



2015 CLEAN ENERGY INVESTMENTS PROJECT SUMMARIES

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Printed in the Philippines.

ISBN 978-92-9257-469-7 (Print), 978-92-9257-470-3 (e-ISBN)
Publication Stock No. RPT168065-2

Cataloging-In-Publication Data

Asian Development Bank.
2015 Clean energy investments project summaries.
Mandaluyong City, Philippines: Asian Development Bank, 2016.

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

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Abbreviations

ADB	-	Asian Development Bank
ADF	-	Asian Development Fund
APC	-	Aboitiz Power Corporation
BTH	-	Beijing–Tianjin–Hebei region
CEFPF	-	Clean Energy Financing Partnership Facility
CO ₂	-	carbon dioxide
CTF	-	Clean Technology Fund
CWRD	-	Central and West Asia Department
DISCO	-	power distribution company
EARD	-	East Asia Department
ESCO	-	energy service company
GDP	-	gross domestic product
GHG	-	greenhouse gas
GEF	-	Global Environment Facility
GWh	-	gigawatt-hour
km	-	kilometer
kV	-	kilovolt
Lao PDR	-	Lao People’s Democratic Republic
MW	-	megawatt
OCO	-	Office of Cofinancing Operations
OCR	-	ordinary capital resources
OGC	-	Office of the General Counsel
PARD	-	Pacific Department
PPP	-	public–private partnership
PRC	-	People’s Republic of China
PSOD	-	Private Sector Operations Department
SARD	-	South Asia Department
SDCC	-	Sustainable Development and Climate Change Department
SERD	-	Southeast Asia Department
TA	-	technical assistance
tCO ₂ e	-	ton of carbon dioxide equivalent
TJ	-	terajoule

Executive Summary

The year 2015 was marked by major global agreements with the potential to change the clean energy landscape in revolutionary ways.

The first of these was CoP 21, and the agreement coming out of it to hold the global temperature increase to well below 2°C compared to preindustrial levels by limiting greenhouse gas emissions through Nationally Determined Contributions (NDCs). Clean energy, in the form of renewable power and energy efficiency, will play a major component in this, as a way to reduce emissions generated through electricity generation.

The second was the adoption of the Sustainable Development Goals (SDGs); specifically, Goal 7—“ensure access to affordable, reliable, sustainable and modern energy for all” by 2030, and to a related degree, Goal 13—“take urgent action to combat climate change and its impacts”. These SDGs put clean energy development front and center as the pathway to a more sustainable future.

In these agreements, there is a reflection of the dual challenges for the energy sector which were identified by the Asian Development Bank (ADB) as the primary concerns for the countries of developing Asia and the Pacific region, and broadly, for all developing countries. The challenge of energy security—ensuring that the supply of energy is accessible, reliable and affordable—and the challenge of climate change, whose impacts are already being felt throughout the Asia-Pacific. A global-scale response to these challenges has been articulated, one that places the importance of clean energy at the fore. As ADB has prioritized these issues for years, it is well placed for the coming, even greater, acceleration of clean energy development.

The past year saw a change in ADB’s policy to reflect the new global priorities. In 2015, ADB set new and dramatic targets for investments in order to respond to climate change, and pledged to double its annual financing for climate-change mitigation and adaptation projects to \$6 billion by 2020. Of this amount, \$4 billion will be allocated for projects meant to mitigate the impact of climate change, including projects in renewable energy, energy efficiency, sustainable transport initiatives, and projects for the creation of greener, smarter cities.

With developing Asian countries continuing to prioritize clean energy solutions, ADB recorded \$2.47 billion in clean energy investments in 2015, making this the fifth year in a row where investments in this sector have been above \$2 billion annual target. At current numbers, clean energy is already meeting 61% of ADB’s investment target for mitigation. But demand for clean energy is high, and the global agreements should trigger an expansion in its development. While ADB cannot predict what its clean energy investments will look like over the next five or ten years, it is aware that clean energy’s potential has been barely tapped in Asia and the Pacific region.

This was demonstrated in 2015 with ADB’s investments in energy efficiency surpassing its investments in renewables for the first time, reversing a ratio of investment that had stood since ADB’s current Energy Policy was launched in 2009. A large portion of these energy efficiency investments were in supply-side solutions, an area which ADB cited in its 2013 report “Same Energy, More Power: Accelerating Energy Efficiency in Asia” as holding significant opportunities to save on energy, lower costs, and “future-proof” infrastructure. These projects are expected to result in 4.4 terawatt hours of electricity saved, or six times the savings of energy efficiency projects in 2014.

While ADB’s renewable energy investments were slightly under a billion dollars in 2015, the overall renewable energy market is healthier than ever. Bloomberg New Energy Finance, through an analysis of the levelized cost of

electricity for onshore wind and solar photovoltaic energy, has stated that these two renewable energy sources are fully competitive with coal across the lifetime of a power plant, with onshore wind being the cheapest source of electricity in Germany. A cycle where new renewables slowly out-compete fossil fuel generation, and create a market where it becomes more economical to develop renewables and less economical to back fossil fuel plants, may have already begun. The countries of developing Asia and the Pacific region have a roadmap for the future, and while difficult challenges of policy, questions of economics, and limitations of technology may slow progress, it will not stop the region's continuing, and growing, development of clean energy solutions. Beyond its financing targets, ADB pledges to aid the developing countries of Asia and the Pacific region in overcoming any and all of the barriers preventing greater adoption of clean energy.

2015 Clean Energy Investments—Infographic



ADB invested **US\$ 2.5 billion** in clean energy in 2015
 This marks the fifth year in a row that clean energy investments have been above \$2 billion annually.



Source: ADB Database 2015.

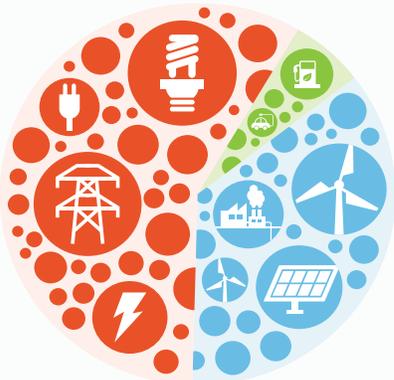
Clean Energy Investment—Public vs Private Sector, 2015 (\$million)



Public (66.1%)
\$1,833.2
 Private (26%)
\$644.5

Source: ADB Database 2015.

Clean Energy Investment by Project Type, 2015 (\$ million)



Energy Efficiency (55.3%)
\$1,370.0
 Clean Fuel (5.9%)
\$146.0
 Renewable Energy (33.8%)
\$961.7

Source: ADB Database 2015.

Clean Energy Investment by Sector, 2015 (\$ million)



Non-energy (33.9%)

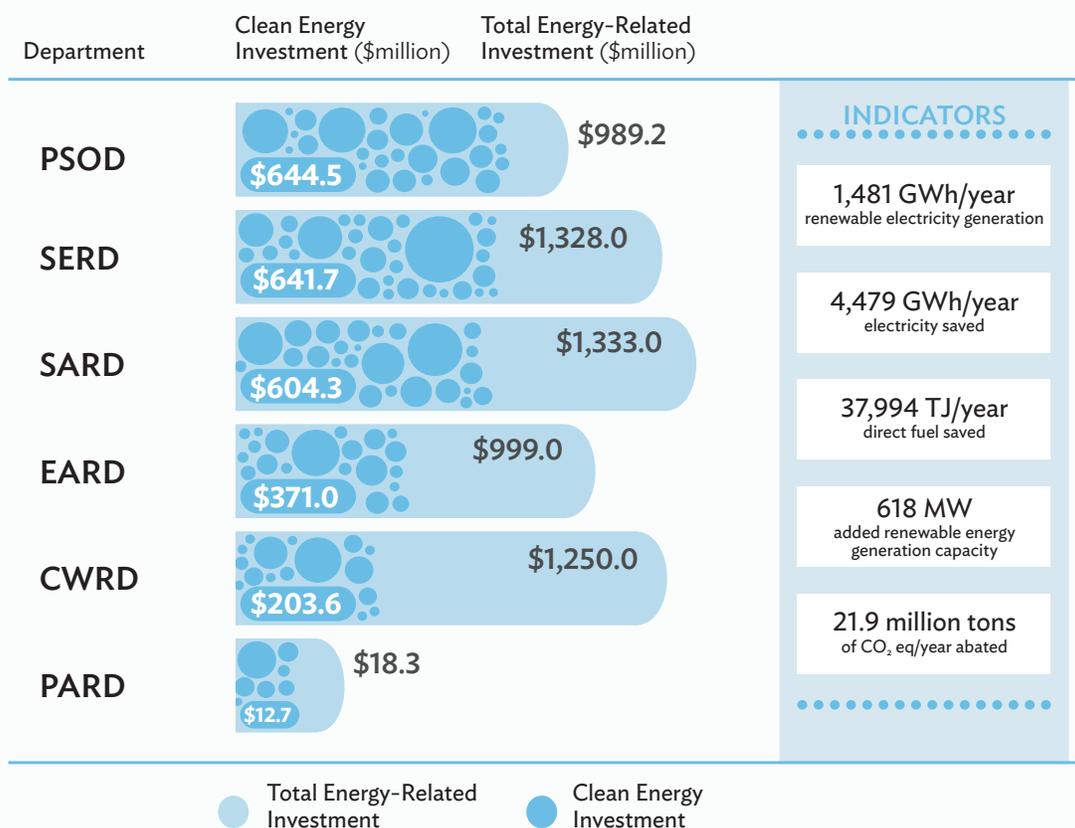
\$839.8

Energy (66.1%)

\$1,637.9

Source: ADB Database 2015.

Indicators for Clean Energy Investments, 2015 (\$million)



CO₂e = carbon dioxide equivalent, CWRD = Central and West Asia Department, EARD = East Asia Department, GWh = gigawatt hours, MW = megawatt, PARD = Pacific Department, PSOD = Private Sector Operations Department, SARD = South Asia Department, SERD = Southeast Asia Department, TJ = terajoule.

Note: Only projects with 5% or above clean energy investment are included.

Source: ADB Database 2015.

Central and West Asia Department

Loan Numbers: 3321/3322-PAK
Project Number: 47015-002
Sustainable Energy Sector Reform Program (Subprogram 2)

Rationale

The programmatic approach and subprogram 1 were approved on 24 April 2014 in support of the 2013 National Power Policy of the Government of Pakistan, which seeks to build an affordable, reliable, sustainable, and secure energy sector to support the country's economic growth. The programmatic approach takes a chronological approach of over 5 years to provide dynamic, long-term support to multidimensional reforms. Subprogram 1 established a solid foundation for implementation of reforms in subsequent subprograms. The proposed subprogram 2 will support the second year of the programmatic approach.

In 2014, Pakistan's economy grew by 4.1%, above the forecasted global growth of 3.6%. The gap between electricity demand and supply is expected to remain about 5,500 megawatts, or 20% of peak demand, until 2018. The chronic energy shortage decreases business confidence and negatively affects manufacturing, trade, and consequently household income.

Pakistan initiated a comprehensive energy sector reform program in the early 1990s, but the results have been mixed and expected efficiencies have not been fully achieved. Still, about two-thirds of the population had access to grid electricity in 2014, and electricity consumption has remained constrained at about 80 terawatt hours per year since 2009 despite the growth in demand.

The proposed subprogram 2 has been prepared in coordination with the International Monetary Fund, World Bank, Japan International Cooperation Agency, and other development partners in order to increase the overall economic impact. Although challenges remain, the International Monetary Fund believes that as structural reforms take hold, bottlenecks will ease, growth will accelerate, and vulnerabilities will recede.

Description

The proposed Program will help the Government with the short-term stabilization measures and start the long-term restructuring for a sustainable power sector.

