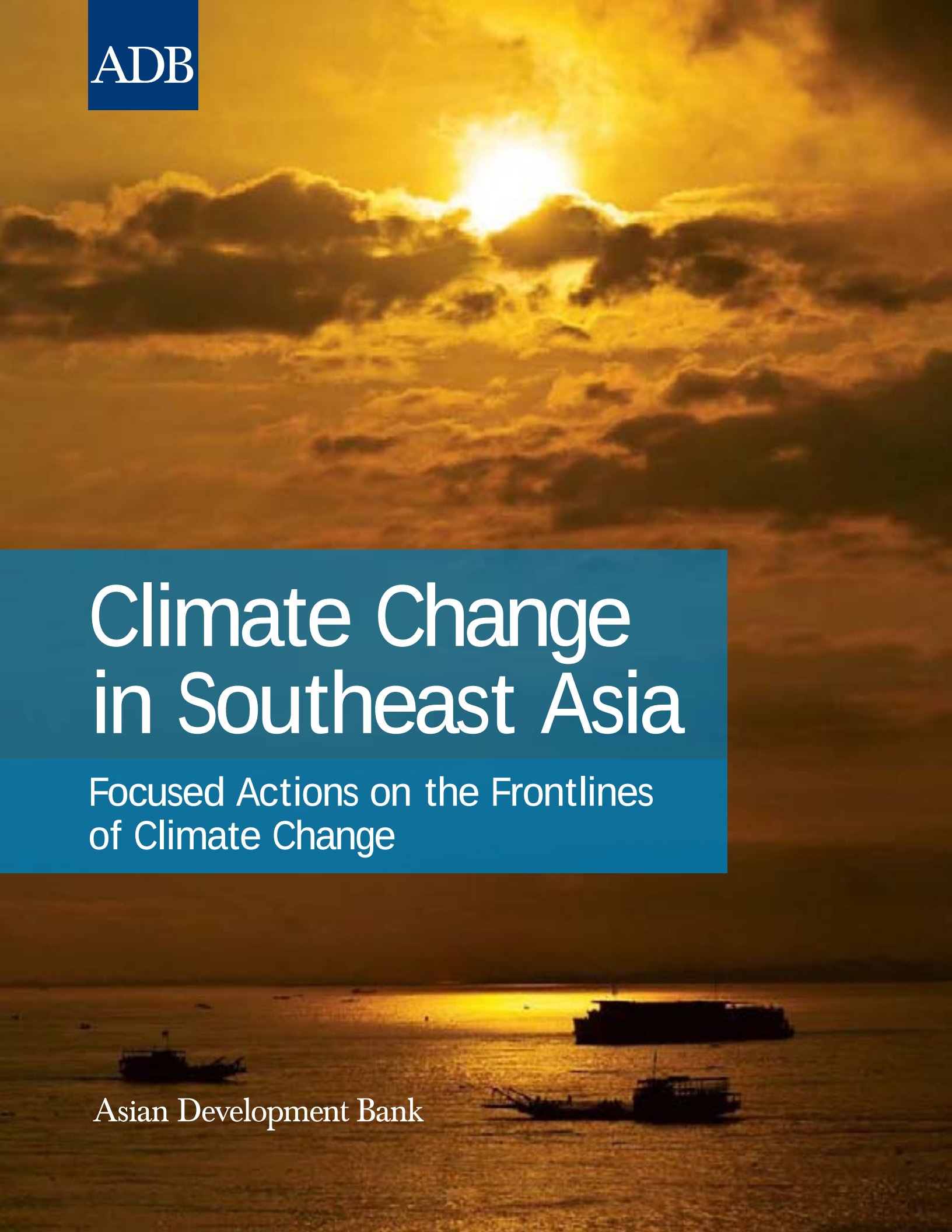

ADB

Climate Change in Southeast Asia

Focused Actions on the Frontlines of Climate Change

Asian Development Bank

Contents

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Note: In this publication, "$" refers to US dollars.

FOREWORD

Southeast Asia is on the frontlines of efforts to counter climate change and its impacts. The countries of the region, spread across archipelagos, river basins and forests, are home to some of the world's most spectacular natural and cultural diversity. With much of the population and infrastructure located in coastal and river delta areas, hundreds of millions of people are at great risk from the impacts of climate change. The region's aggressive economic development plans in turn could further exacerbate the problems. Energy-related emissions, though currently low, are expected to more than double by 2030. Sprawling megacities and spreading agricultural lands lead to land use conversion and forest loss, which will continue to be a major source of greenhouse gas emissions.

In response, the Southeast Asian countries are moving quickly to counter this significant threat to their economic future. Policy measures, technology options, financial innovations, and public campaigns are being increasingly channeled towards mitigating greenhouse gas emissions and adapting to climate change. Examples include Indonesia's voluntary pledge to lower national emissions by 26% by 2020 (or up to 41% with international financial support) and efforts to access international donor funds for renewable energy and forest protection; Viet Nam's bold national strategy of requiring every ministry, province and city to develop climate change action plans; and Thailand's efforts to mainstream renewable energy and efficiency measures through aggressive incentives and targets.

To varying extents, all developing member countries in the region have been successful in mobilizing financing from the Climate Investment Funds to achieve their objectives. Four countries in the region—Indonesia, the Philippines, Thailand, and Viet Nam—have successfully prepared clean technology investment plans to mobilize more than $10 billion to enhance energy efficiency, renewable energy, and sustainable transport. Also in place are a Forest Investment Program for Indonesia and the Lao PDR, and a Pilot Program for Climate Resilience in Cambodia.

In tandem, the Southeast Asia Regional Department (SERD) of the Asian Development Bank (ADB) has responded rapidly and comprehensively to assist developing member countries to realize their ambitious plans and programs. SERD is mainstreaming climate change in all its operations and efforts are under way to integrate climate change concerns into new country partnership strategies and sector assessments, strategies, and roadmaps. The country partnership strategies include technical assistance programs that tackle the knowledge and capacity-building needs of the various sectors and related government agencies and substantial investments that will lower future greenhouse gas emissions while enhancing resilience to climate change.

ADB's portfolio in Southeast Asia includes such diverse activities as promoting energy efficiency; increasing investments in renewable energy; supporting more efficient lower-carbon public transport and urban waste management systems; and reducing emissions from deforestation and land degradation. ADB is helping to develop analytical approaches and tools for large-scale adaptation planning at the local and regional levels, and investing in the climate-proofing of infrastructure including rural roads, water utilities, urban highways and power plants.

ADB's assistance brings to bear the best available science and industry knowledge, and makes the most of existing regional cooperation programs. ADB's own resources are modest relative to the needs of the region, but substantial amounts have been raised to fund climate change-related efforts through collaboration with development partners, multilateral financing sources, and the private sector.

