from 5.7% in 2009 to 4.7% in 2014 and distribution losses from 26% in 2009 to 20% in 2014. These gains in efficiency will reduce the demand for power and avoid emissions of up to 63,000 tCO<sub>2</sub>e per year.

**Total loan amount:** \$16.70 million of which \$1.54 million is clean energy investment

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

**Electricity savings:** 553 gigawatt-hours per year

**Greenhouse gas emissions reduction:** 63,000 tCO<sub>2</sub>e per year

**Grant component:** Grant number 0218

**Board approval:** 27 September 2010

**Project life:** 25 years

Loan numbers: 2671-KGZ(SF) Project number: 43456-02

<b>Impacts</b>	The reliability of the national and regional power supply in the Kyrgyz Republic and Central Asia is improved.
<b>Outcome</b>	The utilities have higher operational efficiency.
<b>Outputs</b>	<ul style="list-style-type: none"> <li>• Commercial metering data automatically obtained</li> <li>• Circuit breakers and current and voltage transformers rehabilitated</li> <li>• Supervisory control and data acquisition system and seven major national electric grid substations and control centers linked</li> </ul>
<b>Clean energy indicators</b>	Transmission losses are reduced from 5.7% in 2009 to 4.7% in 2014, distribution losses are reduced from 26% in 2009 to 20% in 2014, and greenhouse gas emissions are reduced by 63,000 tCO <sub>2</sub> e annually by 2014.
<b>Division</b>	Energy Division
<b>Project team</b>	
<b>Team leader</b>	T. Kadono, energy specialist, CWRD
<b>Team members</b>	M. Eshenaliev, project implementation officer, Kyrgyz Resident Mission, CWRD M. Kunzer, senior environmental specialist, CWRD J. Liston, principal energy specialist, CWRD C. Png, counsel, OGC S. Roth, social development specialist, CWRD R. Sanda, investment specialist, CWRD I. Setyawati, social development specialist, CWRD
<b>Executing agency</b>	Ministry of Energy, National Electric Grid of Kyrgyzstan

---

**Loan number:** 2726-PAK  
**Project number:** 34339-03  
**Renewable Energy Development Sector Investment  
Program in Pakistan—Tranche 2**

---

## Rationale

The government has delegated authority to the provinces to develop power-generating capacity of up to 50 megawatts, and renewable energy programs are a means to deliver this mandate. Renewable energy development, a key feature of the government's poverty reduction and environmental agendas, is also compatible with its twin goals of energy security and promoting indigenous resource utilization. Further, it supports electrification in remote and rural areas, including those not covered by the main grid, and promotes employment generation and improvements in social well-being. In May 2005, the government called for renewable energy to reach 3.5% by 2015 and 6.0% by 2030 of the total energy supply mix.

## Description

The investment program combines physical investments in new power-generating capacity across four provinces in several subsectors and nonphysical interventions in policy reform, capacity development, fiduciary oversight and governance, regulatory and legal frameworks, knowledge management, safeguards, procurement, disbursements, project implementation, evaluation, supervision, monitoring, and reporting. To increase production and use of clean energy through renewable energy sources in a financially sustainable manner, the investment program involves the commissioning of 150–250 megawatts of cumulative generating capacity from three to five “shovel ready” (i.e., projects that are ready to be constructed) wind and other renewable energy power plants operated by independent power producers by the end of 2012. It will mobilize \$400 million–\$670 million of debt and equity from domestic and international investors needed to finance these renewable energy power plants.

**Total loan amount:** \$200 million of which \$200 million is clean energy investment

**Project category:** Renewable energy

**Renewable electricity generation:** 520 gigawatt-hours per year

**Greenhouse gas emissions reduction:** 175,000 tCO<sub>2</sub>e per year

**Board approval:** 13 December 2010

**Project life:** 20 years

<b>Impacts</b>	Annual gross domestic product growth of 4%–8% is sustained, carbon dioxide emissions of 175,000 tons annually from 2012 to 775,000 tons annually from 2018 are avoided.
<b>Outcome</b>	The production and use of clean energy are increased through renewable energy resources in a financially sustainable manner.
<b>Outputs</b>	150–250 megawatts of cumulative generating capacity from a total of three to five “shovel ready” wind and other renewable energy power plants operated by independent power producers commissioned by the end of 2013 \$400 million–\$670 million of debt and equity from domestic and international investors mobilized
<b>Clean energy indicators</b>	Greenhouse gas emissions reduced by 175,000 tCO <sub>2</sub> e annually by 2012, and by 775,000 tCO <sub>2</sub> e annually by 2018.
<b>Division</b>	Energy Division
<b>Project team</b>	
<b>Team leaders</b>	M. Endelman, principal financial specialist, CWRD F. Kawawaki, principal energy specialist, CWRD
<b>Team members</b>	L. Aranda, administrative assistant, CWRD B. Chansavat, young professional, CWRD H. Chen, counsel, OGC J. Chenoweth, counsel, OGC M. Hashimi, investment officer, CWRD R. Jayewardene, principal social development specialist, CWRD M. Kuzner, senior environment specialist, CWRD K. Mitsuhashi, energy specialist, CWRD R. Pladet, senior guarantees and syndications specialist, Office of Cofinancing Operations (OCO) R. Rebolledo, administrative assistant, CWRD S. Shah, senior investment specialist, CWRD A. Tareen, project officer (energy), Pakistan Resident Mission, CWRD
<b>Executing agency</b>	Alternative Energy Development Board

---

**Loan number:** 2727-PAK

**Project number:** 38456-02

Power Distribution Enhancement Investment Program  
in Pakistan—Tranche 2

---

## Rationale

Pakistan's power sector faces tremendous challenges in its efforts to support the government's strategy of increasing the electricity supply to urban and rural populations and securing overall economic growth, including (i) lack of generation capacity, (ii) increasing constraints in the transmission and distribution systems, (iii) weak financial management and sustainability of the sector entities, and (iv) inadequate corporate governance structures for the successor companies. According to the government's power system estimates, at least 8% annual growth in electricity demand in Pakistan is forecasted between 2005 and 2015. Thus, Pakistan will require an additional 2,000 megawatts of power annually to meet this demand, which must be evacuated through the transmission system. Substantial investments are required to strengthen the system to address current shortfalls, evacuate power generated by additional power plants, and supply electricity to meet the growing demand.

## Description

The investment program aims to help customers receive reliable, quality power supply and further alleviate the power distribution bottlenecks by rehabilitating and augmenting the power distribution system. This will help reduce prolonged power outages and load shedding. It will add 3,380 megavolt-amperes of transformer capacity and add 387 kilometers of new distribution lines.

**Total loan amount:** \$242 million of which \$31 million is clean energy investment

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

**Board approval:** 14 December 2010

**Project life:** 30 years

<b>Impacts</b>	Reliable quality power is supplied, and service coverage is expanded.
<b>Outcome</b>	Power distribution systems are rehabilitated, augmented, and expanded, and system bottlenecks are removed.
<b>Outputs</b>	Subprojects commissioned according to schedules indicated in the investment and expansion plans.
<b>Clean energy indicator</b>	Energy loss reduction initiatives for the distribution network
<b>Division</b>	Energy Division
<b>Project team</b>	
<b>Team leader</b>	A. Tareen, project officer (energy), Pakistan Resident Mission, CWRD
<b>Team members</b>	R. Jayewardene, principal social development specialist, CWRD F. Kawawaki, principal energy specialist, CWRD A. Kokhar, social safeguard officer, CWRD M. Kuzner, senior environment specialist, CWRD L. Nazarbekova, senior counsel, OGC H. Woldring, rural development specialist, South Asia Department (SARD)
<b>Executing agency</b>	Pakistan Electric Power Company



---

# East Asia Department

---

---

**Loan number:** 2616-PRC

**Project number:** 42117-01

Tianjin Integrated Gasification Combined-Cycle  
Power Plant Project

---

## Rationale

To provide momentum to the development of integrated gasification combined-cycle (IGCC) and carbon capture and storage technologies, the government announced the GreenGen Program in 2005. The GreenGen Company launched a three-phase program toward this goal, and in the first phase (2008–2010), it aimed to implement a 250-megawatt IGCC plant in Tianjin. The government is also considering the rapid implementation of three other IGCC pilot plants—400 megawatts at Langfang, 400 megawatts at Yantai, and 250 megawatts at Zhejiang—to demonstrate a critical mass of IGCC projects using different gasifier technologies and plant sizes. The implementation of multiple, industrial-size IGCC pilot projects shows the government’s firm commitment to IGCC development. The successful completion of the demonstration phase will identify a clear pathway for IGCC commercial deployment in the People’s Republic of China (PRC).

## Description

The project will demonstrate a key enabling technology with potential for reducing large greenhouse gas emissions from coal use in the largest coal-consuming country in the world. ADB project support will provide additional technical due diligence and help mitigate associated risks, strengthen compliance with safeguard policies, and thereby establish appropriate benchmarks and standards for future IGCC projects. The successful implementation of the project will lead to scaled-up IGCC power plants and trigger the next phases of the GreenGen Program, with the potential for very large reductions in greenhouse gas emissions from coal-fired power plants in the PRC. The project is supported by the Ministry of Science and Technology and the National Development and Reform Commission.

