ADB

Understanding and Responding to

Climate Change in Developing Asia

Asian Development Bank

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Abbreviations

ADB	–	Asian Development Bank
CACILM	–	Central Asian Countries Initiative for Land Management
CAREC	–	Central Asian Regional Cooperation
CCIP	–	climate change implementation plan
CDIA	–	Cities Development Initiative for Asia
CDM	–	Clean Development Mechanism
CIF	–	Climate Investment Funds
CMI	–	Carbon Market Initiative
CO_2	–	carbon dioxide
DMC	–	develolping member country
GDP	–	gross domestic product
GEF	–	Global Environment Facility
GMS	–	Greater Mekong Subregion
ICARDA	–	International Center for Agricultural Research in the Dry Areas
IFPRI	–	International Food and Policy Research Institute
IPCC	–	Intergovernmental Panel on Climate Change
JICA	–	Japan International Cooperation Agency
Lao PDR	–	Lao People's Democratic Republic
LCT	–	Low Carbon Technology
NAMA	–	nationally appropriate mitigation action
NAPA	–	national adaptation program of action
NCCP	–	National Climate Change Program
NGO	–	nongovernment organization
OECD	–	Organisation for Economic Co-operation and Development
PARD	–	Pacific Department
PPCR	–	Pilot Program on Climate Resilience
ppm	–	parts per million
PRC	–	People's Republic of China
REDD	–	reduced emissions from deforestation and degradation
SAARC	–	South Asian Association for Regional Cooperation
UNDP	–	United nations Development Programme
UNFCCC	–	United Nations Framework Convention on Climate Change

"While the challenges are huge, I believe the crisis is also an opportunity-an opportunity for our region and the world to fundamentally restructure our approach to development and bring about a more sustainable global balance." Haruhiko Kuroda, President, Asian Development Bank.

Executive Summary

Climate change is a major threat to improving prosperity in Asia and the Pacific. To avoid the worst predicted impacts of climate change, institutions and individuals around the world must act now. In the Asia and Pacific region, while each country faces distinct challenges, coordinated responses are also critically important. Virtually every country has prepared a national strategy or plan for addressing climate change in an effort both to arrest further increases in greenhouse gas emissions and to cope with already inevitable adverse impacts of climate change.

The Asian Development Bank has an important role to play in helping to respond to these threats. ADB's *Strategy 2020* recognizes the urgent need to promote economic growth that is both locally and globally environmentally sustainable, positioning the economies of the region to be productive and competitive while continuing the pace of poverty reduction. Consistent with this goal, ADB is expanding its partnerships with governments, the private sector and civil society to aid the transition to low-carbon and climate-resilient economic development across the region.

To achieve this objective, ADB is working to better align its investments and associated policy and institutional support with the priorities of its developing member countries (DMCs) relating to climate and development. Each of ADB's five regional departments – covering Central and West Asia, the Pacific, South Asia, East Asia and Southeast Asia[1]—has drafted a Climate Change Implementation Plan (CCIP) to serve as a guide for climate-related responses, both to mitigate greenhouse emissions and to adapt to climate change impacts. The results of these CCIPs are summarized in this report and will be periodically updated, as warranted. Priorities defined in the report will be incorporated into individual country investment plans. In carrying out its climate change program, ADB also will assess and adjust, as appropriate, its own financing modalities and staff capacities to ensure it is able to effectively deliver on this agenda.

Taken together, the sub-regional CCIPs indicated that ADB's efforts will be concentrated in several key areas of high demand in the region, all of which build on ADB's past efforts and comparative advantage as a development finance institution:

[1] ADB's Regions: Central and West Asia: Afghanistan, Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyz Republic, Pakistan, Tajikistan, Turkmenistan, Uzbekistan. East Asia: Mongolia, People's Republic of China (PRC); Pacific: Cook Islands. Fiji Islands, Kiribati, Marshall Islands, Federated States of Micronesia, Nauru, Palau, Papua New Guinea, Samoa, Solomon Islands, Timor-Leste, Tonga, Tuvalu, Vanuatu. South Asia: Bangladesh, Bhutan, India, Maldives, Nepal, Sri Lanka. Southeast Asia: Cambodia, Indonesia, Peoples Democratic Republic of Lao, the Philippines, Thailand, Vietnam.

- Building institutional capacity of developing member countries to respond to climate change.
- Promoting the creation of policy incentives to enable low-carbon and climate-resilient growth.
- Promoting low-carbon energy, transport, rural and urban development, and speeding the transfer of environmentally sound technologies to developing member countries
- Dramatically scaling-up climate change adaptation efforts, including vulnerability analysis, climate proofing of investments and mainstreaming adaptation into development.
- Coordinating and harmonizing responses among multiple partners and encouraging regional cooperation to address climate challenges.
- Developing and disseminating associated knowledge products.

The responses of each sub-region are summarized below. In sum, they show that ADB will build on its traditional strengths in the areas of infrastructure – for water management, transport, urban services, and rural development – by mainstreaming climate change responses into these sectors and related policy and institutional support. ADB's clean energy investments are expected to expand considerably, especially through even greater support for energy efficiency improvement and renewable energy development. A qualitative shift will be taken in ADB's transport sector work, moving away from past emphasis on road and highway construction towards greater emphasis on rail and public transport. Opportunities to help channel significant new financial resources for rural development derived from forest carbon sequestration services will be explored. The agriculture, health and water sectors will be heavily affected by climate change, and adaptation measures will be built such investments as needed.

In Central and West Asia, the natural environment includes high mountains, vast grasslands, and large internal water bodies—including the Indus, Amu Darya, and Syr Darya river basins and the Caspian and Aral seas—all of which are essential for food, trade, and energy production. Water scarcity is predicted to increase as a result of climate change in regions already subject to periodic drought, and ADB will respond by supporting strengthened policies and institutions for agricultural water management and hydropower at the national and regional levels. ADB will also invest in renewable energy and energy efficiency programs, leveraging carbon market financing to help modernize some of the most carbon-intensive economies in the world. Opportunities to invest in measures that generate combined mitigation and adaptation benefits will be explored, for example through the restoration of degraded lands under the Central Asian Countries Initiative for Land Management.

ADB's East Asia Region is made up of two vastly different countries – the People's Republic of China (PRC) and Mongolia – and has two corresponding sets of priorities for addressing climate change. In the PRC, ADB will scale-up its support for climate change adaptation, especially by focusing on ecosystem resilience and water resource management in dryland areas. Long-standing support for energy efficiency improvement and expansion of renewable energy will be scaled-up to help the PRC reduce its carbon footprint. In Mongolia, energy efficiency improvements will likewise be pursued, and land and livestock management will be a priority for both adaptation and mitigation. ADB will work to build capacity in both countries to support all climate-related investments, including improved efficiency of coal-fired power plants and sustainable forest management.

ADB's Pacific Region covers island countries which face serious risks from sea level-rise, increasing intensity of tropical storms, greater rainfall variability, as well as ocean warming and acidification. ADB investments will support improved marine and coastal management to increase the climate resilience of the Pacific's agriculture, fisheries, tourism, and water sectors. ADB will work closely with its development partners to align climate-related interventions with institutional capacity and with country and sector-specific climate vulnerability risk assessments, building on those produced as part of CCIP preparation. ADB will also support the integration of adaptation planning and disaster risk management in the sub-region. While greenhouse gas emissions in the Pacific are not significant on a global scale, ADB will continue to invest in targeted energy efficiency and renewable energy interventions that also will promote improved energy security.

Representing roughly half of the world's absolute poor, the population of South Asia includes hundreds of millions of small farmers and coastal dwellers who are extremely vulnerable to climate change. ADB will work with the governments of South Asia to strengthen policies and build institutional capacity for national and local level responses to climate change. Among others, ADB's investments will respond to severe water-related risks by supporting irrigation system resilience, and coastal and flood protection. To reduce growing greenhouse gas emissions associated with economic expansion in the sub-region, ADB will work closely with the private sector to enable further diffusion of clean technologies in three core sectors – energy, transport, and urban development.

Large and dense rural populations inhabiting long coastlines and islands are at high risk from climate change impacts in ADB's Southeast Asia Region. ADB's investments will protect critical infrastructure and resource-dependent industries – namely, agriculture, aquaculture, and tourism. A key element of mitigation efforts in the sub-region will be promotion of improved policies and institutional capacities for land and forest management by piloting activities under the emerging Reduced Emissions from Deforestation and Degradation (REDD) approach, while contributing to higher rural incomes and associated benefits from biodiversity conservation. Support will also be provided for greater energy efficiency, renewable energy expansion, and better urban planning, including sustainable transport and waste management.

In keeping with the goals laid out in ADB's *Strategy 2020*, these efforts will help raise the share of ADB's support for environmentally sustainable economic growth, including responses to climate change, to at least 40% of investments by 2020. Measures to leverage financing from the private sector—through risk sharing, public private partnerships and clean development funds—will also be expanded.

Introduction

The huge need for investment in critical infrastructure demands innovative responses to attract the finance—estimated to be in the tens of trillions of dollars—to sustain regional economic growth in the next two decades. At the same time, growing understanding of the risks posed by climate change require new investments to leap beyond traditional business practice—to "business as unusual"—and provide stimulus for the deployment of policies and technologies that make countries in Asia and the Pacific the leading low-carbon and climate-resilient economies in the world.

The Asian Development Bank (ADB) is committed to helping its developing member countries (DMCs) finance their own sustainable development at this critical moment for both Asia and the Pacific, and for the global climate. Guided by ADB's long-term development framework, Strategy 2020 (ADB 2008), ADB will focus on three complementary strategic agendas: inclusive growth; environmentally sustainable growth, including climate change; and regional integration. This document summarizes the priorities for ADB's responses to climate change based on regional analysis and ADB's comparative advantage for developing policy, institutional, and operational responses to climate change.

Strategic Context

Impacts and Vulnerability to Climate Change

Climate change impacts threaten to stall economic development in Asia and the Pacific, and endanger the health and safety of its vast population. Climate change causes temperature, wind, and precipitation to vary, with profound effects on natural systems. These in turn have effects on the health, safety, and livelihoods of people—especially poor people. Nowhere in the world are as many people affected by climate change as in Asia and the Pacific.

Climate change poses serious risks to the economic growth of all of ADB's DMCs. However, predicted impacts are more severe for certain regions and countries. Drylands of the Himalayas, Central and West Asia, and southern India are likely to experience changes in rainfall, raising concerns about agricultural production and food security. The greater frequency of extreme storm events places all of the region's large river basins at increased risk from flooding. Many coastal cities, especially those located on or near river deltas, will face multiple risks from storms and floods. The low-lying islands of the Pacific, Southeast Asia, and the Indian Ocean are also highly vulnerable to storms, storm surge, floods, and sea-level rise, and their capacity to respond is often hampered by their isolation and weak infrastructure.

Climate change will cause more intense typhoons, droughts, heat waves, landslides, and other natural hazards in a region which already suffers from more natural disasters than any other in the world. For the last decade, Bangladesh, India, the Philippines, and Viet Nam have topped the list of countries facing serious climate risks, and cumulative losses as a result of natural disasters have averaged nearly $20 billion over the same period. Future warming will also cause increasing sea-level rise, warmer ocean temperatures, and rising ocean water acidity, leading to greater coastal erosion and threatening the health of marine ecosystems—

a major source of nutrition and livelihood in Asia and the Pacific.

The cumulative impacts of climate change over the next two or three decades have the potential to reverse much of the progress made towards attainment of the Millennium Development Goals (Stern 2007). The latest global estimates predict the costs of adapting to climate change in developing countries to be between $9 billion and $67 billion per year (Mani et al. 2008). The recently published ADB study, *The Economics of Climate Change in Southeast Asia: A Regional Review* warned that the total economic cost of climate change threats could be equivalent to an annual loss of between 6% and 7% of these countries' GDPs by the end of the century. But early action can mitigate these impacts; the same study indicates that, investments costing as little as 0.2% of GDP have the potential to protect coastal and urban infrastructure from the greatest impacts of climate change.

Emissions Trends and Causes of Climate Change

> *Emissions of greenhouse gases from Asia and the Pacific are growing; energy and infrastructure investments made in the next two decades will shape the region's development path and the future of the global climate.*

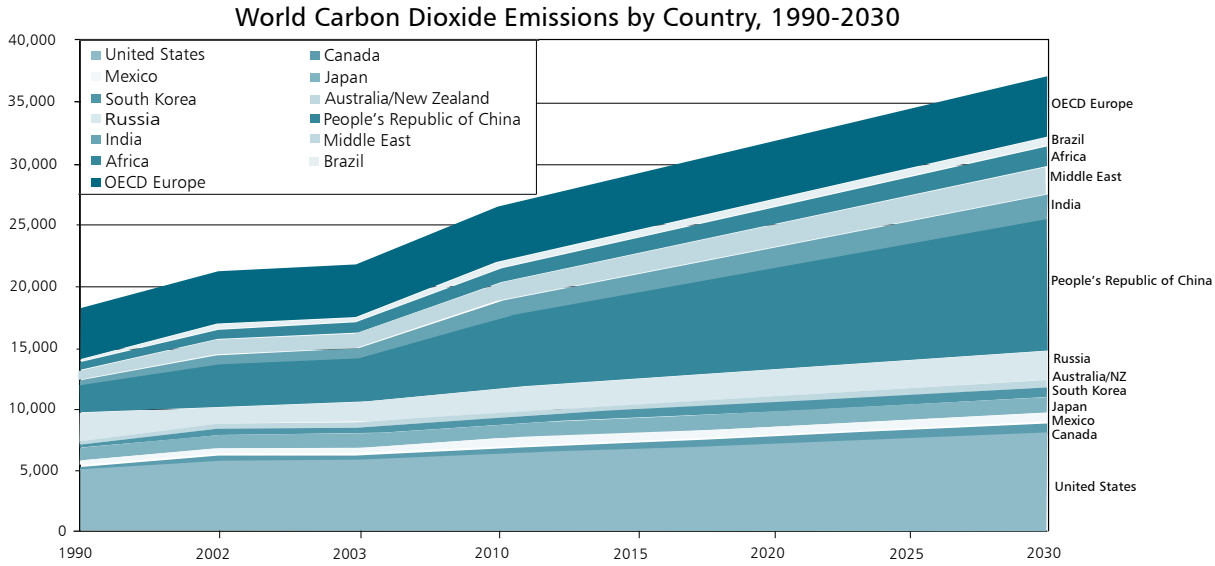
Human activities since the Industrial Revolution—primarily fossil fuel use, deforestation, and agriculture—have nearly doubled the amount of greenhouse gases in our atmosphere. Global scientific consensus confirms that the effects of these heat-trapping gases have already caused global temperatures to rise by 0.5° C, and if current development trends continue, temperatures will increase by 1.4°–5.8° C by 2100. Historically, countries belonging to the Organisation for Economic Co-operation and Development (OECD)[1] have been responsible for the majority of global emissions; however, developing countries are the fastest-growing source of new emissions, and they will soon be the largest absolute source (see Figure 1). India, Indonesia, and the People's Republic of China (PRC) rank in the top 10 emitting countries globally due to the combined effects of their fossil fuel consumption and deforestation (International Energy Agency 2007).

Rapid economic growth, increases in personal vehicle ownership, and the changing face of the region's population—from rural to urban—are primarily responsible for the dramatic upward trends in regional emissions. Energy demand growth in Asia and the Pacific rose 9.7% from 2000 to 2005, and corresponding greenhouse gas emissions rose by nearly 8% (International Energy Agency 2002, 2007) over the same period. By 2030, Asia will demand more than half of the world's primary energy resources (International Energy Agency 2007), will be home to more than half of the world's urban population—around 2.7 billion people (UN Habitat 2006)—and will be responsible for more than 50% of global emissions.

In addition to causing climate-altering emissions, increasing use of fossil fuels—and especially oil for transport—will decrease global energy security and raise energy prices for countries in

[1] Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Inceland, Ireland, Italy, Japan, Korea, Luxemborg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States..

Figure 1: Energy Related CO_2 Emissions by Country



Source: EIA 2007

Asia and the Pacific. Island states of the Pacific, Southeast Asia, and the Indian Ocean are some of the most vulnerable to energy price hikes. When compounded with their vulnerability to the impacts of climate change, these nations stand to lose the most if energy and emissions trends do not change.

Global Policy and Financial Responses

Enabling policy changes and directing financial flows towards clean energy and climate solutions can spur transformational change in Asia and the Pacific.

Global policy action, and a transition towards low-carbon economic growth, began in earnest more than 15 years ago. Under the United Nations Framework Convention on Climate Change (UNFCCC), many developed countries made preliminary commitments to reduce emissions by 5.2% below 1990 levels between 2008 and 2012 by signing the Kyoto Protocol. Nearly all DMCs also have obligations to report on national greenhouse gas emissions under the UNFCCC, and most are active participants in ongoing global negotiations to develop a post-2012 regime to address the issue of climate change.

The guiding strategy for developing a post-2012 agreement, the Bali Action Plan (adopted at the 13th United Nations Climate Change Conference in December 2007), has four essential elements or "building blocks": mitigation, adaptation, financing, and technology transfer, all of which have implications for sustained economic growth of ADB DMCs.

Mitigation. The findings of the 2007 Intergovernmental Panel on Climate Change (IPCC) reports indicate that emissions must be stabilized at between 450 parts per million (ppm) and 550 ppm to avoid dangerous climate change. To achieve this "developing country emissions need to deviate below their projected baselines within the next few decades." (IPCC 2007). Developing countries are increasingly under pressure to commit to nationally appropriate mitigation actions (NAMAs) and increase efforts to reduce greenhouse gas emissions. Investing in cleaner and more efficient infrastructure will help DMCs to meet potential future commitments to reducing emissions, lead to higher quality of life for the region's inhabitants, and may make goods and services more competitive.[2]

Adaptation. Current financing plans include the Adaptation Fund under the UNFCCC. The fund will mobilize at least $100 million per year based on a 2% tax on the sale of carbon credits from Clean Development Mechanism (CDM) projects and many bilateral and multilateral assistance programs including the newly established Pilot Program on Climate Resilience (PPCR) under the multilateral development banks' Climate Investment Funds (CIF). However, funding allocated thus far fails to address projected long-term needs and known technological and capacity constraints.

Financing. Major developing countries, including India, have stated that their willingness to reduce greenhouse gas emissions is contingent on the delivery of finance and clean technology through international cooperative action. The emerging financial architecture under the post-2012 agreements is likely to include rights for developing countries to sell various types of emissions reductions credits (as is the case now with the CDM and REDD).

Technology transfer. It is widely recognized that technology transfer is essential to support mitigation and adaptation efforts, particularly in developing countries. However, there is significant disagreement on whether the role of the UNFCCC in finance and technology transfer should be more action-based or advisory, and to what extent intellectual property rights should be respected in responding to what many deem a global climate crisis.[3] Providing risk insurance and leveraging resources from the Clean Technology Fund of the CIF and others, ADB will promote transformational technology deployment in larger countries, such as Indonesia and the Philippines, while ADB's Clean Energy Financing Partnership Facility is available to support smaller countries in Asia and the Pacific. ADB will support the creation of a Low Carbon Technology (LCT) Marketplace, providing the financial assistance needed to bridge the gap between the expectations of LCT holders and what LCT buyers can reasonably expect to recover from the large but lower priced energy market in Asia and Pacific. The Global Environment Facility (GEF) is tasked with coordinating efforts under the Bali Action Plan, and, as an implementing agency, ADB will further explore opportunities for technology transfer, particularly in the areas of energy and transportation infrastructure development.

[2] Sector targets and taxes on greenhouse-gas-emitting industries are two options under consideration to help countries reduce emissions under a post-2012 agreement. Should either become a reality, moving towards low-carbon production will help keep DMC industries globally competitive.

[3] Similar to the World Trade Organization rulings for compulsory licensing of prescription drugs (namely for HIV/AIDS, malaria, etc.), some countries have argued that compulsory licensing should be used to spread technologies that reduce climate vulnerability and greenhouse gas emissions.

Helping countries to meet immediate infrastructure investment needs can sustain economic growth in the region while simultaneously helping them to achieve long-term energy security and climate benefits.