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Introduction

This publication identifies the significant issues and challenges being faced by countries in Southeast Asia, and highlights emerging responses and best practices. It describes how Asian Development Bank (ADB) is working closely with developing member countries to support their efforts to shift to a low-carbon growth trajectory while also building resilience to the projected impacts of climate change.

Consistent with ADB's Strategy 2020 to incorporate environmental sustainability in the fight against poverty, climate change efforts are guided by five strategic priorities:

- expanding the use of clean and renewable energy;
- encouraging sustainable transport and urban development;
- promoting climate-resilient development, especially in the agriculture and water-dependent sectors;
- strengthening policies, governance and capacities; and
- managing land use and forests for carbon sequestration.

• Rice planting in Lao PDR

• Silk cocoons, Hanoi, Viet Nam

Climate Change as a Key Risk to Economic Development

Climate change in Southeast Asia is expected to lead to significant variations in precipitation patterns, increased incidence of severe weather events, higher temperatures, and sea-level rise in many highly populated coastal regions. These changes will negatively impact agricultural yields, biodiversity, forest harvests, and availability of clean water. It will also lead to a greater incidence of diseases such as malaria and dengue fever. An increased demand for energy and water could strain the ability of urban infrastructure systems to deliver essential services. These impacts cumulatively could slow economic development, causing economic losses of $230 billion, or an equivalent of 6.7% of gross domestic product (GDP), each year by 2100—more than twice the global average loss of 2.6%—and endanger the livelihoods of millions of people.

Water Resources

The region is increasingly subject to floods and susceptible to stronger tropical cyclones and storm surges. Extreme weather events are expected to increase in intensity and frequency, causing extensive damage to property, productive assets, human life, and livelihoods. Flooding in low-lying populated areas such as coastal regions and river basins will affect farmland and settlements, and damage infrastructure such as roads and bridges. During the dry season, prolonged droughts are a concern, particularly during El Niño years, with longer summers, rising temperatures and less rainfall decreasing water levels in rivers, dams, and other reservoirs. This leads to crop failure, and imperils food security and water availability for consumption, irrigation, and hydropower generation in areas where demand pressures from society are increasing.[1]

The Intergovernmental Panel on Climate Change (IPCC) warns that Southeast Asia is particularly vulnerable to sea-level rise and changes to its water resources regime. Without urgent action, mean temperatures could rise by 4.8°C and sea level by up to 70 cm by 2100 from 1990 levels. A projected 40-cm sea-level rise by 2080 could force up to 21 million people (IPCC, 2007) in the region, including about 10% of the residents in the Mekong Delta (Institute for Global Environmental Strategies, 2008), to be displaced. Sea-level rise will also cause saltwater intrusion into coastal and groundwater resources, threatening supplies of fresh water for drinking and irrigation.

[1] ADB. 2009. *The Economics of Climate Change in Southeast Asia: A Regional Review.* Manila

• Sermo dam, Indonesia

Agriculture and Ecosystems

The region has about 115 million hectares of agricultural land planted mainly to rice, maize, oil palm, natural rubber, and coconut. It is a major producer and supplier of grains and the largest producer of palm oil and natural rubber in the world. Increasing heat and water stresses, extreme weather events, and climate-associated pests and diseases have all contributed to the decline in agricultural production potential in many parts of the region. Thousands of hectares devoted to rice production have been damaged by frequent flooding in the Red River Delta, Central Region, and Mekong Delta. Rising sea levels have accelerated salt water intrusion in agricultural areas, causing considerable loss in arable lands.[2] Consequently, the decline in grain production and industrial crops will impact the livestock industry and other emerging industries that depend on natural resources. For example, by 2100, higher temperatures are likely to cause rice yield potential to decline by up to 50% on average compared to 1990 levels, prompting conversion of even more land to agriculture.

These effects are exacerbated by the need for an even greater increase in agricultural production to meet increased demand for food. ADB estimates that in order to supply the domestic and foreign markets, the region must increase rice production by an average of 2.5% per year and double palm oil production. This intensification of agricultural production will lead to both the conversion of land for cultivation and competition with industry and urban areas for water needed to maintain aquatic ecosystems.[3]

[2] ADB. 2009. *The Economics of Climate Change in Southeast Asia: A Regional Review*. Manila

[3] R. M. Johnston et al. 2010. *Rethinking agriculture in the Greater Mekong Subregion: how to sustainably meet food needs, enhance ecosystem services and cope with climate change*. International Water Management Institute.

• Farmer maintaining irrigation canal, Indonesia

• Lahendong geothermal power plant in Manado, Indonesia

Forest Resources

Southeast Asia, with 203 million hectares of forests, accounts for 5.2% of the global total. Expansion of large-scale commercial crops is a significant driver of deforestation in the region, especially as food grain prices rise and oil palm cultivation grows to meet the rising demand for biodiesel. In the early 2000s, about 3 million hectares of peat land in Southeast Asia had been burnt, releasing between 3 to 5 petagrams of carbon (PgC). Draining of peat lands has affected an additional 6 million hectares and released a further 1 to 2 PgC.[4]

Current climate extremes have contributed to an increase in disasters such as fires, landslides, floods, and droughts, which have in turn affected these forests. Over the past 20 years, forest fires have intensified and spread over larger areas. This is attributed largely to the combined effects of rising temperatures, declining rainfall, and more aggressive land use change. In the region, the rate of deforestation among natural forests is faster than in planted forests. This is even more damaging since natural forests have greater carbon sequestration potential and provide more ecosystem services than monoculture planted forests. In some parts of the region, climate change could also trigger the replacement of subtropical moist forests by tropical savannah and shrub lands with low or no carbon sequestration potential. The region is home to some of the planet's most endangered wild species, in addition to hundreds of newly discovered species.[5] Endemic flora and fauna are vulnerable to all these stresses due to loss and disturbance of their habitats.