**Total loan amount:** \$135.00 million of which \$36.61 million is clean energy investment

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

**Energy savings:** 2,533 terajoules in direct fuel savings per year

**Greenhouse gas emissions reduction:** 372,000 tCO<sub>2</sub>e per year

**Grant component:** Grant number 0196

**Board approval:** 8 February 2010

**Project life:** 25 years

**Impact** Greenhouse gas emissions are reduced from coal-based power plants.

**Outcome** The deployment of IGCC plants is expanded.

- Outputs**
- An IGCC power plant of 250-megawatt capacity (1,470 gigawatts per year) constructed and operating in Binhai New Area
  - Adequate capacity in project management, safeguard compliance, and plant operation and maintenance
  - Capacity developed for obtaining carbon offset revenues from IGCC plants
  - Clean energy indicator: Greenhouse gas emissions of 372,000 tCO<sub>2</sub>e per year are avoided.

**Division** Energy Division

**Project team**

- Team leader** A. Bhargava, principal energy specialist, EARD
- Team members** P. Dungca, administrative assistant, EARD  
X. Liu, project officer, PRC Resident Mission, EARD  
K. Mulqueeny, senior counsel, OGC  
T. Oi, energy specialist, EARD  
M. Pajarillo, finance specialist, EARD  
R. Sabur, environment specialist, EARD  
C. Wang, economics officer, PRC Resident Mission, EARD  
H. Yang, energy specialist, East Asia Department (EARD)

**Executing agency** China Huaneng Group

---

**Loan number:** 2632-PRC

**Project number:** 40682-01

**Integrated Renewable Biomass Energy  
Development Sector in the PRC**

---

## Rationale

The PRC is at a crucial stage in its social and economic development. With increasing industrialization and improving living standards, the PRC's overall demand for energy is growing rapidly (i.e., rural energy consumption is increasing at a rate of 2.6% annually), posing severe problems in energy supply and environmental protection. At the same time, livestock breeding and the agricultural processing industry have also been developing quickly and have changed from scattered small farms into professional medium- and large-sized farms. Organic wastes produced from these activities are thus increasing, resulting in serious environmental pollution and public health problems. Due to the high concentration of organic materials in this waste, anaerobic digestion technology is one of the most effective ways to solve such pollution problems, which could also convert the biomass wastes into biogas to relieve energy shortage pressure.

## Description

The project will improve the performance of the biogas subsector through the demonstration of an integrated renewable biomass energy system in the poor rural areas of Heilongjiang, Henan, Jiangxi, and Shandong provinces. The project has four components: (i) sustainable development and demonstration of commercial practices of medium- and large-scale biogas plants, (ii) effective utilization of biogas sludge in eco-farming, (iii) capacity development for improved sector performance, and (iv) project implementation support. The project will adopt a sector loan approach to support the government and target provinces to develop their rural biomass energy system.

**Total loan amount:** \$66.8 million of which \$66.8 million is clean energy investment

**Project category:** Renewable energy

**Renewable electricity generation:** 92 gigawatt-hours per year

**Energy savings:** 98 terajoules in direct fuel savings per year

**Greenhouse gas emissions reduction:** 1 million tCO<sub>2</sub>e per year

**Grant component:** Grant numbers 0203 and 0204

**Board approval:** 16 April 2010

<b>Impact</b>	Rural environmental management and access to clean energy is improved.
<b>Outcomes</b>	The rural biomass energy system is improved, and social benefits are enhanced.
<b>Outputs</b>	<ul style="list-style-type: none"><li>• Commercial practices of medium- and large-scale biogas plants sustainably developed and demonstrated</li><li>• Biogas sludge in eco-farming effectively utilized</li><li>• Capacity developed for improved sector performance</li><li>• Project implementation support</li></ul>
<b>Clean energy indicators</b>	Greenhouse gas emissions are reduced by 1 million tCO <sub>2</sub> e annually by 2015, and about 70 million cubic meters of biogas are produced per year for rural energy use.
<b>Division</b>	Agriculture, Environment and Natural Resources Division
<b>Project team</b>	
<b>Team leader</b>	Y. Feng, principal natural resources management specialist, EARD
<b>Team members</b>	C. Chong, principal portfolio management specialist, Central Operations Services Office (COSO) T. Lin, natural resources economist, EARD L. Medina, project officer, EARD X. Peng, lead professional (counsel), OGC F. Radstake, environment specialist, EARD M. Vorpahl, social development specialist, EARD M. Watanabe, young professional, EARD
<b>Executing agency</b>	Ministry of Agriculture

---

**Loan number:** 2658-PRC  
**Project number:** 40634-01  
Inner Mongolia Autonomous Region Environment  
Improvement Project in the PRC (Phase II)

---

## Rationale

The PRC energy sector depends heavily on coal, which provides about two-thirds of its primary energy supply. This has resulted in substantial environmental damage, including acid rain, harm to public health, and greenhouse gas emissions, the major cause of climate change. The Inner Mongolia Autonomous Region (IMAR) has an even higher dependency on coal, which accounted for 90.5% of total energy consumption and 95.0% of energy for heating in 2007, higher than the national average. Only 40% of its monitored cities achieved class II air quality standards in 2008. The low efficiency of existing heating systems in IMAR, both in generation and distribution, directly causes serious environmental impacts by emissions from increased coal consumption. A large proportion of existing heating systems in IMAR are small, highly polluting, and inefficient neighborhood coal-fired boilers with aging pipe networks that suffer high distribution losses. Further, relatively poor economic conditions mean that remote areas of IMAR often have inadequate heating supplies, which has a disproportionately high impact on the poor. Demand for district heating is also growing rapidly as a result of the privatization of housing and rapid urbanization, and reliable and affordable household heating is a basic necessity in IMAR, as temperatures can fall below  $-40^{\circ}$  Celsius. The heating season generally lasts 7 months.

## Description

This project seeks improvements in energy efficiency through district heating and efficiency gains in urban areas in IMAR that avoid coal consumption by at least 1.04 million tons by 2015, thereby reducing annual emissions by 1.59 million tCO<sub>2</sub>e. Additionally, the project will assist in reducing the energy sector's high reliance on coal by developing natural gas infrastructure in the residential, industrial, and transport sectors.

**Total loan amount:** \$150.0 million of which \$34.5 million is clean energy investment

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

**Energy savings:** 19,656 terajoules in direct fuel savings per year

**Greenhouse gas emissions reduction:** 1.59 million tCO<sub>2</sub>e per year

**Board approval:** 6 August 2010

**Project life:** 20 years

**Impacts** In IMAR’s heating system, the environment and energy efficiency are improved.

**Outcome** The air quality in six urban areas in IMAR is improved.

**Outputs** Improved district heating supply, development of natural gas transmission and distribution infrastructure.

**Clean energy indicator** Greenhouse gas emissions reduced by 1.59 million tCO<sub>2</sub>e per year by 2014.

**Division** Energy Division

**Project team**

- Team leader** S. Yamamura, energy specialist, EARD
- Team members** I. Ahsan, counsel, OGC
- X. Liu, project officer, PRC Resident Mission, EARD
- T. Oi, energy specialist, EARD
- K. Ozoa, administrative assistant, EARD
- M. Pajarillo, finance specialist, EARD
- R. Sabur, environment specialist, EARD

**Executing agency** Foreign Capital Department, IMAR



---

# Pacific Department

---

**Loan numbers:** 2692 and 2691-PAL(SF)

**Project number:** 44031-01

**Water Sector Improvement Program in Palau**

## Rationale

In Palau, operations in the water and sanitation sector are inefficient, with nonrevenue water loss at 43% of production. Collection rates have historically been poor, at 60%–65% of billing, and management and organizational planning is limited. Further, maintenance is underfunded, and not all needed technical skills are available. To improve performance within the sector, an overhaul of current operations and management is required as well as the introduction of a capacity-building program. Water and sewerage flow metering to improve maintenance and leak detection, adjustment of the pricing of water and sewerage, and remedial programs will also improve efficiency. Further, the government is committed to implementing the Medium-Term Development Strategy, 2009–2014, which was developed to support implementation of the National Master Development Plan. Part of the strategy aims to (i) invest in the water and sanitation sector, (ii) move state-owned enterprises toward full cost recovery, and (iii) reduce government expenditure by eliminating subsidies. The country partnership strategy, 2009–2013 also supports the goals and actions of the strategy and includes technical and financial support for sewerage planning, improved water resources management, and water and sanitation sector infrastructure development.

## Description

This program seeks to provide safe, reliable, and sustainable water supply and sanitation services while reducing nonrevenue water loss from the baseline of 43% to less than 25% by 2015. The increase in water efficiency will reduce the power needed for pumping, which will lessen overall emissions from power generation.