Now more than ever, growing financial resources for lower-carbon growth and building climate-resilient economies can influence the direction of development in Asia and the Pacific. Although economic growth in Asia and the Pacific has been strong, the pattern of growth has lacked attention to resource efficiency, energy security, and climate resilience. Exports have been a principal engine of growth, but now the region's economies face sluggish demand as a result of the global financial crisis. Public sector spending on critical infrastructure—including in energy, sanitation, and transport—has a key role to play in keeping the region's economies strong. With more funds earmarked to supporting sustainable growth, this devastating blow to the global economy presents a real opportunity for countries in Asia and the Pacific to invest in public goods that will simultaneously increase energy security, promote long-term economic competitiveness, and address climate change.

Financial resources. Immense investments in energy supply and infrastructure will be made in the next two decades to support economic growth in Asia through to 2030, and more than $6 trillion of this investment is required for Asia alone (International Energy Agency 2007, p. 45–47). In addition to the trillions required for infrastructure investment, the estimated annual investment needs for environmental issues in Asia and the Pacific are as high as $100 billion, including $30 billion for renewable energy, $28 billion for adaptation to climate change, $14 billion for energy efficiency, and $8 billion for sustainable management of water resources. Although financial flows are increasing rapidly overall,[4] the flow of funds does not come close to meeting global needs, and funding for adaptation and mitigation is far from equal.[5] ADB has access to internal climate change funds of less than $400 million—a relatively limited amount compared to its ordinary capital resources. External resources include those administrated by the GEF and the multilateral CIF (see glossary for fund description). ADB will guide internal and external resources to priorities outlined in this report, as well as increase the share of investment it is making in environmentally sustainable growth and climate change.

Catalyzing private sector investments to address climate change. The UNFCCC and others have estimated that over 85% of investment and financial flows into infrastructure investments originate from the private sector. In the context of efforts to address climate change, ADB is helping DMCs create an environment conducive to private

[4] Developed countries are pledging more and more funding for climate change programs through their development assistance programs, and the Climate Investment Funds, managed by the multilateral development banks are becoming operational. From January 2007 to July 2008 alone, 18 new funding initiatives were announced with nearly $3 billion in bilateral finance, and an almost equal amount was pledged to multilateral initiatives.

[5] According to a study by the Oxford Institute for Energy Studies, between 2000 and 2006, $600 million in funding was made available for adaptation efforts while more than $80 billion was made available for mitigation. Much of this difference is a result of flows from the carbon markets, which are increasing rapidly. Trades more than doubled in value in 2008 to $125 billion, and more than $32 billion of this was generated from the CDM—more than five times the amount of bilateral and multilateral financing combined.

sector investment that can reduce greenhouse gas emissions—whether in clean energy, sustainable transport, or improved land use. During 2008, ADB launched five clean energy investment funds that will help provide equity for projects that mitigate climate change in DMCs. ADB will also continue to facilitate private sector investments through innovative financial mechanisms—including equity funds and risk assurance—that help address early stage financial and skills gaps of managers of clean energy projects in developing countries.[6] Insurance schemes will also be explored with the private sector to help countries plan for increasing impacts of climate-related natural disasters.

ADB's Commitment to Addressing Climate Change

> *As part of Strategy 2020, ADB will invest in inclusive and environmentally sustainable growth, addressing climate change as one of five core areas of operation. ADB will use its strengths as a development partner to transform business-as-usual practices to meet regional and country development needs and respond to climate change.*

Strategy 2020 commits ADB to use its technical and financial resources to help DMCs make the transition onto low-carbon growth paths—using cleaner sources of energy and using energy more efficiently—and building resilience to the expected impacts of climate change. Strategy 2020 also sets a target of 40% of investment resources to be directed towards environment and climate change by 2020.

While ADB's commitment to address climate change is increasing, it is not new; on the contrary, ADB has been engaged in promoting low-carbon development and enhancing adaptive capacity of DMCs for well over a decade. Significant recent increases in lending have helped to advance ADB's climate change goals, most notably in 2008 when ADB lending for clean energy topped $1.7 billion and a dedicated fund to address climate change adaptation and mitigation, including reducing emission from deforestation and land degradation, supported more than 25 programs addressing DMC climate change priorities.[7] However, growing urgency and the proliferation of efforts to address climate change in every part of the region demand a closer alignment of ADB support to country and regional climate change and development needs. For ADB, this means increasing the capacity of staff and reorienting investment plans to incorporate climate change considerations into all operations.

Climate Change Implementation Plans

To incorporate climate change considerations into all project areas, a gap analysis was performed to compare ADB's lending portfolio with the unique climate-change-related threats (and opportunities) facing each of its regions. In March 2008, ADB management requested each regional operations department to prepare a climate change implementation plan (CCIP).

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[6] This issue is addressed in more detail in Carmody and Ritchie 2007. The new ADB–GEF project, the Private Sector Operations Division's Renewable Energy Enterprise Development - Seed Capital Access Facility, is also working in this area.

[7] ADB set a $1 billion dollar target for clean energy investment in 2008. This target is expected to double in 2009–2010. ADB's Energy Efficiency Initiative and Climate Change Fund are defined in the glossary.

This document was to provide an analysis of ongoing climate responses funded by ADB and development partners, and provide recommendations on how to better align ADB's lending with country climate priorities. Focal points from each regional operations department and the Regional and Sustainable Development Department, along with technical experts in climate change mitigation, adaptation, and finance, prepared CCIPs from September 2008 to May 2009. Plans were prepared in consultation with resident mission staff and national stakeholders.[8]

The resulting five regional CCIPs describe where ADB can increase efforts to address climate change in each region, as well as areas where ADB will seek partnership to meet DMC needs. The CCIPs provide recommendations for interventions at three levels: policy, institutional, and operational, and include sector-specific responses. Short- and medium-term actions are outlined in Annex 1, showing where ADB will immediately focus climate change investment. Climate change investment at ADB has continued to grow throughout the CCIP process in response to needs identified; in fact, more than a dozen additional projects addressing climate change were designed in parallel with CCIP development.[9]

The implementation and monitoring of CCIPs will be carried out under each DMC's country strategy. In addition, biannual reports will monitor ADB's investment in priority areas identified by CCIPs. Next steps and plans included herein will be refined, based on evolving country priorities, dialogue with donor partners, and improved scientific predictions of climate change impacts.

[8] The CCIP provide input into Country Partnership Strategies; the recommendations are not binding. Therefore, informal consultations were held in ADB DMCs to refine recommendations and formal consultations will be held when investments are proposed as part of ADB's Country Partnership Strategies.

[9] Capacity building technical assistance has been approved for 10 countries in Central Asia, Azerbaijan, India, Nepal, Sri Lanka, and Viet Nam.

Outcomes of the Climate Change Implementation Plans: Common Needs and Opportunities Across Asia and the Pacific

Despite their differences, all ADB regions have common issues that call for concerted responses from ADB and its partners. The recommendations in this section of the report include only a few indicative sector and country-level responses (for more detail see later section on Regional Priorities), and capture issues that need to be addressed in all ADB regions to support low-carbon growth and poverty reduction while increasing resilience to climate change. ADB will organize responses to climate change based on the regional analyses provided in the CCIPs on three levels: policy and institutional, organizational, and operational.

Policy and Institutional Responses: Enabling Global, Regional, and Developing Member Country Responses to Climate Change

The agreement on a post-2012 climate regime will affect national climate change policies of DMCs, and, in turn, the investment choices they make. As outlined in the discussion of the Bali Action Plan, the amount of finance provided for mitigation and adaptation, as well as decisions made about technology transfer, can either increase or decrease the transition pace of DMCs to lower-carbon, climate-resilient economies. As a multilateral development bank, ADB does not have a direct role in climate negotiations. However, it will use funding to promote policies

that build DMC institutional capacity to respond to climate change; enable low-carbon, climate-resilient growth; encourage regional cooperation to address climate problems; and support coordinated country-level responses among donors, nongovernment organizations (NGOs), and other stakeholders working to address climate change.

Building DMC institutional capacity to respond to climate change. Capacity development for institutions involved in the planning and management of responses in vulnerable sectors and regions is one of the most pressing climate change needs in Asia and the Pacific. Integration of climate change impact and adaptation considerations into development planning is a relatively new policy area. Historically, capacity to respond to climate change has been concentrated in a few ministries responsible for reporting to the UNFCCC or leading negotiations, i.e., ministries of environment and foreign affairs. While many DMCs have national climate change coordinating bodies, capacity to adjust sector planning towards low-carbon growth and climate resilience is not necessarily transferred from these ministries to implementing or line ministries. Limited capacity and strict divisions of labor in ministries of finance, industry, trade, transport, and others is a barrier to climate mitigation and adaptation efforts in many of ADB's DMCs.

In response, ADB has planned support to build the capacity within national institutions addressing climate change. For example, in Central and West Asia ADB plans to support capacity building for the institutions dealing with climate change in 10 countries and has specific support planned to develop capacity for renewable energy in Azerbaijan. In South Asia, ADB will support the governments of India and Sri Lanka in developing adaptation strategies. In Southeast Asia, ADB is supporting the Government of the Lao People's Democratic Republic (Lao PDR) as it drafts its first climate strategy, and ADB also plans to support climate response capacity building in several ministries in Viet Nam.

In addition to planning support for specific sectors, ADB will provide an economic analysis of climate-related investments. Policy makers in DMCs must select projects for immediate investment, allocating scarce public resources. To help equip decision makers, ADB will provide analyses of the costs and benefits of both adaptation and mitigation measures for individual sectors and regions. For example, ADB's recent study, *The Economics of Climate Change in Southeast Asia* (ADB 2009a), provides policy recommendations based on detailed economic analysis of the projected impacts of climate change on the region, and an updated perspective on greenhouse gas abatement costs by sector and technology. ADB will undertake similar studies in East and South Asia in 2009–2010.

Providing technical assistance to promote policies that enable low-carbon, climate-resilient growth. ADB has been actively involved in promoting policies for low-carbon, climate-resilient growth through its support of the Energy Efficiency Law in Viet Nam, water sector reform in Pakistan and Afghanistan, and energy sector reform in India, Pakistan, the Philippines, and Pacific island countries, among others. ADB will continue to support sector reform and increase support where climate change and development priorities meet—for example, with planned support for energy sector development in Afghanistan, greening transport corridors and decreasing emissions in the Greater Mekong Subregion (GMS), and promoting more sustainable transport and urban development policies in the PRC.

In addition to promoting sector reform, ADB is actively convening decision makers from across Asia and the Pacific to discuss climate solutions

within the UNFCCC context. In June 2009, ADB will host a high-level dialogue on climate change in cooperation with The Energy and Resources Institute to promote regional dialogue in advance of global climate negotiations in December. In August 2009, a dialogue entitled From Kathmandu to Copenhagen will see governments, donors, and other development partners from the South Asian Association for Regional Cooperation (SAARC) convene to advance a collective commitment to a post-2012 regime. ADB will also fund participation of government representatives in UNFCCC negotiations to increase DMC engagement in the post-2012 process.

Encouraging regional cooperation to address climate problems. Climate change impacts are not constrained by national boundaries, and regional cooperation is often the only means of addressing impacts and decreasing vulnerability. ADB has a number of ongoing initiatives that are well positioned to address climate change. The Central Asian Countries Initiative for Land Management (CACILM), a five-country program to improve drylands management, provides a valuable platform for planning regional adaptation measures in Central and West Asia. Moreover, initiatives in the Mekong River Basin promoting cooperation for basin-wide environmental management form another important platform for collective action. ADB's GMS Environmental Operations Center supported a climate change policy dialogue in 2008 and will continue to support continued engagement and investment to address policy priorities for the region. ADB is supporting the Coral Triangle Initiative which brings together six countries—Indonesia, Malaysia, Papua New Guinea, the Philippines, Solomon Islands, and Timor-Leste—to implement a regional plan of action for improved coastal and marine resources management, including adaptation to climate change, in the world's most biodiverse marine area.

Coordinating country responses among donors, NGOs, and other stakeholders working to address climate change. With the rapid proliferation of climate-change-related initiatives in Asia and the Pacific, ADB remains committed to coordination with partners to maximize investment effectiveness. In Bangladesh, Cambodia, Indonesia, Mongolia, Nepal, the Philippines, Thailand, Viet Nam, and the Pacific island countries, ADB participates in country-wide planning sessions with other donors, NGOs, and the private sector. These sessions help direct the interventions of each participating organization to meet DMC needs. The coordination groups are helping to streamline approaches to DMC governments for climate-related project development and to direct applications for climate change finance.

As an implementing agency of the multilateral CIF, ADB is engaging with other development financing partners in joint programming missions that will help countries to determine how to best use funds to mitigate the causes and impacts of climate change. In 2009, ADB will be working to program Clean Technology Fund resources for Indonesia and the Philippines, and the World Bank's Pilot Program on Climate Resilience funding for Bangladesh, Cambodia, Nepal, Tajikistan, and the Pacific region. ADB will help DMCs to access cofinancing sources from the public and private sector to meet investment needs to support national climate change and development strategies.

Organizational Responses

ADB has the institutional expertise needed to promote a variety of mitigation and adaptation responses in DMCs. In areas where existing resources fall short of DMC needs, ADB will form strategic partnerships, build staff

capacity, and develop knowledge that can be shared with the regional and global community.

ADB's portfolio has focused on climate-related investments to restore degraded lands, improve energy efficiency and water resource management, protect biodiversity, and promote renewable energy. The majority of ADB's work on climate change has been focused on mitigation—and primarily clean energy. ADB will continue to aggressively increase efforts to mitigate climate change in core areas of operation; however, it will also need to dramatically increase adaptation capacity and investment.

Strategic Partnerships

ADB is forming strategic partnerships that complement its operations. These partnerships allow ADB to remain engaged on topics—such as community-based adaptation and clean energy technology—that lie outside of its immediate areas of competence and interests.

Donors. ADB is working with other multilateral development banks on the Clean Energy Investment Framework and programming of the CIF. ADB is also working with bilateral donors on several of its mitigation and adaptation initiatives: with the governments of Germany and Sweden on the Cities Development Initiative for Asia (CDIA); and with the Japan International Cooperation Agency (JICA) and the World Bank on studies of climate change impact on coastal cities.

Clean energy technology research and development. ADB is working to understand the advantages and disadvantages of emerging technologies in order to provide sound policy advice to DMCs on available options. For example, despite increasing investment in renewable energy, many ADB DMCs will remain dependent on coal for energy for the foreseeable future, a fact that could hinder efforts to stabilize global emissions at between 450 ppm and 550 ppm, as recommended by the IPCC. Carbon capture and storage is one of the most promising options to reduce the impact of coal use; ADB is therefore partnering with the Government of Australia to launch the Global Carbon Capture and Storage Institute, which will establish pilot commercial-scale carbon capture and storage facilities and promote cooperation between research institutes, governments, and the private sector to advance research, development, and deployment of carbon capture and storage.

Strategic adaptation partnerships. ADB is preparing a partnership framework agreement to cover cooperation with a range of development agencies and specialized groups. This framework will help to coordinate adaptation efforts in the region, and give ADB access to the latest findings regarding climate change impacts and effective risk management approaches. As an active member of the GEF Adaptation Task Force, ADB stays abreast of all financing matters and technical developments. Through the Poverty Environment Forum, ADB and donor partners are supporting environment and climate change experts in Bangladesh, the PRC, the Lao PDR, Pakistan, and Viet Nam to help these highly vulnerable countries evaluate the impacts of climate change on the environment and guide future investments.

Climate resilience in the agriculture sector. The impacts of climate change will necessitate shifts in crop production and land management for many countries, and precipitate changes in water usage. ADB is working with the International Center for Agricultural Research in the Dry Areas (ICARDA), the Consultative Group on International Agriculture Research, and with the International Food and Policy Research Institute (IFPRI) to develop regional knowledge on the links between climate

change impacts and food security, and on drylands management, among other things.

Land-use, soil carbon sequestration, and REDD. The estimated potential greenhouse gas reductions from forestry measures are up to 6.7 gigatons of carbon dioxide (CO_2) (IPCC 2007b). ADB will partner with leading institutions, including the Center for International Forestry Research, to increase the capacity of DMCs to manage forests to decrease emissions.

Modeling the causes and consequences of climate change. Global climate models are appropriate for understanding the wider impacts of climate change. However, to plan investments, ADB will need to work with partners to generate information appropriate for Asia and the Pacific, individual countries, river basins, and coastal cities. In the water sector, ADB is already engaged with a broad network of partners working to strengthen downscaled modeling capacity and adaptation on river basins (Box 1).

Box 1: Water and Climate Change: Regional Partnership for Project Implementation and Knowledge Sharing

Higher temperatures speed the natural water cycle causing downstream flashfloods, deterioration of watersheds, and more intense storms. As a result, between 120 million and 1.2 billion people are predicted to experience increased water stress as a result of climate change by 2020—making water the most critical element for climate adaptation efforts.

ADB has long been active in the water sector, providing support for improved water and sanitation systems in urban areas and cleaner, more reliable irrigation and drinking water in rural areas, and improved river basin management. However, the predicted scale of climate change impacts on the water sector in Asia and the Pacific requires collaborative action.

In December 2008, the Regional Workshop on Developing Partnerships for Water and Climate Change Adaptation identified specific country needs for better climate change projections, impact assessments, and adaptation strategies. A regional knowledge hub for water and climate change was launched by the National Hydraulic Research Institute of Malaysia under the auspices of the Asia-Pacific Water Forum, with the support of ADB; the Network of Asian River Basin Organizations; the Ministry of Land, Infrastructure, Transport and Tourism of Japan; the International Centre for Water Hazard; the Japan International Cooperation Agency; and the University of Tokyo.

In the next 2 years, the newly formed Water and Climate Change Knowledge Hub will take on projects to achieve shared objectives including (i) developing a water and climate change public awareness campaign; (ii) compiling an assessment of climate change projection and impact assessment results for dissemination to decision makers; (iii) developing guidelines for adaptation, including a review of design standards; (iv) launching training of trainers on Integrated Water Resources Management as a Tool for Climate Change Adaptation; (v) launching a hosting program for on-the-job training; and (vi) developing a hub website to contain a compilation of good practices in water and climate change projection, impact assessment, and adaptation.

In addition to these broader regional projects, the regional workshop agreed to pursue 11 projects at the county or basin level to be implemented immediately by network members. A major output of these projects will be downscaled models for each project country. These models will analyze the impact of different climate change scenarios on water, ecosystems, food, coastal areas, and health. The projects will also provide training and advice to improve the capacity of in-country participants to develop and interpret climate change and water models.

Box 2: WWF and ADB: Shared Commitment to Climate Change Action—Locally, Nationally, and Regionally

ADB and WWF, the global conservation organization, are actively involved in climate change policy dialogue leading up to the 15th United Nations Climate Change Conference in Copenhagen in December 2009. Both institutions share a commitment to helping developing countries in Asia and the Pacific reduce emissions and implement adaptation measures to reduce the impact of climate change on the region's resources.

ADB and WWF are currently working together to promote climate change resilience in the Greater Mekong Subregion, Coral Triangle, and Heart of Borneo region. Each of these programs is a multicountry initiative designed to improve environmental management and conservation by mobilizing local communities and working with local decision makers. By strengthening local capacity to manage natural resources and improving governance, ADB and WWF are enhancing resilience to climate change; developing specific adaptation policies; and funding, establishing, and managing key conservation areas locally, nationally, and regionally.

The ADB–WWF partnership has proved effective in building consensus between large groups of stakeholders. This is evidenced by the Coral Triangle Plan of Action, which brings together the governments of Indonesia, Malaysia, Papua New Guinea, the Philippines, Solomon Islands, and Timor-Leste to implement a series of adaptation measures and share scientific data on coastal and marine management, including responses to climate change.

Strengthening links with civil society. As part of these important partnerships, ADB will continue engagement with civil society to evaluate and implement adaptation and mitigation measures. Cooperation is particularly critical to identify community vulnerabilities and to help ensure bottom-up ownership of climate risk management actions. In several ADB programs, civil society groups are an integral part of service delivery. Recent ADB efforts to protect the Coral Triangle—the so-called Amazon of the Seas—from the impacts of climate change, overfishing, and unsustainable fishing methods, are made possible through partnerships with civil society partners, including Conservation International, The Nature Conservancy, and WWF (the global conservation organization), who are working with the governments of Indonesia, Malaysia, Papua New Guinea, the Philippines, Solomon Islands, and Timor-Leste to allocate the more than $300 million in resources pledged by the ADB, Australia, GEF, the United States and other development partners.

