ADB

CLIMATE CHANGE

ADB PROGRAMS

Strengthening Mitigation and Adaptation in Asia and the Pacific

Asian Development Bank

Abbreviations

ADB	Asian Development Bank
APCF	Asia Pacific Carbon Fund
CDIA	Cities Development Initiative for Asia
CDM	Clean Development Mechanism
CMI	Carbon Market Initiative
CMM	coalmine methane
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
DEAP	Disaster and Emergency Assistance Policy
DMC	developing member country
EEI	Energy Efficiency Initiative
GDP	gross domestic product
GEF	Global Environment Facility
GHG	greenhouse gas
GMS	Greater Mekong Subregion
GWh	gigawatt-hour
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
M2M	Methane to Markets
MW	megawatt
NSIDC	National Snow and Ice Data Center
OECD	Organisation for Economic Co-operation and Development
ppm	parts per million
PRC	People's Republic of China
STI	Sustainable Transport Initiative
tCO_2e	tons of carbon dioxide-equivalent

NOTE: In this report, "$" refers to US dollars.

Publication Stock No. PBB196608

Photo credits: ADB Photo Library, pages 16, 17, 18, 19, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30
AFP Image Forum, page 6, 9, 17, 19

Contents

Message from the President

Intense interest has been raised among policy makers around the world on an evolving long-term international framework to promote the transition to lower-carbon economies needed to address global climate change. Attention to these developments is especially high in Asia and the Pacific, which has the world's most dynamic economies but also the fastest growth in greenhouse gas emissions that cause global warming.

The region's rapid economic expansion has clearly brought substantial benefits to its poor. This would not have been possible without increased access to energy, and this remains an essential input to further poverty reduction—the goal of the Asian Development Bank (ADB). But current energy production and use patterns, coupled with land use changes and other consequences of rapid economic growth, are exacting an increasingly high price on the region's environment, its security, and its people. These impacts are of such a scale as to affect the entire planet.

If current trends continue, Asia and the Pacific's greenhouse gas emissions—whether from energy production, transportation, deforestation, or other sources—will soon be comparable to those of Europe and North America. Emissions from energy use alone are projected to be 107% higher in 2030 than they are today, with the region responsible for 43% of all global energy-related emissions.

Land use changes, booming industrialization, and waste management challenges add further to the region's expanding emissions. If business continues as usual—with the region's production and consumption patterns remaining highly carbon intensive—future growth will be environmentally unsustainable and economic growth itself can be jeopardized.

The region must find and adopt new patterns of urban development, energy production and consumption, land use, and waste management, or else it will find itself increasingly contributing to the global climate change problem and broader resource degradation—with rising negative consequences for the people of the region and the planet as a whole.

The latest report of the UN Intergovernmental Panel on Climate Change as well as the United Kingdom's *Stern Review on the Economics of Climate Change* agree that such adjustments are needed to avoid threats to poverty reduction derived from new threats to the health, safety, and productivity of the poor.

Climate change will have many manifestations in Asia and the Pacific, and measures are needed to protect the most vulnerable from the adverse effects of sea level rise, melting glaciers, more frequent and severe storms, greater variability of rainfall, and other predicted impacts.

The global consensus already tells us that 1.2 billion people could experience freshwater scarcity by 2020; crop yields in Central and South Asia could drop by 50% between now and 2050; and coastal communities, coastal and marine ecosystems, and even entire island nations could vanish. In human terms, people who already struggle day-to-day and season-to-season just to survive will find themselves coping with even worse insecurities. Millions could become climate refugees, and the poorest people in the poorest countries are likely to experience the earliest and greatest suffering.

Action is needed both to mitigate greenhouse gas emissions and to identify and act upon the highest priorities to integrate climate change adaptation measures into planning and investment at the project, municipal, regional, and global levels.

With this challenge facing our region and our planet, ADB is well-placed to respond to the growing demand from its developing member countries for policies, institutions, and investments that can achieve environmentally sustainable economic growth. Projects with environmental components or objectives have increased substantially in recent years—reaching 20% of loans approved in 2006. And we have been working to build understanding in the region on climate change response options for nearly two decades.

There is clearly much to do, and it will take a collective response from governments, international organizations, civil society, and the private sector to make it happen in the necessary timeframe. New policy and institutional approaches are needed, along with an infusion of capital into clean energy projects, new land use practices, and adaptation measures. This will draw upon both the emerging global carbon market and private funding.

In the following pages, you will learn about ADB's ongoing and emerging climate change mitigation and adaptation programs, and how we stand ready to play a catalytic role in helping Asia and the Pacific region meet the challenges brought about by climate change. We invite you to join us in this vital effort.

Haruhiko Kuroda
President
Asian Development Bank

Climate Change—the Cause

Our Earth as a greenhouse

The Earth works like a greenhouse. Carbon dioxide (CO_2), methane, and other naturally occurring greenhouse gases (GHGs), as well as manmade industrial gases trap heat from escaping into space. This keeps the earth within a life-sustaining range. Without the greenhouse effect, the earth is much colder—an average temperature of –19° Celsius (C).

Human reliance on fossil fuels for energy has increased the amount of CO_2 in the atmosphere. Biogenic emissions of GHG from land use have magnified the greenhouse effect. Deforestation and poor land use, which have reduced the absorptive capacity of plants, forests, and soils for CO_2, have made things worse.

The fastest heat rise in history

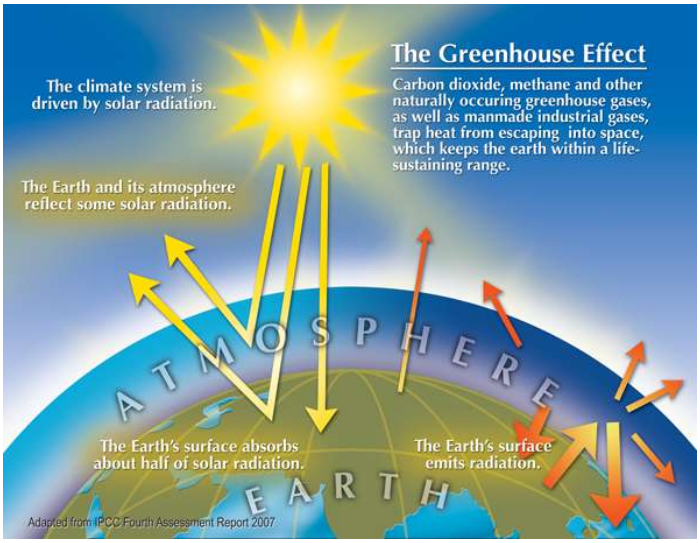
Atmospheric CO_2 concentration was approximately180 parts per million (ppm) during the last ice age. It was 280 ppm by the pre-industrial era. The difference of 100 ppm translated into a 4°C mean temperature rise—the difference between an ice age and a relatively warm period for the planet.

Today, CO_2 level is 380 ppm and rising fast. Adding in other GHGs, it is approximately 430 ppm of carbon dioxide equivalent (CO_2e). If current trends continue, the Intergovernmental Panel on Climate Change (IPCC), co-winner of the 2007 Nobel Peace Prize, projects that GHG levels will rise to 550–700 ppm CO_2e by 2050 and 650–1200 ppm CO_2e by 2100.

IPCC states in their latest report that depending on world GHG emission scenarios, temperatures are predicted to rise between 1.8ºC and 4ºC by 2100. With the planet already in a warm period, any increase in temperatures of more than 2ºC over pre-industrial levels is predicted to have devastating impacts on people's lives, economic infrastructures, and natural environments.

Vicious feedback loops

There are several known feedback loops, where warming begets itself. For example, Arctic ice is melting. Ice acts like a mirror, reflecting nearly 90% of the sunlight striking it back into space. Ocean water absorbs 90% of it as heat. As the water heats up, each new kilometer of ice melts faster than the one before it. This is a feedback loop.



National Snow and Ice Data Center (NSIDC) in Boulder, Colorado, recently reported that last summer's Arctic ice shrank 39% below the average from 1979 to 2000. In fact, the ice has been reducing by about 10% a decade over the past 30 years. NSIDC warned in 2005 that Arctic ice may have reached a tipping point, and an accelerating feedback loop has begun.

Additional accelerating spirals

Oceans hold other destabilizing feedback loops. Each year, they absorb half the CO_2 humans pour into the air. But as oceans warm, they absorb less and less. This is because warm water dissolves less gas, and warming disrupts the mixing of surface and deep water, where CO_2 absorbing plankton reside. Thus, global warming accelerates even faster.

Another loop involves methane, which is over 20 times more potent for the same mass than CO_2 as a GHG. Locked in the Siberian permafrost are tens of billions of tons of organic waste containing methane. According to scientists, the volume of methane trapped is equivalent to at least 70 years of all human-caused GHG emissions at today's levels. The Siberian tundra is melting fast. And that methane has only one place to go.

A listing ship

"Global warming" may sound gradual and manageable. However, the associated climatic changes are anything but this. For analogy, if a damaged ship lists gradually to the port side, passengers may move to the starboard to rebalance. But they are only putting off the inevitable. Sooner or later they will need to hang on to survive until the ship finally tips and goes under. How can we avoid the tipping point?