**Total loan amount:** \$16.00 million of which \$0.89 million is clean energy investment

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

**Electricity savings:** 0.227 gigawatt-hours per year

**Greenhouse gas emissions reduction:** 107 tCO<sub>2</sub>e per year

**Board approval:** 9 November 2010

**Project life:** 15 years

<b>Impact</b>	Water and sewerage services are sustained.
<b>Outcome</b>	The demand for water and sewerage services is met by 2015.
<b>Outputs</b>	<ul style="list-style-type: none"><li>• The legal and policy framework for water sector improvement in place</li><li>• An independent Palau water and sewer corporation delivers improved services.</li><li>• Full cost recovery in the water and sewerage sector achieved</li><li>• Effective public consultation conducted</li></ul>
<b>Clean energy indicators</b>	Nonrevenue water is reduced from the baseline of 43% to less than 25% by 2015; greenhouse gas emissions are reduced by 107 tCO <sub>2</sub> e per year.
<b>Division</b>	Pacific Operations Division
<b>Project team</b>	
<b>Team leader</b>	S. Blaik, senior water supply and sanitation system specialist, Pacific Department (PARD) A. Gill, country specialist, PARD
<b>Team members</b>	K. Emzita, senior counsel, OGC H. Everett, financial sector specialist (public finance), PARD T. Miyao, procurement specialist, COSO N. Sapkota, safeguards specialist, PARD S. Tanaka, social development specialist, PARD A. Woodruff, young professional, PARD
<b>Executing agency</b>	Ministry of Finance

---

**Loan numbers:** 2714 and 2713-PNG(SF)

**Project number:** 41504-01

Town Electrification Investment Program in  
Papua New Guinea—Tranche 1

---

## Rationale

In Papua New Guinea, less than 10% of the population has access to electricity; grid-connected power is largely restricted to the main urban areas. In provincial urban centers not connected to the main power grids, a relatively low percentage of urban residents are connected, and distributed power is rarely available outside of these urban centers. The supply of power to businesses and industries in the provincial urban centers is unreliable, with regular power outages and demand that at times exceeds generation capacity. Thus, lack of access to affordable, reliable power is limiting economic growth in provincial centers. Papua New Guinea has a total of 580 megawatts of installed generation capacity. PNG Power Limited, the national state-owned corporatized power utility, manages generation of about 300 megawatts, including the two main grids (i.e., Port Moresby and Ramu) and 19 geographically isolated independent power grids servicing provincial centers. The remaining 280 megawatts consists of power that is self-generated by industrial facilities, including mines, and private sector generators. The majority of provincial centers are supplied entirely through diesel generation, resulting in high generation costs.

## Description

The investment program will install 6 megawatts of additional hydropower capacity in target provincial areas and contribute to an avoidance of 35,000 tCO<sub>2</sub>e emissions per year by the end of 2016. The generation of 35.6 gigawatt-hours per year will reduce power outages by 20% in target provincial urban areas and reduce fuel costs for PNG Power Limited by 60% in target provincial areas by 2016.

**Total loan amount:** \$57.3 million of which \$57.3 million is clean energy investment:

**Project category:** Renewable energy

**Renewable electricity generation:** 35.6 gigawatt-hours per year

**Greenhouse gas emissions Reduction:** 35,000 tCO<sub>2</sub>e per year

**Board approval:** 6 December 2010

**Project life:** 20 years

Loan numbers: 2714 and 2713-PNG(SF) Project number: 41504-01

**Impact** The economic condition of the population in the targeted provincial centers improves.

**Outcome** The use of reliable, clean power to six provincial urban centers is improved.

**Outputs**

- Six renewable energy power plants put into operation by PNG Power Limited
- Transmission lines constructed and operated by PNG Power Limited
- Capacity building for implementing agency and project beneficiaries undertaken
- Project management unit renders efficient project management services.

**Clean energy indicators** Greenhouse gas emissions are reduced by 35,000 tCO<sub>2</sub>e per year by 2016, and 35.6 gigawatt-hours are generated per year from renewable energy sources.

**Division** Pacific Operations Division

**Project team**

**Team leader** A. Maxwell, energy specialist, PARD

**Team members** E. Brotoisworo, principal safeguards specialist, PARD

A. Gill, country specialist, PARD

R. Kesterton, energy specialist, PARD

S. Lee, senior social development specialist, PARD

R. Nagpal, senior counsel, OGC

N. Sapkota, safeguards specialist, PARD

A. Woodruff, senior energy specialist, Southeast Asia Department (SERD)

**Executing agency** Department of Petroleum and Energy



---

# Private Sector Operations Department

---

---

**Private sector: 7307**

**Project number: 40921-01**

**Sungas LPG Distribution Network in Afghanistan**

---

## Rationale

While natural gas supplied by pipeline is typically more economical in the long run than liquefied petroleum gas (LPG) transported by tanker trucks, the absence of a nationwide pipeline network and the prohibitive construction costs for pipelines over long distances in the near term imply that achieving a wide distribution of LPG will rely on road-based transport. According to the World Bank, in Afghanistan, a natural gas pipeline to Kabul from the north and the use of unconfirmed domestic natural gas in the south are neither viable nor cost-effective. Considering these factors, Sungas's capital investments can be easily scaled according to market conditions, that is, trucks and cylinders can be added or scaled back more readily and at a lower cost than permanently installed piping from terminals to distribution centers. Further, LPG is clean and safe; it has the least-demanding infrastructure requirements of the energy alternatives and has the potential to dramatically improve living conditions for the poor.

## Description

The project will develop a nationwide LPG storage and distribution network in Afghanistan. It will import LPG directly from refineries in Turkmenistan and Uzbekistan and deliver it to consumer households through an efficient supply chain with no intermediaries. Increased LPG consumption improves the environment, improves living conditions, and accelerates economic growth through more efficient use of, and enhanced access to, energy for households and small businesses.

**Total investment amount:** \$8.00 million of which \$2.76 million is clean energy investment

**Project category:** Cleaner fuel

**Energy savings:** 26,519 terajoules in direct fuel savings per year

**Greenhouse gas emissions reduction:** 1,376,808 tCO<sub>2</sub>e per year

**Board approval:** 25 May 2010

<b>Impacts</b>	Access to modern energy sources is improved, facilitating economic growth and well-being. The use of traditional solid fuels for energy is reduced.
<b>Outcome</b>	The retail supply of affordable, high-quality LPG is increased in a safe, reliable manner.
<b>Output</b>	Sungas commissions and expands its nationwide LPG distribution network as planned.
<b>Clean energy indicators</b>	The use of traditional solid fuels is decreased nationally by 15% by 2014, and greenhouse gas emissions are reduced by 1,376,808 tCO <sub>2</sub> e per year by 2014.
<b>Division</b>	Infrastructure Finance Division 1
<b>Project team</b>	
<b>Team leader</b>	T. Minnich, investment specialist, Private Sector Operations Department (PSOD)
<b>Team members</b>	H. Brooke, principal counsel, OGC S. Gupta, principal investment specialist, PSOD J. Munsayac, senior social safeguards officer, PSOD M. Pascua, environment officer, PSOD S. Tu, senior environment specialist, PSOD
<b>Executing agencies</b>	Sungas International Oil and Afghanistan Petroleum

---

**Private sector:** 7311  
**Project number:** 43936-01  
**Solar Power Project in Thailand**

---

## Rationale

Solar energy is an abundant resource throughout Thailand and represents the potential of more than 50,000 megawatts in installed power capacity, according to measurements of average solar irradiation over the last 20 years.

## Description

The project entails the construction of a 55-megawatt peak solar generation plant in Central Thailand (73 megawatt peak gross capacity). Its development and implementation will be covered by a 5-year, automatically renewable power purchase agreement between the Electricity Generating Authority of Thailand and the Natural Energy Development Company under the Small Power Producers Program. The Electricity Generating Authority of Thailand will purchase all of the energy output of the plant up to 55 megawatts, the upper limit set in the power purchase agreement. The agency is also working with ADB to prefinance certified emission reductions under ADB's Carbon Market Initiative. The project will use thin-film photovoltaic technology and is expected to be one of the largest solar photovoltaic projects in the world. It also seeks to demonstrate the commercial viability of large-scale private sector solar farms, a model that other private sector investors can then replicate in Thailand and elsewhere in the region.

**Total investment amount:** \$70 million of which \$70 million is clean energy investment

**Project category:** Renewable energy

**Renewable electricity generation:** 80 gigawatt-hours per year

**Greenhouse gas emissions reduction:** 50,000 tCO<sub>2</sub>e per year

**Grant component:** Grant number 0201

**Board approval:** 16 April 2010

**Project life:** 25 years

<b>Impact</b>	The feasibility and sustainability of a large-scale private sector solar farm is demonstrated that can be replicated by other private sector investors in Thailand and other developing member countries.
<b>Outcome</b>	The profitability and sustainability of a large-scale solar power farm is demonstrated.
<b>Outputs</b>	<ul style="list-style-type: none"><li>• Thailand's first large, utility-scale solar power-generating facility established</li><li>• Through its development, construction, and operation, its personnel acquire the skills to facilitate the spread of solar power projects in the region.</li></ul>
<b>Clean energy indicators</b>	Greenhouse gas emissions are reduced by 50,000 tCO <sub>2</sub> e annually by 2012, and renewable electricity generation is 80 gigawatt-hours per year from solar power.
<b>Division</b>	Infrastructure Finance Division 2
<b>Project team</b>	
<b>Team leader</b>	D. Wiedmer, investment specialist, PSOD
<b>Team members</b>	M. De Los Reyes, Treasury Department O. Jettwatana, economics officer (private sector), Thailand Resident Mission, SERD M. Kanda, investment specialist, PSOD M. Manabat, senior investment officer, PSOD J. Munsayac, senior social safeguards officer, PSOD M. Mahurkar, Treasury Department N. Moller, counsel, OGC B. Raemaekers, guarantees and syndications specialist, OCO S. Tu, senior environment specialist, PSOD S. Tumiwa, principal planning and coordination specialist, Regional and Sustainable Development Department (RSDD)
<b>Executing agencies</b>	China Light and Power Group, Electricity Generating Public Company, Mitsubishi

---

**Private sector: 7313**

**Project number: 43931-01**

**Garadagh Cement Expansion and Energy  
Efficiency Project in Azerbaijan**

---

## Rationale

In 2008, domestic cement consumption in Azerbaijan was 3.2 million tons, representing 374 kilograms (kg) per capita. This compares similarly with per capita consumption in Eastern Europe but is considerably less than in other countries undergoing significant construction and infrastructure rehabilitation, such as Kazakhstan (608 kg per capita), Iran (475 kg per capita), and the Russian Federation (420 kg per capita). The total installed cement capacity in Azerbaijan, consisting of a cement plant and grinding stations, left a supply deficit of 1.27 million tons in 2008, increasing the country's dependence on imports. Based on the gross domestic product per capita growth trends, cement consumption is expected to grow by 5.8% per year up to 2012, leading to a consumption rate of 505 kg per capita.