Partnerships for outreach. To help raise public awareness and promote solutions to climate challenges, ADB is partnering with the Asia Pacific Broadcasting Union on a regional training program and multimedia campaign: Climate Change Impacts and Responses. The program will train more than 40 journalists from 12 ADB DMCs about the causes and potential solutions to climate change. Journalists will produce more than 100 stories on climate change in 2009 and report on developments in climate change technology, science, and policy. ADB will expand outreach from multimedia to print journalists and will develop an online climate change learning center to provide policy makers and

ADB and Asia Pacific Broadcasting Union work with a TV journalist in PRC on a Climate Change Story, L. Sorkin 2009.

the public with up-to-date information on proven solutions to climate challenges.

Knowledge Development

Through the implementation of climate change programs, ADB is constantly gathering knowledge which can help DMCs move onto low-carbon growth paths and adapt to unavoidable climate change impacts. As part of Strategy 2020, ADB is committed to using knowledge services to address its clients' immediate knowledge needs, while determining and passing on best practices. ADB is developing knowledge showcases—briefs that describe good practices in mitigation an adaptation in a clear and concise manner—for DMCs.

ADB funds have supported several landmark studies to help understand how to limit the causes and deal with the consequences of climate change in Asia and the Pacific, including Asia Least-Cost Greenhouse Gas Abatement Studies (1998); Promotion of Renewable Energy, Energy Efficiency and Greenhouse Gas Abatement Studies (2002); and Climate Proofing: A Risk-based Approach to Adaptation (2005).

ADB will continue to capitalize on its unique position to identify and develop knowledge in Asia and the Pacific, and is supporting in-depth analysis that can be shared with the wider regional and international community to enhance climate responses. Planned analyses reflect regional and ADB climate change priorities, outlined in Table 1.

Table 1: Sample Knowledge Products Addressing Regional and ADB Climate Change Priorities

Theme	Titles
Mitigation in Asia and the Pacific	
Sustainable Transport	• Transport and CO_2 emissions • Guidance for post-2012 transport policy development
Energy Security	• Energy and Climate Change, with The Energy and Resources Institute • Sustainable Transport and Fuel Security
Biofuels	• Biofuels in Southeast Asia, with the Southeast Asia Regional Center for Graduate Study and Research in Agriculture.
Adaptation	
Infrastructure	• Coastal Mega-Cities Adaptation, with the World Bank and JICA
Agriculture	• Building Climate Resilience in the Agriculture Sector, with the IFPRI
Migration	• Impacts of Climate Change on Migration in Asia and the Pacific, with the University of Adelaide • Under the Weather and the Rising Tide: Adapting to a Changing Climate in Asia and the Pacific
Adaptation and Mitigation	
Economic Impacts and Costs	• The Economics of Climate Change in Southeast Asia: A Regional Review • The Economics of Climate Change in South Asia • The Economics of Climate Change in East Asia

CO_2 = carbon dioxide, IFPRI = International Food and Policy Research Institute, JICA = Japan International Cooperation Agency.
Source: ADB 2009

Strengthening ADB's Capacity to Address Climate Change

To ensure that investments promote climate resilience and low-carbon growth, ADB staff must be equipped to design responsive projects and provide technical assistance. Where climate change expertise was previously concentrated in a central department (the Regional and Sustainable Development Department), reorienting ADB lending requires staff in all ADB operations departments to have the capacity to design programs with climate considerations in mind. To build in-house capacity, ADB has launched a biannual training program on climate change, appointed focal points for climate change in each regional department and resident mission, started a climate change information sharing network, and established the Climate Change Program Coordination Unit. The Regional and Sustainable Development Department will also continue to support operations departments.

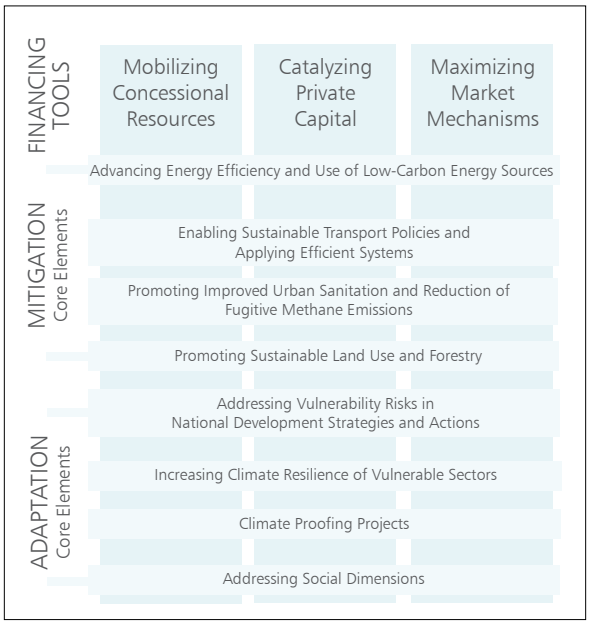
Headquarters operations. ADB currently tracks greenhouse gas emissions of headquarters operations, and these increased slightly in 2008 due to increased staff travel and goods shipment. ADB is working to reduce emissions as part of its overall resource conservation efforts and is

currently exploring options for becoming carbon neutral. Detailed information is provided in ADB's *Sustainability Report* (ADB 2009b).

Operational Responses

Future ADB investments will promote low-carbon growth and build climate-resilient economies by means of eight priority approaches outlined in Figure 2. ADB will promote low-carbon growth by improving energy efficiency; expanding the use of clean energy sources; reducing fugitive greenhouse gas emissions, such as methane released from landfills; modernizing public transport systems; and promoting sustainable land use and forestry.

Figure 2. ADB's Strategic Approach for Addressing Climate Change



Source: ADB 2009

ADB will also help DMCs adapt to the unavoidable impacts of climate change—including those related to health—through national and municipal planning, investments in defensive measures, support for insurance and other risk-sharing instruments, and "climate-proofing" projects. Disaster risk management will be a vital part of the adaptation process and cost-effective precautionary measures will be promoted through infrastructure investments. Sustainable management of forests and other natural resources for provision of clean water supplies, protection of biological diversity, and sequestration of carbon from the atmosphere to offset greenhouse gas emissions will also be part of ADB's assistance to address climate change.

ADB is one of the only donors in Asia and the Pacific that provides technical assistance, grants, and loans, and when this is combined with ready access to global mitigation and adaptation technical expertise, ADB is well placed to help DMCs to access funds for climate-change-related investment, expand its role in donor coordination, and mobilize cofinancing.

Promoting Low-Carbon Growth Strategies

As a development finance institution, ADB's most important and straightforward contribution to reducing the underlying causes of global climate change will be to invest as much as possible in programs and projects that will help mitigate greenhouse gas emissions from their major sources in Asia and the Pacific. Existing scientific, technological, and economic analysis shows that more than half of so-called low-cost potential emissions reductions (i.e., below €40, or approximately $56 per ton) by 2030 are in developing countries and in sectors not well addressed by current policy and financial measures, including agriculture, buildings, forestry, and transportation (Enkvist et al. 2007).

Figure 3: Regional GHG Abatement Potential

Developing economies will play an important role

Abatement potential for greenhouse gases by region, $GtCO_2e$[1] per year by 2030 (costing up to €40 per ton)

100%–26.7

		% of global emissions	
		'Business as usual,'[3] 2030	After Abatement
Eatern Europe[2]	1.6	9	11
Western Europe[2]	2.5	8	7
North America	4.4	15	14
Other developed countries	2.5	11	13
China	4.6	18	18
Other developing countries	11.1	39	37

[1] $GtCO_2e$ = gigaton of carbon dioxide equivalent.
[2] Eastern Europe includes former Soviet Union and Balkans; Western Europe includes EU_{25} plus Iceland, Norway, Switzerland, Turkey, minus Baltic states.
[3] "Business as usual" based on emissions growth driven mainly by increasing demand for energy and transport around the world and by tropical deforestation.
Source: McKinsey 2007.

ADB is already mobilizing over $2.5 billion per year to catalyze low-carbon development through several funds accessible to all DMCs: the Clean Energy Financing Partnership Facility, the Climate Change Fund, and the Carbon Market Initiative (CMI). In future ADB will expand and complement these efforts by promoting improved environmental and energy management in cities (through the CDIA and the Sustainable Transport Initiative), and exploring additional opportunities to leverage carbon finance from REDD. ADB will help DMCs access global funds for mitigation; for example, along with the World Bank, ADB will access the Clean Technology Fund of the CIF to transform the energy and transport sectors in Indonesia and the Philippines.[10]

ADB efforts to promote low-carbon growth in Asia and the Pacific help to realize mitigation targets under the Bali Action Plan. By providing the technical support and finance to help DMCs achieve nationally appropriate mitigation actions (NAMAs), ADB will help DMCs to move their economies onto

[10] For an explanation of the referenced climate funds, please see the glossary.

low-carbon growth paths and assure that resulting emissions reductions are "measurable, reportable, and verifiable."[11]

Energy efficiency and clean energy. In 2008, ADB leveraged more than $1.7 billion in clean energy financing and allocated $19.8 million in grants to 12 climate change mitigation projects. These projects mobilized more than $250 million of investment, more than 90% of which is focused on clean energy. The mitigation projects alone are projected to reduce emissions by more than 2 million tons (t) of CO_2 annually and save more than 7 terawatt-hours of energy.

In keeping with its energy policy,[12] ADB will continue to mobilize a broad range of public and private resources and will focus on diversifying the regional distribution of funds for clean energy and energy efficiency investment. This is especially the case in Central and West Asia which is home to some of the most carbon-intensive economies in the world, and in Southeast Asia, where mega cities are fast becoming significant sources of greenhouse gas emissions. Under its Energy for All initiative, ADB is also helping DMCs to increase access to modern energy services with a goal of providing 100 million people with access to clean, reliable energy by 2015. ADB's proposed clean energy investments for 2008–2011 are estimated at around $6.7 billion.

Sustainable transport. Transport is the largest volume sector of ADB's operations, accounting for 33% of commitments made during 2000–2006—about 80% of which was focused on road construction. While road and vehicular transportation is important to meet the objectives of growth and poverty reduction, the transport sector is the fastest-growing source of greenhouse gas emissions in Asia. In response, ADB recently approved the Sustainable Transport Initiative which will provide technical and financial support across all ADB regions; help plan transport investments that reduce greenhouse emissions; and address concerns over local air quality, congestion, and safety. In addition, ADB's transport projects will promote less energy-intensive construction and the use of recycled and long-life materials to improve project efficiency and reduce carbon emissions.

Urban initiatives and climate change mitigation. ADB has initiated programs to promote reductions in greenhouse gas emissions in Asia's cities while accommodating their continued growth (as well as their adaptation to climate change). Most notably, the CDIA has created a pipeline of sustainable urban investments, with 18 city-specific interventions identified throughout the region. Independently of the CDIA, efforts to reduce urban greenhouse gas emissions derived from transport, residential and commercial buildings, industry, and waste are ongoing in all ADB regions, and many of the waste management projects are now being considered for carbon finance.

Reduced emissions from deforestation and degradation (REDD). Improving land use management, including avoiding deforestation, could provide emissions reductions at a relatively low cost. ADB is already cooperating with several

[11] Measurable, reportable, and verifiable is a term from the Bali Action Plan of the UNFCCC that applies to mitigation actions taken by countries to reduce emissions. For a definition please see the glossary.

[12] ADB's recent W-Paper on Energy Policy prioritized promoting energy efficiency and renewable energy as one of the three main focus areas of ADB's energy sector operations. This is in recognition of global concerns of climate change and the important role its DMCs have to play in mitigating global warming.

international partners through the global Poverty and Environment Partnership to examine how to apply the REDD concept in its DMCs, and is supporting several pilot projects through its Climate Change Fund in Cambodia, the PRC, and Indonesia.

Adaptation to Reduce Vulnerability

ADB will dramatically increase its efforts to help countries in Asia and the Pacific adapt to the impacts of climate change. It will build the capacity of government partners to plan climate responses, as well as internal capacity of staff to develop projects that are climate resilient. However, where authorities, vulnerable sectors, and communities are facing threats from climate extremes, ADB will apply the Precautionary Principle for adaptation and invest in climate-proofing for both hard and soft infrastructure investments. Where feasible, ADB project investments will immediately introduce cost-saving climate-proofing measures to minimize current and expected impacts. To avoid creating unevenness between stage 1 and stage 2 adaptation (planning and preparation) and stage 3 (project-oriented adaptation programming), both levels of adaptation climate-proofing will often be designed and implemented in tandem.

ADB's adaptation response will concentrate on climate-proofing hard infrastructure projects with some focus on building ecosystem resilience through investments in improved management in the agriculture and water sectors.

Mainstreaming adaptation in DMC development planning. ADB is now helping DMCs develop national and sub-national adaptation plans and policies so they are more responsive to future climatic conditions. ADB is currently supporting adaptation planning in Southeast Asia, and will soon provide support to Sri Lanka and India. Climate change impact and adaptation needs are being considered and incorporated into ADB's country policies, policy dialogues, capacity development activities, and investment pipeline.

Mainstreaming adaptation in the ADB project cycle. A screening tool has been developed to assess risks (i.e., glacial melting, sea-level rise, and extreme weather events) in all ADB projects. DMCs will need to consider climate-proofing their investments through the application of similar screening tools. As adaptation planning expands, the incorporation of climate change risks into investment planning can be expected to progress from the project level to the subnational and national levels. ADB will assist DMCs with this process.

Increasing resilience of sector strategies. Sector road maps at the country level are being adjusted to incorporate climate change and disaster risk assessment considerations. The most vulnerable sectors are agriculture and natural resources, urban development, health, water supply and sanitation, transport (including coastal roads and ports), and energy (especially hydropower).

Disaster risk reduction to build resilience and support adaptation. Disaster risk management and disaster risk reduction approaches are areas for immediate adaptation intervention to ensure project resilience against anticipated climate impacts. Proposed ADB adaptation interventions will be strengthened and expanded in line with its *Disaster and Emergency Assistance Policy* and the Hyogo Framework for Action 2005–2015, an international commitment to reduce disaster risk. The $40 million Asia Pacific Disaster Response Fund has been established to ease the impacts of weather-related natural disasters on DMCs. ADB is seeking contributions to this fund from all development partners.

Addressing the social impacts of climate change. There are a number of social impacts of climate change faced by DMCs.

Gender. Children, women, and the elderly are already the most vulnerable within poor communities, and women constitute the largest percentage of the world's poorest people. By enabling women to take a more active role in decision making, opportunities to increase both women's empowerment and the effectiveness of measures for climate change adaptation and mitigation at the community level will be strengthened. Gender participation will be addressed in climate change programs during project design, particularly where ADB and partners are investing in responses to climate change for subsistence sectors primarily managed by women, such as agriculture, water, and household energy.

Migration. Where people decide to relocate as a result of climate-related factors, ADB will support governments to develop strategies to respond, particularly in infrastructure development, education, and regional cooperation, as they are consistent with the core operational areas in Strategy 2020. ADB will consider options for providing the financing needed to improve the absorptive capacity of areas that receive migrants, improve the skills and education of migrants, and help with migrants' resettlement costs.

Human health. The serious implications of climate change for human health in Asia and the Pacific may well require development of a comprehensive suite of human health policies to address waterborne diseases and other sicknesses that are related to climate-induced change, including those arising from poor water quality and nutrition. Adaptation options for the effective control of dengue fever include eradication of artificial breeding sites (e.g., litter, solid waste, and water containers), and preventing entry of mosquitoes by strengthening quarantine regulations and border surveillance. ADB will continue to invest in infrastructure to improve reliability and safety of water supply, and to improve sanitation infrastructure and services to reduce climate-change-related increases in the incidence of diarrheal disease.

Adaptation and Mitigation Synergies

Land conservation, rehabilitation, and sustainable soil and water resource management have significant mitigation potential in several ADB regions. ADB will support more sustainable land management in the rangelands of Central Asia and on farmlands and forestlands in Southeast Asia and East Asia. Regional institutions, including CACILM and the GMS Environment Operations Center, will share lessons learned from combined mitigation and adaptation projects across the region. ADB is already working to promote carbon sequestration in soil and forests by developing and spreading knowledge and by using pilot projects to test innovative financing mechanisms. New technical assistance will be provided to ADB DMCs to develop domestic expertise to support projects such as REDD. Furthermore, grants provided by ADB's Climate Change Fund will support a minimum of four pilot REDD projects during 2009–2012.

Regional Priority Responses for Development and Climate Change

Central and West Asia Region

Recent Development Trends and Climate Change

Central and West Asia is a large region of varied geography, culture, and economic opportunity. The natural environment includes high mountain passes, vast grasslands, and large internal water bodies—including the Indus, Amu Darya, and Syr Darya river basins and the Caspian and Aral seas—all of which are essential for agriculture, trade, and energy production. The economies of Central and West Asia are recovering, despite a period of slowed

Water resources in Afghanistan, critical to every day life are threatened by climate change, F. Radstake 2008.

growth in the 1990s after the dissolution of the Soviet Union. Most countries in the region are experiencing high growth rates of between 5% and 20% of GDP annually, much of it from the oil and gas sectors. In addition to lucrative oil and gas reserves, Azerbaijan, Kazakhstan, Turkmenistan, and Uzbekistan have among them some of the world's largest reserves of manganese, copper, coal, iron, uranium, and gold. Despite this mineral wealth, half of the population in the region—and a much larger portion in Pakistan and Afghanistan—live in poverty and lacks access to sufficient natural and capital resources to sustain their livelihoods (UNDP 2007).[13]

Key vulnerabilities and impacts. Water is by far the most precious and contentious natural resource in the region. Transboundary water and energy conflicts in Central Asia already pitch the summer irrigation needs of downstream countries (Kazakhstan, Turkmenistan, and Uzbekistan) against the winter energy needs of upstream countries (Kyrgyz Republic and Tajikistan), making water and energy efficiency key priorities for economic security and development. The Indus river basin is of major importance for the economies of several countries including Afghanistan, India, and Pakistan, providing irrigation to more than 16 million hectares of agricultural land and generating up to 13 gigawatts of electricity per year. Glacial retreat and changes in precipitation patterns and temperature regimes are expected to jeopardize hydropower generation and irrigated agriculture production, which accounts for close to 25% of GDP in Pakistan and Uzbekistan, and 36% in Afghanistan.

Subsistence farmers and pastoralists in Central and West Asian successfully used scant water resources for crop and livestock production for hundreds of years, before policies aimed at maximizing intensive crop production in the 1950s increased pressures on water systems. Initiatives such as ADB's CACILM have sought to reestablish and strengthen regional cooperation for sustainable water and land management. However, substantial additional support is needed to plan responses to expected climate change so as to increase traditional and contemporary adaptation efforts that lessen risks from increased flooding due to glacial melt, drought, dust storms, and other anticipated impacts.

Key greenhouse gas sources. Total emissions in Central and West Asia are relatively low,[14] and emissions of greenhouse gases fell in the region as a whole during the 1990s as a result of a breakdown of the previous planned economic system (UNDP 2007).[15] Despite this, emissions in Central Asia are currently increasing at rates higher than in the rest of the world, with the five Central Asian countries ranking among the 14 most carbon-intensive economies in the world. Uzbekistan is one of the two most carbon-intensive economies in the world, emitting over 11 t of CO_2 per $1,000 of GDP in 2004. Kazakhstan was ranked fourth in 2004, while Azerbaijan, Kyrgyzstan, Tajikistan, and Turkmenistan all had intensities of around 2.0 compared with 0.5 in the United States and 0.27 in the European Union and Japan (World Bank 2008).

[13] In fact, five of the 10 countries considered in the UNDP report—Afghanistan, Pakistan, Kyrgyzstan, Tajikistan, and Uzbekistan—had nominal per capita GDPs of less than $1,000 in 2007. Kazakhstan had the highest at about $6,000.