Stabilizing GHG concentrations

The only path is to stabilize atmospheric concentrations of GHGs within safe limits. Stabilization means reaching an equilibrium at which the amount of GHG emitted does not exceed the earth's natural capacity to cleanse itself. Scientists are not sure of the exact level. Many say we need to keep mean temperature rise under 2°C. This, in fact, is the goal argued by all European Union members to avoid "dangerous" climate change.

The *Stern Review on the Economics of Climate Change* says this translates to stabilizing GHGs between 450 and 550 ppm. For the earth to stabilize at 500 ppm or below, action must be taken to ensure emissions peak in the next 10 to 20 years and then drop off by 4–6% per year in succeeding years. This would bring down emissions to 50–70% below 2005 levels by 2050.

Climate Change—the Impact on Asia and the Pacific

You are a farmer whose family has been growing rice for 300 years, and has been trying to stay competitive. The local agricultural expert has just informed you climatic conditions will soon lower your rice production.

You are a refugee being ferried away from your home. You look back at your island one last time. Soon it will be under the sea. You are offered no legal protection in the land to which you are headed.

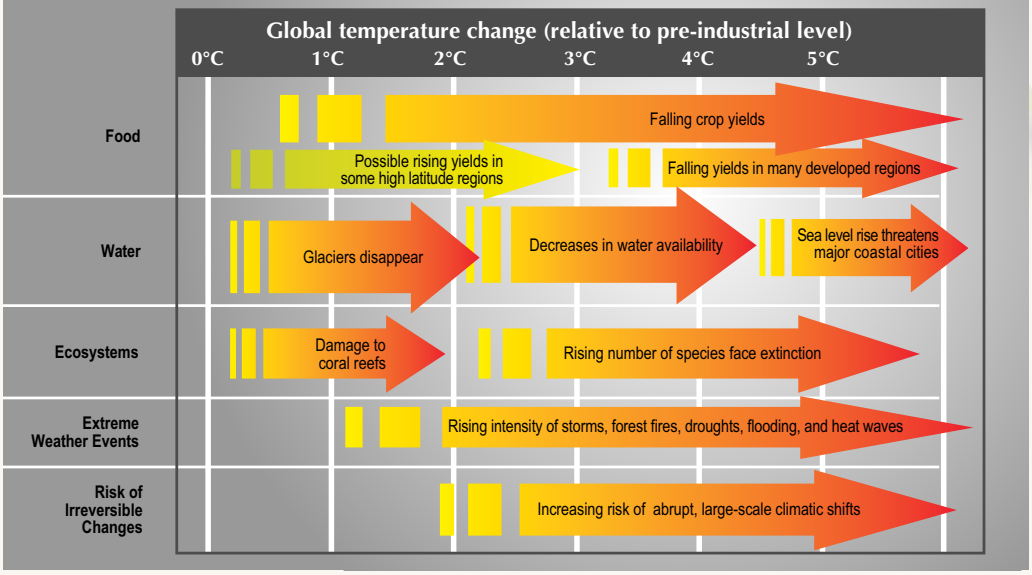
You are a worker who migrated for a better opportunity. Now you are on the move again—not for a different job but to join the growing number of people in search of water.

How business-as-usual practices will impact Asia and the Pacific

The immediate and long-term impacts of climate change are threatening social and economic progress across Asia and the Pacific. Such impacts are already being felt in a number of real and recognizable ways in the region. Small island nations of the Pacific are witnessing measurable encroachment of the sea, forcing them to think of possible adaptation measures and, ultimately, migration. Extreme climate events, such as typhoons, floods, and droughts, are happening more frequently and are becoming more destructive.

Some scientists warn of dire tipping points, such as the loss of the Amazon rainforest, the disintegration of the West Antarctic ice sheet, and the shutdown of the world's ocean circulation, if GHG emissions grow unabated. Even if these worst-case scenarios do not occur, sea level rise and changes to the climate system could profoundly affect the prospects for sustainable development in many countries. Among other impacts, severe pressures on the availability of food and water will be compounded.

Projected Impacts of Climate Change



C = Celsius; CO_2 = carbon dioxide.
Source: Adapted from the *Stern Review on the Economics of Climate Change.*

In Asia and the Pacific, IPCC predicts that climate change could have a range of adverse impacts, including:

Crop Yields. Rising temperatures and extreme weather events will reduce crop yields by 2.5–10% by 2020, putting 132 million people at risk of extreme hunger by 2050.

Water Supply. Fresh water will decrease in Central, East, South, and Southeast Asia (especially in large river basins), affecting more than 1 billion people by 2050.

Coastal and Marine Ecosystems. A total of 24–34% of coral reefs is likely to be lost by 2050. Wetlands and mangroves will be threatened, and brackish water intrusion will affect aquaculture.

Glacial Melt. Glacial meltdown will initially cause devastating floods and slope destabilization and will eventually decrease summertime river flows.

Forests and Biodiversity. Climate changes may lead to the extinction of plants and animals in the region. Intense droughts in some regions will also increase the risk of forest fires.

Coastal Cities. Asia and the Pacific's coastal megacities face increased flooding and seawater intrusion of aquifers, which will affect millions of people and put infrastructure investments at risk.

Socioeconomic Effects. Climate change may reverse many of the important economic gains made by developing countries. National gross domestic product growth may be jeopardized. Revenues may be cut and spending needs increased, thus worsening public finances.

As a result of these and other impacts, the effect on people's lives could be devastating, and whole communities could be threatened. Large-scale migration could someday become common, conflicts may break out, and death rates are projected to rise because of malnutrition and spread of diseases.

The poor are expected to fare worst. They are already highly vulnerable to disruptions in their income and access to services and education, and they generally live and work in locations that are the most prone to natural hazards. Climate change is also expected to disproportionately affect female members of households. For instance, floods and droughts may force women to walk greater distances to collect food and water.

The Case for Action in Asia and the Pacific

To understand the case for climate change mitigation and adaptation in Asia and the Pacific, one needs only to look at the fundamentals.

Asia is fast becoming a major source of GHG emissions

Economic growth in Asia is unprecedented. As if overnight, where was once a village, a metropolis now stands. New industries have risen. Populations and incomes have increased. Millions have been lifted from poverty.

Despite bringing many benefits, the pattern of this growth, fueled by rapid urbanization and intensive energy and resource consumption, has not come without a price. Under current trends, Asia and the Pacific's GHG emissions will soon be the world's largest. Without increased low-carbon investments and better land use practices in Asia and the Pacific, it will not be possible to control global GHG emissions at the level necessary to avert dangerous climate change impacts.

Energy growth is startling

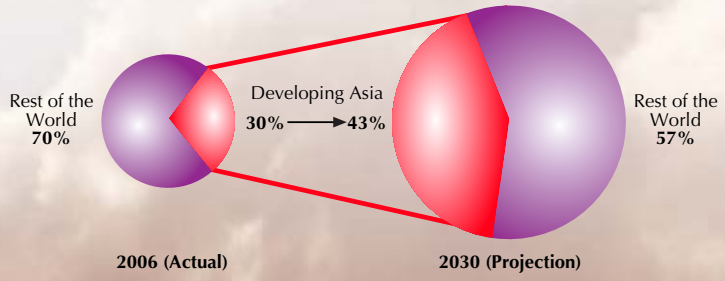
Under a business-as-usual scenario, energy demand in developing Asia will almost double by 2030. Emissions from energy use are projected to be 107% higher in 2030 than they were in 2006, and the region will be responsible for 43% of all global energy-related emissions (compared with 30% in 2006).

If the majority of systems being installed used clean energy options, few alarms might ring. Various clean technologies to mitigate carbon emissions exist today. However, coal fuels the expansion of developing Asia because it is the most affordable, and more coal is on the drawing board. There are other causes for concern as well. A vehicle boom is driving up Asia's demand for oil. In 2030, oil use by the transport sector will be three times bigger than it is today.

Poor land use practices compound the problem

Vegetation and organic matter in soils absorb CO_2 from the atmosphere and thus play a critical role in maintaining the earth's CO_2 balance. Therefore, land use changes that disrupt forests and soils can greatly affect the earth's natural ability to store and release carbon. Deforestation accounts for 17% of global carbon emissions and is the largest source of CO_2 in many developing countries.

Developing Asia's Share in Global CO_2 Emissions from Energy Consumption



Data Source: International Energy Agency. *World Energy Outlook 2008.*

For example, deforestation alone accounts for more than three quarters of Indonesia's GHG emissions. Taken together with fossil fuels, they compound the reasons why the People's Republic of China, India, and Indonesia are now among the world's top 10 GHG emitting nations, although their per capita emissions still remain relatively low.

Vulnerability of Asia and the Pacific

Adaptation has clearly become a vital complement to mitigation. Various studies estimate that even if atmospheric CO_2 concentrations are kept below dangerous levels through concerted international action, adapting to the inevitable climate change impacts will cost poor countries at least $10 billion to as much as $150 billion per year, depending on whether these figures refer to infrastructure alone or broader economic impacts. Costs include necessary adjustments to existing infrastructure in response to floods, storm surges, water shortages, cyclones, and other increased risks brought on by climate change.

Unfortunately, the majority of ADB's developing member countries are particularly prone to one or more of these risks and are not yet adequately prepared to deal with the resulting effects on agricultural output, labor productivity, health, infrastructure, and internal displacement. Asia and the Pacific's vulnerability to climate change is dictated by its unique physical and socioeconomic attributes, including high population density, still relatively low income levels, long coastlines, and the prominence of agriculture and fishing in providing livelihoods for the rural poor.