## Description

The project will expand the production capacity of an integrated cement facility from 2,616 tons of clinker per day to 4,000 tons per day and replace the existing four wet kilns with one modern dry kiln, raising the annual production of cement from 1.3 million tons per year to 1.7 million tons per year. The more efficient dry kiln will reduce specific fuel consumption per unit of clinker produced. The project also includes reopening a limestone quarry and upgrading cement mills, storage facilities, and associated production infrastructure. Further, it represents the first opportunity for ADB to provide direct assistance to Azerbaijan's private sector economy in an industry that directly supports infrastructure development. ADB's participation in this project will complement European Bank for Reconstruction and Development assistance and catalyze more private sector investment in Azerbaijan's infrastructure sector by highlighting attractive investments outside of the oil and gas sector. A private sector solution to cement supply is ideal since consumer prices are driven by production costs, and private enterprises, which compete for market share by reducing costs, can expand the market supply.

**Total investment amount:** \$27.00 million of which \$0.32 million is clean energy investment

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

**Energy savings:** 4,628 terajoules in direct fuel savings per year

**Greenhouse gas emissions reduction:** 7,280 tCO<sub>2</sub>e per year

**Board approval:** 1 June 2010

<b>Impact</b>	Foreign direct investment is increased in the private sector economy in Azerbaijan, outside of the dominant oil and gas sectors.
<b>Outcome</b>	The domestic cement supply, provided by the private sector, is expanded and more efficient.
<b>Output</b>	Garadagh Cement plant expanded, upgraded, and commissioned as planned, and in compliance with ADB environmental, health, safety and social safeguards
<b>Clean energy indicators</b>	Specific fuel consumption decreases from 6,370 kilojoules per kg in 2009 to 3,200 kilojoules per kg (i.e., clinker basis) by 2012; greenhouse gas emissions are reduced by 7,280 tCO <sub>2</sub> e per year by 2012.
<b>Division</b>	Infrastructure Finance Division 1
<b>Project team</b>	
<b>Team leader</b>	D. Purka, senior investment specialist, PSOD
<b>Team members</b>	C. Gin, counsel, OGC M. Manabat, senior investment officer, PSOD T. Minnich, investment specialist, PSOD J. Munsayac, senior social safeguards officer, PSOD M. Pascua, environment officer, PSOD S. Tu, senior environment specialist, PSOD
<b>Executing agency</b>	Garadagh Cement Open Joint Stock Company

---

**Private sector: 7314**

**Project number: 44931-01**

**Bangchak Solar Power Project in Thailand**

---

## Rationale

Thailand has abundant renewable energy sources—biomass, biogas, mini-hydro, solar, and wind. The use of these domestic sources of renewable energy can boost Thailand’s energy security, save on foreign exchange, and protect the country from global energy price fluctuations. As part of the strategy to diversify the energy mix and promote renewable energy, the government has prepared the Alternative Energy Development Plan, 2008–2022 and set a target of 20.3% for primary commercial energy from renewable energy sources by 2022. This implies a renewable energy capacity of 5,608 megawatts by 2022, a significant increase from the present 1,745 megawatts. This can be achieved only with concerted efforts from the regulator, private sector sponsors, and financial institutions.

## Description

The project involves the construction of two solar power generation plants (9.43 megawatts and 34.5 megawatts) in Ayutthaya Province. The project is sponsored by the Bangchak Petroleum Public Company and will be financed on a corporate basis. The project will play a pioneering role in demonstrating the commercial viability of large-scale, private sector solar farms, a model that can be replicated by other private sector investors in the region.

**Total investment amount:** \$134.31 million of which \$134.31 million is clean energy investment

**Project category:** Renewable energy

**Renewable electricity generation:** 58 gigawatt-hours per year

**Greenhouse gas emissions reduction:** 30,000 tCO<sub>2</sub>e per year

**Board approval:** 5 October 2010

**Project life:** 25 years

<b>Impact</b>	Thailand's energy mix is diversified through the addition of renewable energy capacity.
<b>Outcomes</b>	The supply of clean energy sourced from solar power is increased, and carbon dioxide emissions are reduced.
<b>Output</b>	Two solar power generating facilities installed and operational
<b>Clean energy indicators</b>	Greenhouse gas emissions are reduced by 30,000 tCO <sub>2</sub> e annually by 2014, and 58 gigawatt-hours of renewable energy are generated per year from solar power.
<b>Division</b>	Infrastructure Finance Division 2
<b>Project team</b>	
<b>Team leader</b>	D. Wiedmer, investment specialist, PSOD
<b>Team members</b>	M. De Los Reyes, Treasury Department O. Jettwatana, private sector economics officer, Thailand Resident Mission, SERD R. Lockhart, young professional, PSOD M. Manabat, senior investment officer, PSOD V. Medina, social development officer, PSOD N. Moller, counsel, OGC M. Monish, principal treasury specialist, Treasury Department M. Pascua, environment officer, PSOD B. Raemaekers, guarantees and syndications specialist, OCO S. Tu, senior environment specialist, PSOD
<b>Executing agency</b>	Bangchak Petroleum Public Company

---

**Private sector: 7316**

**Project number: 44905-01**

**Municipal Natural Gas Infrastructure  
Development Project (Phase 2) in the PRC**

---

## Rationale

The People's Republic of China (PRC) has abundant, undeveloped indigenous natural gas reserves, estimated at 2.46 trillion cubic meters in 2009. The government aims to reduce coal consumption and to increase the use of natural gas, a cleaner fuel, from the current share of 4% of energy consumed to 10% by 2020. To achieve this target, the government has restructured its largest gas-producing companies and implemented a program of large-scale international and domestic trunk pipeline networks. However, a number of municipalities have faced shortages of natural gas over the last several years. Most affected are newly emerging small and medium-sized "satellite" cities on the outskirts of medium-sized and large "hub" cities, as the network coverage of China Gas Holdings has been limited to these hub cities. To seize business opportunities through expanded market coverage and to fulfill social responsibilities, China Gas Holdings applied for further ADB assistance to extend natural gas pipelines to satellite cities to ensure a stable supply.

## Description

The project will support the investment plan of China Gas Holdings to fund a series of new natural gas distribution infrastructure subprojects in neighboring smaller cities that surround hub cities such as Baoji, Yiyang, and Yulin in the central and western regions.

**Total investment amount:** \$200.00 million of which \$83.24 million is clean energy investment

**Project category:** Cleaner fuel

**Greenhouse gas emissions reduction:** 300,000 tCO<sub>2</sub>e per year

**Board approval:** 9 November 2010

<b>Impacts</b>	The energy mix in the PRC is diversified while urban environmental degradation in the central and western regions is abated. There is also an increased role of the private sector in municipal environmental infrastructure projects.
<b>Outcomes</b>	The supply of clean, affordable natural gas to small and medium-sized cities in the central and western regions is increased through public–private partnerships.
<b>Outputs</b>	<ul style="list-style-type: none"><li>• Subproject companies and/or investments in small- and medium-sized cities created</li><li>• Gas distribution networks and facilities constructed</li><li>• Integrated energy saving solutions documented</li><li>• Training provided to China Gas Holdings management on combining fuel conversion and energy efficiency</li></ul>
<b>Clean energy indicator</b>	Natural gas substitutes coal to reduce greenhouse gas emissions by 300,000 tCO <sub>2</sub> e per year by 2015.
<b>Division</b>	Infrastructure Finance Division 2
<b>Project team</b>	
<b>Team leader</b>	H. Kimura, senior investment specialist, PSOD
<b>Team members</b>	C. Gin, senior counsel, OGC S. Hashizume, investment specialist, PSOD M. Manabat, senior investment officer, PSOD V. Medina, social development officer, PSOD J. Munsayac, senior social safeguards officer, PSOD M. Pascua, environment officer, PSOD S. Roberts, investment specialist, PSOD D. Song, guarantees and syndications specialist, OCO S. Tu, senior environment specialist, PSOD
<b>Executing agency</b>	China Gas Holdings

---

**Private sector: 7317**

**Project number: 44928-01**

**Jilin Wind Power Project in the PRC**

---

## Rationale

The PRC is Asia's largest—and the world's second-largest—consumer of energy. Coal has historically been the fuel of choice, as abundant reserves exist throughout the country, and three-quarters of electricity and 69% of primary energy is derived from burning coal. However, the heavy use of coal can cause severe local impacts such as resource depletion, environmental deterioration, and pollution-related health effects. Sulfur dioxide emissions—70% of which are from coal burning—also cause acid rain on about one-third of the country's land-mass. Greenhouse gas emissions—80% of which are from coal burning—outstrip those of other countries and are seen as a global environmental issue. The government is committed to reducing greenhouse gas emissions and to change the country's pattern of energy use to better balance economic growth and environmental protection. This commitment is reflected in the Medium- and Long-Term Development Plan for Renewable Energy in China, promulgated in August 2007, in which one of the most prominent targets is to increase renewable energy's share of electricity generation to 15% by 2020. Given the expected long-term growth in PRC energy demand, major cuts in carbon intensity require a significant expansion of lower-carbon energy technologies such as wind.