4 2007. M. Parry. Intergovernmental Panel on Climate Change. Working Group II
5 WWF. 2010. New Blood: Greater Mekong New Species Discoveries

Coastal and Marine Resources

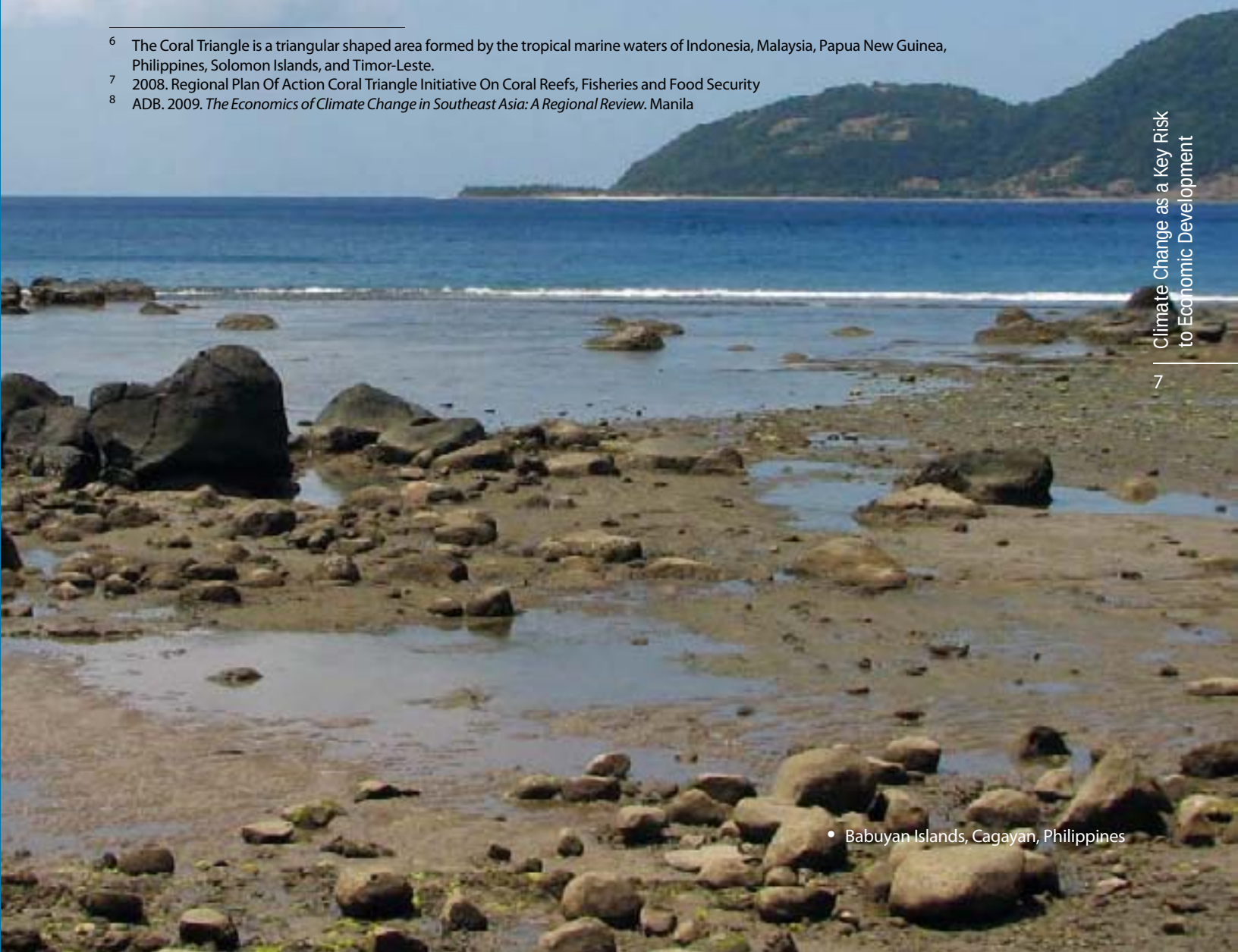
Rising temperatures and sea levels, and extreme weather events threaten to severely impact coastal and marine resources, and the industries and activities that rely on them. In 2005, the estimated population living within 100 km of the coast reached about 452 million people, equivalent to about 79% of the region's total. Fully one-third of the inhabitants within the Coral Triangle [6]—more than 120 million people, particularly those living in coastal communities—depend directly on local marine and coastal resources for their income, livelihoods, and food security.[7] Coastal aquaculture has been the most important fishery activity in Southeast Asia, with more than 30,000 households spread over 64,000 hectares earning a livelihood from shrimp farming.[8] Rising temperatures also lead to a reduction in fish production, threatening the entire region's potential as the world's largest producer of fish and marine products.

Marine ecosystems are highly vulnerable to climate change. Warmer temperatures are leading to increased rates of coral bleaching or the loss of the normal healthy color of the corals, owing to the breakdown of the symbiotic relationship between corals and the algae that provide it with food. Climate change will also likely contribute to the gradual destruction of mangrove vegetation, coastal sea life, and degradation of prized tourism destinations, thus threatening major economic activities. Advancing sea levels and coastal erosion are causing mangrove forests to retreat in order to maintain their preferred environmental conditions. The IPCC projected that with a 1 meter rise in sea level; about 2,500 square kilometers of mangroves in Asia are likely to be lost.

6 The Coral Triangle is a triangular shaped area formed by the tropical marine waters of Indonesia, Malaysia, Papua New Guinea, Philippines, Solomon Islands, and Timor-Leste.

7 2008. Regional Plan Of Action Coral Triangle Initiative On Coral Reefs, Fisheries and Food Security