Total Loan Amount: \$100 million (OCR)
\$300 million (ADF)

Clean Energy Investment: \$40 million

Project Category: Supply-side energy efficiency

Energy Savings: cannot be quantified due to nature of the project

Greenhouse Gas Emission Reduction: cannot be quantified due to nature of the project

Board Approval: 20 November 2015

Project Life: not applicable due to nature of the project

Impact • Economic growth through sustainable energy sector (National Power Policy, 2013)

Outcome • Reliability, sustainability, and affordability of the energy system improved

Outputs • Tariffs and subsidies managed
• Sector performance and market access for private sector participation improved
• Accountability and transparency in the power sector achieved

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Executing Agency Ministry of Finance

Loan Numbers: 3328/3329-PAK
Project Number: 47190-002
**Second Power Distribution Enhancement
Investment Program – Tranche 1**

Rationale

Reliable and sufficient electricity supply is the backbone for Pakistan’s economic growth. In the last 10 years, Pakistan has been suffering from electricity shortages, leaving 33% of the population without access to electricity, and load shedding of around 25% of system demand. While standby electricity amounted to about 30% in 2003–2004, the country now suffers from a severe power crisis resulting in routine load shedding of up to 12 hours in urban areas, and 18–20 hours in rural areas. It has hurt the country’s economy, as reflected in an estimated annual loss of 4%–7% in the country’s gross domestic product (GDP), and a 2% reduction in real GDP growth. The power shortage is dampening business confidence, which is already affected by the country’s security situation.

The supply–demand gap (5,000 megawatts) is attributed to increased demand, insufficient generation, and system inefficiencies. Power distribution companies are contributing the most to the inefficiency in delivering generated power. DISCOs’ customer tariff does not cover the full cost of power distribution, transmission, and generation because the system losses are higher than those allowed by the regulator and revenue collection is low. The cash shortfall hampers DISCOs’ performance, and payments to power generating entities are delayed or subsidized by the government. This is not sustainable given the fiscal impact.

Description

The proposed investment program’s objective is to introduce advanced metering infrastructure in Pakistan’s different DISCOs. In the program’s first phase (tranche 1), two of Lahore Electric Supply Company’s circles and Islamabad Electric Supply Company’s Rawalpindi region have been selected for AMI roll-out. Once developed, the same will be replicated and implemented in the remaining technically and commercially feasible regions or circles of the nine DISCOs. Advanced metering infrastructure aims at: (i) reducing distribution losses and improving revenue collection, (ii) enhancing load control and load management, (iii) providing automated consumption data collection of all customers, and (iv) modernizing the electricity metering and billing system. The investment program will provide funds for metering, communication and billing systems including installation and supporting infrastructure.

Total Loan Amount: \$380 million (OCR)
\$20 million (ADF)
Clean Energy Investment: \$102.43 million
Project Category: Supply-side energy efficiency
Energy Savings: 155.94 gigawatt hours/year
Greenhouse Gas Emission Reduction: 84,256 tCO₂/year
Board Approval: 18 September 2015
Project Life: 40 years

- Impact** • Financial viability of the power distribution system improved (project-defined)
- Outcome** • Electricity revenues increased in the targeted regions of Islamabad Electric Supply Company and Lahore Electric Supply Company
- Outputs** • Smart Meters and communication equipment installed and functional
 - Data management system implemented and operational
 - Operation manuals updated and monitoring procedure improved
 - New billing and customer information systems implemented and operational

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Executing Agency Ministry of Power and Water

Loan Number: 3286-UZB
Project Number: 41340-015
Advanced Electricity Metering Phase 4 Project

Rationale

The Government of Uzbekistan prioritizes modernizing industry and developing infrastructure. Reliable and affordable electricity supply is vital to achieving these goals. One of the key challenges is the high level of losses in the power sector. The State Joint Stock Company Uzbekenergo, a state-owned utility, reported system losses of over 18% in 2014. Revenue collection rate was also low, at 80% or less. These reported losses may be understated due to Uzbekenergo's inability under its current system to accurately collect information on electricity supplied and to monitor the revenue collection.

The high level of electricity losses comes from the lack of investment in modern distribution assets and outdated manual operations. Without proper grid metering, Uzbekenergo faces difficulty in accounting for electricity supplied and used. Manual billing systems leave room for potential collusion between customers and tariff collection officers. Incentive mechanisms to reduce losses are not sufficiently institutionalized.

Uzbekenergo aims to cover 6.3 million customers with advanced electricity metering. ADB has financed its first large-scale AEM project for 1 million customers. Implementation of that first project has been satisfactory, although procurement has taken longer than expected because AEM systems are complex and new to the country. To complete the nationwide rollout of AEM, Uzbekistan has requested ADB to finance the project to cover five regions.

Description

The project will install an advanced electricity metering (AEM) system that uses modern, accurate, and tamper-proof revenue meters for the power grid system and end-users in five regions (Andijan, Fergana, Kashkadarya, Namangan, and Surkhandarya) to complete the nationwide rollout of AEM. The project will promote energy efficiency in power distribution by reducing commercial losses and improving the efficiency of electricity revenue collection. The installation of 3.1 million meters, integrated meter-to-cash solutions, and a capacity development component will help Uzbekenergo and its customers effectively adopt and utilize the new technology.

The project will help ensure (i) accurate accounting and billing of energy, (ii) commercial loss reduction, and (iii) improved energy efficiency. The project will improve metering accuracy, billing efficiency, and tariff collection rates; and provide antitampering and fault-detection capability to Uzbekenergo.

Total Loan Amount: \$300 million (OCR)
Clean Energy Investment: \$44.11 million
Project Category: Supply-side energy efficiency
Energy Savings: 237 gigawatt hours/year
Greenhouse Gas Emission Reduction: 140,766 tCO₂/year
Board Approval: 18 September 2015
Project Life: 40 years

Impact • Power sector financial viability improved (National Investment Program: 2015–2019)

Outcome • Electricity revenue collection in the targeted regions improved

Outputs • AEM infrastructure installed and functional
• Operations manual adopted and loss reduction operations strengthened
• Customer service for end-users improved

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Executing Agency UzbekEnergO

Loan Number: 3285-UZB
Project Number: 47296-001
Northwest Region Power Transmission Line

Rationale

Uzbekistan's development priorities stress structural change and greater productivity. Energy efficiency is a key part of the energy sector strategy. The government adopted policy and legal frameworks with clear goals to reduce energy intensity and losses. In March 2015, the government approved a 5-year rolling Program of Measures to Promote Structural Reforms, Modernization and Diversification of Production in 2015–2019. The program aims to ensure adequate and reliable power system and improved management, operations, and performance of utilities based on commercial principles

The key challenges in the sector are deteriorating infrastructure and unreliable power supply. The existing power transmission network has limited capacities to transmit additional power because of inadequate investments in the past. Most of the transmission facilities are aging which now require rehabilitation and modernization. The Khorezm substation commissioned in 1969 is now more than 40 years old. The poor condition of these assets leads to a higher risk of system outages, poor energy services, higher maintenance costs, and increased transmission losses. A strong transmission system is therefore essential to the provision of an efficient, reliable, and flexible infrastructure that meets the ever growing demand of electricity consumers.

Description

The project aims to (i) improve power transmission network capacity and reliability in the northwest region of the country, the Karakalpakstan and Khorezm regions; (ii) reduce transmission losses; and (iii) improve the operational efficiency of the power sector. The project components include (a) the construction of a 220 kilovolt (kV) single-circuit overhead transmission line approximately 364 kilometers (km) in length, (b) the expansion, rehabilitation and construction of 3 substations, and (c) institutional development, capacity building and project management.

Total Loan Amount: \$150 million (OCR)
Clean Energy Investment: \$17.05 million
Project Category: Supply-side energy efficiency
Energy Savings: 43 gigawatt hours/year
Greenhouse Gas Emission Reduction: 25,574 tCO₂/year
Board Approval: 22 September 2015
Project Life: 40 years

Impact • Adequate and reliable power supply in Uzbekistan by 2023

Outcome • An expanded and modernized high-voltage transmission grid in Khorezm and Karakalpakstan regions

Outputs • 220 kV transmission line between Takhiatash Thermal Power Plant -Khorezm Substation -Ellikkala Substation commissioned
• Substations rehabilitated and new switching station constructed
• Support for institutional development and capacity building

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Executing Agency UzbekEnergO

East Asia Department

Loan Number: 3356-PRC
Project Number: 49232-001
**Beijing–Tianjin–Hebei Air Quality Improvement
– Hebei Policy Reform Program**

Rationale

In 2013, the Beijing–Tianjin–Hebei (BTH) region, with a population of 109.2 million, generated a gross domestic product (GDP) of CNY6.2 trillion, accounting for 10% of the national total. While the region is an engine of socioeconomic development for the PRC, poor air quality jeopardizes its sustainable growth. Hebei is the main source of air pollution in the region. Due to its economy relying heavily on polluting secondary industries: coal-fired energy generation, iron, steel, coking, and cement. To improve the region's air quality, the first priority is to address Hebei's problems, while improving coordination of air quality improvement efforts in the region.

As a national priority, the central government is scaling up its efforts to address this environmental challenge together with climate change. The introduction of the Hebei Clean Air Action Plan and urgent air pollution mitigation requirements led to Hebei's fragmented policy framework. Pollution reduction efforts during 2013–2014 only resulted in several short-term end-of-pipe policy actions and the strengthening of legal enforcement against polluting industries to reduce production capacity and the number of old vehicles, with a number of key issues including increased motor vehicles and the seasonal burning of agricultural biomass waste left unresolved. To remove constraints and enhance long-term development prospects, Hebei needs (i) a basic and comprehensive policy framework, (ii) well-coordinated actions to gradually enhance policies, (iii) investments to better manage air pollution reduction efforts, and (iv) private sector participation in financing necessary investments for industrial modernization.

Description

The program supports the Hebei provincial government in increasing its efforts to improve air quality in the greater capital area, comprising Beijing municipality, Tianjin municipality, and Hebei province. The program will (i) reduce emissions from major air pollution sources, (ii) strengthen environment policy and the institutional framework for implementation, and (iii) enhance employment support for inclusive industrial transformation. The program will provide Hebei provincial government with a solid basis to introduce incremental reforms under the PRC's 13th Five-Year Plan, 2016–2020, while enabling Hebei provincial government to consolidate and accelerate necessary actions during 2015–2016.

Total Loan Amount: \$300 million (OCR)
Clean Energy Investment: \$117.70 million
Project Category: Cleaner Fuel
Energy Savings: not applicable due to lending mode
Greenhouse Gas Emission Reduction: not applicable due to lending mode
Board Approval: 10 December 2015
Project Life: not applicable due to lending mode

- Impacts**
 - Air pollution in the BTH region reduced
 - Public health in the BTH region improved
- Outcome**
 - Framework for incremental policy and investment actions in Hebei to improve air quality in the BTH region strengthened
- Outputs**
 - Policies and actions to reduce air pollution from key sectors issued and approved
 - Environmental policy and institutional framework for implementation strengthened
 - Employment promotion for inclusive industrial transformation enhanced

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Executing Agency Hebei Provincial Government

Loan Number: 3308-PRC
Project Number: 47051-002
Chemical Industry Energy Efficiency and Emission Reduction Project

Rationale

The People's Republic of China (PRC) is the world's largest energy consumer accounting for nearly 20% of global energy consumption. Its rapid energy consumption growth over the past 20 years, with industrial energy demand growth, which accounting for the majority of total energy consumption. The chemical industry is among the PRC's (i) largest industrial energy users, and (ii) most energy-intensive industries. It alone consumed 361.2 million ton of coal equivalent (tce) in 2010, accounting for about 16% of industrial energy use. Compared to the PRC's average energy intensity of 1.034 tce per CNY10,000 of gross domestic product, the average energy intensity of plants belonging to China National Chemical Corporation Group (ChemChina) was 2.66 in 2010.

Though the PRC has successfully targeted energy-intensive industries to realize energy savings and emission reduction in its most recent Five-Year Plans, important market barriers still remain in energy-intensive industries such as the chemical industry. These barriers include (i) limited market-based incentives to implement such projects; (ii) lack of knowledge by enterprises about the best available technologies, combined with their focus on capacity expansion; (iii) inadequate capacity in commercial banks in evaluating risks and benefits of such retrofit projects combined with the projects' insufficient collateral value; and (iv) the underdevelopment of the industry-specific energy service company that can plan and implement such projects. To address these barriers and to enhance the overall impact of the proposed project, it is essential to develop and test new and innovative solutions to financing such projects and strengthen the energy service company model.

Description

The proposed Chemical Industry Energy Efficiency and Emission Reduction Project will support demonstration of innovative technologies to improve energy efficiency and reduce emissions of pollutants from various plants belonging to ChemChina. Building on the lessons learned from previous successful Asian Development Bank (ADB) loans in the PRC, this project proposes for the first time to directly cooperate with a large state-owned enterprise to support industry-specific measures. It will also develop an innovative financing structure to leverage commercial cofinancing and mainstream energy service company participation from the beginning of project implementation. The innovative financing structure will be developed and firmed up during the early stage of the project preparatory technical assistance implementation.