## Description

The project will support China Wind Power Group in building a series of wind farms in Jilin and other provinces in northern PRC where private sector participation is limited and abundant wind resources are underutilized. China Wind Power Group will utilize ADB assistance to fund a series of wind farm projects, with a total production capacity of up to 800 megawatts by 2013. The portfolio approach will enable ADB to provide financing support for multiple wind farm projects.

**Total investment amount:** \$240 million of which \$240 million is clean energy investment

**Project category:** Renewable energy

**Renewable electricity generation:** 1,820 gigawatt-hours per year

**Greenhouse gas emissions reduction:** 1.6 million tCO<sub>2</sub>e per year

**Board approval:** 16 November 2010

**Project life:** 20 years

<b>Impacts</b>	The PRC economy grows sustainably through more wind power in the total energy mix, and the role of private wind projects in Jilin and other target provinces is increased.
<b>Outcome</b>	Clean power is efficiently provided through increased private sector participation.
<b>Output</b>	At a designed performance level of 800 megawatts, wind power-generation facilities installed
<b>Clean energy indicators</b>	Greenhouse gas emissions are reduced by 1.6 million tCO <sub>2</sub> e annually from 2012, and 1,820 gigawatt-hours of renewable energy are generated per year from wind power.
<b>Division</b>	Infrastructure Finance Division 2
<b>Project team</b>	
<b>Team leader</b>	H. Kimura, senior investment specialist, PSOD
<b>Team members</b>	M. Manabat, senior investment officer, PSOD K. Moss, legal consultant, OGC J. Munsayac, social development specialist, PSOD C. Ng, investment specialist, PSOD S. Roberts, investment specialist, PSOD D. Song, guarantees and syndications specialist, OCO S. Tu, senior environment specialist, PSOD
<b>Executing agency</b>	China Wind Power Group

---

**Private sector:** 7619  
**Project number:** 43937-01  
**Zorlu Enerji Power Project in Pakistan**

---

## Rationale

Pakistan's energy generation is highly dependent on imported fossil fuels. The country imports some \$10.5 billion worth of oil each year, the bulk of which is for electricity generation. This is equivalent to about 34% of total imports, imposing a significant burden on the government's scarce foreign exchange reserves and making the country extremely vulnerable to energy supply disruptions and global price fluctuations. At the same time, Pakistan is endowed with abundant renewable energy resources—wind, small hydro (i.e., less than 50 megawatts), solar, and biomass. Accordingly, tapping into this vast potential of renewable energy, especially wind, is of critical urgency to diversify the skewed fuel mix, hence ensuring energy security, saving precious foreign exchange, and enhancing macroeconomic stability by helping protect energy systems. ADB, building on strong CWRD support to the Pakistani Alternative Energy Development Board, has been working to identify potential wind independent power producers that match ADB priorities for renewable energy power development in Pakistan.

## Description

The project involves the construction and operation of a 56.4-megawatt wind power farm in Sindh Province, about 100 kilometers northeast of Karachi. Once completed, the project will be Pakistan's first privately financed wind power project constructed under the Renewable Energy Policy, 2006. The project will supply power to the national grid under a 20-year take-or-pay energy purchase agreement under a tariff approved by the National Electric Power Regulatory Authority, Pakistan's power sector regulator.

**Total investment amount:** \$36.8 million of which \$36.8 million is clean energy investment

**Project category:** Renewable energy

**Renewable electricity generation:** 199 gigawatt-hours per year

**Greenhouse gas emissions reduction:** 86,024 tCO<sub>2</sub>e per year

**Board approval:** 24 November 2010

**Project life:** 20 years

<b>Impact</b>	The energy mix is diversified, and there is more investment in private power generation projects in Pakistan.
<b>Outcome</b>	Pakistan's power consumers receive increased low-carbon power.
<b>Output</b>	A wind power plant installed and operational
<b>Clean energy indicators</b>	Greenhouse gas emissions reduced by 86,024 tCO <sub>2</sub> e annually by 2012, and 199 gigawatt-hours of renewable energy generated per year from wind power.
<b>Division</b>	Infrastructure Finance Division 1
<b>Project team</b>	
<b>Team leaders</b>	M. Hashimi, investment officer, CWRD S. Shah, senior investment specialist, PSOD
<b>Team members</b>	M. Greenhow, counsel, OGC M. Manabat, senior investment officer, PSOD J. Munsayac, social development specialist, PSOD M. Pascua, environment officer, PSOD S. Tu, senior environment specialist, PSOD
<b>Executing agency</b>	Zorlu Enerji Electric Uretim

---

**Private sector: 7320**

**Project number: 44926-01**

**Proposed Equity Investments: Clean Resources Asia  
Growth Fund and Renewable Energy Asia Fund**

---

## Rationale

Aggressive development throughout Asia and the Pacific has put substantial pressure on the region's resource base and natural environment, and this development path must be balanced over the long term with resource alternatives that are more sustainable. The clean energy market comprises companies and projects that provide solutions to improve the use of natural resources to reduce negative ecological impacts. Increasingly broader in scope, the market embraces multiple industries with diverse needs and at varying points in the production cycle—generation, procurement, use and reuse, and residual disposal. Through a combination of economic, political, regulatory, and social drivers, the clean energy industry has risen to prominence in mitigating strategic risks facing individual economies and the global community. Many proponents now view the clean energy industry as the most significant investment opportunity for 2010 to 2020. Investment in Asia and the Pacific provides a means to enhance investment returns in clean energy for three core reasons: (i) the region's demand for clean energy and technology solutions will outpace that of the rest of the world; (ii) a disproportionate share of the supply chain for clean technologies will originate in the region; and (iii) the region is relatively underserved by dedicated clean energy capital sources, attracting less than 5% of clean technology investment to date, versus about 15% of total private equity and venture capital investment.

## Description

The Clean Resources Asia Growth Fund seeks to identify and invest in companies with (i) proven clean technologies for application in the region's markets, (ii) critical elements of the Asia-based supply chain for clean resource technologies, and (iii) high-growth clean technology companies engaged in expanding sales volumes and production capacities. The Renewable Energy Asia Fund will invest primarily in India and the Philippines through renewable energy projects and project developers that use proven technologies and generate project revenue through green electricity, carbon credits, and/or energy by-products.

**Total investment amount:** \$40 million of which \$40 million is clean energy investment

**Project categories:** Renewable energy and energy efficiency

**Renewable electricity generation:** 701 gigawatt-hours per year

**Greenhouse gas emissions reduction:** 556,246 tCO<sub>2</sub>e per year

**Board approval:** 26 November 2010

**Project life:** 20 years

<b>Impacts</b>	The contribution of investee companies and projects to the economy is increased, corporate governance in investee companies and projects is improved, and greenhouse gas emissions are reduced.
<b>Outcome</b>	Access to finance, expertise in clean energy projects, and companies in the target regions is increased.
<b>Output</b>	Funds and their policies established as planned
<b>Clean energy indicators</b>	Greenhouse gas emissions are reduced by 556,246 tCO <sub>2</sub> e annually by 2012, and 701 gigawatt-hours of renewable energy are generated per year from clean energy sources.
<b>Division</b>	Capital Markets and Financial Sector Division
<b>Project team</b>	
<b>Team leaders</b>	S. Kim, investment specialist, PSOD J. Klein, investment specialist, PSOD
<b>Team members</b>	S. Brett, investment specialist, PSOD M. Davidovski, counsel, OGC
<b>Executing agency</b>	Funds' management teams



---

# South Asia Department

---

---

**Loan numbers:** 2623 and 2622-BAN(SF)

**Project number:** 38164-01

**Natural Gas Access Improvement Project in Bangladesh**

---

## Rationale

Natural gas contributes 70% of primary energy supply in Bangladesh and dominates the power sector, fueling 85% of power generation. As the country is highly dependent on natural gas for its economic development, the sustainability of gas supply is critical. Government policy in the gas sector since 1993 has been to attract private investments to upstream gas field development while improving the network coverage and operational efficiency of companies that produce and distribute natural gas. Accordingly, Bangladesh has managed to attract significant investments from the private sector for gas exploration and to increase gas production by over 100% since 1998. The share of gas production by international oil companies grew to almost 50% of the total supply in 2008. However, removing bottlenecks in the transmission system has become critical to ensuring the efficient delivery of higher gas volumes. For example, safety and supply efficiency improvement at the Titas gas field is necessary to avoid a major accident and sustain the current level of production from the field in the long term.

## Description

The project has four components: (i) the construction of 61 kilometers of gas transmission pipeline for transporting 400 million cubic feet per day, including interface metering and regulating stations at selected locations and the installation of compressors at Ashuganj and Elenga; (ii) safety and supply efficiency improvement in Titas gas field to increase gas production by 120 million cubic feet per day; (iii) the construction of a 845 kilometer gas distribution network in the southwest to improve energy access; and (iv) support for supply and demand management.