In preparing for the future impacts of climate change, it will be important to prioritize investments. Appropriate adaptation measures may require investments in inshore coral rehabilitation, watershed reforestation, river levees, wetlands nourishment, and the introduction of hardier and more resistant crops. Over the longer term, coastal sea groyes may be required for small islands, and dams may need to be raised or reinforced to withstand increased runoff from glacial melt and unseasonal flooding.

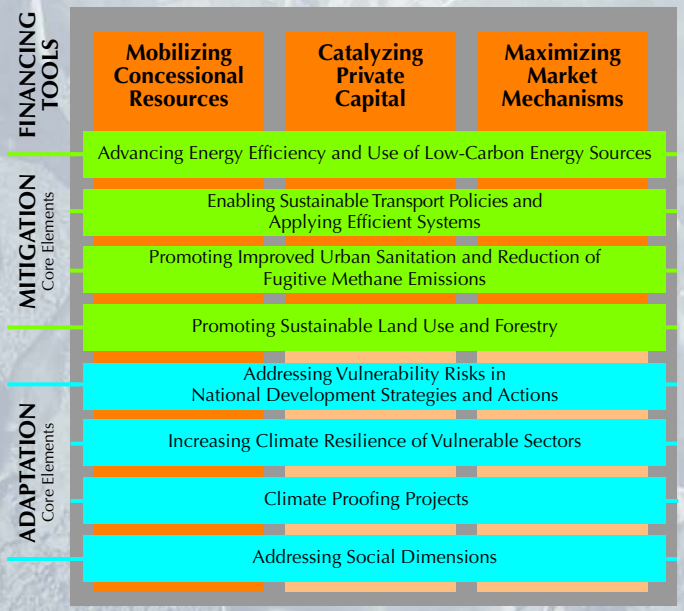
To avert the worst damage, it will take shared understanding of long-term goals, effective leadership, and an ability to build and facilitate concerted action among all players at every level.

ADB's Climate Change Program

The Asian Development Bank (ADB) is taking an active role in Asia and the Pacific to address the causes and consequences of climate change.

Under its new long-term strategic framework "Strategy 2020," ADB focuses on responding to climate change as part of the broader agenda of environmentally sustainable growth in Asia and the Pacific. Addressing climate change is also critical to promoting inclusive growth, another pillar under Strategy 2020, as the adverse impacts are predicted to disproportionately affect the poor.

Consistent with the Clean Energy Investment Framework of the multilateral development banks, ADB has been scaling-up its climate change actions by mainstreaming climate change into its core financing operations. In doing so, we are promoting the integration of climate change mitigation and adaptation considerations in development activities throughout the region. We are working with multiple partners and intensifying our efforts to help fill gaps in financing, capacities, and knowledge.



In the area of climate change mitigation, ADB is implementing a program consisting of four core elements: (i) advancing energy efficiency and use of low-carbon energy sources, (ii) enabling sustainable transport policies and applying efficient systems, (iii) promoting improved urban sanitation and reduction of fugitive methane emissions, and (iv) promoting sustainable land use and forestry.

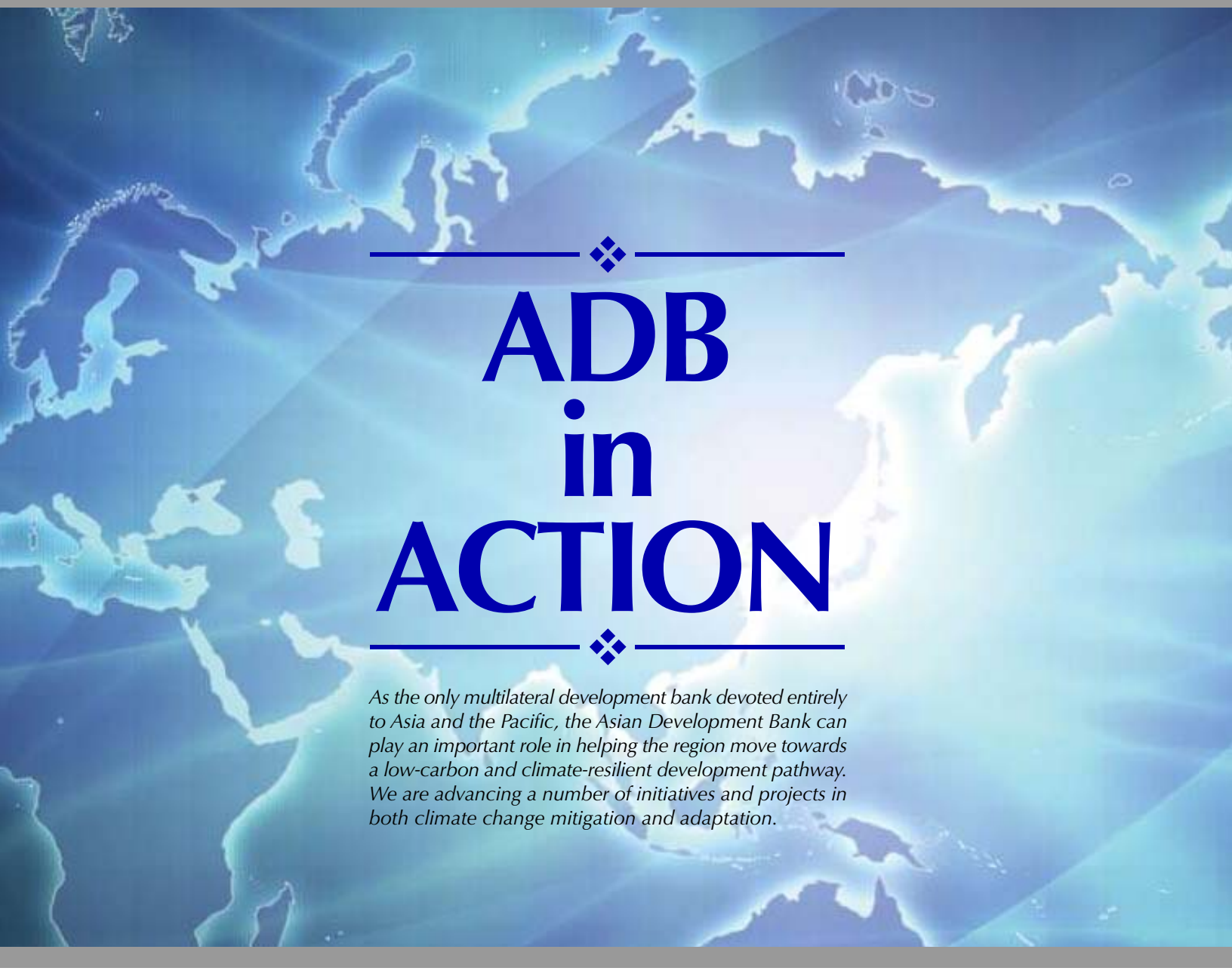
Core elements of the adaptation program include: (i) addressing vulnerability risks in national development strategies and actions, (ii) increasing the climate resilience of vulnerable sectors such as water and agriculture, (iii) climate proofing projects, and (iv) addressing social dimensions.

ADB is working with partners to make mitigation and adaptation actions affordable and more competitive. For example, ADB is an executing agency of the Global Environment Facility (GEF) and can assist developing member countries (DMCs) in accessing grant resources. ADB recently established its Climate Change Fund, which is intended to support both mitigation and adaptation activities. We are mobilizing additional concessional resources, catalyzing private sector investments, and maximizing the use of market-based mechanisms, such as the carbon and insurance markets.

Map of Projects


GEORGIA
AREA: Selected sites
FOCUS: Run-of-river hydro
AZERBAIJAN
ARMENIA
KAZAKHSTAN
AREA: Karkidon, Shaudar, and Bag
FOCUS: Small hydro
AREA: Chui Oblast
FOCUS: Natural gas network rehabilitation
AREA: Countrywide
FOCUS: Energy efficiency
MONGOLIA
AREA: Western PRC
FOCUS: Land degradation
AREA: Gansu Province
FOCUS: Run-of-river hydro
AREA: Henan Province
FOCUS: Agricultural waste to energy
TURKMENISTAN
UZBEKISTAN
KYRGYZ REPUBLIC
TAJIKISTAN
PEOPLE'S REPUBLIC OF CHINA
AREA: Khatlon Province
FOCUS: Flood protection
AREA: Central Asia
FOCUS: Land degradation
AREA: Countrywide
FOCUS: Energy Efficiency
AREA: Countrywide
FOCUS: Adaptation road map
AREA: Shanxi
FOCUS: Coalmine methane
AFGHANISTAN
AREA: Uttarakhand State
FOCUS: Small hydro
AREA: North-West Frontier Province and Punjab
FOCUS: Run-of-river hydro
PAKISTAN
NEPAL
BHUTAN
AREA: Anhui Province
FOCUS: Waste to energy
AREA: Sindh Province
FOCUS: Wind power
AREA: Dagana District
FOCUS: Run-of-river hydro
BANGLADESH
Hong Kong, China
AREA: Rajasthan State
FOCUS: Waste composting
AREA: Kathmandu
FOCUS: Transport management
MYANMAR
TAIPEI,CHIN
INDIA
LAO PEOPLE'S DEMOCRATIC REPUBLIC
AREA: Selected Cities
FOCUS: Methane capture and utilization
AREA: Maharashtra State
FOCUS: Wind energy
AREA: Countrywide
FOCUS: Adaptation road map
AREA: Dhaka
FOCUS: Waste composting
THAILAND
SOCIALIST REPUBLIC OF VIET NAM
CAMBODIA
AREA: Greater Mekong Subregion
FOCUS: Climate change impact analysis on agriculture and natural resources
AREA: Kerala State
FOCUS: Waste composting
AREA: Ho Chi Minh City
FOCUS: Climate impact & adaptation analysis
AREA: Central Highlands
FOCUS: Forestry for livelihoods
SRI LANKA
AREA: North Sulawesi
FOCUS: Geothermal
MALDIVES
AREA: Northwestern Province
FOCUS: Wind power
MALAYSIA
SINGAPORE
INDONESIA
AREA: Java Island
FOCUS: Energy efficiency
INDIAN OCEAN
Site Specific Project
National Program
Regional Program