Total Loan Amount: \$100 million (OCR)
Clean Energy Investment: \$95 million
Project Category: Demand-side energy efficiency
Energy Savings: 7,322 terajoules/year
Greenhouse Gas Emission Reduction: 14,821,396 tCO₂/year
Board Approval: 30 October 2015
Project Life: 30 years

Impact • Environmental sustainability of the PRC's chemical industry enhanced

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

Outputs • More efficient and less hazardous PVC technology at commercial scale at Dezhou Shihua Chemical plant demonstrated
• Energy efficiency and greenhouse gas abatement measures at CGY plant implemented

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Executing Agency China National Chemical Corporation Group

Loan Number: 3296
Project Number: 46081-002
Henan Sustainable Livestock Farming and Product Safety Demonstration Project

Rationale

The ongoing structural transformation of the agriculture sector in the PRC can potentially contribute to two critical issues: food safety and nonpoint source pollution. Vertically integrated livestock farming system allows producers to have better control over product quality and facilitates waste and wastewater collection by producers. Compared to the traditional household farming system, it will also substantially reduce monitoring and inspection cost for food safety and environmental protection regulators.

The waste produced by livestock farms and enterprises contains a high concentration of pollutants and is often discharged without proper treatment, which results in serious nonpoint source pollution affecting land and water resources and livelihoods. Livestock waste also results in significant greenhouse gas emissions. The government has promoted conversion of livestock waste for renewable energy, particularly for medium- and large-scale livestock farms and enterprises, but many do not have proper waste treatment.

Description

The project aims at demonstrating sustainable livestock value chains that deliver quality food in 11 project counties in Henan Province. The project will help (i) the Henan Provincial Government improve livestock product safety monitoring and inspection system; and (ii) 11 medium and large private livestock production and/or processing enterprises, project participating enterprises (PPEs), improve food safety control, and implement environmentally-sustainable livestock production and processing.

Specifically, the project will help the project participating enterprises establish (i) livestock production and meat processing facilities; (ii) feed processing facilities; and (iii) in-house animal waste and wastewater treatment and/or processing facilities, including biogas generators and organic fertilizer processing facilities. These facilities will be equipped with energy- and water-saving technologies. The output is expected to generate significant environmental benefits, including avoided greenhouse gas emissions; and employment and income-generating opportunities at the project participating enterprises for local people and farmers who supply livestock, raw materials, and other inputs, and/or receive organic fertilizer from the project participating enterprises.

Total Loan Amount: \$69 million (OCR)
Clean Energy Investment: \$10 million
Project Category: Renewable energy
Renewable Energy Generation: 0.27 gigawatt hours/year
Greenhouse Gas Emission Reduction: 1,222 tCO₂/year
Board Approval: 15 September 2015
Project Life: 20 years

Impact • Meat industry in Henan Province with improved environmental sustainability and product safety developed

Outcome • Model livestock production and processing with improved environmental sustainability and product safety demonstrated

Outputs • Livestock product safety monitoring and inspection facilities upgraded
• Environmentally sustainable livestock production facilities established
• Capacity and project management strengthened

Division Environment, Natural Resources and Agriculture Division, EARD

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Executing Agency Henan Provincial Government

Loan Number: 3277
Project Number: 47048-002
**Hubei Enshi Qing River Upstream
Environment Rehabilitation Project**

Rationale

The Qing River is the primary water supply for Enshi and Lichuan and their surrounding rural populations. Since the 1990s, the water quality of the Qing River and its tributaries has deteriorated. Continuing deterioration of the water quality poses a public health threat for local residents, who rely on the river for their water use. The major sources of pollution are untreated domestic wastewater, unregulated runoff, and inadequately treated industrial effluent. As a result of prolonged underinvestment, wastewater collection and treatment facilities in Enshi and Lichuan are seriously deficient. Less than 60% of wastewater from Enshi and Lichuan is collected and treated because of the lack of treatment capacity, aging pipelines, and incomplete coverage of wastewater collection systems.

Upstream of Enshi and Lichuan, the Qing River watershed is mountainous with high seasonal rainfall and rapid runoff. This, combined with inadequate flood management facilities, results in regular flooding. There has also been severe riverbank erosion as a result of high-intensity rainfall, loss of vegetation, and lack of revetment works.

Lack of integrated water resource management in the Qing River basin hinders a coordinated and effective response by planning, pollution control, and flood management authorities to improve water quality and reduce flooding. Weak interagency coordination and lack of monitoring and enforcement capacity have resulted in ineffective management of nonpoint source pollution from rural and urban sources.

Description

The project will address inadequate wastewater collection and treatment, extensive nonpoint source pollution, and recurrent flooding that affect living standards and sustainable economic development in the Enshi Tujia and Miao Autonomous Prefecture of Hubei province.

To improve energy efficiency, the project will adopt a variable frequency drive (VFD) controllers for all pumps in WWTP and pumping stations.

Total Loan Amount: \$100 million (OCR)
Clean Energy Investment: \$2.03 million
Project Category: Demand-side energy efficiency
Energy Savings: 2.26 gigawatt hours/year
Greenhouse Gas Emission Reduction: 3,254 tCO₂/year
Board Approval: 11 September 2015
Project Life: 10 years

Impact • Environmental ecological sustainability in the upstream Qing river basin improved

Outcome • River health and flood management in the upper Qing river basin improved

Outputs • Flood management enhanced
• Wastewater management improved
• Water and environmental management integrated
• Project management support and inclusive capacity development strengthened

Division Environment, Natural Resource and Agriculture Division, EARD

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Executing Agency The People's Government of Enshi Tujia and Miao Autonomous Prefecture

Loan Number: 3358
Project Number: 48003-002
Qingdao Smart Low-carbon District Energy Project

Rationale

Qingdao is in Shandong Province in the northeast of the PRC where winter temperatures drop to as low as 17 degrees Celsius and are typically below zero for five months a year. Heating is therefore an essential service for public health and well-being and sustaining people's livelihoods.

Coal-based heating is a major cause of rising levels of outdoor and indoor air pollution during the winter months and the growing risk of respiratory and heart diseases that results. In June 2013, the Government of the PRC issued a policy on 10 air pollution prevention and control measures, which included the reduction of coal use and greater use of natural gas and renewable energy. In July 2013, the Qingdao municipal government developed a comprehensive policy for urban air pollution reduction, which included a ban on the use of coal in district energy systems for new and additional heating areas, and a plan to eliminate the use of coal over time in urban areas.

Qingdao was selected as pilot city for low-carbon development by the government's National Development and Reform Commission in December 2012. A third of carbon dioxide emissions in the city come from residences and the heating industry, many of which still use coal-based systems and high-loss heating networks. This makes the replacement of boilers and centralized district heating networks using coal with decentralized systems using natural gas and renewable sources a high priority of Qingdao in the effort to reduce carbon dioxide emissions.

Description

The project will develop and demonstrate a low-carbon, energy-efficient district heating, cooling, and power production and distribution system in eight locations in Qingdao city. Instead of coal, the system will use natural gas, solar thermal, shallow-ground geothermal, and waste heat recovered from industrial plants as its energy sources. The project will also demonstrate a low-temperature district energy distribution network and combine it with a smart energy management system. The project system is expected to lower energy intensity by 40% and carbon intensity by 64% from the averages achieved by comparable standard systems now in use in the northern People's Republic of China (PRC).

Total Loan Amount: \$130 million (OCR)
Clean Energy Investment: \$89.83 million
Project Category: Demand-side energy efficiency
Energy Savings: 9,683 terajoules/year
Greenhouse Gas Emission Reduction: 1,398,455 tCO₂/year
Board Approval: 10 December 2015
Project Life: 30 years

- Impacts**
- Energy efficiency in district energy improved.
 - Cases of respiratory and heart diseases decreased

- Outcome**
- Carbon and pollutant emission from district energy system in Qingdao avoided

- Output**
- A smart, distributed district energy system constructed in Qingdao

Division Energy Division, EARD

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Executing Agency Qingdao Municipal Government

Loan Number: 3262-PRC
Project Number: 46049-002
**Xinjiang Akesu Integrated Urban
Development Improvement Project**

Rationale

Akesu is a medium-sized city in southern Xinjiang Uygur Autonomous Region. Poor land use and waste management practices threaten environmental conditions in Akesu's rivers and wetlands. While improved services will reduce the negative impact of urbanization on the environment in Akesu, additional measures are needed to rehabilitate and preserve the existing water resources for the city and the larger watershed. The Akesu Duolang wetlands, located within the ecological conservation zone of the pilot Xinjiang Akesu Duolang River National Wetland Park, provide important ecosystem services. These include groundwater replenishment, flood retention, sediment and nutrient removal, microclimate regulation, cultural services, and biodiversity conservation. Rehabilitation of these wetlands will enhance the National Wetland Park network in the PRC, provide a demonstration of wise wetland use as promoted by the Ramsar Convention, and contribute to improved water resources management within the Tarim River Basin.

Description

The proposed project aims to improve the urban environment and promote inclusive economic development of Akesu City. It is a multisectoral and integrated urban upgrading project that will address urgent environmental and infrastructure needs, including the (i) rehabilitation of the Akesu Duolang Wetlands; (ii) upgrading of urban infrastructure and services, including roads, public parks, water supply, sewerage, and district heating; and (iii) strengthening the institutional capacity for sustainable urban development, planning, and management of Akesu Municipal Government (AMG).

The use of waste heat from a combined heat and power plant to supply the district heating network will result in the closure of 28 low-efficient and high-polluting small boilers that will reduce coal use by 25,900 tons per year, resulting in significant emission reduction in terms of SO₂ (173 tons), NO_x (1,559 tons), and CO₂ (64,000 tons). The central heating subcomponent will improve the heating quality and the quality of life for 105,503 residents, and reduce traffic hazards caused by coal and slag transport vehicles in areas currently serviced by small boilers.

Total Loan Amount: \$150 million (OCR)
Clean Energy Investment: \$25.9 million
Project Category: Demand-side energy efficiency
Energy Savings: 691.53 terajoules/year
Greenhouse Gas Emission Reduction: 64,000 tCO₂/year
Board Approval: 26 June 2015
Project Life: 30 years

Impact • Socially inclusive and environmentally sustainable urbanization in Akesu

Outcome • Quality of municipal services and environment improved

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

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Executing Agency Government of Xinjiang Uygur Autonomous Region

Loan Number: 3263-PRC
Project Number: 46063-002
**Xinjiang Tacheng Border Cities and Counties
Development Improvement Project**

Rationale

Tacheng Prefecture is in the northwest of Xinjiang Uygur Autonomous Region and shares a 480 kilometer (km)-long border with Kazakhstan. Due to its strategic geographical location, border trade is playing an increasing role in local economic development.

However, Tacheng Prefecture is still lagging the central areas of Xinjiang Uygur Autonomous Region in terms of income levels and living conditions. A lack of investment and planning, exacerbated by a harsh natural environment and high demographic pressure, has led to outdated and precarious urban infrastructure and municipal services in the cities of Tacheng, Emin, Tuoli, and Yumin. The urban road network in the project cities is inadequate for the planned population growth and the resulting increase in commercial activities.

Access to basic utilities is also low on average. The current coverage rate of district heating in Tacheng City is only 65%, and a significant share of the population still relies on small coal-fired boilers and family heating stoves, resulting in substantial energy inefficiency and air pollution. Municipal solid waste management capacity is limited, which also causes environmental pollution.

Description

By meeting urgent needs in urban infrastructure and municipal services, the project will improve the environment, social inclusiveness, and border trade capacity of Tacheng City and the county cities of Emin, Tuoli, and Yumin.

With the project all new roads will be developed with safe and adequately wide footpaths as well as fully segregated nonmotorized lanes where possible. The use of LED street lights will result in energy savings over 2.43 million KWh per year with an estimated CO₂ equivalent emission reduction of 2,420 t/a as compared to conventional street lighting. With project support, the Tacheng Municipal Government will commission new district heating distribution capacity to supply existing new service areas. The planned combined heat and power plant will use its waste heat to provide hot water to the district heating system. The proposed development will substantially improve energy efficiency and service quality, expand district heating coverage by 4.2 million m², and ultimately lead to reduced emissions resulting from the shift in heat source.