**Total loan amount:** \$266.00 million of which \$154.18 million is clean energy investment

**Project category:** Cleaner fuel

**Energy savings:** 691 terajoules of direct fuel savings per year

**Greenhouse gas emissions reduction:** 40,694 tCO<sub>2</sub>e per year

**Board approval:** 26 March 2010

**Project life:** 20 years

<b>Impact</b>	Access to natural gas is increased and more reliable for sustained economic growth.
<b>Outcome</b>	Capacity is expanded, and efficiency is improved in natural gas production, transmission, and distribution systems.
<b>Outputs</b>	<ul style="list-style-type: none"><li>• Ashuganj–Bakhrabad gas transmission loop line of about 61 kilometers constructed</li><li>• Gas compressors at Ashuganj and Elenga operational</li><li>• Gas seepage in the Titas gas field controlled and four wells developed</li><li>• 845 kilometers of pipelines in the southwestern gas distribution network constructed</li><li>• Prepaid meters for domestic consumers and remote meters for industrial consumers introduced</li><li>• Feasibility studies for energy efficiency improvements conducted</li><li>• Capacity developed</li></ul>
<b>Clean energy indicators</b>	Gas sector losses in nonbulk consumption are reduced from 2.8% in 2009 to 2.0% by 2011, and greenhouse gas emissions reduced by 40,694 tCO <sub>2</sub> e per year by 2011.
<b>Division</b>	Energy Division
<b>Project team</b>	
<b>Team leader</b>	P. Wijayatunga, energy specialist, South Asia Department (SARD)
<b>Team members</b>	I . Caetani, social development specialist, SARD L. George, energy specialist, SARD H. Gunatilake, principal energy specialist, SARD R. Murshed, project officer, SARD S. Sasaki, energy specialist, SARD J. Srinivasan, senior control officer, SARD K. Takebayashi, energy specialist, SARD J. Versantvoort, counsel, OGC
<b>Executing agencies</b>	Bangladesh Gas Fields Company, Gas Transmission Company, Sundarban Gas Company, Titas Gas Transmission and Distribution

---

**Loan numbers:** 2656-NEP(SF)

**Project number:** 43151-02

**Kathmandu Sustainable Urban Transport Project in Nepal**

---

## Rationale

Kathmandu Valley is severely constrained in developing efficient urban infrastructure. Traffic congestion in Kathmandu has become serious—cross-city journeys are measured in hours, not minutes; roads are saturated; and one incident at a junction has implications throughout the entire road network. Further, the transport sector is the biggest producer of carbon dioxide emissions in Nepal, and 386,000 tCO<sub>2</sub>e were released in Kathmandu Valley in 2009. With an increase in vehicles, this is expected to rise two to three times in the next 10 years, together with particulate matter and total suspended particulates, which have become a serious public health concern. Readings from roadside monitoring stations indicate particle levels of particulate matter at 200 milligrams per cubic meter, 67% in excess of the 120 milligrams per cubic meter national standard, and far exceeding World Health Organization standards of 50 milligrams per cubic meter. The main cause is vehicle emissions—less than 1% of all registered vehicles in Kathmandu Valley produce low emissions. Therefore, making the urban transport system more efficient will create numerous benefits such as reduced local air pollution and carbon dioxide emissions.

## Description

The project aims to improve the quality of urban life in the capital city of Nepal, through the delivery of a more efficient, safe, and sustainable urban transport system, favoring local economic growth and addressing climate change and air pollution mitigation. The urban transport system will be enhanced by focusing on (i) the establishment of a method and a plan to rationalize and upgrade the existing public transport network, and a test of this approach through the implementation of pilot routes provided with electric vehicles; (ii) the implementation of traffic management works and measures, which will enable pedestrianization of heritage routes in the city core and improve general walkability; and (iii) the improvement of air quality monitoring.

**Total loan amount:** \$10.0 million of which \$1.8 million is clean energy investment

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

**Greenhouse gas emissions reduction:** 77,200 tCO<sub>2</sub>e per year

**Grant component:** Grant number 0212

**Board approval:** 22 July 2010

**Project life:** 10 years

<b>Impact</b>	A sustainable, efficient urban transport system is created for Kathmandu Valley, favoring local economic growth and addressing climate change and air pollution mitigation.
<b>Outcome</b>	In Kathmandu, public transport services and walkability are improved, favoring a modal shift from private vehicles and improving traffic conditions.
<b>Outputs</b>	<ul style="list-style-type: none"><li>• Public transport improved and upgraded</li><li>• Capacity of the Department of Transport Management strengthened</li><li>• Traffic management improved</li><li>• Walkability in the city center improved</li><li>• Monitoring of air quality enhanced</li></ul>
<b>Clean energy indicator</b>	About 155 electric buses are purchased through the fund and are operated on the pilot routes.
<b>Division</b>	Urban Development and Water Division
<b>Project team</b>	
<b>Team leader</b>	D. Margonsztern, urban development specialist, SARD
<b>Team members</b>	K. Emzita, senior counsel, OGC J. Leather, principal transport specialist, RSDD N. Saito, urban development specialist, SARD L. Sharma, project officer, SARD
<b>Executing agency</b>	Ministry of Physical Planning and Works

---

**Loan numbers:** 2677-IND

**Project number:** 41614-03

Multitranche Financing Facility Assam Power Sector  
Enhancement Investment Program in India—Tranche 2

---

## Rationale

The Assam state government set out a 2003 policy statement for power reforms, detailing (i) achieving commercial efficiency and financial viability of the power sector so that it will not require Assam's financial resources, which are needed for socioeconomic development; (ii) improving delivery of services and cost-effectiveness through technical, managerial, and administrative restructuring of power utilities; and (iii) increasing operating efficiency of all power utilities through competition, managerial autonomy, and higher accountability. Assam's future peak power demand is forecasted to increase to 1,883 megawatts by 2014, with an annual increase of 14.2%. To meet the demand, new power plants are being constructed with sufficient additional capacity through the Assam Power Sector Development Program, which comprises a \$150 million program loan and a \$100 million project loan. However, the limited capacity of the Assam transmission and distribution system can constrain the delivery of power to consumers. Therefore, such capacity needs to be expanded and system access and efficiency enhanced.

## Description

The investment program will directly address sector issues based on the achievement of the Assam Power Sector Development Program, which has successfully created the enabling environment leading to inclusive economic growth through power sector reforms and physical capacity expansion. The investment program will require 5 years for full implementation, and will require flexibility in project selection to achieve overall objectives and mitigate risk.

**Total loan amount:** \$89.7 million of which \$22.0 million is clean energy investment

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

**Board approval:** 5 October 2010

**Project life:** 25 years

<b>Impacts</b>	The state power sector is sustainable and has increased transmission and distribution capacity to support inclusive economic growth.
<b>Outcomes</b>	The quality and expanded service delivery of electricity in Assam are enhanced through improved technical, commercial, and financial performance and capability of the power sector utilities.
<b>Outputs</b>	<ul style="list-style-type: none"><li>• New transmission lines and substations, and other transmission system improvement facilities, constructed</li><li>• Transmission substations extended and augmented, and existing substations refurbished</li><li>• Reactive compensation and new technologies to reduce loss introduced</li></ul>
<b>Clean energy indicators</b>	System losses are reduced from 35% (6% transmission) in 2008 to 19% (4% transmission) in 2014.
<b>Division</b>	Energy Division
<b>Project team</b>	
<b>Team leader</b>	N. Sakai, senior climate change specialist, SARD
<b>Team members</b>	S. Sasaki, environment specialist, SARD K. Takebayashi, energy specialist, SARD
<b>Executing agency</b>	Assam State Electricity Board

---

**Loan numbers:** 2681-IND

**Project number:** 41626-01

**Bihar Power System Improvement Project in India**

---

## Rationale

Bihar's power sector is in dire need of investment. The transmission network suffers from insufficient capacity, resulting in power reliability, quality, and stability issues. Further, its electricity distribution network has failed to keep pace with demand growth. Power transformer capacity is inadequate to meet diversified demand on 11-kilovolt feeders in many areas, 33- and 11-kilovolt feeders are being loaded in excess of thermal limits, and distribution transformer failure rate is about 19%. Power quality is also poor due to undersized conductors, long low-voltage circuits, and distribution transformer overloading. Overall, system losses exceed 40%, a considerable drag on sector finances and sustainability. Upgrading the transmission and distribution systems is one of four power sector priorities in the government's Eleventh Five-Year Plan, 2007–2012, and the ADB country partnership strategy, 2009–2012 specifies ADB support of energy initiatives in India, including expanding and optimizing transmission and distribution systems, providing institutional strengthening, and encouraging energy efficiency and conservation.

## Description

The project will upgrade the electric power system and increase efficiency, reliability, and quality of supply through physical investments in Bihar's power infrastructure, coupled with a capacity development component. Project investments include installation of new, and renovation and modernization of, existing transmission substations; installation of new, and reinforcement of, existing transmission lines; and improvement of distribution systems in seven towns in Bihar. This will reduce system bottlenecks, boost power supply and system reliability, and minimize technical and commercial losses.

**Total loan amount:** \$132.20 million of which \$6.62 million is clean energy investment

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

**Electricity savings:** 34,871 megawatts per year

**Greenhouse gas emissions reduction:** 21,557 tCO<sub>2</sub>e per year

**Board approval:** 19 October 2010

**Project life:** 25 years

<b>Impact</b>	The state power sector is more sustainable and provides better services to end-users.
<b>Outcomes</b>	The transmission and distribution capacity is improved, expanded, and more efficient, and the quality and reliability of services in Bihar is enhanced.
<b>Outputs</b>	<ul style="list-style-type: none"><li>• Transmission substation capacity expanded, and new transmission lines constructed</li><li>• Distribution system capacity and consumer metering increased</li><li>• Project implementation support and institutional and/or capacity development of Bihar State Electricity Board</li></ul>
<b>Clean energy indicator</b>	Greenhouse gas emissions are reduced by 21,557 tCO <sub>2</sub> e per year by 2015.
<b>Division</b>	Energy Division
<b>Project team</b>	
<b>Team leader</b>	A. Jeffries, senior energy specialist, SARD
<b>Team members</b>	L. George, energy specialist, SARD V. Rao Karbar, senior project officer, SARD V. Rekha, principal counsel, OGC S. Sasaki, environment specialist, SARD P. Van Houten-Castillo, social development specialist, SARD
<b>Executing agency</b>	Bihar State Electricity Board

---

**Loan numbers:** 2687-IND

**Project number:** 41627-04

Himachal Pradesh Clean Energy Development  
Investment Program in India—Tranche 3

---

## Rationale

Himachal Pradesh is a small, mountainous state with abundant water resources due to five major rivers flowing from the western Himalayas. Thus, its power generation potential is 20,415 megawatts—about 25% of India’s total hydropower potential—out of which only about 6,150 megawatts has been developed. Recognizing the state’s comparative advantage in hydropower generation, the main strategy of the Himachal Pradesh government is the development of Himachal Pradesh as the “hydropower state” of India, which will enable the export of excess power to the rest of the country for the benefit of poorer and power-deficient states. However, harnessing this hydropower is also vital to meet in-state demand by providing affordable, reliable power to its residents. The state currently meets only about 50% of its power demand through its own power-generating capacity. The government’s focus on clean energy development will provide jobs to state residents and will further the country’s goal of meeting its energy needs through clean, indigenous sources.