8 ADB. 2009. *The Economics of Climate Change in Southeast Asia: A Regional Review*. Manila



• Babuyan Islands, Cagayan, Philippines

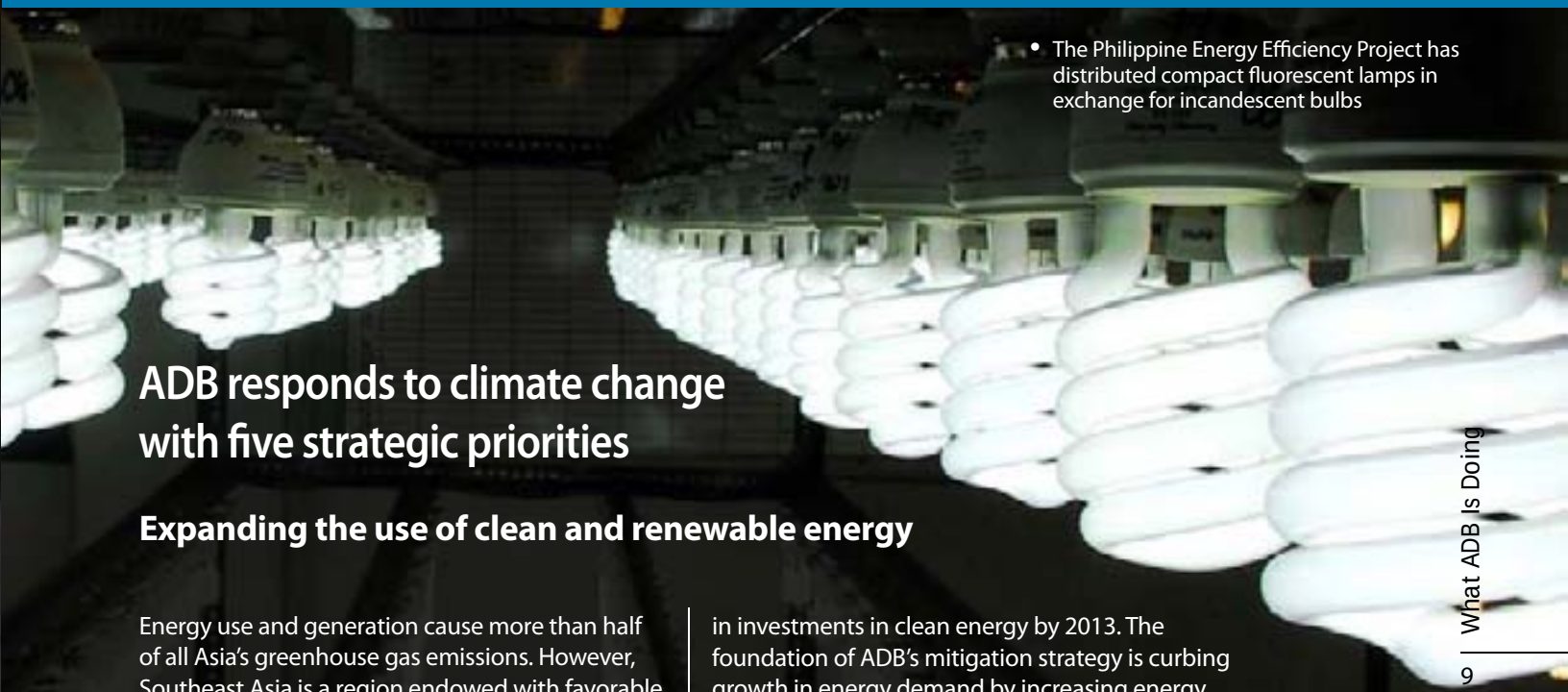
Health

According to the World Health Organization, climate change will have serious and damaging impacts on human health in Southeast Asia. Outbreaks of vector-borne infectious diseases (dengue and malaria), water-borne diseases (diarrhea and cholera), and respiratory diseases have risen in recent years, with a strong correlation to the El Niño phenomenon and worsening floods and droughts. Some other possible direct threats from climate change include heat stress and malnutrition. Several of these impacts (especially heat-related and respiratory illnesses) are exacerbated by the urban heat island effects and increased local air pollution that results from energy-related emissions and urbanization.

In Southeast Asia, those at greatest risk include the very young, elderly, and medically frail. Low-income countries and areas where malnutrition is widespread, education is poor, and infrastructure is weak will have the most difficulty adapting to climate change and related health hazards. Vulnerability is also determined by geography, and is higher in areas with a high endemicity of climate-sensitive diseases, water stress, low food production and isolated populations such as those living on islands, mountainous regions, megacities, and coastal areas. Also, there is insufficient awareness among the general public about the impact of climate change on health, leaving populations vulnerable to exposure and malnutrition when impacts strike.

• Vietnamese family, Hanoi, Viet Nam

What ADB Is Doing



• The Philippine Energy Efficiency Project has distributed compact fluorescent lamps in exchange for incandescent bulbs

ADB responds to climate change with five strategic priorities

Expanding the use of clean and renewable energy

Energy use and generation cause more than half of all Asia's greenhouse gas emissions. However, Southeast Asia is a region endowed with favorable conditions and topography for promoting renewable power generation. Clean energy projects have the potential to mitigate 475 metric tons of CO_2 equivalent each year by 2020.[9] That is 40% of energy-related CO_2 emissions produced if business were to go on as usual. Fuel switching, renewable sources, and carbon capture and storage can mitigate another 40% at a cost less than 1% of GDP. Efficiency can also be improved in energy-intensive sectors such as power, cement, iron, and steel.

Southeast Asia's efforts to harness its enormous potential for renewable energy will be scaled up to realize ADB-wide the goal of reaching $2 billion in investments in clean energy by 2013. The foundation of ADB's mitigation strategy is curbing growth in energy demand by increasing energy efficiency and meeting energy needs through low-carbon options, working in collaboration with industry associations, domestic banks, and specialized energy efficiency agencies and energy service companies. Areas targeted for energy efficiency are the commercial, industrial, and residential sectors, as well as at the municipal level. Carbon capture and storage (CCS) is considered a promising new approach to significantly lower carbon emissions from power plants, natural gas operations, and industrial facilities. ADB is undertaking a scoping analysis in Indonesia, Philippines, Thailand, and Viet Nam to determine the potential for CCS, and develop a roadmap for the first demonstration project.

[9] ADB. 2009. *The Economics of Climate Change in Southeast Asia: A Regional Review.* Manila

Encouraging sustainable urban development and transport

Southeast Asia's urban population is growing at an unprecedented rate, 1.75 times faster than the world average. In 2010, 48.2% of Southeast Asians live in urban areas and by 2030 this is projected to increase to 61.8%.[10] Three of its capitals—Bangkok, Jakarta, and Metro Manila—have populations of over 10 million people, and have been ranked by the United Nations Environment Programme (UNEP) among the world's most polluted mega-cities. The region's high rates of economic growth and personal motorization are driving up its greenhouse gas emissions.

ADB supports the development of sustainable urban infrastructure that leads to competitive and liveable cities with reduced carbon footprints. Priorities are green space, energy efficient buildings and water supply, and reductions in greenhouse gas emissions from urban transport through the development of environmentally sustainable and efficient public transport systems, better urban planning and land use choices, and better solid waste management policies in urban areas. The Cities Development Initiative for Asia (CDIA) is a regional partnership program supported by ADB and the governments of Germany, Sweden, and Spain to assist medium-sized Asian cities to bridge the gap between their development plans and the implementation of their infrastructure investments. The CDIA will provide technical support to cities in areas where current modes of development assistance are unavailable.

Through its Carbon Market Program, ADB will also help develop projects under the Clean Development Mechanism (CDM)—a market-based arrangement under the Kyoto Protocol that allows industrialized countries with greenhouse gas reduction commitments to purchase carbon credits from developing countries to meet their commitments. Through its Sustainable Transport Initiative, ADB is realigning its investments in the sector to reduce greenhouse gas emissions while also addressing concerns over local air quality, congestion, and safety. In particular, ADB will move towards rail and public transport systems coupled with sound urban mobility planning, away from the emphasis on investments in roads and highways.

[10] UN. 2008. World Urbanization Prospects: The 2007 Revision

• ADB helps in reducing emissions from tricycles in Puerto Princesa, Palawan, Philippines

Promoting climate-resilient development

Climate change will adversely affect the region's watersheds, with millions of hectares of agricultural lands dependent on these areas for irrigation, and growing settlements relying on these stressed resources for consumption and energy. This results in highly vulnerable sectors under immense strain from human exploitation, compounded by escalating climate change impacts. ADB provides policy and technical guidance to address climate change and variability in agriculture, infrastructure, transport, health, water, and other sectors. ADB's water sector initiatives are designed and planned to cope with the impacts of climate change by reducing water losses and applying integrated water resources management to improve the resilience of communities and economies to climate change.