Total Loan Amount: \$150 million (OCR)
Clean Energy Investment: \$30.5 million
Project Category: Demand-side energy efficiency
Energy Savings: 2.43 gigawatt hours/year
5,031.67 terajoules/year
Greenhouse Gas Emission Reduction: 183,237.3 tCO₂/year
Board Approval: 29 June 2015
Project Life: 30 years

Impact • Improved urban environment, living conditions, and border trade capacity in the project border cities and counties

Outcome • Enhanced delivery and efficiency of municipal services in the project border cities and counties

Outputs • Improved urban infrastructures and municipal services in Tacheng City
• Improved urban infrastructure and municipal services in Emin County
• Improved urban infrastructure and municipal services in Tuoli County
• Improved urban infrastructures and municipal services in Yumin County
• Improved and inclusive capacity development and project arrangement

Division Urban and Social Sectors Division, EARD

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Executing Agency Government of Xinjiang Uygur Autonomous Region

Pacific Department

Grant Numbers: 0456/0457-SAM
Project Number: 46044-003
**Renewable Energy Development and Power Sector
Rehabilitation – Additional Financing**

Rationale

The proposed additional financing will support the government's efforts to reduce Samoa's reliance on imported fossil fuels for power generation by providing clean and reliable electricity. The government's Strategy for the Development of Samoa, 2012–2016; the Samoa Energy Sector Plan, 2013–2016; and the Electric Power Corporation's corporate plan, 2013–2015 all emphasize the development of indigenous and renewable energy resources as a high priority to reduce the economy's risk exposure to foreign exchange fluctuations and fuel price increases. The proposed additional financing is included as a firm 2015 project in ADB's country operations business plan, 2015–2017 for Samoa.

Description

The proposed additional financing will allow the building of two additional grid-connected small hydropower (SHPs) with a total preliminary capacity of 1.11 megawatts (MW): the 0.68 MW Fuluasou plant and the 0.43 MW Tiapapata plant, both on Upolu Island.

Total Grant Amount: \$5.06 million (European Union)
\$2.49 million (New Zealand)

Clean Energy Investment: \$7.55 million

Project Category: Renewable energy

Energy Savings: 3.79 gigawatt hours/year

Greenhouse Gas Emission Reduction: 8.9 tCO₂/year

Board Approval: 18 November 2015

Project Life: 30 years

Impact • Increased energy security

Outcome • Customers will have access to a higher share of electricity generated by hydropower

Outputs • Electric Power Corporation rehabilitates and reconnects to the grid 4.69 MW of hydropower capacity
• Electric Power Corporation builds and connects to the grid 0.81 MW of hydropower capacity
• O&M knowledge transfer program completed
• Project implemented efficiently
• Electric Power Corporation builds and connects to the grid 1.11 MW of hydropower capacity

Division Transport, Energy and Natural Resources Division, PARD

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Peer reviewer P. Wijayatunga, principal energy specialist, SARD

Executing Agency Ministry of Finance

Grant Numbers: 0444/0445/0446-TON
Project Number: 43452-023
Outer Island Renewable Energy Project
– Additional Financing

Rationale

Petroleum dependency makes Tonga highly vulnerable to oil price shocks, which affect the affordability of food, goods, electricity, and transport. The Asian Development Bank (ADB) approved the current Outer Island Renewable Energy Project on 27 June 2013 to reduce Tonga's dependence on imported fossil fuel for power generation and give consumers greater access at a reduced cost to electricity generated by solar power.

To maximize the distribution of electricity from the solar power systems to be installed under the current project, the government has asked ADB for a grant of \$1.44 million from ADB's Special Funds resources to help it upgrade the existing power distribution grids of 'Eua and Vava'u. To expand the scale of the current project and deliver greater benefits by reducing power distribution losses, the European Union has agreed to provide a grant not exceeding €3.00 million (\$3.57 million), and the Second Danish Cooperation Fund for Renewable Energy and Energy Efficiency for Rural Areas has approved a grant of \$750,000. Both grants will be fully administered by ADB as part of overall project administration.

Description

The additional financing for the Outer Island Renewable Energy Project will allow Tonga to reduce power distribution losses and fuel consumption while delivering the same amount of electricity to consumers. This will be achieved by rehabilitating grid assets—i.e., cables, poles, distribution transformers, and switchgears. It will result in additional savings of about 0.12 million liters of diesel per year.

Total Grant Amount: \$1.44 million (ADF)
\$3.57 million (European Union)
\$0.75 million (DEN-E2)

Clean Energy Investment: \$0.1987 million

Project Category: Supply-side energy efficiency

Energy Savings: 4.31 terajoules/year

Greenhouse Gas Emission Reduction: 319.58 tCO₂/year

Board Approval: 20 October 2015

Project Life: 40 years

- Impact** • Reduction of Tonga’s dependence on imported fossil fuel for power generation
- Outcome** • On-grid and offgrid generation systems are optimized and provide increased consumer access to electricity generated by solar power at a reduced cost
- Outputs** • The project will construct and install solar power systems with a total capacity of 1.32 MWp on nine outer islands of Tonga
 - Existing grid network on the islands of Vava’u and ‘Eua rehabilitated by Tonga Power Limited
 - O&M knowledge transferred through training
 - Project implemented and managed efficiently

Division Transport, Energy and Natural Resources Division, PARD

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Executing Agency Ministry of Finance and National Planning

Private Sector Operations Department

Loan Numbers: 7467/3375-IND
Project Number: 44426-018
Power Grid Corporation of India Limited
(Green Energy Corridor and Grid Strengthening)

Rationale

In 2012, India's Ministry of New and Renewable Energy and the Forum of Regulators commissioned the Power Grid Corporation of India Limited (POWERGRID) to conduct a green energy corridor study to identify nationwide transmission investments required to accommodate the additional renewable energy-generation capacity. Almost 60% of this renewable energy capacity is located in six states—Andhra Pradesh, Gujarat, Karnataka, Maharashtra, Rajasthan, and Tamil Nadu. To facilitate the transfer of power from these renewable energy-rich states to others, as well as address the absorption of power and the intermittency and timing differences of renewable energy, POWERGRID identified \$7 billion in investments to be undertaken in phases, starting under the Twelfth Five Year Plan.

This project is a subset of India's 'green energy corridor' initiative to ensure that transmission system development is commensurate with renewable energy capacity development over time. The project will also incorporate increasing interregional transmission capacity between the southern and western regional systems via an 800 kV high voltage direct current (HVDC) link. The proposed project will thus improve interstate power flows and system reliability.

Description

The project will fund electric transmission system investments in India, including (i) a portion of the Government of India's "Green Energy Corridor" initiative to facilitate the transfer of power from the renewable energy (RE) rich areas to other parts of the country, consisting of 765 kilovolt (kV) and 400 kV high voltage transmission lines and an associated 765/400kV substation and associated equipment, and (ii) four HVDC terminals (two at 800 kV and two at 320 kV) as part of increased interregional connectivity between India's western and southern regional power grids. This will expand western-southern interconnectivity from 10 GW to 16 GW between Chhattisgarh and Tamil Nadu, and the portion between Tamil Nadu and Kerala will have 2 GW capacity. The adoption of HVDC transmission technology improves power transfer efficiency and reduces transmission losses over long distances. It is thus a least-cost solution and low carbon investment option well suited for high-capacity interregional power transfers.

Total Loan Amount: \$500 million (OCR)
Clean Energy Investment: \$155.33 million
Project Category: Renewable energy/Supply-side energy efficiency
Energy Savings: 2,357 Gwh/year
Greenhouse Gas Emission Reduction: 2,118,350 tCO₂/year
Board Approval: 9 December 2015
Project Life: 40 years

Impacts • Increased overall efficiency of the Indian power system, expanded access to electricity, increased private investment in renewable energy, and enhanced energy security in India

Outcome • Improved and more reliable transmission system capacity in the northern, western, and southern regions of India

Output • Green energy corridor transmission system expanded in the northern region

Division Infrastructure Finance Division 1, PSOD

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Peer reviewer A. Wanniachchi, senior energy specialist, SARD

Loan Numbers: 7445/3252-PAK
Project Number: 47929-001
Mira Power Limited
(Gulpur Hydropower Project)

Rationale

Acute energy deficits have been one of the major constraints and bottlenecks to economic growth in Pakistan. To ensure a sustainable supply of energy, the Government of Pakistan has launched a number of initiatives for promoting private sector participation in the country's infrastructure, with a major focus on the energy sector. As part of these efforts, a number of energy policies were introduced and have resulted in significant (albeit insufficient) investment from the private sector. As of FY2013, 11,681 megawatts (MW) or 49.4% of the country's installed power capacity was owned and operated by private sector investors. The project is one of the earlier hydropower projects identified under the Power Policy (2002) by the Private Power and Infrastructure Board—the national institution entrusted with bringing private investment into Pakistan's energy sector.

The project will help alleviate Pakistan's severe power shortage, which hampers the country's economic growth and efforts to reduce poverty. Successful implementation of the project will also foster confidence among potential investors and lenders, and promote further private sector investment in renewable energy and power.

Description

The Project involves construction and operation of a 102 MW run-of-the-river hydroelectric power generation facility on Poonch River some 28 kms upstream from Mangla, Pakistan's second largest water storage reservoir. The Project will be developed under Power Policy 2002 under which ADB has financed several projects and will be undertaken on a build-own-operate-transfer basis for a period of 30 years (from the commercial operations date).

Total Loan Amount: \$65 million (OCR)
Clean Energy Investment: \$65 million
Project Category: Renewable energy
Renewable Energy Generation: 465 gigawatthours/year
Greenhouse Gas Emission Reduction: 253,797 tCO₂/year
Board Approval: 17 April 2015
Project Life: 70 years

- Impacts**
- Improved power supply in Pakistan
 - Diversified power generation mix
 - Increased investments by the private sector in renewable energy projects in Pakistan

- Outcome**
- Increased supply of cleaner hydropower from indigenous energy resources

- Output**
- A 102 MW hydropower project built and commissioned by the private sector

Division Infrastructure Finance Division 1, PSOD

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Loan Numbers: 7442/3246-PHI

Project Number: 48325-001

**EDC Burgos Wind Power Corporation
(150 MW Burgos Wind Farm Project)**

Rationale

In 2010, greenhouse gas (GHG) emissions in the Philippines equaled 159 million tons of carbon dioxide equivalent (tCO₂e). Electricity generation is the highest GHG-emitting sector, principally because of the country's reliance on highly polluting forms of energy, such as coal and petroleum.

To promote development of emerging renewable energy (wind, solar, biomass, and ocean sources), the Government of the Philippines signed into law the Renewable Energy Act in December 2008, with the objective of promoting energy self-reliance and reducing dependence on imported fossil fuels for electricity generation. However, since the Renewable Energy Act was passed, very little investment in renewable energy plants has been made due to delayed implementation of the feed-in-tariff scheme. On 27 July 2012, the Energy Regulatory Commission announced the feed-in-tariff rates and installation targets for each type of renewable energy source. A tariff of P8.53 per kilowatt-hour was set for wind power, with an initial installation target of 200 MW.

The project will be the second wind farm in the country, with a capacity almost five times that of the 33 MW Bangui Bay wind farm; (iii) it will contribute to diversification of the Luzon Grid fuel mix, which currently relies heavily on imported fossil fuels; and (iv) it helps satisfy growing power demand without the use of fossil fuel-fired power plants, thereby avoiding an increase in GHG emissions commensurate with the increase in overall power generation.

Description

The project includes the (i) installation of 50–3.0 MW wind turbine generators (WTGs) and ancillary plant equipment; (ii) construction of a 115-kilovolt transmission line, approximately 42 kilometers (km) in length; and (iii) construction of a substation in Burgos and the expansion of an existing substation in Laoag City, Ilocos Norte.

Total Loan Amount: \$20 million (OCR)

Clean Energy Investment: \$20 million

Project Category: Renewable Energy

Renewable Energy Generation: 370 gigawatt hours/year

Greenhouse Gas Emission Reduction: 160,113.7 tCO₂/year

Board Approval: 26 January 2015

Project Life: 20 years

- Impact** • Increased environmental sustainability of the country’s energy mix
- Outcome** • Demonstrated commercial viability and sustainability of utility-scale private sector wind farm
- Output** • Installation and operation of 150 MW utility-scale wind power plant
- Division** Infrastructure Finance Division 2, PSOD

Project Team

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Loan Numbers: 7551/3266-PHI

Project Number: 48423-001

Tiwi and Makban Geothermal Power Green Bonds Project

Rationale

Aboitiz Power Corporation (APC) acquired the Tiwi and Makiling–Banahaw (Tiwi–MakBan) complexes from the government in 2009, and invested in plant rehabilitation to improve availability and extend operating life. APC’s acquisition of Tiwi–MakBan was financed on an all-equity basis because, at the time, the company was unable to secure project financing from commercial banks. By mid-2013, the APC had increased plant availability to above 90%, improved generation efficiency, and significantly extended the plants’ operating life.