## Description

Under tranche 3, the project includes the addition of hydropower capacity to the existing subprojects. Tranche 3 comprises the construction of the 100-megawatt Sainj hydroelectric power plant (i.e., certain civil works, underground powerhouse, river diversion, intake and desilting, and electrical and interconnection works); and the works of stage II and III of the Kashang Hydroelectric Project (i.e., link tunnel, electrical and interconnection works, and second intake).

**Total loan amount:** \$208 million of which \$208 million is clean energy investment

**Project category:** Renewable energy

**Renewable electricity generation:** 1,368 gigawatt-hours per year

**Greenhouse gas emissions reduction:** 1,026,008 tCO<sub>2</sub>e per year

**Board approval:** 22 October 2010

**Project life:** 30 years

<b>Impact</b>	The state electricity sector is sustainable, and state finances are improved.
<b>Outcome</b>	Clean energy production is increased.
<b>Outputs</b>	<ul style="list-style-type: none"><li>• Hydropower generation infrastructure constructed</li><li>• 100-megawatt Sainj hydroelectric power plant constructed</li><li>• Stage II and III of the Integrated Kashang Hydroelectric Project completed</li></ul>
<b>Clean energy indicator</b>	Greenhouse gas emissions are reduced by 1,026,008 tCO <sub>2</sub> e per year by 2015.
<b>Division</b>	Energy Division
<b>Project team</b>	
<b>Team leader</b>	A. Jeffries, energy specialist, SARD
<b>Team members</b>	I. Caetani, social development specialist, SARD H. Kobayashi, energy specialist, SARD N. Kulichenko, environment specialist, SARD J. Munsayac, senior social safeguards officer, PSOD K. Ogino, energy specialist, SARD J. Versantvoort, counsel, OGC
<b>Executing agencies</b>	Multipurpose Projects, Power Department of the Government of Himachal Pradesh

---

**Loan numbers:** 2695-BAN(SF)  
**Project number:** 39298-01  
City Region Development Project in Bangladesh

---

## Rationale

Bangladesh has urbanized very rapidly, and its urban planning and development frameworks are incapable of meeting the evolving demands. At current rates, the country's urban population is estimated to double by 2035, reaching 74 million people. In the course of this rapid urbanization, large, surrounding secondary towns, and adjacent periurban areas, have been agglomerating into a city region with close economic and social links. However, while effectively one sprawling city, these city regions are still administered by multiple municipal governments. Because a comprehensive framework for integrated planning and coordination among municipalities is lacking, the city regions have been unable to realize their full development potential. Furthermore, implementation of the Dhaka Metropolitan Development Plan, 1995–2015 has been very slow, and the plan is fast becoming outdated. Rajdhani Unnayan Kartripakkha led the preparation of the plan, and there are criticisms that it did not sufficiently consult with the public and the municipalities. Further, private and public development projects are not always coordinated enough to focus limited resources on priority areas.

## Description

The project will support improvement of urban planning through a review and update of urban development plans, notably the Dhaka Metropolitan Development Plan, 1995–2015, and strengthen coordination between municipalities and planning agencies. This project aims to increase growth potential and environmental sustainability of two city regions based on coherent regional urban planning. It includes improvement of water supply and sanitation, solid waste management, urban transport, drainage, urban revitalization, and energy efficiency. The energy efficiency program comprises installation of energy-efficient pumps and energy-efficient and/or solar lighting.

**Total loan amount:** \$120 million of which \$20 million is clean energy investment

**Project categories:** Renewable energy and energy efficiency

**Electricity savings:** 213 gigawatt-hours per year

**Greenhouse gas emissions reduction:** 141,240 tCO<sub>2</sub>e per year

**Board approval:** 10 November 2010

**Project life:** 25 years

Loan numbers: 2695-BAN(SF) Project number: 39298-01

<b>Impact</b>	Growth potential and environmental sustainability are enhanced.
<b>Outcomes</b>	The urban environment is improved, and infrastructure services are based on effective regional and urban planning.
<b>Outputs</b>	<ul style="list-style-type: none"> <li>• Capacity of urban infrastructure enhanced</li> <li>• Urban planning improved</li> <li>• Municipal management and capacity strengthened</li> </ul>
<b>Clean energy indicators</b>	Energy-efficient pumps and solar-powered lights are installed, and greenhouse gas emissions are reduced by 141,240 tCO <sub>2</sub> e per year by 2015.
<b>Division</b>	Urban Development and Water Division
<b>Project team</b>	
<b>Team leader</b>	M. Tachiiri, urban economist, SARD
<b>Team members</b>	<p>K. Emzita, senior counsel, OGC</p> <p>M. Islam, senior project officer, Bangladesh Resident Mission, SARD</p> <p>D. Margonsztern, urban development specialist, SARD</p> <p>R. Slangen, urban development specialist, Bangladesh Resident Mission, SARD</p> <p>P. Wijayatunga, senior energy specialist, SARD</p>
<b>Executing agencies</b>	Local Government Engineering Department, Rajdhani Unnayan Kartripakkha

---

**Loan numbers:** 2732-IND

**Project number:** 32298-06

**Madhya Pradesh Power Sector Investment  
Program in India—Tranche 6**

---

## Rationale

The Madhya Pradesh state government has demonstrated its commitment to power sector reforms and has made encouraging progress. In December 2001, ADB approved the Madhya Pradesh Power Sector Development Program, which had a \$150 million program component and a \$200 million project component. The objectives of the program component are to (i) establish independent regulation, (ii) improve sector governance through institutional and organizational actions, (iii) establish and begin operations of new sector companies, (iv) reduce system losses, and (v) increase the delivery capacity of the power system. With substantial support from this program loan, unbundling has been completed, all companies in the sector have been given cost-reflective tariffs that will gradually move to full cost recovery, and capacity is being developed in all companies to operate in the evolving commercial and competitive sector.

## Description

The tranche will partially fund distribution system investments to deliver more reliable, higher-quality power to consumers. It will reduce distribution losses of 35% in 2009 to 25% in 2014.

**Total loan amount:** \$69.0 million of which \$26.8 million is clean energy investment

**Project categories:** Supply and demand-side energy efficiency

**Electricity savings:** 2,061 gigawatt-hours per year

**Greenhouse gas emissions reduction:** 1,796,685 tCO<sub>2</sub>e per year

**Board approval:** 21 December 2010

**Project life:** 15 years

<b>Impact</b>	Economic growth in Madhya Pradesh is sustained.
<b>Outcome</b>	Operational performances of distribution companies and MP Tradeco are improved.
<b>Outputs</b>	<ul style="list-style-type: none"><li>• High voltage distribution systems installed</li><li>• Distribution system renovated and upgraded</li><li>• Energy and consumer profile reports audited</li><li>• System management computerized</li></ul>
<b>Clean energy indicators</b>	Distribution losses of 35% in 2009 are reduced to 25% by 2014 in 117 towns by 2014, and greenhouse gas emissions are reduced by 1,796,685 tCO <sub>2</sub> e per year.
<b>Division</b>	Energy Division
<b>Project team</b>	
<b>Team leader</b>	H. Gunatilake, principal energy specialist, SARD
<b>Team members</b>	H. Kobayashi, senior energy specialist, SARD S. Sasaki, environment specialist, SARD P. Van Houten-Castillo, social development specialist, SARD J. Versantvoort, counsel, OGC P. Wijayatunga, senior energy specialist, SARD
<b>Executing agency</b>	Madhya Pradesh Madhya Kshetra Vidyut Vitaran Company



---

# Southeast Asia Department

---

---

**Loan numbers:** 2619-INO

**Project number:** 40061-01

Java-Bali Electricity Distribution Performance  
Improvement Project in Indonesia

---

## Rationale

Indonesia ranks among the top 20 polluters in the world. The country's carbon dioxide emissions per capita have grown significantly since the 1980s, mostly due to the burning of oil. Emissions will get worse in the short term, as the government plans to expand the use of coal for power generation to reduce its reliance on imported oil. The government's energy conservation and energy-efficiency initiatives will offset part of these emissions, but these efforts need to be part of mainstream planning to have larger impact. The State Electricity Corporation (PLN) has invested in energy-efficiency projects for its power distribution, which has reduced overall distribution losses and carbon dioxide emissions. To maintain the momentum, PLN has an ambitious plan to invest about \$1.2 billion in distribution between 2010 and 2014. A large part of this plan will be financed by internal resources and loans from bilateral and multilateral partners.