[14] Approximately 600 t of CO_2 equivalent emissions were estimated to have been produced by Central and West Asian countries in 2007, which was 1.25% of the global total. (World Bank 2008, UNFCCC 2007).

[15] Although greenhouse gas emissions grew in Uzbekistan and Turkmenistan through the 1990s.

Policy and institutional environment. All Central and West Asia countries are members of the UNFCCC and, with the exception of Afghanistan, have ratified the Kyoto Protocol. However, climate change institutions (national climate change coordination councils, climate change coordination centers, and designated national authorities for the CDM) are not well developed. While these institutions have been established in most countries, they do not have the technical capacity for climate projections and impact assessment, greenhouse gas inventories, and CDM proposals, and are reliant on donor assistance. While activities have been initiated in all countries in the region, this has not translated into concerted action. There are limited incentives to promote energy efficiency and significant institutional, financial, and technological barriers remain for renewable energy and energy efficiency.

Moreover, few resources have been allocated to reduce the vulnerability of the water, hydropower, and agriculture sectors to climate change. In fact, Uzbekistan is the only country in Central and West Asia with a national climate change adaptation plan. Only Pakistan and Kazakhstan participate in GEF adaptation funding. Tajikistan has become one of only eight least-developed countries to be eligible under the World Bank-administered CIF Pilot Program on Climate Resilience.

Policy and institutional support. In Central Asian countries, the water–energy nexus is a key issue, with conflicting energy and irrigation needs and major international tensions. Integration and expansion of existing ADB regional projects in Central and West Asia can address these issues in the context of regional water and land resource management, while leading to multiple adaptation

Irrigation system in need of upgrade in Central Asia, R. Everitt 2009.

and mitigation benefits. ADB will support regulatory and legislation changes at the country level. For example, ADB will provide assistance for policy reform in Afghanistan for the energy sector, and in Pakistan and Uzbekistan for the water sector through 2011. Through CACILM, the Central Asian Regional Cooperation (CAREC), the South Asian Association for Regional Cooperation (SAARC), and other regional dialogues, ADB will support regional policy development to inform planning and build greater resilience in Central and West Asian economies. Across the region, ADB will help countries dramatically increase their carbon productivity by increasing energy efficiency, replacing carbon-based fuels in the electrical power sector with renewable energy sources, and preserving and expanding carbon sinks (e.g., forests and grasslands).

There will be support for capacity building interministerial policy dialogue, and development of policy and legislation favoring investment in energy efficiency, renewable energy, improved water management, and land conservation. Technical assistance will build the capacity of national climate change institutions to assess impacts and to strengthen adaptation planning, as evidenced by the ongoing analysis supported by ADB's Climate Change Fund—Glacial Melt and Downstream Impacts on Indus-Dependent Water Resources and Energy. At the regional level, ADB recently approved technical assistance on Enabling Climate Change Interventions in Central and West Asia. This technical assistance will help 10 countries to remove barriers to renewable energy development and develop climate change policies and the capacity of national climate change institutions, and incentives to promote energy efficiency. It will foster carbon market development, assist with climate change adaptation planning, and provide for climate-proofing of ADB investment projects. Furthermore, ADB will continue its involvement in CACILM, prioritizing activities that build climate resilience through improved land management techniques that lead to increased ecosystem resilience and carbon sequestration activities in Central Asia.

Promoting low-carbon growth. Mitigation projects focusing on improved energy efficiency and clean energy, transport (including non-fuel aspects such as better urban planning), improved waste management systems, and land restoration, offer cost-effective opportunities in Central and West Asia. ADB will assist countries to harness international financial flows to support structural and sector-specific adjustments, aligning its operations with a long-term vision for the energy sector in the region concentrating on investments in hydropower development; clean energy and energy efficiency; and cross-border energy infrastructure, focusing on Kazakhstan, Pakistan, and Uzbekistan. Perhaps the most significant renewable energy project to be implemented in the region in the short term is the multitranche financing facility for the Renewable Energy Development Sector Investment Program (over $500 million) in Pakistan. In addition to investment in projects, ADB and its partners will help develop and improve greenhouse gas inventory systems and energy modeling systems to facilitate better energy resource management.

ADB will expand the scope of its investments in transport infrastructure as it continues to support country and cross-border network development. Climate change considerations will be incorporated into project design and implementation, specifically by working to decrease emissions during construction and make travel more efficient. Assistance has already begun to help develop the rail sector in Afghanistan, Azerbaijan, Georgia, Pakistan, and Uzbekistan.

ADB will continue to develop its portfolio of urban projects focusing on district heating, water supply, and sanitation providing energy efficiency benefits in Central and West Asia. Efforts in the urban transport sector will involve mitigation opportunities that promote urban mass transport systems, intercity and intracity rail transport, and improved fleet usage of existing bus transit systems. ADB's planned investments include energy efficiency improvements combined with water and waste management service upgrades in Azerbaijan, the Kyrgyz Republic, Pakistan, and Uzbekistan—projects that will concurrently reduce emissions and ensure broader access to healthy drinking water and modern sanitation.

Carbon market development. High and rising emissions in Central Asia mean there are vast opportunities to invest in emissions-reduction measures, including in energy efficiency, fuel switching, industrial processes, renewable energy, waste-management systems, and land restoration. These measures offer cost-effective abatement options attractive for carbon financing. In Central and West Asia, very high carbon intensities offer significant opportunity to develop sector policy reforms and regional programs with carbon market appeal. For example, Kazakhstan has halved its carbon intensity in 2004–2009, and has the potential to repeat this reduction, mitigating 100 t of CO_2 per year. Similar reduction potential exists in Uzbekistan and Pakistan. Carbon markets are poorly developed in Central and West Asia, with limited development only in a handful of countries. Afghanistan has not ratified the Kyoto Protocol; Tajikistan ratified the protocol in September 2008 as a CDM country but has not yet appointed a CDM designated national authority. Kazakhstan ratified in February 2009 as a Joint Implementation country and thus will need time before the appropriate designated national authority and project development processes can be put in place. Of only eight registered CDM projects in Central and West Asia, four are in Armenia, two are in Pakistan, and there is one each in Georgia and Uzbekistan.

Currently, under the CMI, ADB is considering CDM development for hydropower projects in Pakistan and Uzbekistan, among others. ADB will track the potential of new and innovative carbon market approaches for countries in Central and West Asia, including expansion of the CDM to finance large regional projects, and support for project activities that couple mitigation activities and adaptation benefits.

Box 3: Regional Responses in Central and West Asia

Many international private and public organizations aim at supporting climate change response strategies in Central and West Asia, either directly by enhancing capacity and enabling specific mitigation and adaptation actions, or indirectly by supporting sustainable energy, water, and soil resource use. Efforts include CACILM, focusing on land restoration with significant mitigation and adaptation potential; the Central Asia Regional Economic Cooperation program, focusing on improving efficiency in transport and energy; and the South Asian Association for Regional Cooperation (SAARC), focusing on mitigation and adaptation with attention to rural poverty. Global Environment Facility (GEF) funding to individual Central and West Asian countries totals more than $140 million to date, with $250 million allocated for regional efforts. ADB will continue support of, and coordination through, these initiatives to expedite the implementation of climate change responses.

Adaptation to Reduce Vulnerability

In Central and West Asia, ADB will increase investment in adaptation measures through sustainable land and water management; strengthening capacity to improve land management and reduce risks of land degradation; and improving infrastructure to prevent damage from increased flooding, drought, dust storms, and other expected impacts of climate change. In the water sector, ADB will invest in climate-resilient water infrastructure in Afghanistan, Pakistan, and Uzbekistan in 2009–2011, primarily to ensure agricultural productivity.

Country sector road maps will incorporate climate change considerations into all relevant investment programs, the first of which (for Tajikistan) will be finalized in 2009. ADB will also support Tajikistan as the government plans to use funds from the Pilot Program for Climate Resilience.

Adaptation and Mitigation Synergies

Opportunities to design activities that simultaneously address mitigation and adaptation, especially in renewable energy, water, and land resource management sectors, exist throughout Central and West Asia. Land conservation, rehabilitation, and improved management of soil and water resources in marginal growing areas have significant adaptation and mitigation potential if projects are designed to build more resilient ecosystems and provide additional sources of income for local populations, as well as increase carbon sequestration in soils. However, there are currently few efforts focused on land-based carbon sequestration. Armenia, Azerbaijan, and Georgia have the potential for reforestation of degraded lands, yet there is much less land available than in Central Asian countries. The vast rangelands of Central Asia have significant mitigation potential connected with land restoration and conservation activities; however, in practice, only a small fraction of these lands can be restored to natural grasslands. ADB will support projects that support sustainable land use through CACILM and will work with additional partners—ICARDA, IFPRI, and others—to evaluate and implement projects that will simultaneously reduce emissions and improve the resilience of ecosystems.

East Asia Region

Recent Development Trends and Climate Change

ADB's East Asia Region is made up of two very different countries: the People's Republic of China (PRC), an economic and population giant with largely a coal-based economy; and Mongolia, a country with barely 0.2% of the PRC's population but with a combination of location, resource endowments, and economic structure that make it highly vulnerable to the impacts of climate change. Both countries have witnessed fast economic growth in recent years, although it is more rapid and broadly based in the PRC than in Mongolia. Economic growth has led to significant reductions in poverty in both countries, but the reduction is deeper and more sustained in the PRC than in Mongolia. Greater energy production has accompanied much of the PRC's economic growth but, given the high share of coal in energy production, this has placed the PRC on a high-carbon development path. In Mongolia, the revival of economic activity during recent years has increased greenhouse gas emissions, although from a very low base. Over the last decade, leaders in both the PRC and Mongolia have become more aware of the likely impacts of climate change on their economies and populations and their ability to adapt to them.

Desertification in Xingjiang, PRC F. Radstake, 2008.

Key vulnerabilities and impacts. Climate change impacts on economies, populations, and ecosystems are already observable across the PRC and Mongolia. Desertification affecting large areas of drylands on the edges of the Gobi Desert threatens fragile livelihoods which are based on natural resources. Glacial melt on the Tibetan Plateau and in the Mongolian Altai is a long-term threat to the countries' agricultural and urban (in the case of the PRC) heartlands.[16] Water scarcity exacerbated by climate change and poor water management is already causing more than 150 million people to relocate in the PRC (Watts 2009). In the absence of appropriate countervailing steps, climate change is likely to become even more of a factor in rural–urban migration, placing increasing pressure on infrastructure and social services in both the PRC and Mongolia. Increasing temperatures are expected to accelerate the global water cycle and have complex—but largely unfavorable—repercussions for annual river flows. This is especially worrying in the case of the Yellow River, and for the productivity of important ecosystems such as pasturelands. Climate change is becoming a major determinant of agricultural productivity in both the PRC and Mongolia, with negative results expected for domestic food prices and social welfare.

Continued and more rapid sea-level rise is a threat to industrialized and heavily populated coastal areas of the PRC, such as the Pearl River delta and coastal mega cities such as Shanghai and Tianjin. These two cities have a combined population of over 80 million people. The prospect of greater frequency of extreme weather events, mainly droughts and flooding in Mongolia (*dzuds*[17]), and droughts, floods, and typhoons in the PRC, is of great concern and requires improvement of existing disaster risk management strategies to include systematic climate-proofing of public and private infrastructure, among other interventions.

Key greenhouse gas sources. In spite of low per capita energy consumption, the PRC contributed more than 40% of the increase in global demand for primary energy and over 70% of global incremental demand for coal between 2000 and 2006. The PRC is now the world's second-largest energy consumer and, alongside the US, the largest emitter of greenhouse gases (Global Carbon Project 2007). Mongolia's total greenhouse gas emissions are minimal; however, per capita greenhouse gas emissions are among the highest in Asia due to the need for heating for up to 9 months of the year, energy inefficiency, and methane emissions from livestock. Burning coal—the most CO_2-intense and least environmentally friendly fossil fuel—results in approximately 75% of the total CO_2 emissions in the PRC and approximately 60% in Mongolia.[18] With an annual output exceeding 2.4 billion tons—one-third of the world total—coal accounts for about two-thirds of the PRC's total primary energy usage and fuels nearly 80% of power generation, 75% of industrial processes, and 80% of household cooking and heating.[19] Dependence on coal and

[16] The analysis of the PRC's National Assessment Report on Climate Change of 2006, and Mongolia's Initial National Communication to the UNFCCC 2000 (with several subsequent refinements) give detailed information on potential climate impacts in the region.

[17] *Dzud* is a local term for an extreme episode of winter weather when very low temperatures combine with snow cover over a prolonged period, exacting high toll on livestock and their owners. The history of Mongolia's pastoral economy could be described (also) as a history of resistance to dzuds, and one of rebuilding of the national herd following dzud-related losses.

[18] The mining, transportation, and storage of coal, and ash treatment add further volumes of greenhouse gas and other pollutants. The shares of the transport, household, and services sectors have been relatively small compared with in developed economies, but have started to increase with rapid urbanization and income growth.

[19] In the US, coal accounts for one-third of the total energy supply and half of the country's electricity generation.

Box 4: Regional Cooperation

Although most efforts to address climate change within ADB's East Asia Region take place at a country (rather than regional) level, regional and international cooperation is vital to containing climate change, especially in the areas of technology transfer and institutional capacity building. Here, ADB's support has been increasingly embedded in regional cooperation strategy programs, including the Central Asia Regional Economic Cooperation (CAREC) program which links Mongolia and the PRC provinces of Xinjiang Uygur Autonomous Region and Inner Mongolia with the countries of Central Asia and the Greater Mekong Sub-region (see section on Southeast Asia). Although CAREC activities have so far favored regional rather than global public goods (such as greenhouse gas mitigation), the program scope can be expanded to embrace them.

CAREC aside, ADB's substantive program of DMC-wide regional technical assistance has often had Mongolia and the PRC as participating countries. ADB will continue to offer its services as a climate change facilitator in the coal and energy sectors increasingly linking investors in Mongolia and the PRC. ADB will encourage highest efficiency performance standards for new power plants in Mongolia, potentially through CAREC, and use existing regional knowledge hubs such as the climate change knowledge hub at Tsinghua University to promote best mitigation and climate change adaptation practices in the region.

abundant reserves guarantee it as a major source of primary energy for decades to come.[20]

Transport-related CO_2 emissions accounted for around 7% of each country's total and are expected to increase to about 15% by 2030 if current vehicle ownership trends continue. The mining sector has been a major indirect contributor to greenhouse gas emissions in Mongolia through high energy use.[21] Livestock has accounted for over one-third of total greenhouse gas emissions in Mongolia (at CO_2 equivalent). In both countries, the management of soils and biomass has had major repercussions on the carbon balances. In Mongolia, plowing up the grasslands to produce crops ceased as collectivized agriculture collapsed in the early 1990s, slowing greenhouse gas emissions. Where agriculture-related emissions have slowed, land use change due to forest and steppe fires have increased, contributing an estimated 20% of the country's greenhouse gas emissions and making forest management and forest fire prevention much higher mitigation priorities.[22] In the PRC, due to large-scale reforestation efforts in recent years and some improvements in soil management, the country has had a modest positive carbon-storage balance on its land account. Carbon sequestration through biomass management and agricultural practices could become a powerful way of offsetting much of the projected growth in the PRC's industrial greenhouse gas emissions.

[20] Rapid replacement of coal based energy in the PRC might turn out to be unpopular since, in the absence of technological innovation, it would increase the PRC's import of cleaner hydrocarbons, thus increasing the world price of those hydrocarbons. Technological innovation or modernization in the PRC's coal-based energy industry would be very beneficial globally, without question. However, how this innovation should be organized and financed, especially in proportion to be paid by those outside the PRC who would also benefit from the country's reduced GHG emissions.

[21] The Erdenet copper complex, for instance, with its ore-enriching operations, consumed more than one-third of the country's total power output at the end of the 1990s.

[22] The annual totals of forest and steppe areas lost to fires varies, and here an average of the period 1990–1995, around 5,500 hectares, is used to derive the order of magnitude.

Policy and institutional environment. Both the PRC and Mongolia are signatories to the Kyoto Protocol and have developed national plans directing responses to climate challenges. Following a number of initial steps, in 2007 the Government of the PRC released the National Climate Change Program (NCCP)[23] outlining the policies and objectives in the areas of climate change mitigation, adaptation, research and development, public awareness, and international cooperation.[24] The NCCP sets binding, quantitative targets for certain parameters linked to emissions reductions (such as energy intensity), identifies adaptation intervention priorities, and recommends considerations informed by climate change to be incorporated into the design of future investment projects. Mongolia has formulated the National Action Plan on Climate Change which identifies priorities for climate change responses without binding targets. The action plan is supplemented by several sector plans or strategies, in areas such as renewable energy and climate change adaptation in the livestock sector; however, there is limited coordination between sectors to respond to climate change.

In the PRC, aggressive national policies helped reduced emission intensity by nearly 50% between 1990 and 2004. The improvements slowed in 2000 as domestic and foreign investment in heavy industries such as steel, aluminum, and cement intensified.[25] PRC's 11th 5-year plan aims to further reduce overall energy intensity by 20% by 2010. Mongolia, with a much slower rate of replacement for energy infrastructure, has not been able to achieve similar improvement.

Policy and institutional support. ADB has been working on climate change in its East Asia Region for over two decades, although it has recently become much more explicit. Over time, ADB investments have yielded climate change benefits alongside more conventional benefits (e.g., improved incomes for local stakeholders and access to energy). ADB will continue its support to the PRC and Mongolia to improve energy efficiency, land use, and wastewater management, building capacity to support sector policies that will result in lower greenhouse gas emissions, especially at the subnational level. In both the PRC and Mongolia, ADB will support strengthened disaster risk management by building strong institutional connections between climate change adaptation and official disaster preparedness and response mechanisms. In the PRC, priority will be given to

[23] Given further endorsement in October 2008 in the State Council's *White Paper on China's Policies and Actions for Addressing Climate Change*.

[24] To a significant degree, the NCCP brings together elements of other important official programs such as the Medium and Long-term Plan of Energy Conservation, the 1000 Enterprise Program, several old plant closure schemes, the China Green Lights Program, the National Landfill Gas Action Plan, and several others on the mitigation side alone. In the case of Mongolia, this integrating task has not been completed and, as a result, this CCIP had to construct the overall picture from individual documents.

[25] Prime Minister Wen Jiabao's speech to the 2009 National People's Party Congress referred to a 4.59% decrease in overall energy intensity in 2008, a significant achievement in the face of the global financial crises that slowed down the PRC's export industry, generally the more energy efficient segment of the economy. To put the impact of foreign direct investment on energy intensity in context, the cumulative inward foreign direct investment in the PRC was $703 billion (equal to 25.4% of GDP) at the end of 2006 (ADB cumulative lending to the PRC as of the same year was about 2% of that figure). Subsidiaries of foreign multi-national firms in the PRC accounted for 58.2% of the PRC's exports and 59.7% of its imports in 2006. The flow of goods in either direction embodies greenhouse gas emissions generated in the original place of production and in transport. The pattern of greenhouse gas emissions associated with international trade is an important topic, but one that defies overgeneralizations.

critical infrastructure in low-lying coastal areas and its protection from sea-level rise and extreme weather.

Promoting Low-Carbon Growth

ADB's existing pipeline investment in climate change mitigation in East Asia focuses on energy efficiency and energy conservation, alternative energy development, cleaner coal technologies, coal mine and coal bed methane, urban environmental improvement, and sustainable transport.

Increasing already significant support to energy efficiency and continuing support for alternative energy. In both the PRC and Mongolia, ADB will replicate successful approaches to (i) increasing energy efficiency in buildings, heat and power supply utilities, and key industries; and (ii) promoting renewable energy, adding elements of technological or financial innovation. In both countries ADB will also promote energy efficiency in public sector services such as hospitals and government offices, and participate in dedicated clean technology funds, multilateral forums, and projects that catalyze transfer and diffusion of clean technology. This includes the innovative Guangdong Energy Efficiency and Environment Improvement Investment Program with its application of CDM carbon credits. To lessen the impact of continued reliance on coal, ADB is investing in the Integrated Gasification Combined Cycle Power Plant in Tianjin in the PRC, one of the region's first carbon capture and sequestration-ready installations.