ADB approached APC in August 2014 with a proposal to normalize Tiwi–MakBan’s capital structure (i.e., to transition it from an all-equity financing to a more conventional debt–equity mix) through the issuance of a project bond. The structure was proposed as a way to help APC redeploy invested capital for new projects (including renewable power) without undermining the company’s ability to raise debt from local banks. In offering a bond credit enhancement, ADB partnered with the Credit Guarantee and Investment Facility, a multilateral trust fund established in 2010 to develop local debt capital markets through bond guarantees.

Description

ADB will provide a project loan in pesos (or its equivalent in US dollars) and a credit enhancement (in the form of a partial credit guarantee in pesos) to support the issuance of the Philippines’ first peso-denominated green project bond. The project involves AP Renewables Inc.’s (APRI) refinancing of capital expenditure (including acquisition and plant rehabilitation) and ongoing operations and maintenance at Tiwi–MakBan, the 7th and 4th largest geothermal facilities in the world at two locations on Luzon. APRI is a wholly owned subsidiary of APC, a leading developer and operator of power generation and distribution assets in the Philippines.

The Tiwi complex is located in the province of Albay, about 569 kilometers south of Metro Manila. With a combined nameplate capacity of 234 MW, Tiwi consists of three power plants with two generating units each. The MakBan complex is located about 70 kilometers southeast of Metro Manila on the boundary of Laguna and Batangas provinces. With a combined nameplate capacity of 442 MW, MakBan consists of five power plants with a total of 10 generating units.

Total Loan Amount: \$40.637 million (OCR)

Partial Credit Guarantee: \$181.17 million (OCR)

Clean Energy Investment: \$221.807 million

Project Category: Renewable energy

Renewable Energy Generation: cannot be quantified due to nature of project

Greenhouse Gas Emission Reduction: cannot be quantified due to nature of project

Board Approval: 2 July 2015

Project Life: 18 years

- Impacts**
- Development of the private sector bond market in the Philippines
 - Support investment in geothermal power in the Philippines

- Outcome**
- Viability of green project bonds for renewable energy demonstrated

- Outputs**
- Tiwi–MakBan green project bonds for geothermal energy successfully introduced
 - Green bond status and application for climate bond certification from an international standards body achieved
 - Bond guarantee capacity from the financial market on a risk-sharing basis mobilized

Division Infrastructure Finance Division 2, PSOD

Project Team

Team Leaders F. Thomas, senior investment specialist, PSOD
S. Roberts, investment specialist, PSOD

Team Members I. Aguilar, social development officer (safeguards), PSOD
M. Manabat, senior investment officer, PSOD
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K. Taniguchi, senior economist, PSOD
C. G. Uy, investment specialist, PSOD

Loan Numbers: 8298-IND
Project Number: 49238-001
Simpa Energy Private Limited
(Off-Grid Prepaid Solar Leasing Project)

Rationale

According to a recent report by the Climate Group, about 77 million households in India lack adequate access to grid electricity, with an additional 20 million underserved households receiving less than 4 hours of reliable electricity per day. While the availability of grid electricity is expected to improve by 2025, it is estimated that 70–75 million households will still lack access to grid electricity in India by 2024. Solar photovoltaic technology offers a clean alternative to address off-grid access to electricity. However, the effective decentralized energy solutions using solar photovoltaic technology, such as solar home systems (SHSs) and community-scale solar microgrids, involve significant upfront costs for rural consumers and have, as a result, very limited market penetration.

Simpa, a wholly owned subsidiary of Simpa Networks Inc., targets the underserved and unelectrified rural population in India by providing simple, affordable, and accessible solar energy to consumers (households and microenterprises).

Description

A debt facility of up to \$6 million using third-party donor capital from the ADB-administered Clean Technology Fund (CTF) to Simpa Energy India Private Limited to allow the company to expand its deployment of prepaid off-grid solar home systems in the state of Uttar Pradesh. Simpa provides solar-based energy solutions to rural customers with a need for energy access. The company has received early stage funding from venture capital investors and is showing year-over-year revenue growth. In 2013, ADB made a \$2 million investment in Simpa for a stake in the company.

Total Loan Amount: \$6 million (CTF)
Clean Energy Investment: \$6 million
Project Category: Renewable energy
Renewable Energy Generation: 103.3 Gwh/year
Greenhouse Gas Emission Reduction: 77,108 tCO₂/year
Board Approval: 1 December 2015
Project Life: 25 years

- Impacts**
- Access to off-grid electricity supply to rural population improved
 - Greenhouse gas emissions reduced
 - Access to gender benefits

- Outcome**
- Access to clean energy, enabled by a financially viable energy services company, increased

- Output**
- Sustainable solar systems for houses and microenterprises installed

Division Infrastructure Finance Division 1, PSOD

Project Team

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Loan Numbers: 7462/3366 to 7466/3370-THA
Project Number: 49263-001
Northeastern Thailand Wind Power Projects

Rationale

Thailand generates 70% of its electricity using natural gas and 18% using coal and lignite. Its domestic natural gas resources have long been a reliable source of low-cost energy, but growing demand and dwindling reserves in the Gulf of Thailand mean that it must find new fuels to meet its growing electric power needs. Fortunately, the country has abundant biomass, biogas, mini hydro, solar, and wind resources available for renewable energy development. Making use of these sources can improve Thailand's energy security, save foreign exchange by reducing the need for energy imports, and shield the economy from the impact of global energy price fluctuations.

Description

The Project entails the construction and operation of five wind farm subprojects, with a total generation capacity of 260-megawatt (MW), in Chaiyaphum province. The Project will enter into 5 power producing agreements with Electricity Generating Authority of Thailand under the Small Power Producer (SPP) program. The power producing agreements include an adder incentive of B3.5 per kilowatt-hour (kWh) applicable for 10 years from the date of commercial operation. The Project will be constructed under a fixed-price, date-certain, turnkey engineering, procurement, construction arrangement. The scheduled commercial operation dates under the power producing agreement are 2Q 2018.

Total Loan Amount: \$157.5 million (OCR)
\$18.90 million (CTF)

Clean Energy Investment: \$176.4 million

Project Category: Renewable energy

Renewable Energy Generation: 411 gigawatthours/year

Greenhouse Gas Emission Reduction: 222,000 tCO₂/year

Board Approval: 8 December 2015

Project Life: 20 years

- Impacts**
- Production and consumption of renewable energy broadened
 - Investment in renewable energy from private sector increased

- Outcome**
- Viability and sustainability of a large utility-scale private sector wind power project demonstrated in Thailand

- Output**
- 260 MW of utility-scale wind power capacity installed, operational, and transmitting electricity

Division Infrastructure Finance Division 2

Project Team

Team Leader R. Lockhart, investment specialist, PSOD

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K. Taniguchi, senior economist, PSOD

South Asia Department

Loan Number: 3350-BAN
Project Number: 42378-017
**Power System Expansion and Efficiency Improvement
Investment Program – Tranche 3**

Rationale

Bangladesh is focused on achieving universal access to grid connected electricity by 2021 with a total installed generation capacity of 20,000 MW by 2020. This is a challenging task in light of the electrification rate standing at 62% (2014) and the country still undergoing frequent power shortages. These ambitious targets require significant investments in the power sector infrastructure during the coming years. The multitranche financing facility is contributing toward this target through its generation, transmission, distribution investments. Tranche 3 is specifically focused on enhancement of generation and transmission capacity to facilitate achieving the target.

Description

Tranche 3 will cover investments in generation system expansion and efficiency improvement, transmission system enhancement, and demand side energy efficiency improvement.

Total Loan Amount: \$205 million (OCR)
Clean Energy Investment: \$50 million
Project Category: Supply-side energy efficiency
Energy Savings: 14,925 terajoules/year
Greenhouse Gas Emission Reduction: 837,282 tCO₂/year
Board Approval: 8 December 2015
Project Life: 30 years

Impact • Better access to reliable electricity supply in Bangladesh

Outcome • Increased efficiency and capacity of the power system in Bangladesh

Outputs • Power generation system expanded and upgraded through replacement of an aging steam and gas turbine power plant of 220 megawatt (MW) capacity with a more efficient 400 MW gas-fired Combined Cycle Power Plant at Ashuganj Power Station complex

- Transmission system expanded and upgraded through upgrade or construction of 132kv transmission lines and substations in Chittagong Division
- Demand side energy efficiency improved through replacement of meters with approximately 700,000 prepayment meters in Dhaka Division

Division Energy Division, SARD

Project Team

Team Leaders L. Zhang, energy specialist, SARD
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Y. Jang, social development specialist, SARD
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M.S. Rahman, project officer (energy), BRM, SARD
S. Shafiq, financial management specialist, SARD
A. Yusupov, energy specialist, SARD
Y. Zhou, environment specialist, SARD

Peer reviewer A. Tareen, energy specialist, CWRD

Executing Agencies Ashuganj Power Station Company (APSCL)
Bangladesh Rural Electrification Board (BREB)
Power Grid Company of Bangladesh (PGCB)

Loan Number: 3327-IND
Project Number: 47101-003
Assam Power Sector Investment Program – Tranche 2

Rationale

Assam Power Distribution Company Limited has previously had some success in reducing system losses, but the progress with loss reduction has stagnated in the past three years owing to providing of new power connections without upgrading the system, inadequate investments, and poor management practices. Improvements to the subtransmission network are necessary for reduction of technical losses, and to ensure delivery of power to distribution transformers at the required voltage levels. These improvements are imperative to meet the projected growth in demand and they have to be undertaken in a planned and systematic manner.

A load flow study up to the 11 kV bus of the 33/11 kV substation proposed in this project, along with load flow studies on the existing 33 kV, 11 kV and low voltage lines proposed for rehabilitation, refurbishment/re-conductoring, have been carried out, with results indicating a need to strengthen the existing distribution network at subtransmission levels, and re-conductoring some existing lines with larger conductors.

Description

Tranche 2 will finance the expansion and upgrading of power distribution system in the state of Assam, and strengthen institutional capacity of Assam Power Distribution Company Limited. Specifically tranche 2 includes: (i) one new 33 kV/11 kV substation and associated lines; (ii) 137 km of 33 kV lines; (iii) 33 kV railway line and river crossings; (iv) 7 km of 11 kV lines; (v) installation of seventeen 33 kV bays; (vi) re-conductoring and refurbishing of 955 km of 33 kV lines; (vii) 1,000 km of 11 kV lines; (viii) 1,555 km of low voltage lines; (ix) replacement of 204 distribution transformers; and (x) replacement of 14 km 11 kV overhead lines with underground cables. Output 2 includes: (i) establishing two area load dispatch centers; (ii) setting up of an independent meter testing laboratory; (iii) establishing one IT module to expand the centralized uniform revenue billing system for 1.2 million customers; and (iv) project management, supervision and implementation support.

Total Loan Amount: \$48 million (OCR)
Clean Energy Investment: \$18 million
Project Category: Supply-side energy efficiency
Energy Savings: 190 gigawatt hours/year
Greenhouse Gas Emission Reduction: 152,000 tCO₂/year
Board Approval: 23 November 2015
Project Life: 20 years

Impact • Enhanced quality and expanded service delivery of electricity in Assam

Outcome • Increased efficiency and capacity of the power distribution system in Assam

Outputs • Expansion and upgrading of the distribution system
• Strengthening the institutional capacity of Assam Power Distribution Company Limited

Division Energy Division, SARD

Project Team

Team Leader A. Yusupov, energy specialist, SARD

Team Members H. Austria, project officer, SARD
J. Banerjee, senior project officer, SARD
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S. Shafiq, financial management specialist, SARD
Y. Zhou, environment specialist, SARD

Executing Agency Assam Power Distribution India Company

Loan Number: 3301-BAN
Project Number: 49094-001
Railway Rolling Stock Project

Rationale

Despite a growing demand for transport, Bangladesh Railway's market share in passenger and freight transport has declined due to a lack of investment in infrastructure and rolling stock (its transport capacity is the same as it was in 1975). Railway travel in Bangladesh is safer, more energy-efficient and reliable, and has a lower environmental impact than other modes of transport. Railway transport is also considered more comfortable than long-distance buses. Intercity trains operated by Bangladesh Railway are very popular. Occupancy is very high, especially in the east zone (98%); intercity trains in the Dhaka–Chittagong corridor are usually sold out. About 40% of Bangladesh Railway's passengers travel by intercity trains, which account for more than 75% of passenger revenue. The high demand for intercity service in the Dhaka–Chittagong corridors cannot be fully met and no additional trains can be scheduled to tap into the lucrative market for Bangladesh Railway due to insufficient line capacity and rolling stock availability.