ADB projects involved in planning and managing for irrigation, flood management, and drinking water provisions need to incorporate climate change risks into their regular practices for designing water structures and measures. In the region, ADB's climate resiliency programs deal with river basin management, water conservation, rural infrastructure, coastal highways and power utilities. The Water for All initiative supported by ADB's Water Financing Partnership Facility works to increase investments in rural water supply, urban sanitation and basin-wide regional cooperation and support reforms, capacity development, and regional cooperation in the water sector. ADB is also helping to coordinate the efforts of various water institutions such as the Asia-Pacific Water Forum and the Regional Water Knowledge Hub for Water and Climate Change Adaptation in Southeast Asia.

• The Nam Theun 2 Hydropower Project in Lao PDR

Strengthening policies, governance, and capacities

Ensuring successful climate change programs and projects also depends on acceptance and administration at the national and sub-national levels. ADB works to strengthen good governance and policies in support of climate change mitigation and adaptation. Capacity building is bolstered at many levels, from assisting government ministries in crafting climate supportive policies to helping country stakeholders better understand climate science and good practices required to properly respond to country-specific needs.

In the region, ADB is working on mainstreaming climate change into energy and water development plans. Policy reforms for improved energy efficiency, renewable energy, and climate risk management are also being promoted alongside sectoral approaches and the establishment of greenhouse gas inventories for priority industries. ADB will assist countries to access carbon financing for clean energy and other greenhouse gas mitigation projects that qualify under the CDM. To bring in innovative financing options for scaling up clean energy, ADB promotes the use of carbon markets to leverage investments for low-carbon technology. Building capacity in the sector is not limited to knowledge transfer but also includes transferring skills, organizing and facilitating workshops and seminars in the region, supporting the CDM approach to increase economies of scale for regional mitigation, and promoting projects that generate joint mitigation and adaptation benefits such as in the land use and forestry sector.

- The new micro hydropower plants, which operate under environmentally friendly renewable-energy plans, Negros Occidental, Philippines

Managing land use and forests for carbon sequestration

Greenhouse gas emissions from deforestation and land use change are the region's major contributor to global climate change. Southeast Asia offers many low-cost opportunities for greenhouse gas mitigation in the land use, land-use change and forestry (LULUCF) sector, demonstrating the greatest potential for reducing global emissions (by about 40% in Indonesia, Philippines, Thailand, and Viet Nam for 2000–2050). The IPCC also reported that the potential for technical mitigation in agriculture was highest in Southeast Asia among all other regions in the world.

Improving forest and agricultural land management is one of the most cost-effective ways to reduce greenhouse gas emissions in Southeast Asia. ADB is encouraging countries to conserve forests, reduce land degradation and restore peat lands, and is helping them prepare for and gain access to climate financing, or incentives such as Payments for Ecosystem Services (PES), in exchange for improved management practices.

Through loans and technical assistance, ADB helps countries maximize opportunities to secure people's livelihoods from climate impacts, plus supplement incomes with new sources of revenue from carbon sequestration. In the region, ADB will collaborate with other donors to implement innovative initiatives such as the Forest Investment Program (FIP) and carbon-neutral transport corridors in the Greater Mekong Subregion, support preparation of additional projects for the Forest Carbon Partnership Facility of the World Bank, and implement readiness projects on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD).

• Rainforest in Manado, Indonesia

ADB Responds at the Regional and Country Levels

Regional Programs

The Greater Mekong Subregion (GMS) comprises Cambodia, Lao People's Democratic Republic, Myanmar, Thailand, Viet Nam, and the provinces of Yunnan and Guangxi in the People's Republic of China. In 1992, with ADB's assistance, the six countries entered into a program of subregional economic cooperation that has spurred the development of regional infrastructure and the free flow of resources, goods, and people in the region. Linking ecosystems and economies through this regional corridor has resulted in more community-based and cooperative efforts between the countries to mitigate emissions, protect biodiversity, manage forests, and reduce poverty. The GMS Core Environment Program aims to assess risks and vulnerabilities from climate change, focusing on local livelihoods and ecosystems, agriculture and food security, energy (particularly hydropower), ecotourism, and transport. The potential to channel REDD+ financing to communities will also be explored. The GMS Flood and Drought Risk Management and Mitigation Initiative prepares investment projects to strengthen flood management in the subregion and improve the ability of communities to prepare for and adapt to the negative impact of floods and droughts. The Regional Power Trade Coordination Committee (RPTCC) is paving the way for a regional approach to providing environmentally-friendly power supplies to the member countries by leveraging the resource endowments and comparative advantages of each member country. ADB will initiate a regional technical assistance program in 2011 that will support the GMS Subregional Energy Forum (SEF) and promote sharing of knowledge, experiences, and best practices on renewable energy, energy efficiency, and clean fuels among the member countries.

The Brunei Darussalam-Indonesia-Malaysia-Philippines East ASEAN Growth Area (BIMP-EAGA) initiative was launched in 1994 to close the development gap across the neighboring EAGA member countries as well as the ASEAN

• Tonle Sap lake and river system, Cambodia

member states. The ADB study Strengthening Sound Environmental Management in the BIMP-EAGA promotes the sustainable management of natural resources in one of the world's most resource-rich regions. A subregional environment program has been designed with aims to increase climate resilience, and strengthen policy and institutional conditions for sustainable management of fisheries, coastal and marine resources; promote the sustainable financing of coastal and marine resources management measures; and promote coordination and harmonization of project management. Within the subregion, ADB is supporting the development of viable options for energy trade within the region such as the Malaka–Pekanbaru interconnection and the Sarawak–West Kalimantan interconnection that can help displace inefficient and polluting energy supply with cleaner options.

The Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security (CTI) was launched in 2007 as a program of cooperation between the member countries of Indonesia, Malaysia, Philippines, Timor–Leste, Papua New Guinea, and Solomon Islands to protect the coastal and marine resources of the region, providing social and economic benefits to more than 120 million coastal people dependent on fishing and tourism. The participating governments have collaborated on the development of a regional plan of action that calls for greater cooperation in research, education and policy-building to accelerate development in the region. The Global Environment Facility (GEF) is providing funding for the CTI and ADB serves as the lead agency in coordinating the program of international technical and financial support. ADB is implementing the Strengthening Marine and Coastal Resource Management in the Coral Triangle of the Pacific program by designing a management plan to prevent environmental degradation and prepare for the challenges posed by climate change impacts.