ADB is supporting renewable energy projects and exploring opportunities to leverage carbon finance to improve the financial terms of projects. In

Biogas digester helps reduce emissions and provide clean energy in PRC, F. Radstake 2008.

cooperation with the private sector, ADB recently completed construction of the Zhangbei Wind Power Project in the PRC—a 100.5 megawatt wind power facility that will replace 86,118 t of standard coal for power generation and reduce annual CO_2 emissions by 242,127 t. ADB has plans to invest in additional alternative energy projects, including more wind power, biomass, and hydropower plants. ADB will also expand private sector engagement in East Asia, furthering opportunities to address a number of issues, particularly industrial emissions.

Promoting sustainable transport and urban development. ADB supports sustainable transport and urban development, including investments in public transportation and improved mobility. ADB will invest in sustainable urban transport infrastructure in Ulaanbaatar in Mongolia and in selected cities in the PRC to minimize increases in CO_2 emissions from the urban transport sector. Urban investments will continue to promote low-carbon growth and improve environmental management in cities by reducing methane emissions in wastewater treatment, wastewater sludge management, and in landfill gas recovery as components of urban waste management, and where appropriate, formulate CDM projects. In partnership with the Clean Air Initiative for Asia and others, ADB will further increase investments—such as those planned for Gansu Baiyin, Guangxi, and Xinjiang in the PRC—that yield local health benefits and global climate benefits.

Zhangbei Wind Project provides clean energy in PRC, L. Sorkin 2009

Carbon Market Development

Building on the PRC's successes in tapping carbon markets to leverage more funding for technology retrofits in the most emission-intensive industries, ADB will support measures to increase local (province and county) capacity to implement CDM and similar projects in the PRC. ADB will also promote the transfer of CDM know-how to project developers in Mongolia and other countries in Asia and the Pacific. More than a dozen projects are being evaluated for CDM potential in the PRC, including agricultural waste management, wind power, and urban landfills. In the PRC, four ADB supported carbon market project developers will continue to identify projects and develop methodologies.

Adaptation to Reduce Vulnerability

Increasing support for climate change adaptation to match the recent attention given to greenhouse gas mitigation. Climate change adaptation in the East Asia region will be pursued primarily through integrated river basin development projects, and increasing attention to climate-proofing urban water services infrastructure. In urban sector projects, ADB will help policy makers to incorporate the issue of incremental internal migration (resulting from climate change) into development planning, anticipating additional demands on urban infrastructure and social facilities (Revkin 2009). In both urban and rural areas, ADB will make water-related infrastructure more resilient to current and probable future impacts of climate change, incorporating climate change into proposed water management projects in Jilin and Shandong in the PRC, among others. ADB will also increase investment to strengthen ecosystem resilience to reduce the impacts of climate change, as in the Qingdao Water Resources Management and Wetland Protection project. This project is designed to restore degraded wetlands, helping to minimize flooding and reduce pollution impacts.

Adaptation and Mitigation Synergies

ADB assistance for tackling climate change in the PRC and Mongolia will increasingly address both the mitigation and adaptation dimensions that coexist in individual sectors of the economy, including agriculture, livestock, and water. ADB is promoting synergies between climate change mitigation and adaptation activities in single projects. For example, the Integrated Ecosystem and Water Resources Management in Baiyangdian Basin project improves ecosystem resilience, and promotes more efficient heating from renewable (geothermal) energy instead of coal. ADB will continue to invest in improved food and livelihood security projects in the PRC and Mongolia, focusing on dryland and forest management, with an eye towards carbon sequestration. ADB is already working to promote carbon sequestration in soil and forests by developing and spreading knowledge and by using pilot projects to test innovative financing mechanisms. ADB will assist the PRC and Mongolia in developing domestic expertise to support projects on REDD. One such project will be implemented in Jiangxi in the PRC and will be supported by ADB's Climate Change Fund.

Pacific Region

Recent Development Trends and Climate Change

Despite variation across countries in the region, ADB's Pacific Region is not keeping pace with the economic growth of its Asian counterparts or with high population growth rates. Sluggish growth is preventing peri-urban populations and those left behind on outer islands from meeting basic needs. While data are not definitive, more than 25% of the populations of Fiji Islands, Kiribati, the Federated States of Micronesia, Papua New Guinea, Solomon Islands, Timor-Leste, and Vanuatu are believed to be living in poverty (ADB 2004). Compounding these development challenges are the serious socioeconomic, environmental, physical, and cultural consequences of recent changes in climate. Increases in high-sea-level events (e.g., storm surges), rainfall and other extreme weather events, drought, air and sea temperatures, water shortages, and erosion are causing significant economic and related problems for all sectors of the island economies and societies. In the absence of prompt and substantial reductions in global greenhouse emissions, these and new impacts will undoubtedly become even more serious in the future.

Coral Triangle Initiative Builds Adaptation Capacity in the Pacific, ADB 2009

Key vulnerabilities and impacts. Pacific island countries have identified common areas of vulnerability related to climate change, including coastal hazards, sea-level rise, coral bleaching, food and water supplies, health, and climate-related natural disasters. The Pacific region's existing geophysical hazards—earthquakes and volcanic activity, and associated secondary hazards such as fires and tsunami—compound increasing climate vulnerabilities. According to IPCC projections, the Pacific will experience sea-level rise of 0.19–0.58 meters by 2100, resulting in accelerated coastal erosion and saltwater intrusion causing significant complications for the more than 50% of the region's population that lives within 1.5 kilometers of the shoreline. Despite ongoing adaptation responses, the long-term effects of climate change, particularly sea-level rise, are likely to result in the relocation of substantial numbers of people.

Furthermore, the Pacific region poses complex adaptation challenges due to widely varying geography among countries; varying institutional capacity to diagnose problems and design appropriate solutions; and varying economic, social, and environmental conditions.

Key greenhouse gas sources. The Pacific region accounts for less than 0.1% of global greenhouse gas emissions, due primarily to its relatively small population, limited industrial activity, and underdeveloped energy services. All Pacific countries are relatively small greenhouse gas emitters, but are heavily reliant on petroleum-based fuels for power generation and transport, making them highly vulnerable to oil price shocks. In the Pacific, greenhouse gas mitigation poses unique challenges and opportunities. The majority (70%) of the region's population does not have access to electricity and modern energy services, but this figure varies from 10% to 100% by country.[26] The demographic patterns result in small energy markets which are difficult to serve and cannot provide economies of scale.

Greenhouse gas emissions assessment prepared by the Pacific Islands Climate Change Assistance Programme, completed in 2000,[27] indicated that forest growth provided a carbon sink large enough to cancel out the region's greenhouse gas emissions. However, ADB's Pacific Region Environmental Strategy, 2005–2009, noted that deforestation in Papua New Guinea was occurring at a rate of about 80,000 hectares per year and that unsustainable logging was occurring in Solomon Islands, suggesting that recent deforestation may have resulted in positive net greenhouse gas emissions.

Policy and institutional environment. DMCs in the Pacific have implemented a large number of national activities on adaptation and mitigation, covering sector and national policies, programs, and plans that address or reflect the threat of climate change through to community-based adaptation initiatives. Initially, climate-related initiatives focused on ensuring compliance with international reporting requirements related to the UNFCCC. However, National Communications to the UNFCCC have not been kept current, and donor support is proving necessary to help Pacific DMCs prepare their second National Communications.

[26] This average is skewed by Papua New Guinea, with the largest population of the Pacific Region countries, but an electrification rate of only 10%; excluding Papua New Guinea, about 50% of the population has access to electricity and modern energy services.

[27] The study covered the Cook Islands, Fiji Islands, Kiribati, the Marshall Islands, the Federated States of Micronesia, Nauru, Samoa, Tuvalu, and Vanuatu.

Box 5: Regional Coordination in the Pacific.

Several regional strategies support climate change action in the Pacific:

- Pacific Islands Framework for Action on Climate Change, 2006–2015: Outlines principles and expected outcomes for addressing climate change including (i) adaptation measures, (ii) governance and decision making, and (iii) improving climate change understanding.
- The Pacific Islands Disaster Risk Reduction and Disaster Management Framework for Action, 2005–2015: Reflects commitment to disaster risk reduction and disaster management on an "all hazards" basis and in support of sustainable development, and contributing to the implementation of the Mauritius Strategy and the global Hyogo Framework for Action on Disaster Risk Reduction and Disaster Management.
- Pacific Islands Energy Policy and Plan: Helps coordinate energy programs of regional organizations and development partners, providing context for mitigation actions.

To support implementation of these strategies, the Secretariat for the Pacific Regional Environment Programme convenes regular meetings of the Pacific Climate Change Roundtable—a group of all regional and international organizations, as well as civil society organizations, with active programs on climate change in the Pacific region—to share information about ongoing actions and planned activities.

Subsequent project activities have focused on building adaptive capacity and on assessing vulnerability to climate change and appropriate adaptation responses. National adaptation programs of action (NAPAs) guide adaptation efforts in least-developed countries, outlining sector vulnerabilities and identifying priority actions to increase resilience to climate change. All four Pacific least-developed countries—Kiribati, Samoa, Tuvalu, and Vanuatu—have prepared NAPAs, submitted them to the UNFCCC, and used them to frame national adaptation activities.

Policy and institutional support. Support for climate change programming in the Pacific began with mitigation efforts in the mid-1990s, and adaptation considerations started to be incorporated into programming in 2003. Current and proposed ADB programs include 16 technical assistance projects and investment projects with mitigation and/or adaptation components, comprising approximately $9 million of technical assistance grants and $71.5 million in investments. ADB's Pacific strategy guides ongoing and future climate change interventions, built around the three priorities of private sector development, infrastructure investment, and good governance. Adaptation to climate change can be incorporated into all interventions, while mitigation opportunities exist primarily in infrastructure, renewable energy, energy efficiency, energy conservation, and reforestation projects. Pacific countries have started to mainstream climate change initiatives into national policies and planning processes, and have requested assistance from ADB to further and follow up on these efforts. ADB has responded positively, with a commitment to provide a broad spectrum of assistance[28] including the provision of

[28] Letter from PARD Director General dated 3 June 2008 to the Honorable Elbuchel Sadang, ADB Governor and Finance Minister of Palau. PARD also recently recruited a professional climate change specialist to be based at ADB's South Pacific Subregional Office.

additional resources to strengthen the capacity in its South Pacific Subregional Office.

In the Pacific region, where implementation capacity often falls short of donor support, ADB and other development assistance partners will pay increased attention to ensuring an effective approach and national ownership to aid harmonization and alignment, avoiding activities that undermine national institution building and good governance. Continued participation in, and strengthening of, the Suva-based development partners group[29] can help to ensure coordination and cooperation among development partners in addressing climate change in the Pacific.

Adaptation to Reduce Vulnerability

In 2005, ADB's Pacific Department (PARD) adopted *Guidelines on Adaptation Mainstreaming in PARD Operations*.[30] The department has already identified possible modifications that will climate-proof ongoing projects and incorporate climate-resilient design for new projects. In the future, ADB will place much greater emphasis on adaptation, and on new assistance to capture the synergies between adaptation and mitigation, and between disaster risk reduction and climate change adaptation. In the Pacific the sectors where addressing climate-related risks is of highest priority are (i) infrastructure and human settlements, including

Improving Roads in the Solomon Islands, R. Guild 2008.

[29] A regular meeting of ADB, the Australian Agency for International Development (AusAID), the European Union (EU), JICA, New Zealand Agency for International Development (NZAID), and the United Nations Development Programme (UNDP) to discuss climate change programming.

[30] The guidelines were prepared under the project *Climate Change Adaptation for the Pacific* which was implemented from early 2003 through early 2005.

water supply and drainage infrastructure, transport infrastructure (including coastal roads and ports), and energy generation capacity (especially hydropower); (ii) natural disasters and hazards; and (iii) coastal and marine adaptation.

Infrastructure and human settlements. Decreasing vulnerability to extreme weather and climate events requires better monitoring and management of current infrastructure as well as projected development. For existing infrastructure, ADB will work with government and development partners in each Pacific country to assess infrastructure at risk and design measures to build resilience against expected climate impacts. For new developments, Pacific countries need to incorporate climate-oriented design engineering, include protocols in their development plans, and incorporate stringent climate-adaptive development. Transport and urban investments in Solomon Islands and Tonga will provide initial opportunities for ADB to provide development guidelines in the Pacific.

Retreat inland is an adaptation option for some of the larger islands in less-inhabited atolls, but can only occur with the concurrence of the owners of the less-affected land. Moreover, when affected people have to move further inland or to other islands, they must be able to gain access to social services and resources without disrupting their new host communities. Both host communities and migrants will have to work to develop mutual understanding, and traditional values of the island peoples will need to be carefully considered in designing adaptation options. Through PARD, ADB will support communities to choose the best response to their national circumstances. ADB will also consider requests from DMCs to contribute to efforts to improve the education and workplace skills of migrants to assist with their integration.

Natural disasters and hazards. Natural hazard management policies and plans will be improved across the Pacific through the Regional Partnerships for Climate Change Adaptation and Disaster Preparedness program. Partnerships will be forged with national Red Cross and Red Crescent societies, which are at the forefront of civil defense in the Pacific region and have a long track record in risk management activities. ADB together with the World Bank is also assessing feasibility for a Pacific catastrophe risk financing facility that will assist in the management of budget as a result of financial shocks following a catastrophe event. Country interventions will support planning and enhance capacity to respond to disasters in the Cook Islands, the Marshall Islands, and Vanuatu.

[31] ADB guidelines for financial and economic analyses (i.e., the criteria that economic internal rate of return is greater than 12%, and the economic rate of return is greater than the financial internal rate of return, which is greater than the weighted average cost of capital) will apply to all projects and should not be waived. Where the financial internal rate of return is estimated to be subcommercial, concessional financing may be mobilized if there is a clear path to long-term commercial operations.

[32] The study noted that the Fiji Islands and Vanuatu had net negative emissions, while Samoa had net positive emissions due to deforestation.

Coastal and marine areas. ADB will consider further investment in creation and protection of natural marine buffer zones such as sandbars, near-shore coral reefs, and onshore coastal dunes, especially in high-risk mangroves and coral reef areas vulnerable to sedimentation and bleaching. As demonstrated through its role in the Coral Triangle Initiative, ADB will continue to work with government, NGOs, and donor partners to support programs to protect and renew fish stocks and corals.

Promoting Low-Carbon Growth

For the Pacific, ADB will prioritize investment in emissions reduction solutions that simultaneously provide greater energy security and increase economic competitiveness, including energy conservation and efficiency; supply- and demand-side measures; renewable energy deployment; reduction of greenhouse gas emissions from transport, solid waste, and wastewater treatment systems; and land use. New near-term projects will be identified and selected based on relevance to ADB's Pacific strategy priorities, least-cost analyses, and relative greenhouse gas abatement cost.[31] In the short term, a regional program—Promoting Energy Efficiency in the Pacific—implemented by ADB will assist the Cook Islands, Samoa, Tonga, and Vanuatu to develop the required policy, legal, and institutional frameworks for energy efficiency projects to be funded by ADB, the GEF, and others.

Adaptation and Mitigation Synergies

Opportunities exist to design interventions that support both adaptation and mitigation in the Pacific. Integrated programs focused on forest and land management and community livelihood development can contribute to better resource management, enhanced resilience to climate change, and mitigation where land use change is avoided or reversed. An assessment prepared by the Pacific Islands Climate Change Assistance Programme demonstrated that forest growth provided a carbon sink such that the region had negative net greenhouse gas emissions.[32] Reforestation of areas cleared by logging in Papua New Guinea and Solomon Islands represents potential opportunities for creation of carbon sinks as well as reducing the adverse impacts of climate change. ADB will consider engagement in the forest sector on a limited basis, particularly in the Fiji Islands, Papua New Guinea, Solomon Islands, and Tonga, where emissions reductions can be achieved from small-scale projects.

South Asia

Recent Development Trends and Climate Change

In demographic terms, South Asia is the region most vulnerable to climate change in the world. Not only do nearly half of the world's absolute poor people live in South Asia, the sheer numbers of small farmers, as well as settlements on South Asia's long coastline, leave hundreds of millions in ADB's South Asia Region at risk. While ADB's six DMCs in South Asia—Bangladesh, Bhutan, India, the Maldives, Nepal, and Sri Lanka—have made notable progress in terms of accelerating their economic growth,[33] recent macroeconomic events have shown that they continue to be vulnerable to external economic shocks. The global economic downturn has weakened their fiscal positions, lowered economic growth projections, and decreased resources available to governments to deliver basic services and develop much-needed infrastructure.

Solar installations provide clean, reliable energy to households, ADB Photo Library 2009

[33] By 2007, most of the DMCs achieved economic growth rates of 6% or more, resulting in a regional growth rate of 8.6%.

Key vulnerabilities and impacts. Impacts of climate change are already affecting millions of people in South Asia. The region's geographic features—extensive mountain ranges, river valleys, small islands, and fertile lowland plains—make it especially susceptible to climate impacts including drought, flooding, and sea-level rise. The Himalayas have the largest concentration of glaciers outside the polar caps, and these feed South Asia's major rivers—the Ganga, Indus, and Brahmaputra—ensuring a year-round water supply to millions of people. Over the past 30 years, the majority of glaciers in Bhutan, India, and Nepal have been retreating and thinning, with accelerated losses in the last decade. Increased glacial melt will intensify seasonal flooding and landslides, which have historically plagued upland areas and inundated communities in the large and fertile Indo-Gangetic Plain, one the most populated areas on Earth.[34] Coastal areas and island nations such as the Maldives will be hit hard by inundation and flooding as a result of sea-level rise, where, according to the most recent report by the IPCC, 60 million people in South Asia are living in high-risk coastal flooding zones.[35] As a result of sea-level rise, freshwater sources of islands and coastal regions will suffer saltwater intrusion. Floods and more intense and more frequent monsoon rains and tropical cyclones are causing considerable damage to critical infrastructure in vulnerable coastal areas of Bangladesh, India, the Maldives, and Sri Lanka.

While too much water is a problem in the region, too little water from climate change impacts will prove to be even more problematic. Extreme population growth in South Asia's river basins over the last century has put pressure on the region's water resources. In the long run, the disappearance of glaciers, along with shifting rainfall patterns and declining groundwater levels, could contribute to persistent droughts in various locations, affecting electricity production and exports, and irrigated agriculture due to disruption of river flows. Reduced water availability will also cause food insecurity in the region. In Nepal, for instance, a shift in monsoon precipitation patterns will threaten current agricultural practices and resultant floods and landslides will damage agricultural infrastructure, while glacial retreat and reduced winter precipitation may bring about droughts from November to April. More frequent and prolonged water shortages will increase the vulnerability of populations in South Asia to malnutrition and diseases such as malaria, diarrhea, and cholera (IPCC 2007b). Existing health risks, such as high levels of malnutrition in children, poor access to health care, and urban population growth, will be compounded by climate impacts.

Key greenhouse gas sources. While average greenhouse gas emissions of South Asia are a relatively low 3.0 t CO_2 equivalent per person per year, the total greenhouse gas emissions of the South Asia region accounted for 13.1% of global emissions in 2000 (IPCC 2007b).[36] A significant

[34] It is home to nearly 900 million people, or over one-seventh of the world's population.

[35] Of the nearly 200 million people at risk worldwide.

[36] In addition to the six DMCs (Bangladesh, Bhutan, India, the Maldives, Nepal, and Sri Lanka), South Asia in this context covers Afghanistan, Comoros, Cook Islands, Fiji Islands, Indonesia, Kiribati, Malaysia, Marshall Islands, the Federated States of Micronesia, Myanmar, Nauru, Niue, Pakistan, Palau, Papua New Guinea, the Philippines, Samoa, Singapore, Solomon Islands, Thailand, Timor-Leste, Tonga, Tuvalu, and Vanuatu.

percentage of South Asia's greenhouse gas emissions are generated from the manufacture of products for export. As in other regions in Asia, countries in South Asia are largely dependent on fossil-fuel-based power generation. Energy use by the six DMCs is dominated by coal (49%), followed by petroleum fuels (35%) and natural gas (9%) (aggregate data for six DMCs in South Asia for 2003; Energy Information Administration 2006). In these countries, greenhouse gas emissions from energy use contributed 55% of the total emissions in South Asia.[37]

The balance of South Asian emissions come from a variety of sources including urban energy use, transport, waste, and land use change. More than 285 million people, or 28% of total population of the region, live in urban areas, and many of the world's mega cities are located here, particularly in India. The urban population is expected to increase to about 40% of the total population by 2021. Emissions from transport, residential and commercial buildings, industry, and waste contribute heavily to greenhouse gas emissions. This is partly due to the fact that, in most cities in the region, there is no dependable public transport system,[38] nor is there adequate traffic management or land use planning. In addition to other impacts, solid-waste management in South Asian cities results in the release of methane gas into the atmosphere. Outside cities, changes in the use of agricultural and forest land account for around one-third of total greenhouse gas emissions in South Asia.