Bangladesh Railway has a shortage of modern and reliable rolling stock: of the fleet of 282 locomotives and 1,476 passenger carriages, 76 locomotives and 651 passenger carriages have passed their economic life of 35 years and need to be replaced. Procurement of 70 locomotives and 270 passenger carriages is ongoing; together with 20 multiple units recently commissioned, this will enable Bangladesh Railway to replace the majority of the oldest and least-efficient rolling stock.

Description

The proposed project will improve railway transport capacity in Bangladesh on key corridors such as the Dhaka–Chittagong and Dhaka–Khulna main line corridors by financing additional rolling stock (locomotives, passenger carriages, and related equipment). The new rolling stock will enable Bangladesh Railway to satisfy steadily growing demand and increase its market share.

The project is limited to the procurement of rolling stock and equipment that will operate on existing railway lines. The review of environmental impacts indicates that there will be no adverse environmental impacts during project implementation. During project operation, there will be a net environmental benefit through reductions in carbon dioxide emission due to a modal shift of passengers from road to rail, and the use of more efficient locomotives.

Total Loan Amount: \$200 million (OCR)

Clean Energy Investment: \$200 million

Project Category: Demand-side energy efficiency

Energy Savings: cannot be quantified due to the nature of the project

Greenhouse Gas Emission Reduction: cannot be quantified due to the nature of the project

Board Approval: 30 September 2015

Project Life: 20 years

Impact • Efficient and safe railway transport in Bangladesh (Sixth Five-Year Plan: 2011–2015)

Outcome • Railway transport capacity in the main line network of Bangladesh Railway increased

Outputs • New rolling stock procured and commissioned
• New equipment procured and commissioned

Division Transport and Communication Division, SARD

Project Team

Team Leader M. Roesner, principal transport specialist, SARD

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A. Syed, counsel, Office of the General Counsel
K. Yangzom, environment specialist, SARD

Peer reviewer S. Saxena, principal transport specialist, EARD

Executing Agency Bangladesh Railway

Loan Number: 3307-IND
Project Number: 47083-003
**Accelerating Infrastructure Investment Facility
in India – Tranche 2**

Rationale

The Accelerating Infrastructure Investment Facility in India is a \$700-million multitranche financing facility to the India Infrastructure Finance Company Limited (IIFCL). It supports the Government of India in accelerating infrastructure growth through the facilitation of increased private sector investment in public-private partnership (PPP) infrastructure under the Twelfth Five Year Plan, 2012–2017. According to the plan, India needs to mobilize about \$500 billion in private funding to meet its \$1 trillion infrastructure financing requirements. The facility is an integral part of the Asian Development Bank (ADB) strategy for infrastructure finance in India, and complements parallel initiatives in PPP and capital markets—all of which contribute to creating an enabling environment for long-term financing for infrastructure development.

Description

This periodic financing request is the final tranche under the Accelerating Infrastructure Investment Facility in India. It includes a pilot project that extends lending in local currency using offshore rupee-linked bonds. As such, it will effectively source foreign investments to fund India's infrastructure development without incurring foreign exchange risk.

There are 28 subprojects under this tranche, 2 of which are renewable energy power plants with a capacity of 30 MW each.

Total Loan Amount: \$300 million (OCR)
Clean Energy Investment: \$159 million
Project Category: Renewable energy
Renewable Energy Generation: 123.52 gigawatt hours/year
Greenhouse Gas Emission Reduction: 110,992 tCO₂/year
Board Approval: 30 October 2015
Project Life: 20 years

Impact • Investments in infrastructure increased (Twelfth Five-Year Plan, 2012–2017)

Outcome • Private sector investment in infrastructure PPPs facilitated

Outputs • Availability of long-term finance for PPP subprojects enhanced and
• Operational capacity of IIFCL improved.

Division Public Management, Financial Sector and Trade Division, SARD

Project Team

Team Leaders D. Lambert, senior finance specialist, SARD
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Y. Hirao, financial control specialist, Controller's Department (CTL)
Z. Pilapil, safeguards analyst, SARD
K. Recomono, operations assistant, SARD
Y. Sakurai, financial control specialist, CTL

Peer reviewers R. Poddar, principal treasury specialist (institutional coordination), TD
S. Sampath, principal public-private partnership specialist, Office of Public-Private Partnership

Executing Agency India Infrastructure Finance Company

Loan Number: 3337-IND
Project Number: 35290-043
Northeastern Region Capital Cities Development
Investment Program – Tranche 3

Rationale

North Eastern Region Capital Cities Development Investment Program was framed within Gol's (Government of India) 11th Five Year Plan (2007–2012), which aimed to reduce poverty and regional disparities by ensuring, among others, access to basic physical infrastructure. Aizawl and Agartala were selected for financing under Project 3 based on their progress on urban reforms and implementation performance of projects 1 and 2, in accordance with the agreed framework financing framework for North Eastern Region Capital Cities Development Investment Program.

Description

Tranche 3 will include physical investments in water supply, solid waste and sanitation improvement in Agartala and Aizawl, and nonphysical investments to continue supporting implementation of urban reforms agreed under the North Eastern Region Capital Cities Development Investment Program in these cities. Two tranches have been approved to date under North Eastern Region Capital Cities Development Investment Program (Projects 1 and 2). All three projects have been sequenced based on the implementation capacity and sector priorities of the Investment Program cities, and will collectively meet the intended outcomes of North Eastern Region Capital Cities Development Investment Program.

Total Loan Amount: \$80 million (OCR)
Clean Energy Investment: \$21.92 million
Project Category: Demand-side energy efficiency
Energy Savings: 5.52 gigawatt hours/year
Greenhouse Gas Emission Reduction: 4,959 tCO₂/year
Board Approval: 27 November 2015
Project Life: 20 years

Impact • Improved environment and well-being of urban residents in the program cities

Outcome • Increased access to sustainable and improved urban services in Agartala and Aizawl

Outputs • Water Supply Infrastructure constructed and rehabilitated
• Sanitation Infrastructure constructed
• Solid waste management infrastructure constructed and rehabilitated
• Capacity for project implementation and service delivery improved

Division Urban and Water Division, SARD

Project Team

Team Leader N. Pokhrel, senior urban development specialist, SARD

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I. Setyawati, safeguards specialist, SARD
S. Shafiq, finance management specialist, SARD
R. Slangen, urban development specialist, SARD

Peer reviewer S. Joshi, senior urban development specialist, CWRD

Executing Agencies Ministry of Urban Development, Urban Development Department, Urban Development and Poverty Alleviation Department

Loan Number: 3365-IND
Project Number: 44426-016
Power Grid Corporation of India Limited
(Green Energy Corridor and Grid Strengthening Project)

Rationale

In 2012, the Ministry of New and Renewable Energy (MNRE) and the Forum of Regulators commissioned Power Grid Corporation of India Limited (POWERGRID) to conduct a green energy corridor study to identify nationwide transmission investments required to accommodate the additional renewable energy-generation capacity. Almost 60% of this renewable energy capacity is located in six states—Andhra Pradesh, Gujarat, Karnataka, Maharashtra, Rajasthan, and Tamil Nadu. To facilitate the transfer of power from these renewable energy-rich states to others, as well as address the absorption of power and the intermittency and timing differences of renewable energy, POWERGRID identified \$7 billion in investments to be undertaken in phases, starting under the Twelfth Five Year Plan. These include (i) intrastate transmission investments of about \$3.6 billion within renewable energy-rich states and (ii) phased interstate investments of more than \$3.4 billion to enable power flows across states over long distances.

This project is a subset of India's 'green energy corridor' initiative to ensure that transmission system development is commensurate with renewable energy capacity development over time. The project will also incorporate increasing interregional transmission capacity between the southern and western regional systems via an 800 kV high voltage direct current link. The proposed project will thus improve interstate power flows and system reliability.

Description

The project will fund electric transmission system investments in India, including (i) a portion of the Government of India's "Green Energy Corridor" initiative to facilitate the transfer of power from the renewable energy (RE) rich areas to other parts of the country, consisting of 765 kilovolt (kV) and 400 kV high voltage transmission lines and an associated 765/400kV substation and associated equipment, and (ii) four high voltage direct current terminals (two at 800 kV and two at 320 kV) as part of increased interregional connectivity between India's western and southern regional power grids. This will expand western-southern interconnectivity from 10 GW to 16 GW between Chhattisgarh and Tamil Nadu, and the portion between Tamil Nadu and Kerala will have 2 GW capacity. The adoption of high voltage direct current transmission technology improves power transfer efficiency and reduces transmission losses over long distances. It is thus a least-cost solution and low carbon investment option well suited for high-capacity interregional power transfers.

Total Loan Amount: \$500 million (OCR)
Clean Energy Investment: \$155.33 million
Project Category: Renewable energy/Energy efficiency
Energy Savings: 2,357 gigawatt-hours/year
Greenhouse Gas Emission Reduction: 2,118,350 tCO₂/year
Board Approval: 9 December 2015
Project Life: 40 years

Impact • Increased overall efficiency of the Indian power system, expanded access to electricity, increased private investment in renewable energy, and enhanced energy security in India. (Electricity for All, Twelfth Five Year Plan)

Outcome • Improved and more reliable transmission system capacity in selected regions of India

Outputs • Green energy corridor transmission system expanded in the northern region
• Transmission interconnection capacity between the western and southern regional grids expanded

Division Energy Division, SARD

Project Team

Team Leader A. Jeffries, principal energy specialist, SARD

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Y. Zhou, environment specialist, SARD

Peer reviewer A. Wanniachchi, senior energy specialist, SARD

Executing Agency Power Grid Corporation of India

Grant Number: 0429-MLD
Project Number: 46122-003
**Preparing Outer Island for Sustainable
Development – Additional Financing**

Rationale

The government of Maldives plans to enhance its renewable capacity to reduce dependence on imported diesel for electricity generation, enhance the country's energy security, reduce its carbon footprint, and reduce government budget on diesel subsidies. This has been identified as an area for ADB support. The level of installed renewable energy capacity in particular for isolated island grid as in the Maldives depends significantly on the introduction of new technologies for energy management and storage.

Description

The additional financing is to fund the procurement and installation of advanced storage and energy management system in S. Addu through the Japan Fund for the Joint Crediting Mechanism. The investment would (i) facilitate addressing the integration challenges for renewable energy on island grids, (ii) support efficient operation of the solar diesel hybrid grids, (iii) enable a higher mix of renewable energy in the island from 7% to 20%, (iv) build capacity in the utility to procure, install, manage, and operate advanced storage and energy management system.

Total Grant Amount: \$5 million (Japan Fund for the Joint Crediting Mechanism)
Clean Energy Investment: \$5 million
Project Category: Renewable energy
Renewable Energy Generation: 3.974 gigawatt hours/years
Greenhouse Gas Emission Reduction: 3,179 tCO₂/year
Board Approval: 19 March 2015
Project Life: 20 years

Impact • More sustainable energy sector based on renewable resources

Outcome • Shift toward clean and cost-effective energy sources

Outputs • Renewable-energy-ready grid systems developed for outer islands and greater Male region
• Enhanced capacity of Ministry of Environment and Energy (MEE), State Electricity Company (STELCO), and Fenaka Corporation (FENAKA) to implement renewable energy grid interventions

Division Energy Division, SARD

Project Officer L. George, energy specialist, SARD

Executing Agency Ministry of Finance and Treasury

Southeast Asia Department

Grant Number: 0468-CAM
Project Number: 42361-013
**Medium Voltage Sub-Transmission Expansion
Sector – Additional Financing**

Rationale

The scope of the ongoing project covers expansion of the MV networks but it does not cover the downstream installations for connecting the houses to the electricity network. Approximately 22% of the households located in villages with access to grid electricity are identified as living below the national poverty line and are unable to afford the up-front service connection cost, estimated at around \$110 per household.