## Description

The project aims to reduce the peak load demand and system losses by implementing distribution network rehabilitation and an efficient lighting program that will also contribute toward greenhouse gas emissions reduction. About 200-megawatt equivalent in distribution system capacity will be freed and about 400 gigawatts will be saved annually through energy efficiency at a cost well below the cost of developing equivalent new capacity. This will reduce the emissions of Indonesia's power sector by about 330,000 tons each year.

**Total loan amount:** \$50.00 million of which \$39.95 million is clean energy investment

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

**Electricity savings:** 400 gigawatt-hours per year

**Greenhouse gas emissions reduction:** 330,000 tCO<sub>2</sub>e per year

**Grant component:** Grant number 0198

**Board approval:** 22 March 2010

**Project life:** 25 years

<b>Impact</b>	Carbon dioxide emissions are reduced in the Indonesian power sector.
<b>Outcomes</b>	The project contributes to PLN's overall power distribution efficiency and quality of power supply.
<b>Outputs</b>	<ul style="list-style-type: none"><li>• Distribution losses in selected areas reduced</li><li>• Incremental sales and access to power increased</li><li>• Peak demand reduced, and awareness of efficient lighting options in isolated grids and selected islands increased</li><li>• Project implemented efficiently</li></ul>
<b>Clean energy indicators:</b>	Overall distribution loss reduced from 8.4% in 2008 to 7.0% by 2012, and greenhouse gas emissions reduced by 330,000 tCO <sub>2</sub> e per year.
<b>Division</b>	Energy and Water Division
<b>Project team</b>	
<b>Team leader</b>	S. Hasnie, principal energy specialist, Southeast Asia Department (SERD)
<b>Team members</b>	D. Bui, economist, SERD R. Butler, social development specialist, SERD R. Kausar, infrastructure specialist, SERD M. Sultana, senior social development specialist, SERD Y. Tsujiki, financial analysis specialist, SERD S. Tumiwa, principal planning and coordination specialist, RSDD S. Zaidansyah, counsel, OGC
<b>Executing agency</b>	PLN



## Appendix 1 2010 Clean Energy Grants-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)	Linked to 2010 Loan	Funding Source
228	Bhutan	SARD, Energy Division	K. Ogino	Rural Renewable Energy Development	Energy, renewable energy	21.59	21.59	ADF	
201	Thailand	PSOD, Infrastructure Finance Division 2	D. Wiedmer	Natural Energy Development Company Project (Solar Power Project)	Energy, renewable energy	2.00	2.00	7311	Multidonor Clean Energy Fund under the CEFPF
203	People's Republic of China	EARD, Energy Division	Y. Feng	Integrated Renewable Biomass Energy Development Sector	Multisector, renewable energy	9.20	9.20	2632	Global Environment Facility
202	People's Republic of China	EARD, Energy Division	Y. Feng	Biomass Energy Development Sector	Multisector, renewable energy	3.00	3.00	2632	Multidonor Clean Energy Fund under the CEFPF
198	Indonesia	SERD, Energy Division	S. Hasnie	Java-Bali Electricity Distribution Performance Improvement Project	Energy, energy efficiency/supply	1.00	0.70	2619	Multidonor Clean Energy Fund under the CEFPF
9148	Republic of the Marshall Islands	PARD, Office of the Director General	A. Maxwell	Improved Energy Supply for Poor Households	Energy, cleaner fuels	1.76	1.06		Japan Fund for Poverty Reduction
212	Nepal	SARD, Urban Development and Water Division	D. Margonsztern	Kathmandu Sustainable Urban Transport	Transport, energy efficiency/demand	10.00	2.00	2656	ADF
196	People's Republic of China	EARD, Energy Division	A. Bhargava	Tianjin Integrated Gasification Combined-Cycle Power Plant Project	Energy, energy efficiency/supply	5.00	1.35	2616	Climate Change Fund
218	Kyrgyz Republic	CWRD, Energy Division	T. Kadono	Power Sector Improvement Project	Energy, energy efficiency/supply	28.10	2.53	2671	ADF

ADF = Asian Development Fund, CEFPF = Clean Energy Financing Partnership Facility, CWRD = Central and West Asia Department, EARD = East Asia Department, PSOD = Private Sector Operations Department, SARD = South Asia Department, SERD = Southeast Asia Department

## Appendix 2 2010 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>			<b>2,198.22</b>	<b>1,015.22</b>
PRC	2616	Tianjin Integrated Gasification Combined-Cycle Power Plant Project	135.00	36.61
Indonesia	2619	Java-Bali Electricity Distribution Performance Improvement Project	50.00	39.95
Bangladesh	2622/23(SF)	Natural Gas Access Improvement Project	266.00	154.18
Uzbekistan	2629/30(SF)	Talimarjan Power Project	350.00	120.02
Azerbaijan	2646	Janub Gas-Fired Power Plant Project	232.32	76.70
PRC	2658	Inner Mongolia Autonomous Region Environment Improvement Project (Phase II)	150.00	34.50
Kyrgyz Republic	2671(SF)	Power Sector Improvement Project	16.70	1.54
India	2677	Assam Power Sector Enhancement Investment Program—Tranche 2	89.70	22.00
India	2681	Bihar Power System Improvement Project	132.20	6.62
India	2687	Himachal Pradesh Clean Energy Development Investment Program—Tranche 3	208.00	208.00
Papua New Guinea	2713/14(SF)	Town Electrification Investment Program—Tranche 1	57.30	57.30
Pakistan	2726	Renewable Energy Development Sector Investment Program—Tranche 2	200.00	200.00
Pakistan	2727	Power Distribution Enhancement Investment Program—Tranche 2	242.00	31.00
India	2732	Madhya Pradesh Power Sector Investment Program—Tranche 6	69.00	26.80
<b>Nonenergy Sector</b>			<b>352.80</b>	<b>91.13</b>
PRC	2632	Integrated Renewable Biomass Energy Development Sector	66.80	66.80
Uzbekistan	2633(SF)	Water Supply and Sanitation Services Investment Program	140.00	1.64
Nepal	2656(SF)	Kathmandu Sustainable Urban Transport Project	10.00	1.80
Palau	2691/92(SF)	Water Sector improvement Program	16.00	0.89
Bangladesh	2695(SF)	City Region Development Project	120.00	20.00
<b>Subtotal</b>			<b>2,551.02</b>	<b>1,106.35</b>
<b>Nonsovereign Projects</b>				
<b>Energy Sector</b>			<b>756.11</b>	<b>607.39</b>
Afghanistan	7307	Sungas LLC (Sungas LPG Distribution Network Project)	8.00	2.76
Thailand	7311	Natural Energy Development Company (Solar Power Project)	70.00	70.00

continued on next page

<b>Country</b>	<b>Loan/ Investment No.</b>	<b>Project Title</b>	<b>Total Amount (\$ million)<sup>a</sup></b>	<b>Clean Energy Investment (\$ million)<sup>a</sup></b>
Azerbaijan	7313	Garadagh Cement Open Joint Stock Company (Garadagh Cement Expansion and Energy Efficiency Improvement Project)	27.00	0.32
Thailand	7314	Bangchak Petroleum Public Company (Bangchak Solar Power Project)	134.31	134.31
PRC	7316	Zhongran Investment Limited (Municipal Natural Gas Infrastructure Development Project—Phase 2)	200.00	83.20
PRC	7317	Jilin Wind Power Project (Tianjin Xiehe Wind Power Invest)	240.00	240.00
Pakistan	7319	Zorlu Enerji Power Project	36.80	36.80
Regional	7320/21	Proposed Equity Investments: Clean Resources Asia Growth Fund and Renewable Energy Asia Fund	40.00	40.00
Nonenergy Sector (No project in 2010)				
Subtotal			756.11	607.39
Grants				
Energy Sector			59.50	29.30
PRC	0196 <sup>b</sup>	Tianjin Integrated Gasification Combined-Cycle Power Plant Project	5.00	1.40
Indonesia	0198 <sup>b</sup>	Java-Bali Electricity Distribution Performance Improvement Project	1.00	0.70
Thailand	0201 <sup>b</sup>	Natural Energy Development Company (Solar Power Project)	2.00	2.00
Kyrgyz Republic	0218 <sup>b</sup>	Power Sector Improvement Project	28.10	2.50
Bhutan	0228	Rural Renewable Energy Development	21.60	21.60
Republic of the Marshall Islands	9148	Improved Energy Supply For Poor Households	1.80	1.10
Nonenergy Sector			22.20	14.20
PRC	0202 <sup>b</sup>	Integrated Renewable Biomass Energy Development Sector	3.00	3.00
PRC	0203 <sup>b</sup>	Integrated Renewable Biomass Energy Development Sector	9.20	9.20
Nepal	0212 <sup>b</sup>	Kathmandu Sustainable Urban Transport	10.00	2.00
<b>Subtotal</b>			<b>81.70</b>	<b>43.50</b>
<b>Total</b>			<b>3,388.83</b>	<b>1,757.24</b>

PRC = People's Republic of China

<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.

<sup>b</sup> These grants are directly linked to loans above.



## 2010 Clean Energy Investments Project Summaries

This report summarizes the investments in clean energy made by the operations departments of the Asian Development Bank (ADB) in 2010, 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.

Asian Development Bank  
6 ADB Avenue, Mandaluyong City  
1550 Metro Manila, Philippines  
[www.adb.org](http://www.adb.org)  
ISBN 978-92-9092-397-8  
Publication Stock No. RPT113684

 Printed on recycled paper



Printed in the Philippines