Country Programs

Cambodia

Cambodia ratified the Kyoto Protocol in August 2002 and launched its National Adaptation Programme of Action (NAPA) in 2006. Climate change impact studies have reported increasing episodes of drought and flooding (Royal Government of Cambodia, 2007), thus priority has been given to programs that focus on adaptive management of agriculture, infrastructure, water and coastal ecosystems, forests and land use, health (focusing on malaria prevention), community capacity building, forecasting and surveillance. In April 2006, the National Climate Change Committee was formed to coordinate development and implementation of policies, plans, and measures to address climate change issues. Climate Change concerns will thus be integrated into all agriculture, water management, and rural infrastructure projects. Also in 2006, Cambodia approved its first CDM project, the 1.5 megawatt electrical Angkor Bio Cogen Rice Husk Power Project, designed to use locally available agricultural residue to replace imported fossil oil for power generation and heat. In line with the NAPA, ADB is supporting Cambodia in developing projects to further raise awareness on climate change in the water sector, strengthening climate resilience of infrastructure, restoration of mangrove ecosystems, strengthening of community disaster preparedness, and preventing malaria.

The Pilot Program for Climate Resilience (PPCR) is the first active program under the Strategic Climate Fund (SCF) of the Climate Investment Funds (CIF). The program aims to provide incentives for scaled-up action and transformational change in integrating climate resilience considerations in the country's development strategies and programs and on other ongoing initiatives; and enable learning-by-doing and sharing of lessons and good practice at country, regional, and global levels. Cambodia has been selected for participation in the PPCR as one of nine pilot countries and two regions. Steps have been taken by ADB and the World Bank Group to develop a program of

• Women Development Center, Cambodia

support that will rapidly increase Cambodia's capacity and experience to integrate climate adaptation concerns in development planning. The PPCR will aim at national and subnational mainstreaming, and in integrating climate change concerns into private sector operations.

Upgrading the country's energy grid of small, isolated power system based on diesel generators, ADB's Second Power Transmission and Distribution Project complements previous investments in transmission and distribution facilities. A reliable electricity supply will allow for the decommissioning of existing diesel generators, reducing greenhouse gas emissions. A conservation strategy was developed as part of a regional program supported by ADB to identify biodiversity corridors to offset the impact of economic development. The pilot project covers areas and watersheds that provide water supply, climate regulation, and abundant fisheries for hundreds of thousands of people. The goal is to restore and maintain the ecological integrity of areas including the Cardamom and Elephant Range landscape through improved management of core areas for biodiversity conservation and watershed protection and development of sustainable-use corridors that connect existing protected areas.

With Nordic Development Fund support, pilot activities on enhancing climate-resilience of water infrastructure and provincial roads are in preparation. ADB is helping finance a major upgrade of rural roads in some of Cambodia's poorest provinces as part of a project that will also address growing road safety and climate change challenges. The Rural Roads Improvement Project will pave over 500 kilometers of roads in seven provinces, located mostly around the Tonle Sap Basin, and will also aim to develop pilot programs for early warning and emergency management planning systems, as well as water capture and storage systems to cope with an expected increase in floods and droughts.

Indonesia

The Indonesian government ratified the Kyoto Protocol in December 2004 and has identified its Ministry of Environment as the lead agency in implementing its climate change response efforts. In December 2007, Indonesia launched its NAPA to guide institutions towards a coordinated and integrated approach to combating climate change. The focus areas for Indonesia's mitigation strategies are the energy; land use, land use change, and forestry (LULUCF); and marine sectors; while its adaptation efforts are focused on monitoring and information, water resources, food security, integrated coastal management, biodiversity and forests, human health, and resilient infrastructure. The government has also envisioned the Kampung Iklim, a village built and designed with climate change issues taken into consideration. Indonesia has set an ambitious emissions reduction target of 26% below business as usual projections by 2020, and as much as 41% with international support. This shall be attained through policies that step up investment in renewable energy, such as geothermal power, and curb emissions from deforestation and changes in land use.

The Heart of Borneo (HoB), which straddles Indonesia, Malaysia, and Brunei Darussalam contains the largest contiguous forest area remaining in Southeast Asia and is one of the most biologically diverse habitats on Earth. In support of the HoB Initiative, ADB has submitted a proposal to the GEF on Sustainable Forest and Biodiversity Management in Indonesian Borneo to support Indonesia's action plan under the HoB strategic framework for the management of Indonesia's Borneo forest resources for biodiversity conservation, forest conservation, and reduction in greenhouse gas emissions. Further support has been provided from the ADB Climate Change Fund for the development and adoption of systems and measures to promote reduced emissions from deforestation and degradation (REDD), laying the groundwork for future financing under the REDD forest carbon market. Indonesia's conservation efforts are also being supported by the FIP and the Coral Reef Rehabilitation and Management Program.

• A lady farmer passing through the Sermo Dam, Indonesia

Deforestation has caused an increase in water-related disasters such as floods, landslides, and droughts. Such is the case in the Citarum River Basin, where forest ecosystems are shrinking and limited water resources are stressed by growing demand from settlements. Since agriculture is the main driver of household income in the river basin, ADB's Integrated Citarum Water Resources Management Program reduces poverty and improves living standards by effectively developing and maintaining water resource infrastructure that incorporates climate change adaptation needs, promoting efficient water use, improving resilience to disasters, and empowering communities to participate in water planning and management.

With ADB assistance, the government has started identifying available funds and projects in renewable energy with CDM potential. Only 53% of the Indonesian population is connected to the power grids, with significant losses due to flawed distribution networks.

To enhance energy efficiency and reliability of the power supply, ADB is financing the implementation of the Renewable Energy Development Project and the Power Transmission Improvement (Sector) Project. In concert with other development partners, ADB assisted Indonesia in accessing $375 million in financing from the Clean Technology Fund which would be deployed in conjuction with donor funds and private capital to double geothermal-based power generation and scale up energy efficiency financing in the country. ADB is pursuing a $550 million multitranche financing facility-based loan program to develop 145 MW of power generation capacity, and support the government's plan to develop a revolving fund that will help lower exploration risk on green field sites that are to be developed by the private sector. ADB is also in discussions to support a Climate Change Program loan in cooperation with Japan International Cooperation Agency, Agence Francaise de Developpement, and the World Bank.

Lao PDR

The government of Lao PDR ratified the Kyoto Protocol in February 2003 and demonstrated its commitment to working with the international community to address climate change by putting in place a set of policies and institutions at the national level. Through the Water Resources and Environment Agency, the government prepared its NAPA in 2009 and established its National Climate Change Office and technical working groups to manage its climate change activities. The focus of the Lao PDR government's adaptation efforts are on agriculture, forestry, water resources, and public health. With support from ADB, a national strategy and action plan on climate change has been prepared in 2010. ADB and the Nordic Development Fund are also financing a technical assistance project to enhance the capacity of Lao PDR to cope with the impacts of climate change by building up technical skills and providing policy support for eight working groups of the National Steering Committee on Climate Change, responsible for implementing the country's climate change action plan. ADB is also supporting studies assessing climate change, vulnerability mapping for key economic sectors, critical public infrastructure, urban and industrial development, and sector-based mitigation and CDM opportunities.