AREA: Jilin Province
FOCUS: Waste to energy
AREA: Liaoning Province
FOCUS: Coalmine methane
JAPAN
NORTH PACIFIC OCEAN
AREA: Northern Luzon
FOCUS: Wind power
AREA: Countrywide
FOCUS: Mainstreaming economic analysis of adaptation
AREA: Kosrae
FOCUS: Climate proofing
AREA: Selected sites
FOCUS: Waste to energy
MARSHALL ISLANDS
REPUBLIC OF PALAU
AREA: Countrywide
FOCUS: Climate adaptation
FEDERATED STATES OF MICRONESIA
PAPUA NEW GUINEA
NAURU
KIRIBATI
SOLOMON ISLANDS
AREA: Countrywide
FOCUS: Energy efficiency
TUVALU
AREA: Selected sites
FOCUS: Small hydro
AREA: Countrywide
FOCUS: Energy efficiency
SAMOA
VANUATU
TONGA
COOK ISLANDS
REPUBLIC OF THE FIJI ISLANDS
AREA: Countrywide
FOCUS: Energy efficiency
AREA: Countrywide
FOCUS: Energy efficiency
AREA: Countrywide
FOCUS: Energy efficiency
AREA: Selected sites
FOCUS: Climate risk and proofing analysis



ADB in ACTION

As the only multilateral development bank devoted entirely to Asia and the Pacific, the Asian Development Bank can play an important role in helping the region move towards a low-carbon and climate-resilient development pathway. We are advancing a number of initiatives and projects in both climate change mitigation and adaptation.

ADB is Mainstreaming Climate Change Mitigation

The challenge to mitigate greenhouse gas (GHG) emissions is perhaps the greatest one the world has ever faced. The longer we delay mitigating GHG emissions, the greater the ultimate price tag will be.

Developing countries should take advantage of many of the existing technologies and practices designed to solve environmental challenges in developed countries, i.e., those in the Organisation of Economic Co-operation and Development (OECD). Aggressively adopting new technologies and sound policies will enable DMCs to "leapfrog" many of the problems that have been experienced by developed countries, and avoid investments in infrastructure that could soon become obsolete. Mobile communication networks, light-emitting diode traffic lights, and hybrid or flexible fuel vehicles are prime examples of leapfrogging already achieved by developing economies.

Advancing energy efficiency and use of low-carbon energy sources

GHG emissions from energy represent about half of all GHG emissions in Asia. Thus, the foundation of ADB's mitigation strategy is curbing energy demand growth by making economies as energy efficient as possible and meeting essential energy needs through low-carbon options. In this effort, demand- and supply-side interventions must work hand in hand.

Demand-side energy efficiency

Sound end-use efficiency improvements can be implemented in the industrial, commercial, residential, municipal, and transport sectors, among others. When end-use efficiency is improved, the positive effect through the energy value chain is compounded.

For example, in developing countries, savings of one unit of end-use electricity in motors, controls, and lighting can translate to savings of up to 10 units of energy input at a power plant—offering great GHG mitigation potential.

In the industrial and commercial sectors, energy-efficient plant and machinery retrofits reduce GHG emissions and can be self-financed from the cost savings they generate. Buildings and homes can benefit from energy-efficient technologies, such as heating and cooling systems, lighting, energy management controls, and variable speed-drive motor systems for fans and pumps.

ADB's Energy Efficiency Initiative (EEI) is helping clean energy grow

EEI was launched in 2005 to increase clean energy investments to $1 billion per year starting 2008. We have developed country-specific strategies to promote clean energy projects in the People's Republic of China, India, Indonesia, Pakistan, Philippines, and Viet Nam and expect to mobilize additional resources focusing on smaller countries. A financing facility with a targeted size of $250 million helps fund EEI's activities in the areas of: (i) smaller energy efficiency investments; (ii) technology costs; and (iii) grant assistance for activities such as advocacy, institutional capacity building, project preparation, and establishment of ADB's monitoring and evaluation mechanisms. As of November 2008, ADB has exceeded its annual target of $1 billion for 2008.

In Guangdong Province of the People's Republic of China (PRC), ADB is assisting a comprehensive demand-side efficiency project that will upgrade industrial and commercial equipment. In Indonesia, ADB is considering financing the replacement of 60 million residential lighting fixtures to energy-saving bulbs.

Supply-side energy efficiency

Supercritical steam turbines can increase efficiency over conventional subcritical steam turbines by more than 20%. ADB is currently evaluating the financing of several supercritical coal plants in India. These plants, if built, promise generation efficiencies of 43%, as opposed to the national average of 33% today. This will result in significant savings of coal and GHG emissions over the 20–30 year life of each plant.

Recovering and using waste heat dramatically increases overall energy efficiency. ADB has financed several waste heat recovery projects in PRC, and is currently implementing a boiler rehabilitation project in Mongolia. Smart investments in transmission and distribution can cut losses by half. ADB has assisted many projects that upgrade transmission and distribution systems to use state-of-the-art equipment. Since 2001, there have been projects in several countries, including PRC, India, Pakistan, and Viet Nam.

Renewable energy and fuel switching

Renewable sources promise environmental as well as energy security benefits. Incremental costs for many renewable energy technologies are declining. In many countries and regions, biomass cogeneration, wind, geothermal, small hydropower, and domestic solar water heating can compete with conventional

ADB's Carbon Market Initiative (CMI) harnesses the power of carbon pricing

CMI harnesses the power of carbon pricing. Adequate finance and capacity are fundamental obstacles for developing countries trying to adopt cleaner energy technologies. CMI supports the development of GHG mitigation projects by cofinancing project preparation and implementation. CMI's Asia Pacific Carbon Fund and the recently established Future Carbon Fund will use carbon credits generated up to 2020 to cofinance clean energy and other GHG mitigation projects. CMI also provides experts for technical advice on project development and implementation, documentation, and capacity building. In addition, it offers developing member countries marketing support for their carbon credits to be sold in the global carbon market.

ADB is Mainstreaming Climate Change Mitigation

energy at the retail and wholesale levels. Renewable energy can be particularly valuable in off-grid and rural communities to provide a range of energy services, including lighting, cooking, refrigeration, and water supply.

ADB has assisted numerous run-of-river hydropower projects in recent years. These range from 5 megawatts (MW) to 100 MW. ADB is a financing partner to the Tata wind power project in India, and is looking at several more wind projects in the coming years. ADB has also assisted geothermal power plants in Indonesia and geothermal heating projects in northern PRC. ADB's Energy Efficiency Initiative and Carbon Market Initiative are actively involved in helping to make renewable energy work for the region.

ADB is also supporting projects that promote cleaner fuel in an effort to shift from fossil fuel to renewables and to reduce GHG emissions before ultimately stopping and reversing them. ADB is supporting natural gas transmission and distribution improvement projects in several countries, including Bangladesh, PRC, India, Indonesia, and Kyrgyz Republic.

A new area for ADB is biofuels. Biomass-based alcohol fuels and biodiesel can yield reduced emissions over conventional fuels when feedstock is chosen carefully and fossil energy input is minimized. Of course, food security for poorer countries must always be considered in biofuel production decisions. Biofuel production creates other concerns as well. For instance, it requires energy input for farming, transport, and conversion to final product, plus fertilizers, pesticides, and herbicides.

ADB is sensitive to these considerations and will study the various tradeoffs of feedstock and promote only projects that do not lead to land degradation, monoculture, or price shocks for food oils. In the Greater Mekong Subregion program, ADB is promoting the use of biodiesel from non-agricultural feedstock, such as jatropha, and emerging cellulose manufacturing technologies.

ADB's Energy for All Initiative is helping improve access to modern energy services

ADB is developing new strategic approaches to help countries increase the access to modern energy services for the poor while simultaneously reducing greenhouse gas emissions. The Energy for All Initiative is supporting a number of activities that have these dual benefits, such as promoting modern cooking stoves that can be operated using a wide range of fuels (including biomass); promoting community-managed decentralized energy systems (e.g., micro-hydro, solar, biomass); and promoting local financing for individual household-level technologies. ADB is now establishing a regional platform that brings together funding agencies, civil society, governments, financial institutions, and the private sector to help scale up these activities.