In order to support the poorest households and help them connect to grid electricity supply, ADB and the executing agency Electricite du Cambodge considered complementing the loan financing with grant subsidies under an Output-Based Aid mechanism. Output-Based Aid is a financial instrument for increasing access to services such as water, energy, health and sanitation to the poor and vulnerable households in developing countries. It uses a results-based approach where service providers prefinance the supply and installation costs to be later reimbursed using grant financing after verification of the delivered outputs.

Description

The proposed output-based aid program aims at increasing the outputs of the ongoing project by subsidizing the connection to the electricity grid to an additional 10,000 poor households that would not be able to do so without subsidy support, because of the high upfront connection cost of approximately \$120 per household. The output-based aid will pay for the 80% of the cost of connection, about \$96 of materials and installation costs while the beneficiaries will shoulder the remaining \$24, which includes administrative fees and deposit.

Total Grant Amount: \$1 million (CEFPF)
Clean Energy Investment: \$1 million
Project Category: Fuel displacement by electricity
Greenhouse Gas Emission Reduction: 25,600 tCO₂/year
Board Approval: 9 December 2015
Project Life: 40 years

Impact • Broader access to grid electricity in Cambodia

Outcome • Increased access to electricity at poor households in targeted areas
• Reduced impact on climate change due to fossil fuel avoidance

Outputs • Provision of subsidized grid electricity connections to poor households
• Reduced CO₂ emissions
• Increased economic productivity, especially by female-headed households
• Increased support to female headed households to access modern energy services
• Improved health at targeted households, especially among women and children

Division Energy Division, SERD

Project Officer Rehan Kausar, unit head, SEEN

Executing Agency Electricite du Cambodge – Rural Electrification Fund Department

Grant Number: 0336-CAM
Project Number: 45303-001
Rural Energy Project – Additional Financing

Rationale

ADB approved Grant 0336-CAM on 15 January 2013 to the Royal Government of Cambodia in an amount not exceeding \$6.11 million (comprising US\$4.11million and A\$2 million) financed by the Government of Australia and administered by ADB. Of the total \$5.07 million will be passed on to Electricite du Cambodge under subsidiary grant agreement between the Government of Cambodia and Electricite du Cambodge. The remaining grant proceeds will be passed on to Electricity Authority of Cambodia and Ministry of Mines and Energy through budgetary allocations. The grant agreement was signed on 5 December 2013 and declared effective on 5 March 2014.

The additional financing was requested to increase the allocation for consulting services for the three main components of the original grant.

Description

The additional financing will be allocated to consulting services under the three components of this grant which addresses both power and nonpower energy supply in rural Cambodia by (i) electrifying up to 8,000 households in Svay Rieng Province by extending the 22 kilovolt medium-voltage subtransmission line and the low-voltage distribution network and installing meters; (ii) promoting the use of up to 90,000 improved Neang Kongrey Cookstoves with higher efficiency in rural areas of Kampong Cham Province; and (iii) developing the capacity of Electricity Authority of Cambodia which is the regulatory body overseeing the power sector.

Total Grant Amount: \$0.36 million (Australia)
Clean Energy Investment: \$0.36 million
Project Category: Supply-side/Demand-side energy efficiency
Energy savings: cannot be quantified due to lack of data
Greenhouse Gas Emission Reduction: cannot be quantified due to lack of data
Board Approval: 7 August 2015
Project Life: 10 years (cookstove)

- Impact** Increased access to economical and reliable energy supply by rural communities
- Outcome** Expanded supplies of reliable grid-electricity and Neang Kongrey Cookstoves
- Outputs**
- Expanded medium-voltage and low-voltage networks in Svay Rieng Province.
 - Established manufacturing and distribution network for Neang Kongrey Cookstoves in Kampong Cham Province.
 - Developed regulatory capacity of Electricity Authority of Cambodia
- Division** Energy Division, SERD
- Project Officer** Rehan Kausar, unit head, SEEN
- Executing Agency** Electricity Authority of Cambodia

Loan Number: 3339-INO
Project Number: 49080-001
Electricity Grid Strengthening – Sumatra Program

Rationale

Expanding energy infrastructure and increasing investments in the sector is a key mandate of the government which is taking the necessary steps to diversify the country's energy mix, reduce its dependence on imported fuels, move toward cost-reflective electricity and energy prices, rely more on indigenous sources of energy, and lower greenhouse gas emissions. This will require a substantive and sustained multi-year effort to improve and strengthen the country's power transmission and distribution networks and regional grids to deliver the power from its generation points to the load centers across the country and promote industrial development of the regions.

Sumatra currently accounts for about 25% of Indonesia's gross domestic product and has the second-largest electricity system in the country with an installed capacity of about 6,000 megawatts (MW) in 2013 but despite that, it suffers from an average power deficit of 250 MW. The government is keen to boost Sumatra's productivity which implies strengthening its existing power grid and increasing the generating capacity to around 15,000 MW.

Description

The proposed Electricity Grid Strengthening—Sumatra program will take a results-based lending programmatic approach in consultation with Perusahaan Listrik Negara (State Electricity Corporation) or PLN and government over the five-year National Medium-Term Development Plan, 2015–2019 period with a series of programs anchored to PLN's Electricity Power Supply Business Plan 2015–2024. This will ensure a long-term continuous engagement for the strengthening of the Sumatra power grid and ensuring reliable and uninterrupted provision of electricity. The RBL modality is appropriate, given (i) ADB's long-term assistance to PLN in financing generation, transmission, and distribution; (ii) its capacity for implementation; (iii) the alignment of the RBL with the national planning frameworks; (iv) PLN and the government's strong ownership of the 35 GW program; (v) the government's shift to direct lending to state-owned enterprises backed by a government guarantee, in order to increase efficiency and simplify the project approval process; (vi) lower transaction costs associated with program implementation; and (vii) the potential to stimulate cofinancing and donor harmonization with other development partners. The program will be included in the draft country operations business plan 2015–2017 and complements the proposed Sustainable and Inclusive Energy Program Subprogram 1 policy-based loan.

Total Grant Amount: \$575 million (OCR)
\$25 million (ASEAN Infrastructure Fund)

Clean Energy Investment: \$180 million

Project Category: Supply-side energy efficiency

Energy Savings: 1,485 gigawatt hours/year

Greenhouse Gas Emission Reduction: 1,125,507 tCO₂/year

Board Approval: 2 December 2015

Project Life: 40 years

Impact • The quality of life in Indonesian society enhanced by the sustainable use of electricity as a key driver of increased economic activity. Electricity Power Supply Business Plan, 2015–2024

Outcome • Adequacy and reliability of power supply achieved for Sumatra

Outputs • Existing transmission system strengthened and expanded
• Existing distribution system strengthened and expanded
• Performance management and implementation improved

Division Energy Division, SERD

Project Team

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Executing Agency P.T. Perusahaan Listrik Negara

Loan Number: 3303-INO

Project Number: : 49043-001

Sustainable and Inclusive Energy Program (Subprogram 1)

Rationale

Indonesia's national electrification ratio of 84% in 2014 is low relative to its neighbors in Southeast Asia. In many small power markets and parts of eastern Indonesia, supply is limited to a few hours a day. The high cost of delivering fossil fuels to small islands and remote areas combined with low power loads, limited household ability to pay, lack of interconnected grids that can support larger generating units, and a constrained policy environment have made State Electricity Company (PLN) reluctant to add new consumers. Nevertheless, the rich renewable energy potential of these regions could support a range of grid-connected, mini grid, and household systems. The government's electrification effort overall lacks a comprehensive regulatory framework that incorporates the private sector, a national program, an institutional framework, and the necessary budgetary resources.

Description

Sustainable and Inclusive Energy Program (SIEP) is closely aligned with the government's National Medium-Term Development Plan (RPJMN), 2015–2019, the goals of which include (i) expanding electricity access to all Indonesians and increasing per capita consumption from 843 kilowatt-hours to 1,200 kilowatt-hours per year as key goals; (ii) bolstering domestic energy security through expanded production of gas, improved security for downstream oil and oil products, and increased utilization of renewable energy; and (iii) scaling up energy efficiency. The program is also designed to support PLN via the company's Electricity Power Supply Business Plan, 2015–2024. Realizing these goals will require a sustained and multi-year effort. SIEP will be ADB's first policy-based operation in Indonesia that is fully focused on the energy sector. The proposed program takes a chronological approach over the 5-year RPJMN period with three subprograms.

Total Grant Amount: \$400 million (OCR)
\$100 million (Asean Infrastructure Fund)

Clean Energy Investment: \$291.65 million

Project Category: Supply-side energy efficiency

Energy Savings: cannot be quantified due to the nature of the project

Greenhouse Gas Emission Reduction: cannot be quantified due to the nature of the project

Board Approval: 30 September 2015

Project Life: not applicable due to the nature of the project

Impact • A more sustainable and inclusive energy sector in Indonesia

Outcome • Supply from sustainable and more accessible energy options increased

Outputs • Sector governance improved
• Markets for private participation enabled
• Access to clean energy increased

Division Energy Sector, SERD

Project Team

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Executing Agency Coordinating Ministry for Economic Affairs

Loan Number: 3250-LAO PDR
Project Number: : 45041-002
Vientiane Sustainable Urban Transport Project

Rationale

Many of the roads in Vientiane are narrow, and many of the intersections operate in an inefficient manner. The total number of private vehicles registered in Vientiane increased at an average annual growth rate of 17% during 2000–2009, and has increased at a growth rate of more than 10% since then, placing Vientiane on an unsustainable transport development path, as the city is starting to experience congestion, increased incidence of road accidents, and deteriorating local air quality. The expanding use of private vehicles is also increasing greenhouse gas emissions. Motorcycles are the primary mode of transport, accounting for 67.0% of daily trips, while public transport only accounts for an estimated 0.6% of daily trips. Public transport in Vientiane is largely provided by privately operated vehicles, particularly tuk-tuks (motorized tricycles). While Vientiane Capital State Bus Company provides service from the central bus station in the core area to other points in Vientiane, there is no bus service linking points within the core area. Vientiane Capital State Bus Company lacks (i) staff with sufficient skills, (ii) competition, (iii) incentives to improve efficiency, and (iv) capital. There is no parking management system in Vientiane, with no charge for on-street parking and little enforcement of parking regulations.

Description

The Vientiane Sustainable Urban Transport Project will improve the quality of life in Vientiane by improving access and mobility. The project will do this by establishing a sustainable urban transport management agency, a high-quality public bus transport system, a parking management system, and a national electronic vehicle registration system, and by improving traffic management and accessibility for pedestrians and nonmotorized transport. The project promotes gender mainstreaming, greenhouse gas reduction, and public private partnership.

Total Loan Amount: \$35 million (OCR)
\$15 million (OPEC Fund for International Development)
Total Grant Amount: \$1.84 million (GEF)
Clean Energy Investment: \$51.84 million
Project Category: Demand-side energy efficiency
Energy Savings: 337 terajoules/year
Greenhouse Gas Emission Reduction: 25,000 tCO₂/year
Board Approval: 10 March 2015
Project Life: 12 years (buses)

Impact • Development of the Vientiane core area in an environmentally sustainable and pedestrian-friendly manner

Outcome • Improved urban transport operations and capacity in Vientiane

Outputs • A sustainable urban transport management agency for Vientiane established
• High-quality bus services and bus rapid transit operating in Vientiane
• Traffic management in the core area of Vientiane improved
• Paid parking system and national vehicle registration system established
• Accessibility for pedestrians and other nonmotorized transport in the core area of Vientiane improved

Division Transport and Communications Division, SERD

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Executing Agency Ministry of Public Works and Transport

Loan Number: 3316-MYA
Project Number: : 47127-002
Mandalay Urban Services Improvement Project

Rationale

Mandalay City, with a population of about 1.25 million, is Myanmar's second largest city and the capital of Mandalay Region. The Mandalay City Development Committee is tasked with urban service delivery and infrastructure development. However, it does not effectively carry out its responsibilities because it lacks staff, skills, funds, and data. The piped-water supply system serves only 55% of the city population and only for 10 hours per day on average. The remaining residents use mainly private shallow wells. Nonrevenue water is estimated at 52%. Neither a piped sewerage system nor a centralized wastewater treatment plant exists. Sanitation provision consists of septic tanks draining largely into the roadside drains and of latrines of varying designs. Although Mandalay is located in the heart of the Central Dry Zone, rainstorms can be very intense during the wet season. Seasonal floods are caused mainly by a lack of maintenance of canals and storage ponds, and insufficient capacities of the existing pumping stations. Although Mandalay City Development Committee collects about 780 tons of domestic solid waste per day, large amounts are disposed in the drains and canals. Primary collection uses the bell system and the waste is transported to the final disposal sites via transit stations.