With a large number of its people dependent on rain-fed agriculture and marine resources, Lao PDR is highly vulnerable to mounting climate change impacts such as floods, droughts, and cyclones. ADB's Climate Impacts and Adaptation Strategies for the Rural Infrastructure Sector study assessed the impacts and risks associated with climate change-induced flooding on priority rural infrastructure and agricultural outputs in Southern Lao (PDR). In the water sector, ADB's Nam Ngum River Basin Development Sector Project aims to optimize use of water resources by institutionalizing integrated water

• Resettlement village community in Vientiane Province, Lao PDR

resources management; and support investment interventions in relatively degraded parts of the river basin to ensure sustainable watershed management and provide livelihood opportunities for the poor and ethnic groups. In line with the NAPA, ADB also plans to invest in alternative livelihood programs—in particular through the Biodiversity Conservation Corridors Initiative—promoting secondary professions in order to improve farmers' livelihoods, and improving forest and land management. Pilot adaptation options in the water, agriculture and forestry sectors are also in development. The FIP is also mobilizing funds to reduce deforestation and forest degradation and to promote sustainable forest management in the country.

Lao PDR has abundant hydropower resources that generate electricity for local demand or export. The Nam Theun 2 Hydroelectric Project is the largest hydropower project in the country, supported by financing from 27 parties including the World Bank and ADB. The project will produce 1,070 megawatts of clean energy, more than 1.5 times the current generating capacity of the country. About 93% of the electricity generated will be exported to Thailand and the remaining 7% will be available for domestic consumption. Revenues from the project will be used by the Lao government to invest in programs targeted to the country's poor. The project's social and environmental programs have been designed so that the impacted communities and environment will benefit.

However, there remain settlements in mountainous locations where connection to the power grid will be difficult. Through its Small and Mini Hydroelectric Power Development Project and off-grid solar energy projects, ADB is developing approaches to provide clean and renewable electricity generated by hydroelectric power plants and solar home systems to remote rural communities.

• Banaue rice terraces, Philippines

The Philippines

Prior to ratifying the Kyoto Protocol in November 2003, the Philippines had already instituted a number of responses to climate change with a series of policy and legal initiatives as early as 1991. The Inter-Agency Committee on Climate Change was created in order to coordinate various climate change–related activities, propose climate change policies, and prepare positions to the United Nations Framework Convention on Climate Change (UNFCCC) and other related issues. In terms of adaptation, the country has undertaken a range of climate change technical studies in areas such as vulnerability of agriculture, water resources, and coastal areas. In 2001, the Philippines established the Klima Climate Change Center, an information center which has undertaken greenhouse gas mitigation assessment and capacity development under the CDM. In 2007, the Presidential Task Force on Climate Change was also created, and a Philippine Climate Change Response Action Plan (PCCRAP) was released. The Climate Change Act of 2009 was enacted to mainstream climate change into government policies and created a new Climate Change Commission which has drawn up the National Framework Strategy on Climate Change 2010–2022. The country is also utilizing CDM as an opportunity to encourage investments in biogas, methane technologies, and renewable energy.

More than half of Philippine territory is vulnerable to natural disasters and approximately 85% of GDP comes from areas at risk. In the uplands, changes in rainfall patterns are increasing the rate of conversion of forests to agricultural lands due to migration from areas degraded by drought and erosion. ADB's Strengthening Climate Change Resilience in the Integrated Natural Resources and Environmental Management (INREM) Sector Development Program is expected to increase the resilience of upland communities, fragile mountain ecosystems, and river basins to localized climate impacts. Taking a grassroots, holistic community-based approach in climate risk management and adaptation, the program aims to identify natural resources at greatest risk and reduce the vulnerability of these watershed-dependent areas. Opportunities to channel

payments for ecosystem services, including carbon sequestration are being explored with support from ADB's Climate Change Fund.

With estimated potential wind energy capacity of 76,600 MW, the Philippines can breathe new life into renewable low-carbon energy options by tapping this resource. ADB and Japan will fund studies into the feasibility of wind power facilities within the northern Philippines. With the help of private sector investment, ADB's Pasuquin East Wind Farm Development Project is developing a phased 120 megawatt wind farm to augment the country's energy supply. The data and analysis generated by the project will help determine the viability of commercial wind energy operations. ADB expects the Philippine Energy Efficiency Project to reduce the cost of power generation and prevent large amounts of greenhouse gas emissions, thus creating carbon credits under the CDM. The project is estimated to help defer $450 million of investments in new power plants and save about $120 million annually in fuel costs, equivalent to an emission reduction of 250,000 tons of CO_2 per year. Shining a bright spot on energy efficiency, the project will retrofit lighting in government buildings, provide 13 million compact fluorescent lamps to consumers, and implement schemes for energy-efficient public lighting and buildings. ADB assisted in preparing a Clean Technology Investment Plan for the Philippines to mobilize additional funds for promoting solar energy.

Some island and upland communities in remote areas of the country still lack access to electricity, limiting livelihood opportunities and keeping them trapped in poverty. The Renewable Energy and Livelihood Development Project for the Poor in Negros Occidental project provides efficient renewable energy for local communities in off-grid areas of the Philippines. As of June 2009, three micro-hydropower plants have been commissioned, benefiting 270 families, and a $350,000 microcredit fund has been provided to help poor communities acquire household electricity connections and provide livelihood opportunities in 11 off-grid areas.

Thailand

Having ratified the Kyoto Protocol in August 2002, the government of Thailand, through its Ministry of Natural Resources and the Environment prepared its first national strategy on climate change in 2006 and developed a National Strategic Plan on Climate Change for 2008–2012. Thailand's plan focuses efforts on adaptation: building capacity for climate change adaptation and reducing vulnerability; promoting greenhouse gas mitigation activities; supporting research and development on both adaptation and mitigation; raising awareness and public participation; building capacity of relevant institutions and of government officials; and supporting international cooperation. ADB's support to Thailand's government agencies in addressing climate change vulnerabilities has ranged from developing risk assessment and disaster management systems, particularly in the agriculture sector, to help farmers adapt to impacts. As a regional leader in the adoption of energy efficiency programs and renewable energy technologies, Thailand is expected to play a key role in ADB's GMS programs as a provider of knowledge and experience.

The ADB-supported Mainstreaming Energy Efficiency Measures in Thai Municipalities study will improve Thailand's energy security and decrease the rate of greenhouse gas emissions by promoting energy efficiency initiatives. The

study will achieve this by strengthening the capacity of the Provincial Electric Authority and municipalities to identify, design, finance, and implement energy efficiency measures and by piloting energy efficiency projects, which include retrofitting municipal buildings and upgrading public street lighting.