Enabling sustainable transport policies and applying efficient systems

Rapid urbanization and rising incomes have led to an explosive increase in the use and number of private vehicles in DMC urban areas. As traffic increases, so does the consumption of oil-based fuels and the emissions of GHGs. Other impacts include a declining quality of life in the region's cities because of congestion and local air pollution.

Weighed down by inefficient allocation of road space, inadequate traffic management, institutional weaknesses, and insufficient financial resources, most cities have not been able to find sustainable solutions. Minimal efforts have been made to integrate transport with land use planning in most cities.

To address these problems, expanded support will be needed for policies and

technologies to introduce higher vehicle fuel efficiencies. Alternatives to automobiles, such as public transport systems, bikeways, and other efficient means to move people and goods must be considered. Installed, these alternatives will simultaneously generate local and global benefits by reducing air pollution and congestion.

Throughout the region, ADB is helping develop national transport policies that place a high emphasis on emissions, energy use, and mobility efficiencies. ADB's flagship program in this area—the Sustainable Transport Initiative—is helping ensure future transport sector projects incorporate the effects of climate change in decision-making processes.

In the Greater Mekong Subregion program, ADB is also promoting carbon-neutral transportation by encouraging the use of fuel-efficient engines in the freight fleet and the use of biodiesel.

ADB's Sustainable Transport Initiative (STI) is driving things ahead

STI is helping ensure future transport sector projects incorporate the effects of climate change in decision-making processes. Much of STI's work is at the policy level. Goals call for synergistic land use and transport planning designs. STI is developing a coherent investment and development framework to deliver effective city planning and transportation systems that move climate change mitigation ahead. Efforts are progressing to improve existing mass transit systems or design new systems in a number of cities, including Bangkok, Hanoi, Ho Chi Minh City, Karachi, Lahore, and Manila. ADB is also working on pilot urban transport projects in Changzhou, Colombo, Dhaka, Harbin, and Kathmandu to develop sustainable and integrated transport solutions.

ADB is Mainstreaming Climate Change Mitigation

Promoting improved urban sanitation and reduction of fugitive methane emissions

An essential part of climate change mitigation is capturing "fugitive" methane emissions, often arising from equipment leaks or evaporative processes. Methane is over 20 times more potent than carbon dioxide (CO_2) as a GHG. By capturing and using methane, developers can help mitigate climate change by first converting sequestered methane to a less powerful GHG and then using it as an energy source to replace more carbon intensive fuels such as coal and kerosene.

ADB's efforts to reduce these emissions center on several common sources, including:

Landfills. The global landfill sector is the third largest source of manufactured emissions, accounting for 12% of global methane emissions in 2005. By 2020, currently available measures could cut landfill emissions in Asia by half. ADB actively assists DMCs in reducing or capturing methane emissions from solid waste. There are nine waste-to-energy projects in PRC, and waste composting projects in 60 towns in Bangladesh and India.

Coalmines. Improved drilling technologies and engines can be used to produce, capture, and use coalmine methane (CMM), which now accounts for 6% of global methane emissions. Capturing CMM offers significant safety benefits, plus it can be profitable. ADB has already assisted two CMM projects in PRC, one in Shanxi Province and another in Liaoning Province.

Agriculture and Livestock. These emissions are projected to increase from 18–23% of methane volume worldwide from 2005 to 2020. Developing countries will experience the largest percentage increases in emissions. ADB has been involved in a large biogas utilization project in PRC, which will introduce 330 medium-sized digesters in pig and dairy farms.

ADB is also promoting the use of carbon mechanisms to advance methane utilization projects. In addition, ADB is a member of the Methane to Markets (M2M) Partnership promoted by the United States Environmental Protection Agency. The M2M Partnership aims to capture fugitive methane emissions and steer them toward energy

ADB's Cities Development Initiative for Asia (CDIA) is contributing to the promotion of sustainable urban development

purposes whenever possible. It now includes 20 developed and developing countries and the European Commission as members. More than 640 private sector and nongovernment organizations have signed on to participate in project-investment and project-development activities.

Promoting sustainable land use and forestry

Because the livelihoods of many of the world's poorest people depend on forest products, any mechanism to reduce emissions from deforestation and degradation will have direct economic implications for affected communities. This argues for a careful balancing of social, climate change, and biodiversity conservation goals.

To address emissions from land use change, ADB is supporting several forest conservation initiatives that integrate forest protection and sustainable utilization while capturing

benefits from carbon sequestration and biodiversity conservation.

The Forests for Livelihood Improvement project in Viet Nam supports an investment of over $90 million to prevent forest loss and degradation for more than 3 million hectares of forest. In Indonesia, we have provided technical assistance to the Ministry of Environment to implement forestry-based Clean Development Mechanism (CDM) projects. We are also developing several pilot projects to develop experience with "reduced emissions from deforestation and degradation" (REDD) approaches.

ADB is also assisting dry-land farming projects across Central Asia and in Mongolia and PRC. The aim is to increase organic material in dry soils to improve land productivity and enhance the ability to sequester CO_2.

Greater Mekong Subregion core environment program is promoting CO_2 sequestration

Current CO_2 emissions due to forest loss in the Greater Mekong Subregion (GMS) North-South and East-West Economic Corridors are estimated at 5 million tons per year, growing at about 5% per annum. Under the GMS Biodiversity Corridors Initiative, ADB is exploring possibilities of sequestering carbon in the economic corridors through enhanced conservation, reforestation, and afforestation, to reduce poverty and support rural development and biodiversity conservation.

ADB is Mainstreaming Climate Change Adaptation

Countries in Asia and the Pacific need to adapt to climate change risks to protect the lives and livelihoods of millions of their citizens. Costs for adaptation are anticipated to be in the billions of dollars annually. However, not adapting will involve even greater costs and will undermine regional progress towards poverty reduction and economic development.

Since most countries request external support for adaptation, international organizations have an important role to play in providing technical advice and access to financing. To ensure a systematic response, ADB has an adaptation program that helps reduce the negative effects of climate change and anticipates and counters long-term impacts. Bolstering these efforts are long-standing programs of support for disaster preparedness and response, which are increasingly integrated with adaptation efforts.

Addressing vulnerability risks in national development strategies and actions

With the growing demand by DMCs for national assessments of climate change vulnerabilities and adaptation responses, ADB is supporting the integration of adaptation considerations through policy dialogue, institutional development, knowledge transfer, and investment planning.

These efforts include analyzing of the national and local consequences of climate change and identifying of cost-effective measures to improve the resilience of infrastructure and vulnerable populations to adverse impacts. National assessments for Bangladesh, Nepal, and Palau have recently been made. As future country partnership strategies are developed, climate change impacts and adaptation needs will be considered and incorporated in ADB's capacity development activities and investment pipeline.

Adaptation mainstreaming is especially important as a next step for those highly vulnerable least developed countries that have prepared their National Action Plans for Adaptation (NAPAs). Fourteen countries in Asia and the Pacific are eligible for support through the Least Developed Countries Fund for adaptation administered by GEF. As an executing agency of GEF, ADB can help prepare and implement NAPAs.

ADB's Disaster and Emergency Assistance Policy (DEAP) bolsters our climate change adaptation efforts

Asia and the Pacific is prone to natural disasters. For this reason, ADB has often been called upon to help countries prepare for such eventualities or to assist in the aftermath of an earthquake, flood, or tsunami. DEAP guides such actions, ensuring timely responses. Our proactive stance calls for actions taken before a hazard results in disaster rather than on post-disaster recovery. DEAP also promotes partnerships to provide sustainable financing of disaster preparedness. ADB is now working to improve the integration of its disaster preparedness and climate change adaptation efforts.

Increasing climate resilience of vulnerable sectors

Country sector road maps, including current practices for country environmental analysis and disaster risk assessment, will be adjusted to include the assessment of climate change vulnerabilities.

Sectors at greatest risk in Asia and the Pacific are agriculture and natural resources, urban development, health, water resources management, transport—including coastal roads and ports, and energy—especially hydropower. DMCs will need help to develop the necessary policy, institutional, and investment responses for each of these sectors to ensure that adaptive measures are implemented, and resiliency to climate impacts is improved. Below are some examples of ADB's ongoing support for increasing sector resilience.

Agriculture. ADB is studying climate variability and its impact on cropping patterns, structures of income and employment, as well as adaptation-coping strategies. The focus is on the rural poor and most vulnerable farmers in semi-arid tropic villages of Bangladesh, PRC, India, Pakistan, and Sri Lanka.

Urban Development. ADB is working with the World Bank and the Government of Japan to support the analysis of climate change risks and their costs in four coastal Asian megacities—Bangkok, Ho Chi Minh City, Kolkata, and Manila. Together, these urban areas are home to more than 50 million residents, and all face increasing risks from flooding, heat waves, water shortages, and other adverse impacts of climate change. The study includes economic analysis in key sectors to determine the likely costs associated with these phenomena to help prioritize adaptation measures.

Regional study is examining climate change adaptation costs

In 2008, ADB launched the Regional Review of the Economics of Climate Change in Southeast Asia with support from the Department for International Development of the United Kingdom and members of the Stern Review Team. The study is analyzing the climate change adaptation costs and options facing five economies in Southeast Asia—Indonesia, Philippines, Singapore, Thailand, and Viet Nam. The project will also analyze the cost effectiveness of possible mitigation options and develop policy recommendations for the participating countries and relevant regional bodies.