Policy and institutional environment. In line with requirements under the UNFCCC and Kyoto Protocol, many South Asian countries have formulated national programs containing measures to mitigate climate change and to facilitate adequate adaptation to climate change impacts.

India has the National Action Plan on Climate Change, with eight national missions: (i) solar energy, (ii) enhanced energy efficiency, (iii) sustainable habitat, (iv) integrated water resource management, (v) sustaining Himalayan ecosystems, (vi) enhanced ecosystems including carbon sinks, (vii) promoting sustainable agriculture, and (viii) collaborating on strategic knowledge on climate change.

Bangladesh set out the Bangladesh Climate Change Strategy and Action Plan to advance in "globally cooperative actions" and achieve national goals for clean energy, forestry, energy efficiency, and knowledge creation and dissemination to address priority climate challenge risks.[39]

A number of countries, including **Nepal and the Maldives**, have recently developed **national climate change committees**. **Bhutan** and the **Maldives** have formulated and started to implement their respective national adaptation programs of action (NAPAs), and **Nepal's** NAPA preparation is under way.

[37] Aggregate of greenhouse gas emissions as reported in initial National Communications of the six DMCs in South Asia.

[38] Except for Mumbai, Kolkata, and Delhi, none of the mega cities have a mass rapid transit system, and fragmented bus-based networks are generally the only means of urban public transport. About 20 of the cities in India have no public transport system.

[39] These goals are developing solar energy resources, enhanced energy efficiency, sustainable habitat, water conservation, sustaining the Himalayan ecosystem, a "green India" tree planting program, sustainable agriculture, and building a shared knowledge platform on climate change.

Sri Lanka is preparing its second National Communication study to assess climate change trends and predicted impacts. Responsibility for the study rests with the recently formed National Advisory Council on Climate Change, which is coordinated by the Ministry of Environment and Natural Resources.

Policy and institutional support. Cognizant of the fact that some South Asian countries are further ahead in planning and implementing national adaptation and mitigation programs than others, all ADB strategic interventions will be guided by country-specific capacity and priorities. In several South Asian countries, ADB will provide technical assistance to build government capacity to manage climate change. In Bangladesh and Nepal, for example, new organizational structures are being put into place to strengthen coordination and management across line agencies. In India, the government will embark on a planning process for climate change investments based on its National Action Plan on Climate Change. ADB will support government decentralization processes in Nepal, the Maldives, and Sri Lanka by providing training to local government units to conduct vulnerability analyses and to prepare climate change adaptation initiatives. Specifically, in Nepal, ADB is supporting a climate modeling activity—Community-Based Vulnerability Assessment, Risk Mapping and Adaptation Planning—which will yield downscaled climate impact information to inform adaptation responses. In Sri Lanka, ADB proposes to support the government in developing a climate change adaptation strategy.

In addition to providing policy and planning support, ADB is helping South Asian countries to identify and manage funds to scale-up adaptation interventions; ADB is active in programming the funds for Bangladesh and Nepal from the Pilot Program for Climate Resilience. To speed technology transfer and increase private sector participation in mitigation activities, ADB will convene conferences in India to develop innovative public–private partnerships for solar and municipal solid-waste power generation projects.

Box 6: Regional Efforts to Address Climate Change in South Asia

At the South Asian Association for Regional Cooperation (SAARC) ministerial meeting held in Dhaka in July 2008, leaders released the draft Dhaka Declaration on Climate Change and adopted a 3-year action plan. The declaration stressed the need for close cooperation through exchanging information (e.g., disaster preparedness, climate change impacts), building capacities, developing CDM projects, and raising advocacy and mass awareness about climate change. It also urged the international community to provide additional financial resources. The action plan focuses on seven thematic areas, including adaptation, mitigation (sharing of best practices in energy, waste management, transport, sustainable forestry, and CDM capacity building) and a common regional stance in international negotiations.

Promoting Low-carbon Growth

ADB, in close collaboration with the private sector, will assist South Asian DMCs to enable further development, acquisition, deployment, and diffusion of technologies in three core sectors: energy, transport, and urban development. The South Asia Regional Department will maximize both internal resources, under ADB's Energy Efficiency Initiative and CMI, and external resources, including the CIF and GEF.

Energy. ADB will expand investment in renewable energy development including solar, wind and

hydropower; technology transfer for cleaner coal generation and natural gas development; and energy efficiency enhancement both on the demand side for urban and rural areas and on the supply side in the transmission and distribution subsectors. ADB will try to replicate successful renewable energy projects such as the development of the largest—50 megawatt—solar thermal power plant in Rajasthan, India, with government agencies and international and domestic private sectors. ADB will also support energy service companies to promote greenhouse gas emission reductions through capacity development and financial assistance. To promote energy access and reduce emissions, ADB will continue to fund rural electrification programs, through grid extension and off-grid solutions such as solar and mini-hydro power.

Transport and urban development. ADB will promote development of public transport systems, thereby discouraging urban sprawl and reducing the need for personal vehicular transport. In particular, ADB will support development of bus rapid transit systems in Pimpri and Pune, India, as well as light metro rail transit in Ludhiana, also in India. In addition, the promotion of energy efficient infrastructure and buildings will be an important area for investment. Avoidance or capture of methane emissions from urban waste will also be a key mitigation focus area.

Carbon Market Development

Use of energy efficient equipment and application of aerobic composting of organic waste are contributing to reducing greenhouse gas emissions. Some CDM-eligible subprojects have been identified, and are currently assisted under the CMI in going through necessary steps for registration. ADB will support continued leveraging of the carbon markets through the CMI and will work to spread CDM know-how from India to other countries in South Asia.

Adaptation to Reduce Vulnerability

Within the context of the strategic approach to adaptation interventions mentioned, the South Asia Regional Department will help DMCs adapt to the

unavoidable impacts of climate change through risk management at the national, municipal, and community level, and improved physical planning, investments in defensive measures, support for insurance and other risk-sharing instruments, and climate-proofing of projects. Key sectors for adaptation intervention in South Asia will be water and agriculture. Risk management for possible disasters, such as floods and cyclones, will be a critical element in the process of adapting to climate change impacts.

Water. ADB will work to strengthen risk management capacities within water authorities and agencies at the national, local, and community levels in all South Asian countries. Where sufficient adaptive capacity has been developed, ADB will invest in (i) climate-proofing measures, especially in coastal cities in Bangladesh and India, and in the Maldives; (ii) flood and river erosion management; (iii) rainwater harvesting and increased water storage; (iv) restoration and protection of natural water courses; and (v) improved sewage systems.

Agriculture. Along with development partners, ADB will support research and development of new varieties of crops and alternative cropping patterns, capable of withstanding extremes of weather, long dry spells, flooding, and variable water availability. ADB will also make investments to increase resilience of irrigation systems in India and Nepal where water shortages already have a devastating impact on rural livelihoods, and in Bangladesh where saltwater intrusion from sea-level rise will render existing cropping systems unproductive.

Despite flooding, education continues on rooftops in Bangladesh, ADB Photo Library 2008

Southeast Asia Region

Recent Development Trends and Climate Change

Despite rapid growth over the last decade,[40] more than 44% of the population of Southeast Asia lives below the $2 per day poverty line. Across the region, cities are expanding and the urban population is expected to increase to more than 402 million by 2025.[41] While urban employment is rising, the vast majority of people in the region are directly dependent on natural resources for their livelihoods. Despite declining contributions to GDP, the agriculture and forestry sectors continue to employ a significant proportion of the labor force—more than 45% in 2004. Further, a great many more people derive their livelihoods from coastal and marine resources.

Women plant new species in Laos PDR.

[40] In the last decade, GDP in Southeast Asia increased at 5.5% annually compared to a global average of 2.9%.

[41] In addition to the six countries in ADB's Southeast Asia region this analysis includes: Brunei Darussalam, Malaysia, Myanmar, and Singapore.

According to ADB's recent assessment, *The Economics of Climate Change in Southeast Asia* (ADB 2009a), the potential losses caused by climate change to Indonesia, the Philippines, Thailand, and Viet Nam are predicted to be $230 billion, or 6.7% of annual GDP, by 2100. These four nations are likely to be hit hard because they have long coastlines and largely agrarian economies, and are experiencing rampant deforestation. They will also be at risk from rising sea levels, higher temperatures, falling agricultural yields, and more frequent extreme events.

Key vulnerabilities and impacts. The countries which comprise ADB's Southeast Asia Region—Cambodia, Indonesia, the Lao PDR, the Philippines, Thailand, and Viet Nam—are among highly vulnerable to climate change. With only 3.3% of the world's land mass and more than 11% of the world's coastline Southeast Asia is highly vulnerable to climate impacts from flooding, sea-level rise, and cyclones (ADB 2009a). The most at-risk areas identified within the region include the north-western Mekong River delta, coastal Viet Nam, Bangkok and the surrounding areas in Thailand, large low-lying areas in Cambodia, and the north and east of the Lao PDR. Furthermore, as low-lying archipelagic areas, the Philippines and the west and south of Sumatra and the western and eastern parts of Java in Indonesia are also highly vulnerable to climate impacts. In addition to high physical vulnerability, the region is characterized by low adaptive capacity—a direct result of the large numbers of people dependent on irrigated agriculture and marine resources for their livelihoods. In addition, climate change is expected to increase the incidence of vector-borne diseases and heat-related illnesses.

Key greenhouse gas sources. In 2000, Southeast Asia contributed 12% of global greenhouse gas emissions (ADB 2009a). Key greenhouse gas emissions sources are land use, land use change, and forestry; combustion of fossil fuels for energy use; supply and transportation; and other industrial activities (see Table 3). Emissions from land use,

Table 3: Global GHG Emissions by Sector in 2000 ($MtCO_2$-eq)

Sector	Southeast Asia	Annex 1 Countries	World
Energy	791.8	14,728.1	2,6980.4
Industrial process	50.8	628.6	1,369.4
Agriculture	407.0	1,445.8	5,729.3
Land use change and forestry	3,861.0	-274.0	7,618.6
Waste	76.6	473.4	1,360.5
Total	5,187.2	17,001.9	43,058.2

Source: CAIT Database (WRI 2008).

land use change, and forestry were as high as 75% of total emissions from the region in 2000, primarily due to deforestation and forest fires. Although emissions from the region are rapidly increasing (27% increase between 1990 and 2000), per capita annual energy consumption remains extremely low—averaging only 645 kilowatt-hours—due to uneven electrification coverage in the region, which varies between 99% in Thailand and a mere 20% in Cambodia. Southeast Asia offers many low-cost opportunities for greenhouse gas mitigation from improved land and forest management and from the energy sector. The IPCC reported that, among all world regions, technical mitigation potential in agriculture in 2030 was highest in Southeast Asia (IPCC 2007b).

Policy and institutional environment. Each of the countries in ADB's Southeast Asia Region is actively supporting climate change responses that support both adaptation and mitigation activities. All of the governments are signatories to the UNFCCC and have ratified the Kyoto Protocol. The governments of Indonesia, the Philippines, Thailand, and Viet Nam have recently passed renewable energy, energy efficiency, and biofuels legislation that contribute to climate change mitigation efforts.

Cambodia. Cambodia established the Cambodian Climate Change Office in June 2003 under the Ministry of the Environment. It serves as a focal point for the Kyoto Protocol and as Cambodia's designated national authority for CDM initiatives. The country launched its NAPA in 2006, and formed the National Climate Change Committee, comprising representatives from 19 government ministries and agencies, to coordinate development and implementation of policies, plans, and measures to address climate change issues.

Box 7: Regional Responses in Southeast Asia

The Association of Southeast Asian Nations (ASEAN) articulated commitments to collective action to address climate change in November 2007. Commitment was related to both mitigation and adaptation, with particular focus on increasing cooperation to enhancing energy efficiency and security, reforestation efforts, and improving capacity for adaptation, accessing carbon markets, and disaster risk management.

ADB supports regional responses to climate change through the Greater Mekong Subregion (GMS) Environment Operations Center, including Cambodia, two provinces from the PRC, the Lao PDR, Myanmar, Thailand, and Viet Nam. The climate change program is focusing on local livelihoods and ecosystem services; agriculture and food security; energy, particularly hydropower; tourism, with special focus on ecotourism; transport; and the Vientiane Plan of Action. During 2009–2011 ADB will support projects to decrease the greenhouse gas impact of transport corridors, increase adaptive capacity of ecosystems, and provide improved capacity to analyze climate risks and design disaster responses in the region.

Serving as lead GEF agency, ADB is working with six countries—Indonesia, Malaysia, Papua New Guinea, the Philippines, Solomon Islands, and Timor-Leste—as well as the governments of the United States and Australia and the environmental groups WWF, The Nature Conservancy, and Conservation International to increase adaptive capacity of the "Amazon of the Seas" through the Coral Triangle Initiative. The initiative aims to improve information sharing and the management of common marine resources to sustain aquaculture and ecotourism.

Indonesia. In 2008, Indonesia launched the National Action Plan for climate change to coordinate institutional responses to climate change. For mitigation it focused on energy; land use, land use change, and forestry; and marine sectors. For adaptation the focus was on monitoring and information, water resources, food security, integrated coastal management, biodiversity and forests, human health, and resilient infrastructure for adaptation.

Lao PDR. The Lao PDR prepared a NAPA in 2009 and established its National Climate Change Office and technical working groups to manage its climate change activities. Key issues and priority actions identified in the Lao PDR's NAPA include deforestation prevention, energy efficiency, and capacity building for farmers and institutions within the agriculture sector. A CDM decree was proclaimed in 2008, one CDM project is now under preparation, and a few others are actively under way. In May 2008, a national steering committee on climate change, responsible for the national climate change strategy (which is being prepared with ADB support), was established. The National Strategy and Action Plan on Climate Change[42] identifies eight themes: (i) building climate change awareness, (ii) strengthening policies and institutional capacity, (iii) mainstreaming climate change, (iv) expanding the knowledge base, (v) building the adaptive capacity of the poor, (vi) enhancing ecosystem resilience, (vii) comprehensive disaster management, and (viii) climate change mitigation.

***Philippines*.** The Philippines began incorporating climate considerations into sustainable development in the late 1990s and has implemented a series of capacity building programs nationwide. In October 2007, the Philippine Climate Change Response Action Plan was released, and in 2008 the Presidential Task Force on Climate Change was created to coordinate responses between various government agencies.

Thailand. In 2006, Thailand launched its National Strategic Plan on Climate Change, building on six strategies: (i) building capacity for climate change adaptation and reducing vulnerability, (ii) promoting greenhouse gas mitigation activities, (iii) supporting research and development on both adaptation and mitigation, (iv) raising awareness and public participation, (v) building capacity of institutions and government officials, and (vi) supporting international cooperation.

Viet Nam. In 2008, Viet Nam prepared the National Target Program to address climate change. Main activities under its program include (i) assessing climate change impacts in Viet Nam; (ii) identifying measures to respond to climate change; (iii) developing a scientific and technological program on climate change; (iv) strengthening organizational, policy, and institutional capacity in responding to the impacts of climate change; (v) raising awareness and developing human resources; (vi) improving international cooperation; (vii) mainstreaming the program into strategies, plans, socioeconomic development planning, and other sector and local development plans; and (viii) developing action plans to respond to climate change.

Policy and institutional support. To successfully address mitigation and adaptation priorities, climate change considerations must be integrated

[42] Lao PDR National Strategy and Action Plan on Climate Change for Phase I (2009–2010), Phase II (2011–2015), and Phase III (2016–2030), draft for consultation, 2009 National Climate Change Office.

into sustainable development planning. Therefore, ADB will continue to provide technical and financial support for making nationally appropriate climate actions the core of sustainable development planning, with an increased emphasis on making all sectors climate resilient while capitalizing on opportunities to reduce greenhouse gas emissions. For example, in cooperation with the World Bank, ADB will assist Cambodia to effectively benefit from the Pilot Program for Climate Resilience and will help mainstream climate change considerations into national planning and increase adaptive capacity. In partnership with the Government of Australia, ADB will support adaptation in the energy and transport sectors.

Promoting Low-Carbon Growth

Mitigation efforts in the region will focus on the transition to low-carbon growth by increasing ADB's strong existing portfolio of energy efficiency, renewable energy, sustainable transport, and waste management investments. ADB will explore opportunities to invest in rural infrastructure related to forestry and agriculture sectors in Southeast Asia to support important mitigation opportunities for improved land and forest management—through increasing soil carbon sequestration, and readiness for REDD programs.

Land use, land use change, and forestry. Since greenhouse gas emissions from this sector are a major contributor to global climate change, ADB is encouraging countries to conserve forests, reduce land degradation, and restore peat lands. ADB will implement pilot REDD programs in Cambodia and Indonesia and continue to work with other donors to develop knowledge on good practices for REDD project implementation. For example, through its Biodiversity Corridors program in Thailand and Viet Nam, ADB will explore opportunities to improve land-use and forestry policy enforcement along major roadways, where possible providing access to carbon finance.

Energy. Southeast Asia's efforts to harness its enormous potential for renewable energy will be supported by ADB, especially for providing electricity to remote and rural communities in Cambodia, Indonesia, the Lao PDR, Thailand, and Viet Nam. Renewable energy infrastructure for mini-hydro power will also be supported. Energy efficiency projects will be well supported by ADB across Southeast Asia, including programs to improve power transmission and distribution in Indonesia, capacity building for the industry sector in Viet Nam, and to improve energy efficiency efforts in Thai municipalities. In the Philippines, as part of the investment program for the Clean Technology Fund, ADB will support renewable energy, and demand- and supply-side efficiency measures that aim to cut the share of future coal-fired plants by 50%. In the GMS, ADB will support technology transfer through a regional renewable energy marketplace and by developing local manufacturing capacity.

Transport. As high rates of economic growth and personal motorization are contributing to significant increases in transport-related greenhouse emissions, ADB will support the development of environmentally sustainable and efficient public transport systems. Strategies to promote more energy efficient transport systems will be disseminated. ADB will provide assistance to improve public transport in Ho Chi Minh City and Bangkok, and conduct a feasibility study on railway potential in the GMS. ADB will advise Indonesia and the Philippines on sustainable transport planning to optimize co-benefits of air quality improvement and human health.

Urban and industrial development. Three of the capital cities in Southeast Asia— Bangkok, Jakarta, and Metro Manila—are mega cities each with a population of over 10 million people. More effective urban land use planning and waste management can contribute to mitigation of greenhouse gas emissions. Therefore, ADB will support projects to improve urban services in several provinces in the Philippines (e.g., Mindanao and Luzon) as well as several towns in the Lao PDR and Viet Nam (e.g., Viet Tri and Dong Ha). ADB will provide assistance to develop CDM projects in these sectors, especially in Indonesia and the Philippines, through its CMI.

Adaptation to Reduce Vulnerability

Any comprehensive adaptation effort must help build resilience in the region's industries which depend on natural resources, i.e., agriculture, aquaculture, forestry, and tourism. Effective interventions to reduce vulnerability must also strengthen the response capacity of government institutions, and empower local communities to implement effective disaster response strategies and adaptation responses that ensure livelihood security, especially in the agriculture and fisheries sectors. In the short-to-medium term, ADB and its partners plan to increase investments in "win–win" measures which combine successful sustainable development approaches with climate change adaptation actions.