Description

Output 1 will build a new water treatment plant, rehabilitate the existing water supply networks, and extend the networks to new urban areas. A comprehensive nonrevenue water reduction program will be implemented including the rehabilitation of pipes, replacement of connections with meters, and improvement of tariff collection efficiency. Output 2 will provide the first centralized wastewater collection and treatment system in Mandalay. Output 3 will cover project implementation support, capacity development for urban services management, and awareness programs for the residents on health and environment.

The project integrates a biogas-generating system with sludge stabilization as part of the wastewater treatment plant. Biogas generated in the sludge-digesting process will be used to produce electricity, which will power the wastewater treatment plant. The wastewater treatment plant is expected to be carbon-neutral and at least 50% energy self sufficient. Sludge from the digester will be stabilized for potential reuse in agriculture and/or material reuse in cement works. Training will be conducted for Mandalay City Development Committee to ensure effective operation of this system.

Total Grant Amount: \$60 million (ADF)
Clean Energy Investment: \$2 million
Project Category: Demand-side energy efficiency
Energy Savings: 3.716 gigawatt hours/year
Greenhouse Gas Emission Reduction: 13,167 tCO₂/year
Board Approval: 12 November 2015
Project Life: 20 years

Impact • Improved urban environment and public health in Mandalay

Outcome • improved access to sustainable urban services in Mandalay

Outputs • Improved water supply systems
• Improved wastewater and drainage management
• Strengthened capacity for urban services management

Division Urban Development and Water Division, SERD

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Executing Agency Mandalay Regional Government

Loan Numbers: 3363/3364/8302-VIE

Project Number: : 40080-025

Ha Noi Metro Line System Project
(Line 3: Nhon-Hanoi Station Section)
(Additional Financing)

Rationale

The 2009 approved feasibility study estimated the overall project cost at \$990.5 million. Detailed design and updated cost estimates were completed by the project implementation consultant in March 2012 under DGT (Direction Générale du Trésor/General Directorate of Treasury) financing. However, delays and cost increases caused by design changes, audits, incompetent contractors, removal of existing utility lines, preparation and implementation of resettlement plans and site clearance, as well as continued price escalation, has raised the project cost to the current estimate of \$1.375 billion. The Government of Viet Nam approved the revised Project Outlines on 5 and 23 December 2014, which authorize increases in official development aid financing. This will ensure that the project will complete in 2019 by promptly addressing unexpected constraints using the additional financing to achieve the government's economic development objectives addressed in the Ha Noi Urban Transport Master Plan.

Description

The Ha Noi Metro Rail System Project (Line 3: Nhon - Ha Noi station section) is to develop: (i) a 12.5 kilometer (km) long dual track rail line from Nhon to Ha Noi main railway station ; and (ii) electrical and mechanical (E&M) systems, including all railway systems required to operate a modern metro line. In addition, support will be provided for detailed design, procurement, construction supervision, design verification, project management and capacity development.

Total Grant Amount: \$59 million (OCR)
\$5.8 million (ADF)
\$50 million (CTF)

Clean Energy Investment: \$114.8 million

Project Category: Demand-side energy efficiency

Energy Savings: no available data

Greenhouse Gas Emission Reduction: no available data

Board Approval: 11 December 2015

Project Life: 35 years

- Impact** • An integrated sustainable public transport system in six districts of Ha Noi
- Outcome** • Competitive metro rail services along the project corridor
- Outputs** • Metro line 3 is operational
• Improved implementation capacity of Ha Noi Metropolitan Railway Management Board

Division Transport and Communications Division, SERD

Project Team

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Executing Agency Ha Noi People's Committee

Appendix 1: 2015 Grant-Financed Clean Energy Projects

Grant Number	DMC	Department and Division	Project Officer	Project Name	Sector and Clean Energy Category	Total Amount (\$ million)	Clean Energy Investment (\$ million)	Funding Source
468	CAM	Energy Division, SERD	Rehan Kausar	Medium Voltage Sub-Transmission Expansion Sector – Additional Financing	Energy/Supply-side energy efficiency	1.00	1.00	CEFPF
336	CAM	Energy Division, SERD	Rehan Kausar	Rural Energy Project	Energy/Demand-side energy efficiency	0.36364491	0.36	Australian Government
471	LAO	Transport Division, SERD	Jeffrey Miller	Vientiane Sustainable Urban Transport Project	Transport/Demand-side energy efficiency	1.84	1.84	GEF
429	MLD	Energy Division, SARD	Len George	Preparing Outer Island for Sustainable Development – Additional Financing	Energy/Renewable energy	5.00	5.00	JFJCM
456	SAM	Energy Division, PARD	Woo Yul Lee	Renewable Energy Development and Power Sector Rehabilitation – Additional Financing	Energy/Renewable energy	5.06	5.06	European Union
457	SAM	Energy Division, PARD	Woo Yul Lee	Renewable Energy Development and Power Sector Rehabilitation – Additional Financing	Energy/Renewable energy	2.49	2.49	New Zealand
444	TON	Energy Division, PARD	Woo Yul Lee	Outer Island Renewable Energy Project – Additional Financing	Energy/Supply-side energy efficiency	1.44	0.05	ADF
445	TON	Energy Division, PARD	Woo Yul Lee	Outer Island Renewable Energy Project – Additional Financing	Energy/Supply-side energy efficiency	3.57	0.12	European Union
446	TON	Energy Division, PARD	Woo Yul Lee	Outer Island Renewable Energy Project – Additional Financing	Energy/Supply-side energy efficiency	0.75	0.03	Second Danish Cooperation Fund for Renewable Energy

ADF = Asian Development Fund, CAM = Cambodia, CEFPF = Clean Energy Financing Partnership Facility, GEF = Global Environment Facility, JFJCM = Japan Fund for the Joint Crediting Mechanism, LAO = Lao People's Democratic Republic, MLD = Maldives, PARD = Pacific Department, SAM = Samoa, SARD = South Asia Department, SERD = Southeast Asia Department, TON = Tonga.

Appendix 2: 2015 Sovereign and Nonsovereign Projects with Clean Energy Components

Loans and Investments				
DMC	Loan/ Investment No.	Project Name	Total Amount (\$ million)	Clean Energy Investment (\$ million)
Sovereign Projects				
Energy Sector				
BAN	3350	Power System Expansion and Efficiency Improvement Investment Program – Tranche 3	205	50
IND	3327	Assam Power Sector Investment Program – Tranche 2	48	18
IND	3365	Power Grid Corporation of India Limited (Green Energy Corridor and Grid Strengthening Project)	500	155.33
INO	3303	Sustainable and Inclusive Energy Program (Subprogram 1)	500	291.65
INO	3339	Electricity Grid Strengthening – Sumatra Program	600	180
PAK	3328/3329	Second Power Distribution Enhancement Investment Program – Tranche 1	400	102.43
PAK	3321	Sustainable Energy Sector Reform Program (Subprogram 2)	100	10
PAK	3322	Sustainable Energy Sector Reform Program (Subprogram 2)	300	30
PRC	3308	Chemical Industry Energy Efficiency and Emission Reduction Project	100	95
PRC	3356	Beijing-Tianjin-Hebei Air Quality Improvement – Hebei Policy Reform Program	300	117.70
PRC	3358	Qingdao Smart Low-carbon District Energy Project	130	89.83
UZB	3286	Advanced Electricity Metering Phase 4 Project	300	44.11
UZB	3285	Northwest Region Power Transmission Line	150	17.05
Nonenergy Sectors				
BAN	3301	Railway Rolling Stock Project	200.00	200.00
IND	3337	North Eastern Region Capital Cities Development investment Program – Tranche 3	80	21.92
IND	3307	Accelerating Infrastructure Investment Facility in India – Tranche 2	300	159
LAO	3250	Vientiane Sustainable Urban Transport Project	50	50.00
MYA	3316	Mandalay Urban Services Improvement Project	60.0	2.0
PRC	3277	Hubei Enshi Qing River Upstream Environment Rehabilitation Project	100	2.03
PRC	3262	Xinjiang Akesu Integrated Urban Development Improvement project	150	25.9
PRC	3263	Xinjiang Tacheng Border Cities and Counties Development Improvement project	150.0	30.49
PRC	3296	Henan Sustainable Livestock Farming and Product Safety Demonstration Project	69.0	10.00

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Appendix 2 *continued*

Loans and Investments				
DMC	Loan/ Investment No.	Project Name	Total Amount (\$ million)	Clean Energy Investment (\$ million)
VIE	3363	Ha Noi Metro Line System Project (Line 3: Nhon-Hanoi Station Section) (Additional Financing)	59.00	59
VIE	3364	Ha Noi Metro Line System Project (Line 3: Nhon-Hanoi Station Section) (Additional Financing)	5.80	5.80
VIE	8302	Ha Noi Metro Line System Project (Line 3: Nhon-Hanoi Station Section) (Additional Financing)	50.00	50.00
Subtotal (Sovereign Projects)			4,906.8	1,817.23
Nonsovereign Projects				
Energy Sector				
IND	8298	Simpa Energy Private Limited (Off-Grid Prepaid Solar Leasing Project)	6.0	6.0
IND	7467/3375	Power Grid Corporation of India Limited (Green Energy Corridor and Grid Strengthening Project)	500	155.33
PAK	7445/3252	Mira Power Limited (Gulpur Hydropower Project)	65.0	65.0
PHI	7442/3246	EDC Burgos Wind Power Corporation (150 MW Burgos Wind Farm Project)	20.0	20.0
THA	7362/3366	Northeastern Thailand Wind Power Project – Banchuan Development	31.5	31.5
THA	7363/3367	Northeastern Thailand Wind Power Project – Benjarat Development	31.5	31.5
THA	7364/3368	Northeastern Thailand Wind Power Project – Nayangklak Development	31.5	31.5
THA	7365/3369	Northeastern Thailand Wind Power Project – Nayangklak Wind Power	31.5	31.5
THA	7366/3370	Northeastern Thailand Wind Power Project – Pongnok Development	31.5	31.5
THA	8301	Northeastern Thailand Wind Power Project	18.9	18.9
Nonenergy Sector				
PHI	7551/3266	AP Renewables Inc. (Tiwi and Makban Geothermal Power Green Bonds Project)	221.807	221.807
Subtotal (Nonsovereign Projects)			989.2	644.54

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Appendix 2 *continued*

Grants				
DMC	Grant Number	Project Name	Total Amount (\$ million)	Clean Energy Investment (\$ million)
Energy Sector				
CAM	468	Medium Voltage Sub-Transmission Expansion Sector – Additional Financing	1.00	1.00
CAM	336	Rural Energy Project	0.36364491	0.36
MLD	429	Preparing Outer Island for Sustainable Development – Additional Financing	5.00	5.00
SAM	456	Renewable Energy Development and Power Sector Rehabilitation – Additional Financing	5.06	5.06
SAM	457	Renewable Energy Development and Power Sector Rehabilitation – Additional Financing	2.49	2.49
TON	444	Outer Island Renewable Energy Project – Additional Financing	1.44	0.05
TON	445	Outer Island Renewable Energy Project – Additional Financing	3.57	0.12
TON	446	Outer Island Renewable Energy Project – Additional Financing	0.75	0.03
Nonenergy Sector				
LAO	471	Vientiane Sustainable Urban Transport Project	1.84	1.84
Subtotal (Grants)			21.51	15.95
Total			5,917.52	2,477.72

BAN = Bangladesh, CAM = Cambodia, IND = India, INO = Indonesia, LAO = Lao People's Democratic Republic, MLD = Maldives, MYA = Myanmar, PAK = Pakistan, PHI = Philippines, PRC = People's Republic of China, SAM = Samoa, THA = Thailand, UZB = Uzbekistan, VIE = Viet Nam.

2015 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 2015, condensing information from project databases and formal reports in an easy-to-reference format. This report was prepared by ADB's Clean Energy Program which provides the cohesive agenda that encompasses and guides ADB's lending and nonlending assistance, initiatives, and plan of action for sustainable growth in Asia and the Pacific.

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