ADB is Mainstreaming Climate Change Adaptation

Water Resources Management. ADB is helping the countries in arid Central Asia adapt to anticipated future climatic conditions—warmer temperatures, increased winter precipitation, increased summer drought, and eventual loss of glacial melt—by developing adaptation measures that include drought resistant crops, improvements in irrigation efficiency, water resource management, rehabilitation of degraded forests and pasturelands, and watershed protection.

ADB is also working with its DMCs and other development agencies to develop subregional partnerships such as the Coral Triangle Initiative that will mobilize resources and coordinate action to address high priority adaptation needs.

Climate proofing projects

ADB aims to ensure that projects and programs take into account predicted changes in precipitation patterns, the severity and frequency of storms, accelerated glacial melting, sea-level rise, and other climate-related impacts. This is no small task, and given the limited global and regional experience in this area, each climate-proofing intervention ADB undertakes is also designed for significant upscaling and replication, with lessons learned being conveyed to both member countries and other development partners.

Climate-proofing activities at ADB date back to 2003, when ADB provided regional technical assistance to several Pacific countries to climate proof small-scale infrastructure through its Climate Change Adaptation Program for the Pacific. In the Cook Islands, the project included climate proofing of the design of the Avatiu Harbor and the breakwater for the newly developed Western Basin in Rarotonga, as well as measures to protect the neighboring community from typhoon damage. Similar analysis was applied to a coastal community in Sapwohn, Pohnpei, and a road

Coral Triangle Initiative (CTI) addresses impacts to coastal ecosystems

CTI was launched in 2007 as a joint effort of six Southeast Asian and Pacific countries to sustainably manage coastal and marine resources in a region with incredible marine biodiversity. The impact of global warming, especially sea-level rise, greater intensity and frequency of storms, and increases in ocean temperatures and acidity levels, threaten its integrity. ADB has helped to mobilize $70 million in grant funding from the GEF and is designing three projects to address coral reef conservation, reduce land-based pollution

development project in Kosrae, Federated States of Micronesia.

ADB is also supporting work on assessing climate change considerations in the design and implementation of water projects across Asia and the Pacific. For example, in the Citarum River Basin of Indonesia, more than $3 billion will be invested in upgrading water resources management infrastructure and institutions over the next 15 years under an ADB-led program. A parallel analysis will examine areas of climate proofing or specific investment required to adjust to the added risks from climate change.

ADB is also working with the United Nations Development Programme to climate proof a coastal infrastructure project in Central Viet Nam with support from the Special Climate Change Fund administered by GEF.

Addressing social dimensions

Climate change actions, particularly for adaptation, are about helping people cope with increased threats to their livelihoods and well-being. This must include providing adequate attention to the needs and participation of women, the poor, and minority groups. Ensuring water security at the onset of climate change is essential.

To strengthen regional knowledge in this area, ADB is undertaking studies on social impacts and responses. For example, a regional study on climate change migration has been initiated. The study includes a review of climate-induced migration risks in Asia and the Pacific; analysis of migration policy options; and specific suggestions on ways forward to address policy, institutional, infrastructure, and financing aspects of migration.

threatening coastal ecosystems, and adapt to climate change in low-lying islands. Under ADB's coordination, GEF's contribution will catalyze at least $425 million in cofinancing for CTI to enhance climate change resilience, introduce sustainable fisheries management, and conserve coastal ecosystems while reducing poverty.

Turning Ideas into Action

Coming up with designs to tackle climate change is important. But making them a reality through projects is what counts. That is why ADB is teaming with its DMCs to bring climate change mitigation and adaptation ideas to life throughout Asia and the Pacific.

Central and West Asia

Combating land degradation (regional)

Land degradation in the transition economies of Central Asia—Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan, and Uzbekistan—directly affects the livelihoods of rural populations by reducing the productivity of land resources and adversely affecting the stability, functions, and ecological services of natural systems. With support from ADB, these countries formed the Central Asian Countries Initiative for Land Management (CACILM). The goal of this 10-year program is to combat land degradation and improve rural livelihoods through comprehensive and integrated approaches. The current target is to mobilize about $1.4 billion towards this effort, with ADB as the largest contributor and GEF providing $100 million over 10 years in grant cofinancing to support projects approved under the CACILM framework.

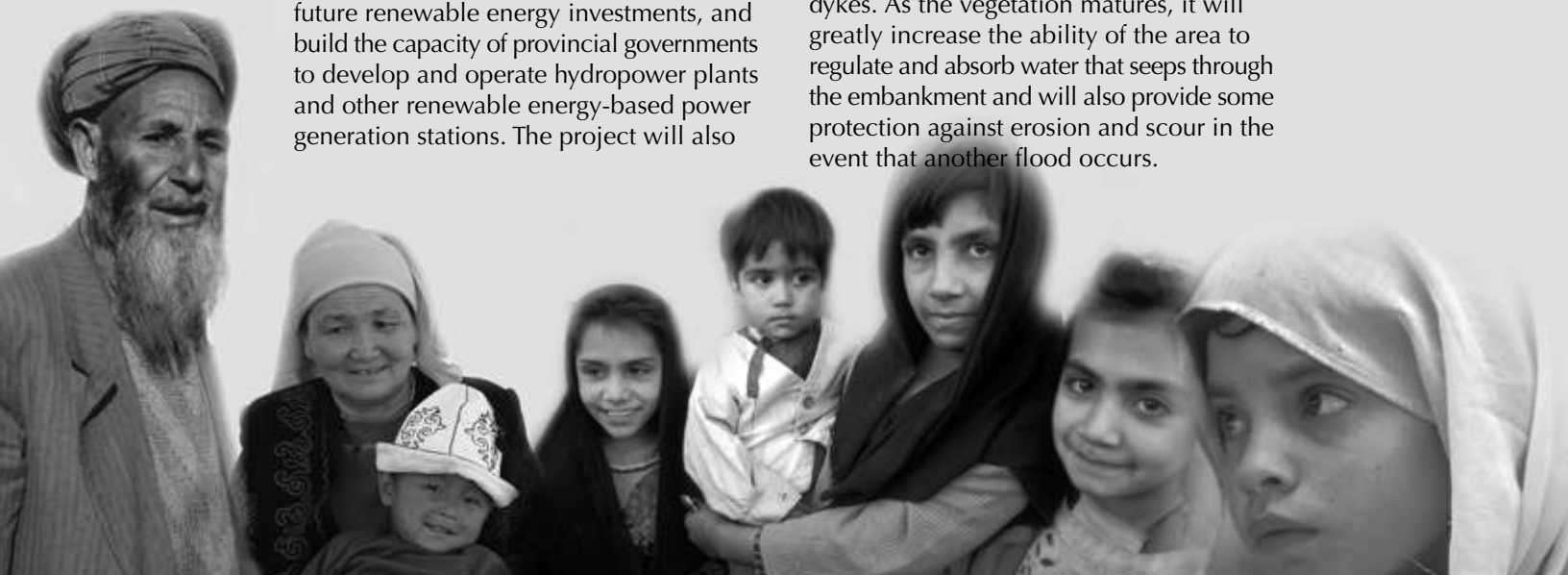
Expanding rural power supplies with hydroelectric power (Pakistan)

In 2006, ADB approved a $510 million multitranche loan to develop a renewable energy program for Pakistan. ADB will finance new investments in hydropower, develop feasibility studies of new sites for future renewable energy investments, and build the capacity of provincial governments to develop and operate hydropower plants and other renewable energy-based power generation stations. The project will also promote enhanced social and environmental safeguards in program implementation and catalyze public-private participation. The first tranche loan of $105 million will support the development of small hydropower projects in the provinces of Punjab and Northwest Frontier to serve about 600,000 new domestic connections for 4.8 million people. It will also improve reliability and supply quality.

GHG Mitigation Benefits. Together, these hydropower Clean Development Mechanism (CDM) projects will generate annual carbon credits of about 150,000 tons of carbon dioxide-equivalent (tCO_2e). Preparations are underway for host country approval and validation. ADB's Asia Pacific Carbon Fund is considering providing project cofinancing.

Supporting flood protection (Tajikistan)

To follow up on a $22 million loan for the Khatlon Province Flood Risk Management Project, ADB helped develop long-term solutions to address recurring flood risks that could be confounded by climate change. In addition to rehabilitating 8.3 kilometers of flood protection embankment, project activities included planting an area of community forest behind the repaired dykes. As the vegetation matures, it will greatly increase the ability of the area to regulate and absorb water that seeps through the embankment and will also provide some protection against erosion and scour in the event that another flood occurs.



East Asia

Promoting energy efficiency (PRC and Mongolia)

PRC and Mongolia both rely heavily on coal to supply their energy. The burning of coal releases twice as much CO_2 per unit of energy as natural gas combustion and also releases harmful sulfur dioxide and particulates that affect local air quality. Controlling the demand side of energy can offset the need to build and burn coal in conventional power plants. Under the Guangdong Energy Efficiency and Environment Improvement Investment Program in PRC, ADB is providing $100 million to the Guangdong Provincial Government to retrofit existing electricity-consuming facilities. In Mongolia, ADB is supporting a boiler rehabilitation project that will install about 25 heat-efficient boilers in rural remote areas.