Water. Precipitation patterns in Southeast Asia will be heavily impacted by climate change. While the Philippines may benefit from increasing precipitation, the other countries in ADB's Southeast Asia Region will witness declining rainfall, which will reduce the availability of water for agriculture. Furthermore, sea-level rise and flooding will cause saltwater intrusion and decrease the availability of freshwater. ADB is helping to coordinate the efforts of various water institutions, including the Asia-Pacific Water Forum and the Regional Water Knowledge Hub for Climate Change Adaptation in South East Asia. ADB will invest in a variety of projects that will help contribute to improved water and irrigation management, thereby increasing the climate resilience of communities in Indonesia, the Lao PDR, and the Philippines. All future hydropower investments will be evaluated for long-term viability given predicted climate change impacts.

Agriculture and rural development. Crop production and aquaculture are threatened by a combination of thermal and water stresses, sea-level rise, increased flooding, and strong winds associated with intense tropical cyclones. In addition to the support to improved irrigation management, ADB will invest in alternative farm livelihood programs in the Lao PDR, and investigate the impact of climate change on agriculture in Thailand and Viet Nam. Efforts to improve the climate resilience of rural infrastructure, especially in coastal areas, will also be strengthened.

Disasters and natural hazards. Early warning and management systems for floods, droughts, and forest fires must be put in place as increased risks from climate change guarantee more intense episodes of flash fires in the region. ADB will support flood and drought risk management across the GMS, as well as in specific river basins (e.g., the Citarum River basin) in Indonesia.

Infrastructure and human settlements. ADB will increase investments in climate-proofing selected infrastructure and hydropower projects. ADB is planning to invest in climate-proofing coastal infrastructure in the northern and central provinces of Viet Nam, in cooperation with the GEF. ADB is currently working with the World Bank, JICA,

and other development partners to identify the needs of, and invest in, improved coastal and flood protection, especially for cities at risk in Southeast Asia. Increasing investment will be made to build infrastructure which is resilient to climate impacts—dykes, pumping systems, and natural buffer zones, including mangrove restoration, beach nourishment, and near-shore coral reef replanting.

Human health. Warmer and wetter conditions will contribute to higher incidence of heat-related and infectious diseases. ADB has a history of supporting national health programs as well as capacity building and communicable disease control across the GMS. ADB will scale up this support to respond to climate risks. ADB will also use investments in urban sanitation and health as opportunities to build climate resilience, especially in large cities where climate-related risks will exert greater pressure on health services.

Adaptation and Mitigation Synergies

In Southeast Asia, there are significant opportunities to increase adaptive capacity and reduce greenhouse gas emissions simultaneously through improving land use and forest management, developing biofuels, improving urban sanitation, decreasing air pollution, and improving water management. In the short-term, ADB will mobilize investments to address climate change concerns in water supply and sanitation in all of its Southeast Asian member countries. It will enhance investments in specific land and marine resource management projects in Indonesia and the Philippines to protect forests, fisheries, and coral reefs to address both mitigation and adaptation. In Viet Nam, ADB will invest in air pollution reduction initiatives which will have co-benefits for climate and health. ADB will also work with other donor partners to increase investments in sustainable agriculture to decrease greenhouse gas emissions from farming, while increasing livelihood security.

Forest rangers on patrol in Cambodia, S. Griffiths 2008

Conclusion

To avoid the worst predicted impacts of climate change, institutions and individuals must act now. In terms of planning both adaptation measures to respond to the predicted impacts of climate change and mitigation measures to avoid rapid increases in global emissions, nowhere in the world are coordinated responses as critical as in Asia and the Pacific. Actions must be decisive and informed to transform greenhouse gas intensive business-as-usual practices. ADB's Strategy 2020 (ADB 2008) recognizes the urgent need for significant progress on energy efficiency and other measures to address climate change across developing Asia and the Pacific in order to produce positive results reaching far beyond regional borders and the present generation. As such, ADB will work more aggressively than ever with governments, the private sector, and civil society to move towards low-carbon, climate-resilient economies.

Existing scientific, technical, and economic analysis inform areas for priority investment, and ADB will respond by concentrating support to DMCs to increase energy efficiency, develop sustainable transport systems, and improve land use management to reduce emissions. ADB will continue to provide significant support to DMCs to leverage carbon finance and develop CDM projects that reduce emissions, help transfer technology, and increase energy security.

Funding and cooperation to support adaptation and risk management efforts in Asia and the Pacific will need to dramatically increase to meet the needs of DMCs. ADB will expand both technical and financial resources to address adaptation, focusing on climate-proofing existing and planned investments, and sectorwide support to water and agriculture. ADB will partner with leading organizations to ensure that the social dimensions of climate change—including health, gender, and migration—are adequately addressed as part of our DMCs' responses.

Within the next decade, climate change considerations will be incorporated into all development planning. Investment in low-carbon growth strategies may be given strong signals by the agreements reached at the 15th United Nations Climate Change Conference in Copenhagen in December 2009, or at subsequent conferences. Resilience measures will soon be build into national development plans using sophisticated tools under development to estimate the risks and corresponding incremental costs that must be considered as a result of climate change. However, there is no time to wait: climate change is real and is affecting ADB DMCs, threatening to undo hard-won development gains. In the short term, ADB will continue to actively engage with partners and rapidly increase its support for core sustainable infrastructure and climate change adaptation activities, using its technical and financial resources to transform and protect economies in Asia and the Pacific.

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Glossary

Many of the definitions found in this glossary have been drawn from *Climate Resilient Cities 2008 Primer.*[1] Any working definitions are not intended to substitute for established definitions adopted in various international forums, such as the United Nations Framework Convention on Climate Change (UNFCCC) and Intergovernmental Panel on Climate Change (IPCC).

Adaptation. Adaptation to climate change refers to adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory and reactive adaptation, private and public adaptation, and autonomous and planned adaptation.[2]

- **autonomous adaptation**. Refers to spontaneous adaptation.
- **adaptation (planned)**. Adaptation that is the result of a deliberate policy decision, based on an awareness that conditions have changed or are about to change and that action is required to return to, maintain, or achieve a desired state.
- **adaptation benefits**. The avoided damage costs or the accrued benefits following the adoption and implementation of adaptation measures.
- **adaptation costs**. Costs of planning, preparing for, facilitating, and implementing adaptation measures, including transaction costs.

[1] World Bank. 2008. *Climate Resilient Cities 2008 Primer.* Contributors include World Bank, Global Facility for Disaster Reduction and Recovery, UN International Strategy for Disaster Reduction; Asian Development Bank; Organe consultatif en matière de recherche sur le climat et les changements climatiques (OcCC); Centre for International Climate and Environmental Research; United Nations Framework Convention on Climate Change.

[2] IPCC. 2001. *Third Assessment Report.*

Adaptation Fund. The Adaptation Fund will finance concrete adaptation programs in developing country Parties to the Kyoto Protocol with high vulnerability to the adverse effects of climate change. It is financed from a 2% levy on clean development mechanism project activities.

Adaptation in development. The marriage of humanitarian aid, disaster management, and poverty alleviation as an integral component of the development process.[3]

Adaptive capacity. The ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damage, take advantage of opportunities, or cope with the consequences.[4]

Annex 1 (countries). Parties include industrialized countries that were members of the Organisation for Economic Co-operation and Development (OECD) in 1992, plus countries with economies in transition (the "EIT Parties"), including the Russian Federation, the Baltic States, and several Central and Eastern European States. See: http://unfccc.int/parties_and_observers/items/2704.php

Atmosphere. The envelope of gases surrounding the earth and bound to it by the earth's gravitational attraction.

Bali Action Plan. The United Nations Climate Change Conference in Bali in 2007 culminated in the adoption of the Bali Road Map, which consists of a number of forward-looking decisions that represent the various tracks that are essential to reaching a secure climate future. The Bali Road Map includes the Bali Action Plan, which charts the course for a new negotiating process designed to tackle climate change, with the aim of completing this by 2009.

Carbon capture and storage. See **carbon sequestration.**

Carbon intensity. The ratio of carbon emissions produced to GDP or other unit of measurement (e.g. per unit of production, amount of energy produced).

Carbon productivity. Carbon productivity can be thought as the inverse of carbon intensity, which is measured in terms of greenhouse gas emissions (tons of CO_2 equivalent) divided per GDP.

Carbon sequestration. Carbon sequestration is defined by the IPCC as the carbon storage in terrestrial or marine reservoirs. Biological sequestration includes direct removal of CO_2 from the atmosphere through land use change, afforestation, reforestation, carbon storage in landfills, and practices that enhance soil carbon in agriculture.

Carbon sinks. Natural or artificial systems that absorb carbon dioxide from the atmosphere and store them. Trees, plants, and the oceans all absorb carbon dioxide and therefore are all carbon sinks.

Carbon Market Initiative. The CMI an innovative financing scheme by which ADB provides "upfront" co-financing through its Asia Pacific Carbon Fund in return for a proportion of certified emissions reduction (CERs) to be generated until 2012 by

[3] P Hayes. 2004. Master's thesis: *Vulnerable Coastal Communities And Participatory Climate Adaptation In Development: A Case Study Of Scott's Head/Soufriere, Commonwealth Of Dominica.* pp9.

[4] IPCC. 2001. Climate Change 2001: Impacts, Adaptation and Vulnerability. *Third Assessment Report.*

projects eligible for CDM. For projects that generate post-2012 carbon credits, ADB has established the Future Carbon Fund (FCF). The initial target fund size of FCF is $100 million. Approved in July 2008, the FCF commenced operations in January 2009. CMI also provides technical support for project preparation and marketing services for CERs.

Central Asian Countries Initiative for Land Management (CACILM). CACILM is a partnership between Central Asian countries and international donor community to combat land degradation and improve rural livelihoods in Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan, and Uzbekistan.

Civil society. According to the United Nations Research Institute for Social Development definition of civil society in the context of poverty reduction, "civil society can be understood as the realm of citizen's informal and formal private associations to pursue non-economic interests and goals."

Clean Development Mechanism (CDM). The Clean Development Mechanism (CDM) is an investment scheme under the Kyoto Protocol whereby industrialized countries with a greenhouse gas reduction commitment can implement projects that reduce emissions in developing countries as an alternative to more expensive emission reductions in their own countries.

Climate. The average trend of weather, including its variability in a geographic region. Climate in a wider sense is the state, including a statistical description, of the climate system. The classical period of time is 30 years, as defined by the World Meteorological Organization. One popular phrase can help distinguish weather from climate: "Climate is what you expect. Weather is what you get."

Climate change. A change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods (UNFCCC). See also **climate variability.**

Climate change adaptation. ADB defines adaptation as: "Adjustments to reduce costs and vulnerabilities, based on anticipated climate change impacts."[5] The World Bank defines adaptation as "efforts to protect against climate change impacts."[6]

Climate Change Fund. ADB's $40 million Climate Change Fund (CCF) provides grant financing for projects, technical assistance, research, and other activities to address the causes and consequences of climate change in its DMCs. The fund is open for contributions from countries, other development organizations, foundations, the private sector and other sources. $5 million is reserved for land use interventions including forestry.

Climate change migrant. Person who, for compelling reasons of sudden or progressive changes in the environment as a result of climate change that adversely affect their lives or living conditions, are obliged to leave their habitual home, or chooses to do so, either temporarily or permanently, and who moves either within their country or abroad.

[5] ADB working definition, ADB. 2007. *Promoting Climate Change Adaptation in Asia and the Pacific. Manila.*

[6] World Bank. 2000. *Cities, Seas, and Storms.*

Climate impacts. Defined by the IPCC as "the extent to which climate change may damage or harm a system. It depends not only on a system's sensitivity but also on its ability to adapt to new climate conditions."

Climate Investment Funds (CIF). The CIF is a portfolio of funds established by ADB, AfDB, IDB, the World Bank and other partners. It consists of two funds: the Clean Technology Fund (CTF), for mitigation, that will scale up financing for demonstration, deployment, and transfer of low-carbon technologies; and the Strategic Climate Fund (SCF), for both mitigation and adaptation, will provide financing to test innovative approaches or scale up activities for targeted actions.

Climate models. Large and complex computer programs used to mathematically simulate global climate. They are based upon mathematical equations that seek to represent the physical processes that govern the earth–atmosphere system.

Climate-proofing. Climate-proofing refers to enhancing resilience to, and reducing the risks posed by, climate change; for example, improving the ability of infrastructure to withstand floods and cyclones.[7]

Climate risk management. An approach to systematically manage climate-related risks affecting activities, strategies, or investments, by taking account of the risk of current variability and extremes in weather as well as long-term climate change.

Climate variability. Climate variability refers to fluctuations in climate over a shorter term; the departures from long-term averages or trends, over seasons or a few years, such as those caused by the El Niño Southern Oscillation (ENSO) and North Atlantic Oscillation (NAO) phenomenon; also shorter-term extreme weather events. Variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic external forcing (external variability). See also **climate change**.

Community-based disaster risk management. A process that seeks to develop and implement strategies and activities for disaster preparedness (and often risk reduction) that are locally appropriate and locally "owned."

Consequences (risk and impact). Risk is often expressed as the product of the consequences flowing from an event and the frequency of the event. The term "impacts" is used for consistency with the terminology of climate change.

Climate risk management. A term used for a large and growing body of work, bridging the climate change adaptation, disaster management, and development fields. Climate risk management is a generic term used to refer to an approach to promote sustainable development by reducing the vulnerability associated with climate risk. Climate risk management involves proactive no-regrets strategies.[8]

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[7] International Institute for Environment and Development. *Climate Change & Poverty Reduction.* Irish Aid Key Sheet. www.irishaid.gov.ie/Uploads/5%20Climate%20Change%20%20Poverty%20Reduction.pdf

[8] IRI. 2007. *Climate Risk Management in Africa: Learning from Practice*. pg. 8. Available http://portal.iri.columbia.edu/portal/server.pt/gateway/PTARGS_0_2_1171_0_0_18/Climate%20and%20Society%20No1_en.pdf

Climate risk management and adaptation. To integrate the management of current climate variability and extremes with adaptation to climate change—a climate risk management and adaptation approach.[9]

Disaster. A serious disruption to the functioning of a community or a society causing widespread human, material, economic, or environmental losses that exceed the ability of the affected community or society to cope using its own resources.

Disaster preparedness. Activities that contribute to the pre-planned, timely, and effective response of individuals and communities to reduce the impact and deal with the consequences of a (future) disaster.

Disaster recovery. Decisions and actions taken after a disaster with a view to restoring or improving the pre-disaster living conditions of the stricken community.

Disaster risk management.[10] The systematic process of using administrative decisions, organizations, operational skills, and capacities to implement policies, strategies, and coping capacities of a society to reduce the impacts of disasters.

Disaster rehabilitation. The set of actions taken after a disaster to enable basic services to resume functioning, to repair physical damage and community facilities, to revive economic activities, and support the psychological and social well-being of the survivors.

Disaster relief and/or response. Coordinated activities aimed at meeting the needs of people who are affected by a disaster.

Disaster risk reduction. A systematic approach to reduce human, social, economic, and environmental vulnerability to natural hazards.

Downscaled modeling. Obtaining finer resolution scenarios of climate change from the coarser resolution global circulation model output. www.cccsn.ca/Downscaling_Tools/Downscaling_Tools_Introduction-e.html

Early warning. Providing timely and effective information about an imminent hazard that allows people to take action to avoid a disaster or prepare for effective response.

Energy Efficiency Initiative (EEI). An ADB initiative to rapidly scale up clean energy operations. It has twelve focus countries in the region including: PRC, India, Indonesia, Pakistan, Philippines, Viet Nam, Afghanistan, Bangladesh, Cambodia, Lao People's Democratic Republic, Mongolia, and Uzbekistan.

Emissions. The release of greenhouse gases and/or their precursors into the atmosphere over a specified area and period of time.

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[9] African Development Bank Climate Change Strategy. www.cccsn.ca/Downscaling_Tools/Downscaling_Tools_Introduction-e.html Regarding the link between risk management and adaptation, the Department for International Development of the United Kingdom takes the view that adaptation is not a separate activity or an end in itself, but a means to sustain development gains, so it needs to be integrated into everyday risk management and planning processes.

[10] Disaster risk management and disaster risk reduction are nomenclature of the United Nations International Strategy for Disaster Reduction (UNISDR); ADB's 2008 DEAP Action Plan differentiates between disaster risk management and disaster risk reduction.

Environmental aspects. (specific to climate change) An element of the organization's activities, products, or services that can interact with, or be impacted by, the environment.

Extreme weather event. Weather that is extreme and rare in a particular place, such as extremely intense rainfall, extreme heat, or a very strong windstorm. However, these events may occur at much more frequent intervals in the future (once every 30, 50, or 100 years) due to the influence of climate change.

Fossil fuels. Carbon-based fuels formed in the ground over very long periods; includes coal, oil, and natural gas.

Global Environment Facility (GEF). The Global Environment Facility (GEF) is a partnership among 178 countries, international institutions, non-governmental organizations (NGOs), and the private sector to address global environmental issues while supporting national sustainable development initiatives. It provides grants for projects related to six focal areas: biodiversity, climate change, international waters, land degradation, the ozone layer, and persistent organic pollutants. For the Convention on Biological Diversity, the United Nations Framework Convention on Climate Change, the Stockholm Convention on Persistent Organic Pollutants, and the UN Convention to Combat Desertification (UNCCD) it is the designated financial mechanism helping countries meet their obligations to these agreements.

Global warming. The rise in average temperature on earth due to the increasing amounts of greenhouse gases in the atmosphere. The media often use this term to refer to climate change.

Grassroots Adaptation in Development (GrAD). Climate change adaptation efforts, combined with other developmental priorities, conducted at the community or grassroots level (footnote 3).

Greenhouse gas. A gas that absorbs and re-emits infrared radiation. Greenhouse gases include carbon dioxide, carbon monoxide, nitrous oxide, oxides of nitrogen, methane, and non-methane volatile organic compounds. The Kyoto Protocol also addresses hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride.

Hazard. A potentially damaging physical event that may cause loss of life or injury, property damage, social and economic disruption, or environmental degradation.

Hyogo Framework for Action 2005–2015. The Hyogo Framework is a global blueprint for disaster risk reduction efforts during the next decade. Its goal is to substantially reduce disaster losses by 2015 - in lives, and in the social, economic, and environmental assets of communities and countries.

Hurricane. See **tropical cyclone.**

Impact. Something that logically or naturally follows from an action or condition related to climate change or climate variability.

Intergovernmental Panel on Climate Change (IPCC). The international mechanism established by the United Nations Environmental Program (UNEP) and the World Meteorological Organization to assess available information on the science, impacts, and economics of climate change, and of the mitigation options to address it.

Inventory (greenhouse gas). An estimation and quantification on anthropogenic greenhouse gas emissions and removals, using a standardized tabular reporting format for six major sectors: energy, industrial processes, solvents and other

product use, agriculture, land-use and forestry, and waste.[11]

Kyoto Protocol. The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change. The major feature of the Kyoto Protocol is that it sets binding targets for 37 industrialized countries and the European Community for reducing greenhouse gas emissions. These amount to an average of 5% against 1990 levels over 2008–2012.[12]

Joint Implementation. This is a flexible mechanism that allows countries with emission targets (Annex B) to implement projects in towards meeting their Kyoto targets in other Annex B countries.

Likelihood. The degree of certainty of an event occurring. Likelihood can be stated as a probability.

Loss. An injury or damage to health, property, the environment, or something else of value.

Low-carbon economy. A low-carbon economy or low fossil fuel economy is a concept that refers to an economy which has a minimal output of greenhouse gas emissions into the biosphere, but specifically refers to the greenhouse gas carbon dioxide.

Low-carbon growth path. Strategies for developing countries that promotes efficient management of natural and energy resources and discourages fossil fuel dependence. A means of moving towards a **low-carbon economy** see above.

Magnitude. A measure of how adverse or beneficial an effect may be.

Mainstreaming. The World Bank Working Group defines mainstreaming as "the full and systematic incorporation of a particular issue into the work of an organization so that it becomes an accepted and regular part of the organization's policies and practices."

The second "transformational" definition of mainstreaming is more acceptable to grassroots organizations, and refers to the popularizing of specific socioeconomic issues and/or practices through local decision making, by and for target communities via their primary partners, stakeholders' and the broader community membership.