ADB is helping finance the construction of two solar power plants in central Thailand, thus keeping the Thai government in line to achieve its target of getting 20.4% of its primary commercial energy from renewable sources by 2022. The plants are part of ADB's Asia Solar Energy Initiative, which seeks to support projects that will help Asia make the most of its potential to generate solar power. The initiative aims to provide $2.25 billion in financial support to realize 3,000 megawatts of solar power in ADB's developing member countries by mid-2013.

Thailand produces an abundance of agricultural residues. ADB's Biomass Power Project will finance a 125 megawatt biomass power plant that will help diversify the country's energy mix and augment the supply of renewable energy. About 4 million tons of CO_2 equivalent will be saved during the first 10 years of the plant's operation, and significant air quality improvements are expected since this biomass would have otherwise been burnt in the open.

• Chao Phraya River, Bangkok, Thailand

Viet Nam

Following its ratification of the Kyoto Protocol in September 2002, Viet Nam established its Climate Change Country Team and National Technical Expert Team to manage and implement projects regarding climate change issues. The Hydro-Meteorological Service under the Ministry of Natural Resource and Environment has been appointed the national authority for implementing UNFCCC and Kyoto commitments. The government approved a National Target Program (NTP) on Climate Change Response in 2008. Its strategic objectives include assessing climate change impacts, developing feasible action plans to effectively respond to climate change to ensure sustainable development, developing a low-carbon economy, and joining the international community's efforts in mitigating climate change and protecting the climatic system. The Vietnamese government has set aside $143.6 million between 2009 and 2015 to address climate change.

The Ministry of Agriculture and Rural Development has established a standing committee on climate change to help mainstream climate responses and has been actively engaging other donors in a number of initiatives. ADB will support the ministry in assessing sector and provincial climate change options, developing the 2010–2015 planning cycle, and capacity building. ADB's Mekong Climate Change Adaptation technical assistance is developing a detailed assessment of climate risks, impacts, and suitable adaptation options for the energy, transport, and agricultural sectors in Cau Mau and Kiang Gieng provinces. In 2011, ADB will initiate a comprehensive two-year effort to support the Ministries of Industry and Trade, and Transport, and the local governments of urban areas (Da Nang, Ho Chi Minh, and Thanh Hoa) to develop climate change mitigation and adaptation plans in line with the NTP and implement these action plans through development of quantitative tools and aids, implementing policies, guidelines and programs, and institutional strengthening and public awareness campaigns.

The Forests for Livelihood Improvement in the Central Highlands project addresses the problems of forest loss, degradation, and

rural poverty in Viet Nam's Central Highlands by instituting sustainable forest management over one third of the country's natural forest estate. To date, six performance-enhancing, sustainable forest management plans covering over 3 million hectares and timber stocks worth $4.4 billion are operational. About 30,000 hectares of high-yielding plantations have been established, and 99,000 hectares of natural forests are protected, improving the livelihoods of over 80,000 households. The project is enhancing forest planning and management decision-support systems, and strengthening relevant stakeholders' technical, management, and monitoring capacity. ADB also expects this project, and the regional Biodiversity Conservation Corridors Initiative, to mitigate greenhouse gas emissions while supporting the livelihoods of local communities. Global Environment Facility/Special Climate Change Fund projects are also in place to increase the resilience of communities and infrastructure in vulnerable coastal and mountainous rural areas of Viet Nam to climate change impacts.

The Clean Technology Fund investment plan for Vietnam has allocated $150 million to ADB projects in industrial energy efficiency ($50m) and urban transport ($100). ADB's Supporting Implementation of the National Energy Efficiency Program study is expected to promote energy conservation and substantially reduce energy consumption through the establishment of energy-efficient best practices among industries. ADB expects Viet Nam to achieve a target of 8% reduction in the energy consumption of large industrial enterprises by 2015. To improve the quality of urban living and reduce reliance on private modes of travel, the Ho Chi Minh City and Hanoi Metro Rail System studies are developing feasibility analyses for implementing mass rapid transit in these cities and lead to a reduction of emissions from the transport sector. ADB has also completed detailed reports on climate change adaptation options for Ho Chi Minh City as part of its Asian Coastal Mega Cities project.

• Motorbikes in Hanoi, Viet Nam

Going Forward

ADB is in the forefront in assisting the region to mainstream climate change in a wide range of sectors by mobilizing additional finance, developing knowledge products, and enhancing partnerships with other donors. More public awareness, research to fill in knowledge gaps, and better coordination across sectors and levels of government will go a long way toward enhanced adaptive capacity in Southeast Asia. Adaptation actions in climate-sensitive sectors such as water resources, agriculture, coastal and marine resources, forestry, and health must be scaled up by adopting a more proactive approach and integrating adaptation in development and poverty reduction strategies.

The ADB supports Southeast Asia in playing an important part in developing global solutions, with international funding and technology transfer and cooperation as essential components for the success of climate change measures. Regional cooperation will continue to

be an important means through which many cross-boundary issues may be addressed and knowledge and experiences may be shared. ADB will continue to work to identify financing that meets growing country demands. Many development partners have pledged significant funds to tackle climate change and ADB will collaborate with them to promote synergies.

Confronting the issue of climate change offers an opportunity toward developing a sustainable, climate-resilient, and low-carbon economy in Southeast Asia. Because of its wide impact on human development and the natural resource base like no other global challenge, climate change will require sharing programming and implementation knowledge; concerted and coordinated activities, projects, and programs; and stronger collaborative mechanisms and frameworks on adaptation, mitigation, capacity building, technology, and financing.

• Children at play,Champasak Province, Lao PDR

Climate Change in Southeast Asia: Focused Actions on the Frontlines of Climate Change

Southeast Asia is on the frontlines of efforts to counter climate change and its impacts. The countries of the region, spread across archipelagos, river basins, and forests, are home to some of the world's most spectacular natural and cultural diversity. With much of the population and infrastructure located in coastal and river delta areas, hundreds of millions of people are at great risk from the impacts of climate change. The region's aggressive economic development plans in turn could further exacerbate the problems. Sprawling megacities and spreading agricultural lands lead to land use conversion and forest loss, which will continue to be a major source of greenhouse gas emissions.

In response, the Southeast Asian countries are moving quickly to counter this significant threat to their economic future. ADB's efforts in the region include such diverse activities as promoting energy efficiency; increasing investments in renewable energy; supporting more efficient lower-carbon public transport; and reducing emissions from deforestation and land degradation. ADB is also in the forefront in assisting the region to mainstream climate change in a wide range of sectors by mobilizing additional finance, developing knowledge products, and enhancing partnerships with other donors. Confronting the issue of climate change offers an opportunity toward developing a sustainable, climate-resilient, and low-carbon economy in Southeast Asia.

About the Asian Development Bank

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

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

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