GHG Mitigation Benefits. The first tranche of the project in Guangdong has the potential to reduce up to 150,000 tCO_2e per year. The Mongolia project is expected to reduce emissions by an average of about 17,000 tCO_2e per year. Both projects are now being developed as CDM projects.

Combating land degradation (PRC)

Much of Western PRC lies in arid or semi-arid zones and is highly vulnerable to drought and desertification. Partly because of climate change, land degradation continues to increase in recent years, affecting the lives of several hundred million people. To address this problem, ADB has taken a lead role in developing and implementing the PRC-GEF Partnership on Land Degradation in Dryland Ecosystems, a 10-year program to combat land degradation in the region. ADB's first project under the partnership involved strengthening the enabling environment and building implementation capacity for future investment projects. Future projects will largely focus on supporting the efforts of rural farmers to manage and adapt to the impacts of changing climatic conditions.

Tapping geothermal resources (PRC)

Xiong County in Hebei Province (south-southwest of Beijing) is endowed with geothermal water that could significantly reduce its dependence on coal, but this resource has not been tapped fully because of a number of barriers. As part of the Integrated Ecosystem and Water Resources Management in the Baiyangdian Basin Project, ADB will replace the current coal-fired boilers and room heaters and provide geothermal space heating for urban residents. The heating system will also supply hot water to buildings and homes.

GHG Mitigation Benefits. The replacement of coal will reduce CO_2 emissions by about 120,000 tCO_2e over the 10-year crediting period. ADB has also developed a new CDM methodology for this Project, which was recently approved by the CDM executive board.

Turning Ideas into Action

Pacific

Preparing a regional hazard risk and exposure database (regional)

Many Pacific island countries have not been able to hedge against disasters because insurance against such events has been either unavailable or prohibitively expensive, and when such events do occur, funding agencies have been willing to provide post-disaster funding. With natural disasters occurring more frequently, this situation needs to be addressed. The Regional Partnerships for Climate Change Adaptation and Disaster Preparedness Project will support the development of up to eight national databases encompassing risk, hazard, and vulnerability data, as well as a consolidated regional database. The outputs will support the work of the Pacific Islands Applied Geoscience Commission and national organizations in hazard risk management and vulnerability assessment and will be critical to the future development of a Pacific regional catastrophe insurance scheme.

Assisting in climate proofing adaptations (regional and Cook Islands)

ADB recently completed a 3-year project to assist selected Pacific DMCs to adapt to climate change variability. Climate change impact stocktaking and risk profiling were conducted in eight countries. Support kit and guidelines with project briefs on mainstreaming adaptation were also included. The analysis demonstrated the importance of mainstreaming adaptation into development planning in the Pacific, including strengthening the enabling environment for successful adaptation at project and community levels. Governments of each participating country adopted the National Guidelines for Mainstreaming Adaptation to Climate Change. These are now being used as references to mainstream adaptation at the national level. The guidelines are based on the project's main report, *Climate Proofing: A Risk-Based Approach to Adaptation*. Relevant stakeholders were trained on climate proofing.

ADB is now applying climate proofing to specific projects in the region. For instance, as part of an effort to improve the port in Avatiu in the Cook Islands, an ADB-funded project will help climate proof the wharf by replacing the existing structure with one that is completely resistant to wave forces. Additionally, the wharf will be designed such that it can be raised along with the container yard in the future, should the extent of sea level rise require it.

Promoting energy efficiency (regional)

Two negative effects of fossil fuel use are keenly felt throughout the Pacific region. First, the high cost of petroleum fuel strains the region's economies and their trade balances, thereby intensifying poverty. Second, global warming, driven by fossil fuel combustion worldwide, makes Pacific countries vulnerable to adverse impacts, especially sea level rise.

The Promoting Energy Efficiency in the Pacific Project addresses these issues by establishing the needed policy and regulatory environment that will encourage and assist energy end users to use commercial energy more efficiently. This includes supporting a demand-driven and private sector-based market in energy efficiency services. The project's principal outcome will be reduced fossil fuel consumption in five countries—Cook Islands, Samoa, Tonga, Vanuatu, and Papua New Guinea—compared with business-as-usual scenarios.

South Asia

Capturing fugitive methane emissions (India)

In cities throughout Asia, solid waste is disposed in dumpsites, generating GHGs that contribute to climate change. In Rajasthan, ADB is promoting organic waste composting in several urban local bodies. This will reduce the release of methane into the atmosphere in landfill sites, while providing business opportunities for the marketing and selling of compost. The project will also help avoid ground seepage of toxic and contaminated leachate.

GHG Mitigation Benefits. The project is expected to reduce 20,000 to 28,000 tCO_2e of GHG emissions annually from 17 towns. The project is being developed as a programmatic CDM project, and the carbon revenue can be used to operate and maintain the composting plant.

Supporting innovative project for cross-border power trade and rural electrification (Bhutan)

Bhutan has vast potential for hydroelectric power generation from Himalayan water streams. The Green Power Development Project will help tap these underutilized hydropower resources, while increasing government revenues for development spending and improving the standard of living for nearly 9,000 rural power consumers.

Specifically, the project will help finance the construction of the 114 MW Dagachhu hydropower plant that will generate 500,000 megawatt-hours of power annually, mostly for export to India. This will be Bhutan's first public-private partnership for an infrastructure project. The project will also support a rural electrification program that will provide electricity to households and businesses in remote regions of the country using renewable energy sources of hydropower and solar power.

GHG Mitigation Benefits. By replacing fossil fuels currently used by power companies in India, the project will reduce GHG emissions of about 525,000 tCO_2e annually. It will also entitle the operators to carbon emission credits that can be sold for additional revenue. The governments of Bhutan and India have already provided host country approvals.

Supporting the development of climate change adaptation road maps (Bangladesh and Nepal)

Incorporating climate risk management and adaptation in development practices is essential to minimize the impacts of extreme and variable weather on human settlements and localized ecosystems, and build coping skills and resilience in vulnerable communities. ADB is currently supporting Bangladesh and Nepal in preparing their climate change road maps. The road maps seek to (i) describe the current climate change action plan in Bangladesh and Nepal, and actions needed to further develop their respective action plans; (ii) identify gaps between the current and future stock of adaptation and mitigation activities and proposed measures to fill those gaps; and (iii) identify possible activities for ADB consideration in accordance with existing climate change adaptation and mitigation funding.

Turning Ideas into Action

Southeast Asia

Installing hydropower and geothermal for small power grids (Indonesia)

In 2002, ADB approved a $161 million Renewable Energy Development Sector Project loan for Indonesia to focus on the country's many small power grids. The project will add about 80 MW of power generation capacity from hydropower and geothermal renewable energy sources, and will displace 480 gigawatts per hour of electricity from fossil fuel annually to provide electricity access to about 76,000 new households.

GHG Mitigation Benefits. The Lahendong II – 20 MW geothermal subproject has been operating since July 2007 and will generate carbon credits of about 59,026 tCO_2e per year.

Promoting energy efficiency (Philippines)

ADB's Energy Efficiency Project in the Philippines will reduce the peak load power demand by focusing on efficient lighting. The project will distribute 13 million compact fluorescent lamps (CFLs) to low-income households and establish an energy service company to mainstream energy efficiency in public, industrial, and commercial sectors. It is estimated that this project could help defer $450 million of investments in new power plants and save about $120 million annually in fuel costs.

GHG Mitigation Benefits. The project will reduce large amounts of GHG emissions through demand side management. The CFL component alone will reduce 300,000 tCO_2e per year.

Installing household biogas digesters (Viet Nam)

Household-level biogas installations can reduce GHG emissions by substituting fossil fuels, unsustainably harvested wood, and chemical fertilizers that emit nitrous oxide. As one component of the proposed Quality and Safety Enhancement of Agricultural Products and Biogas Development Project, ADB will assist Viet Nam in providing clean energy for households to meet their cooking and lighting needs. The project will seek to install 40,000 units of household biogas digesters in 16 provinces in Viet Nam.

GHG Mitigation Benefits. Considering the fossil fuel replacement alone, the project can reduce from 40,000 to 60,000 tCO_2e per year.

Assessing climate change impacts and options in Asian coastal megacities (Viet Nam)

Ho Chi Minh City (HCMC) is one of 10 cities most likely to be severely affected by climate change, particularly coastal flooding caused by storm surge and damage from high winds. ADB is supporting an analysis of climate change impacts and options in HCMC in cooperation with the World Bank and the Japan Bank for International Cooperation. With the HCMC People's Committee, ADB is working with relevant government agencies to better understand the economic, social, and environmental impacts of climate variability and change, and associated vulnerabilities of the urban community, especially the poor, to such impacts; and the need to adapt urban infrastructure to mitigate these impacts and protect urban population.

Private Sector

Supplying energy needs with wind power (Tata Power Company Limited)

Rapid growth in India's power sector has led to increasing dependence on fossil fuels. Hikes in oil and gas prices, as well as potential for future fossil fuel shortages, is causing concern. Environmental issues are also arising. To address these concerns, India can tap its wind energy potential, which is estimated at 13,000 MW. In 2007, ADB approved an Indian rupee-denominated loan equivalent of $79.3 million to Tata Power Company Limited for a wind power project. The company plans to set up and operate wind energy facilities at two locations in the state of Maharashtra. Both will generate about 50 MW of power.