Maladaptation. An adaptive response, made without consideration for interdependent systems may, inadvertently, increase risks to other systems that are sensitive to climate change (and for social well-being).[13]

Mauritius Strategy. The Mauritius Strategy for the further implementation of the Programme of Action for the Sustainable Development of Small Island Developing States recognizes the unique vulnerability of these countries and outlines strategies to respond to environmental

[11] A number of factors need to be considered when designing a corporate greenhouse gas inventory, including emissions factors versus direct measurements, boundary definition around operations, the inclusion of emissions from contractors, etc.

[12] http://unfccc.int/national_reports/non-annex_i_natcom/items/2716.php

[13] Scheraga, Joel D., and Anne E. Grambsch. 1998. *Risks, Opportunities, and Adaptation to Climate Change.* Vol 10, pp92. Washington, D.C.

vulnerabilities (including climate change), remoteness from world markets, high energy costs and waste management problems.

Measurable, reportable, and verifiable. Refers to measurable, reportable and verifiable nationally appropriate mitigation commitments or actions, including quantified emission limitation and reduction objectives. Improving the evaluation of both developed and developing countries mitigation actions is an important discussion point in the post-2012 climate negotiations.[14]

Micro-adaptation. The gradual acquiring of contemporary and/or traditional environmental knowledge, through adaptation risk consciousness-raising and Grassroots Adaptation Development (GrAD) activities, to reduce risk." (footnote 3).

Mitigation (climate change). Structural and nonstructural measures (energy conservation, renewable energy such as wind or solar, and tree planting) undertaken to limit or reduce greenhouse gas emissions into the environment and atmosphere.

Mitigation (disaster risk management). Measures aimed at moderating or reducing the severity of disaster impacts.[15]

Monitoring. A continuing assessment of conditions at, and surrounding, the action.

Nationally appropriate mitigation action (NAMA). NAMA are approaches to reducing and reversing growth in carbon emissions in developing countries that do not compromise development needs. The post-2012 climate change agreement discusses options for developing countries to adopt NAMAs to deviate from business as usual development paths.

National adaptation program of action (NAPA). NAPAs provide a process for least-developed countries to identify priority activities that respond to their urgent and immediate needs with regard to adaptation to climate change. The rationale for NAPAs rests on the limited ability of least-developed countries to adapt to the adverse effects of climate change. NAPAs focus on urgent and immediate needs—those for which further delay could increase vulnerability or lead to increased costs at a later stage. NAPAs are designed to use existing information, and no new research is needed. They must be action-oriented and country-driven and be flexible and based on national circumstances.[16]

National Communications (for non-Annex I countries). A country report to the UNFCCC on the steps taken or envisaged to be undertaken by signatory countries to implement the UNFCCC (Articles 4.1 and 12), in accordance with the principle of "common but differentiated responsibilities" enshrined in the convention.[17]

[14] http://unfccc2.meta-fusion.com/kongresse/090601_SB30_Bonn/templ/ply_page.php?id_kongresssession=1766&player_mode=isdn_real

[15] Structural mitigation measures are intended to directly reduce the damage, save lives and protect property (i.e., building retention walls, water reservoirs, and reforestation to avoid landslides). Nonstructural mitigation measures are intended to improve the ability to cope with the disaster (mock drills for disaster preparedness). For climate change, mitigation (disaster risk management) measures would be labelled as adaptation because they help reduce the negative impacts of climate change.

[16] http://unfccc.int/cooperation_support/least_developed_countries_portal/ldc_work_programme_and_napa/items/4722.php

[17] http://unfccc.int/national_reports/non-annex_i_natcom/items/2716.php

Natural hazard. A rare or extreme event in the natural environment that adversely affects human life, physical or human capital, or activity to the extent of causing disaster.[18] Some natural hazards are more likely to occur with human-induced climate change.

Non-Annex I (countries). Developing country parties to the United Nations Framework Convention on Climate Change (UNFCCC), under no obligation to reduce greenhouse gas emission but are vulnerable to adverse impacts of global climate change.

Precautionary Principle. The precautionary principle is a moral and political principle which states that if an action or policy might cause severe or irreversible harm to the public or to the environment, in the absence of a scientific consensus that harm would not ensue, the burden of proof falls on those who would advocate taking the action.[19]

Precipitation. Rain, snow, or hail.

Reduced emissions from deforestation and degradation (REDD). An approach to climate change mitigation that includes preventing deforestation and preventing and the resultant release of carbon emissions into the atmosphere.

Rehabilitation. The social processes that encompass decision making about restoration and reconstruction activities.

Relief or response. The terms are used interchangeably to mean the provision of assistance or intervention during or immediately after a disaster to meet life preservation and basic subsistence needs of those affected. Duration can be immediate, short term, or extended.

Resilience. The amount of disturbance a system can absorb and still remain in the same state, and the degree to which a system is capable of recovery and self-organization. With respect to climate change, resilience has been increasingly used as a term describing a system's quality regarding its capacity to adapt to climate change.[20]

Risk. The chance of injury or loss as defined as a measure of the probability and severity of an adverse effect to health, property, the environment, or other things of value; or the probability of harmful consequences due to interaction between hazards and vulnerable conditions.

Risk analysis. The systematic use of information to identify hazards and to estimate the chance for, and severity of, injury or loss to individuals or populations, property, the environment, or other things of value.

Risk assessment. A methodology to determine the nature and extent of risk by analyzing potential hazards and evaluating conditions of vulnerability that could pose a potential threat or harm to people, property, livelihoods, and the environment on which they depend.

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[18] Organe consultatif en matière de recherche sur le climat et les changements climatiques (OcCC) definition.

[19] Raffensperger C. and J. Tickner (eds.) (1999) *Protecting Public Health and the Environment: Implementing the Precautionary Principle*. Island Press, Washington, DC

[20] The United Nations International Strategy for Disaster Reduction (UNISDR 2002a) defines "resilience" as follows: "The capacity of a system, community or society to resist or to change (so) that it may obtain an acceptable level in functioning and structure. This is determined by the degree to which the social system is capable of organising itself, and the ability to increase its capacity for learning and adaptation, including the capacity to recover from a disaster."

Risk communication. Any two-way communication between stakeholders about the existence, nature, form, severity, or acceptability of risks.

Risk management. The systematic application of management policies, procedures, and practices to the tasks of analyzing, evaluating, controlling, and communicating about risk issues.

Saltwater intrusion. Increase of salinity in underground freshwater located close to the coast. It can be caused by excessive withdrawal of water from the freshwater source (aquifer) or by sea-level rise.

Risk screening (for climate risks). Involves analyzing project concepts, with a view to identifying

- whether climate risks have been taken into consideration,
- whether vulnerable to climate change,
- whether plans could lead to increased vulnerability, and
- what steps taken in project design are needed to reduce risks and associated costs.

Sea-level rise. An increase in the average level of the sea or ocean. The global sea level is rising as a result of increasing global temperature because melting of ice in mountains and glaciers leads to more water in the ocean, and warmer water in the oceans expands, occupying more volume.[21]

Sinks (carbon). Any process or activity or mechanism which removes a greenhouse gas or a precursor from the atmosphere.

Stakeholder. Any individual, group, or organization able to affect, be affected by, or believe it might be affected by, a decision or activity. Decision makers are stakeholders.

Sustainability. Development that meets the needs of the present, without compromising the capacity of future generations to meet their own needs;[22] or "a level of resource use that is both sufficient for a good life for its population, and within the carrying capacity of the environment if generalized to the whole world."[23]

Tropical cyclone. A violent, rotating storm with heavy wind and rain. The most severe versions are called hurricanes (in the north Atlantic, and

[21] Local sea levels are determined by a combination of the global sea-level rise and the local lowering or subsidence of the land (for instance due to geological processes).

[22] MediaCompany. 2002. *Poverty and Climate Change: Reducing the Vulnerability of the Poor Through Adaptation.* pp38. Berlin.

[23] H. Daly. 1996. *Beyond Growth, Boston, Massachusetts.* Beacon Press. p 3.

the northeast Pacific east of the International Dateline longitude 180°, or the south Pacific east of longitude 160° East) or typhoons (in the northwest Pacific, west of the International Dateline). Tropical cyclones only form and intensify above warm water, and are probably becoming more intense due to the warming of the ocean surface caused by global warming.

United Nations Framework Convention on Climate Change (UNFCCC). The international response to climate change, the objective of which is to stabilize greenhouse gas concentrations in the atmosphere at a level that will prevent dangerous anthropogenic interference with the climate system.

Vulnerability. The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change including climate variability and extremes. Vulnerability is the function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity.[24]

[24] Vulnerability depends on physical, social, economic, and environmental factors and processes. It is related, for instance, to the places where people live, the strength of their houses, the extent to which their crops can survive adverse weather, or whether they have organized evacuation routes and shelters. **Physical vulnerability** relates to the built environment and may be described as "exposure". **Social vulnerability** is caused by such things as levels of family and social networks, literacy and education, health infrastructure, and the state of peace and security. **Economic vulnerability** is suffered by people of less privileged class or caste, ethnic minorities, the very young and old, etc. They suffer proportionally larger losses in disasters and have limited capacity to recover. Similarly, an economy lacking a diverse productive base is less likely to recover from disaster impact which may also lead to forced migration. **Environmental vulnerability** refers to the extent of natural-resource degradation, such as deforestation, depletion of fish stocks, soil degradation, and water scarcity, which threaten food security and health.

Annex 1 Priority Climate Change Responses at ADB 2009–2015

PRIORITY AREA	POLICY and INSTITUTIONAL RESPONSES	REGIONAL OPERATIONS: SHORT AND MEDIUM TERM RESPONSES *(indicative projects from 2009–2011 pipeline)				
		CWRD	EARD	PARD	SARD	SERD
Low-carbon Growth	Asia Clean Energy Forum (w/USAID) High-Level Dialogue on Climate change (w/TERI) Climate Change Fund, Mitigation Component Carbon Market Initiative : Asia Pacific Carbon Fund and Future Carbon Fund Low-carbon Technology Marketplace Clean Technology Fund of the Climate Investment Funds Study: Climate Change and Energy Study: Sustainable Transport and Fuel Security	Enabling Climate Change Interventions in CWRD Countries Alternative Energy in Azerbaijan: Sector Analysis and Road Map Central Asia Water-Energy Nexus	Regional Technical Assistance -Pricing for Renewable Energy and Advanced Clean Coal Technology	Capacity building for clean energy funds and energy service companies PNG: Power Sector Samoa Power Sector Expansion Project Development Plan	Bangladesh, India, Sri Lanka: Support to power sector reforms in several states in both countries India: Support for India's National Climate change Action Plan	GMS Energy Sector Analysis GMS Capacity Development for Energy Sector Planning and Energy Trade Coordination

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Annex 1: continued

PRIORITY AREA	POLICY AND INSTITUTIONAL RESPONSES	REGIONAL OPERATIONS: SHORT AND MEDIUM TERM RESPONSES *(indicative projects from 2009–2011 pipeline)				
		CWRD	EARD	PARD	SARD	SERD
Energy Efficiency	Energy Efficiency Initiative, financed by the Clean Energy Financing Partnership Facility	Afghanistan: Energy Sector Development Investment Program Azerbaijan: Power Transmission Enhancement Project Georgia: Energy Development Afghanistan and Kyrgzstan, Tajikistan: CASAREM Rehabilitation of Transmission System	PRC: Tianjin IGCC Power Plant Project PRC: Guandong Energy Conservation and Resource Manage ment* PRC: Partial Risk Guarantee for Energy Efficiency Improvements in Buildings Mongolia: Ulaanbaatar Energy Efficiency in Buildings	Promoting Energy Efficiency in the Pacific and follow-on investments co-financed with GEF	India: GHG Emission Reductions through Grid Connected High Efficiency Power Generation* India; Assam Energy Efficiency Enhancement	Indonesia: Energy Efficiency (transmission, demand and supply ef-ficiency) in five regions Philippines: Energy Efficiency Project (energy efficient lamps)
Renewable Energy	Energy for All Initiative, financed by the Clean Energy Financing Partnership Facility	New Bong Escape Hydropower Project* Pakistan Renewable Energy Development*	PRC: Gansu Heihe Rural Hydropower Development PRC: Zhangbei Wind Power Project* PRC: Henan Efficient Utilization of Agricultural Waste (Biogas)*	Fiji: Kinoya Waste Water Biogas* Samoa: Hydropower Rehabilitation * Fiji: Preparing the Renewable Power Sector Project PNG: Power Sector Development Plan	India: The Tata Power Wind Energy Financing Facility Company Limited (TPC)* Bhutan Green Power Development Maldives National Development Plan for renew-able energy *	Laos: Small and Mini-Hydroelectric Power Development Project Philippines: Ctrade Pig Farms (Biogas)* Philippines: Renewable Energy and Livelihood Development (JFPR)

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Annex 1: continued

PRIORITY AREA	POLICY AND INSTITUTIONAL RESPONSES	REGIONAL OPERATIONS: SHORT AND MEDIUM TERM RESPONSES *(indicative projects from 2009–2011 pipeline)				
		CWRD	EARD	PARD	SARD	SERD
Transport and Urban Planning	Sustainable Transport Initiative and Sustainable Transport Forum Cities Development Initiative for Asia Support for Energy, Transport and Urban sector planning	Georgia: Tbilisi Urban Transport Project Pakistan: Faisalbad Urban Transport Pakistan: Punjab Cities Urban Services Uzbekistan: Surkhandarya Water Supply and Sanitation Project	PRC: Lanzhou Sustainable Urban Transport Project Mongolia: Urban Transport Development PRC: Gansu Baiyin Urban Development Project		Bangladesh: Integrated City Transport India: Kerala Sustainable Urban Development* Maldives: Multimodal Transport Nepal: Secondary Towns Integrated Urban Environment Improvement	Laos: Clean Environment Solid Waste Management Project Thailand: Bangkok MRT Integrated Ticketing Project Viet Nam: Ho Chi Minh City Mass Rapid Transit Line 2 Project
Resilient Economies	High-Level Dialogue on Climate change (w/TERI) Pilot Program for Climate Resilience: Participation in Bangladesh, Cambodia, Nepal, Tajikistan and Pacific Region Publication: Under the Water and the Rising Tide: Adapting to Climate Change in Asia and the Pacific	Enabling Climate Change Interventions in CWRD Countries Improved Capacity for Climate Change Projection in the Syr Darya River Basin Central Asia Water-Energy Nexus	Planned Study: Economics of Climate Change in East Asia PRC: Study: Government Public Expenditure in Agricultural Production	Coordination of donor initiatives (led by SPSO) Continue dialogue with regional organizations (CROP, SPREP)	The Coral Triangle Initiative: Adaptation of Coastal and Marine Resources Planned Study: Economics of Climate Change in South Asia Sri Lanka: SRI: Strengthening Capacity for Climate Change Adaptation	Economics of Climate Change in Southeast Asia (w/ Economics Research Department) GMS Communicable Disease Control The Coral Triangle Initiative: Adaptation of Coastal and Marine Resources

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Annex 1: continued

PRIORITY AREA	POLICY AND INSTITUTIONAL RESPONSES	REGIONAL OPERATIONS: SHORT AND MEDIUM TERM RESPONSES *(indicative projects from 2009–2011 pipeline)				
		CWRD	EARD	PARD	SARD	SERD
	Publication: "Climate Proofing – A Risk-based Approach to Adaptation"	High-level Conference: "From Katmandu to Copenhagen"			Nepal: Community-based Vulnerability Assessment, Risk Mapping and Adaptation Planning High-level Conference: "From Katmandu to Copenhagen"	Cambodia, Laos, Viet Nam: Mekong Water Supply and Sanitation Project
Mainstreaming Adaptation in Planning	Promoting Climate Change Adaptation in Asia and the Pacific Study: Climate Change and Migration Technical Assistance: Addressing Climate Change-Induced Migration in Asia and Pacific	Glacial Melt and Downstream Impacts on Indus-Dependent Water Resources and Energy		Mainstreaming climate change mitigation and adaptation in the CPSs of PDMCs (Samoa 2008)	Bangladesh: Supporting National Action Plan for Climate Change Nepal: Strengthening Capacity for Managing Climate Change and the Environment	GMS – Land Use Management and Spatial Land Use Planning Decision Support Tools
Disaster Preparedness	Strengthen adaptation in line with ADB Disaster and Emergency Assistance Policy and the Hyogo Framework for Action. Asia Pacific Disaster Response Fund		Coastal and river delta flooding (PRC) Hunan Flood Management	Regional Partnerships for Climate Change Adaptation and Disaster Preparedness	Bangladesh: National Disaster Risk Management Project India: Sustainable Coastal Protection and Management Project	Cambodia, Laos, Viet Nam: GMS Flood and Drought Risk Management and Irrigation Indonesia: Flood Management in Selected River Basins

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Annex 1: continued

PRIORITY AREA	POLICY AND INSTITUTIONAL RESPONSES	REGIONAL OPERATIONS: SHORT AND MEDIUM TERM RESPONSES *(indicative projects from 2009–2011 pipeline)				
		CWRD	EARD	PARD	SARD	SERD
Sector Strategies	Study: Building Climate Resilience in the Agriculture Sector Water Financing Partnership Facility and Water and Climate Change Fund Water and Climate Change Knowledge Hub (w/ NAHRIM)	Uzbekistan: Surkhandarya Water Supply and Sanitation Project Pakistan: Punjab Irrigated Agriculture Sector Uzbekistan: Irrigation and Water Management	Qingdao Water Resources Management and Wetland Protection Henan Sustainable Agriculture and Productivity Improvement	Climate Risk Profiles studies in ten PDMCs Fiji: Power sector development projects with the Fiji Electricity Authority	Nepal: Climate Impact Scenarios and Adaptation Strategies through Sustainable Watershed Management and Livelihood Practices	Indonesia Metropolitan Sanitation Management and Health Project Philippines: Irrigation Systems Operation Efficiency Improvement
Climate Proofing Infrastructure	ADB Climate Risk Screening Tool Climate Change Fund Adaptation Component	Pakistan National Highway Development Kyrgyzstan CAREC Transport Corridor Tajikistan Dushanbe-Kyrgyz Border Road Rehabilitation		Cook Islands: Avatiu Harbor Development PNG: Highland Region Road Improvement Program Timor Leste: Road Network Project in Timor Leste	Nepal: Road Connectivity Sector II Project	INO: Climate Change Adaptation in the 6 CI's River Basin Territory Viet Nam: Central Regions Water Supply and Sanitation

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Annex 1: continued

PRIORITY AREA	POLICY AND INSTITUTIONAL RESPONSES	REGIONAL OPERATIONS: SHORT AND MEDIUM TERM RESPONSES *(indicative projects from 2009–2011 pipeline)				
		CWRD	EARD	PARD	SARD	SERD
Forestry and Land Use	Climate Change Fund – REDD Pilot Component Regional Technical Assistance on Capturing Economic Benefits from Ecosystem Services Poverty Environment Fund	Central Asian Countries Initiative for Land Management	Integrated Ecosystem Management in Ningxia Hui Autonomous Region (financed by GEF) Integrated Ecosystem Management in Ningxia Hui Autonomous Region (financed by GEF) Mongolia: Development of a Sustainable Agro-Pastoral System in Semi-Arid Areas		Bangladesh: Sustainable Participatory Livestock Development	GMS Lao PDR Forest Sector Material Flow Analysis Cambodia, Laos and Viet Nam: Biodiversity Conservation Corridor Philippines: Integrated Natural Resources and Environmental Management Project

Understanding and Responding to Climate Change in Developing Asia

Climate change is a major threat to improving prosperity in Asia and the Pacific. The Asian Development Bank has an important role to play in responding to the threats—and opportunities—presented by climate change in the region. To better align its investments and associated policy and institutional support with the priorities of its developing member countries relating to climate and development each of ADB's five regional departments—covering Central and West Asia, East Asia, the Pacific, South Asia, and Southeast Asia—has drafted a Climate Change Implementation Plan to serve as a guide for climate-related responses, both to mitigate greenhouse emissions and to adapt to climate change impacts. This report summarizes the recommendations of the regional plans and outlines ongoing and planned interventions to help build low-carbon, climate resilient economies in Asia and the Pacific.

About the Asian Development Bank

ADB's vision is an Asia and Pacific region free of poverty. Its mission is to help its developing member countries 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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