GHG Mitigation Benefits. The project will reduce GHG emissions by 2.6 million tCO_2e during the project life of 20 years. This will help the company reduce its dependence on fossil fuels and achieve the green energy procurement requirement established by the regulator. The project is exploring possible carbon financing through CDM.

Promoting district energy systems (Dalkia)

Using appropriate technologies for heating and cooling in buildings improves the pattern of energy use in cities for many years. District energy systems (DES) are a prominent example of such technologies. DES involves connecting a large number of buildings to centralized thermal energy plants that are economically viable and environment-friendly. If combined heat and power is used for such centralized plants, energy efficiency is further improved through the use of waste heat.

In PRC, ADB will provide a credit line to support the investment plan of Dalkia, a leading energy services company that operates more than 700 DES throughout the world, to rehabilitate and expand DES across the country in partnership with municipalities. The project aims to cover 100 million square meters with DES technologies by 2013.

GHG Mitigation Benefits. Energy savings by DES provide opportunities to reduce GHG emissions and have the potential to generate carbon credits under CDM.

Asian clean energy funds catalyze capital flow

The supply of adapted risk capital that can be accessed by small and medium-sized clean energy companies in developing Asia is inadequate. To address this challenge, the credibility of private equity in the emerging clean energy sector needs to be proven, and capital to support other private equity funds needs to be mobilized.

In this effort, ADB plays a catalyst by identifying and supporting fund managers willing to establish clean energy-focused private equity funds. ADB recently selected five funds that will invest for long-term capital appreciation in private companies and projects that are active in the renewable energy and energy efficiency sector in Asia. The aggregate size of the funds is $1.2 billion.

The funds will each receive up to $20 million in limited partner interests or equivalent, representing up to 25% of the total capitalization of a given fund, with the balance to be raised from other sponsors and private sector investors.

Looking Ahead

It is increasingly apparent that continued poverty reduction is impossible without mitigating extreme climate change and helping the most vulnerable communities adapt to unavoidable impacts. Some prominent experts now call climate change the "most regressive tax" in the world, where the poor pay for the excesses of the rich.

The world must deliver on the "contraction and convergence" principle conceived two decades ago and supported by numerous countries and regions, in which every person on the planet will have the same right to our atmosphere's assimilative capacity. Per capita emissions of the rich nations must contract over time, and developing nations' emissions can grow, but in a way that converges with the per capita level of rich nations, while keeping aggregate emissions within the natural absorptive capacity of the planet. However, at the current pace, developed nations are far from cutting their emissions to necessary levels, and developing nations have an emission trajectory that will quickly exceed sustainable per-capita levels. The rich, the poor, and those in-between must all do their part—this global crisis cannot be solved by just a few parties.

With the existing Kyoto commitments expiring in 2012, the world is entering a key transition period. Scientists say the next 10–20 years will make or break global efforts. Without strong action, we will exceed a 2-degree average temperature rise, with increased risk of triggering large, irreversible changes to the climate system. A post-2012 agreement under the United Nations will be pivotal in fostering coordinated global action. At the same time, countries can do a lot on their own to ensure that their energy, transport, urban, and land use investments are well balanced and resilient to adverse climate change impacts.

ADB is fully committed to assist its DMCs in meeting the extraordinary challenges of climate change, as well as taking advantage of expanding opportunities. We will do this by advancing a number of innovative initiatives in coordination with our development partners and catalyzing private sector capital.

One prominent example is the recently established Climate Investment Funds (CIF). Administered by the World Bank and implemented together with ADB and other regional development banks, CIF will help scale up assistance to developing countries for mitigation and adaptation measures. ADB also has the Clean Energy Financing Partnership Facility that uses grants and concessional financing to help start projects that are smaller than those targeted under CIF, but can be replicated across many developing countries. Through the recently-approved Future Carbon Fund, ADB also plans to extend carbon finance to its members well beyond 2012. This fund will pay upfront for carbon credits to help projects fill their financing gaps.

Another area in which ADB is providing innovative ideas is energy security. ADB is currently studying the merits of establishing a market mechanism to promote alternative urban development and transport policies, end-use technologies, and fuels. This will complement the carbon market and help make projects with dual climate change and energy security benefits become more competitive.

On adaptation, ADB will continue to develop regional and local responses to global warming. Our priority work includes strengthening cooperation between disaster risk management and climate change to increase sector resilience and climate proof projects, and working with scientific partners and governments to make local climate impact prediction more meaningful. We will also support emerging areas of interest, such as climate change migration, gender and climate change, community-based approaches to building climate resilience, and private-sector based instruments such as insurance products.

In all of these efforts, ADB welcomes partnerships with both developed and developing nations, as well as with leading institutions around the world. We are confident that through committed and coordinated action, Asia and the Pacific can transition to a sustainable development pathway and overcome the additional burden to poverty reduction efforts caused by the climate crisis.

ADB Climate Change Team
November 2008

Bibliography

Homer-Dixon, Thomas. 2007. Global Overheating: A Swiftly Melting Planet. *International Herald Tribune*. 4 October. Available: www.iht.com/articles/2007/10/04/news/edhomer.php

Intergovernmental Panel on Climate Change (IPCC). 2007. *IPCC Fourth Assessment Report: Summary for Policymakers of Working Group I Report—the Physical Science Basis*. UK: Cambridge University Press.

_____. 2007. *IPCC Fourth Assessment Report: Summary for Policymakers of Working Group II Report—Impacts, Adaptation, and Vulnerability*. UK: Cambridge University Press.

_____. 2007. *IPCC Fourth Assessment Report: Summary for Policymakers of Working Group III Report—Mitigation of Climate Change*. UK: Cambridge University Press.

_____. 2007. *IPCC Fourth Assessment Report: Summary for Policymakers of Synthesis Report of the Contributions of Working Groups I, II, and III*. UK: Cambridge University Press.

International Energy Agency. 2008. *World Energy Outlook 2008*. Paris.

_____. 2007 *Key World Energy Statistics 2007*. Paris.

National Snow and Ice Data Center. Boulder, Colorado. 2007. Arctic Sea Ice Shatters All Previous Record Lows. Available: http://nsidc.org/news/press/2007_seaiceminimum/20071001_pressrelease.html

_____. 2005. *Sea Ice Decline Intensifies*. Available: http://nsidc.org/news/press/20050928_trendscontinue.html

Nicholls et al. 2007. *Screening Study: Ranking Port Cities with High Exposure and Vulnerability to Climate Extremes: Interim Analysis: Exposure Estimates*. Paris: OECD.

Norwegian Nobel Committee. 2007. The Nobel Peace Prize 2007. Available: http://nobelprize.org/nobel_prizes/peace/laureates/2007/press.html

Peskett, L., D. Brown, and C. Luttrell. 2006. *Can Payments for Avoided Deforestation to Tackle Climate Change Also Benefit the Poor?* UK: Overseas Development Institute.

PT Pelangi Energi Abadi Citra Enviro. 2007. *Indonesia and Climate Change: Current Status and Policies*. Indonesia: World Bank and Department for International Development of the United Kingdom.

Sample, Ian. 2005. Warming Hits Tipping Point. *Guardian Unlimited*. 11 August. Available: www.guardian.co.uk/environment/2005/aug/11/science.climatechange1

Stern, Nicholas. 2006. *Stern Review: The Economics of Climate Change*. London: Treasury Office of the Government of the United Kingdom and Northern Ireland.

United States Environmental Protection Agency. 2006. *Global Anthropogenic Emissions of Non-CO_2 Greenhouse Gases 1990–2020*. USA.

Climate Change and the Asian Development Bank

Accelerating climate change poses a danger to the future health, safety, and livelihoods of people worldwide. Especially vulnerable are those who live in poverty. Rapid economic expansion in Asia and the Pacific has brought substantial benefits to the region's poor. But it is now clear that transition to low carbon economies is necessary to mitigate dangerous levels of climate change, or else economic growth itself could be threatened.

Reduction of greenhouse gas emissions to acceptable levels is needed in the next 10 to 20 years. And because changes in climate patterns and sea level rise are already in progress, adaptation measures must be put in place to protect communities from anticipated adverse near-term and long-term impacts. The Asian Development Bank (ADB) is responding to the challenge by taking an active role to promote the mainstreaming of mitigation and adaptation considerations throughout Asia and the Pacific.

About the Asian Development Bank

ADB aims to improve the welfare of the people in Asia and the Pacific, particularly the nearly 1.9 billion who live on less than $2 a day. Despite many success stories, the region remains home to two thirds of the world's poor. ADB is a multilateral development finance institution owned by 67 members, 48 from the region and 19 from other parts of the globe. ADB's vision is a region free of poverty. Its mission is to help its developing member countries reduce poverty and improve their quality of life.

ADB's main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance. ADB's annual lending volume is typically about $6 billion, with technical assistance usually totaling about $180 million a year.

ADB's headquarters is in Manila. It has 26 offices around the world and more than 2,000 employees from over 50 countries.

Asian Development Bank
6 ADB Avenue, Mandaluyong City
1550 Metro Manila, Philippines
www.adb.org
Publication Stock No. PBB196908 Printed in the Philippines