



CLIMATE CHANGE

ADB PROGRAMS

Strengthening Adaptation and Mitigation
in Asia and the Pacific

December 2009

Asian Development Bank

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
CO₂	carbon dioxide
CO₂e	carbon dioxide equivalent
DEAP	Disaster and Emergency Assistance Policy
DMC	developing member country
EI	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
tCO₂e	tons of carbon dioxide-equivalent

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

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Message from the President



Policy makers around the world are working toward a long-term international framework 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 (GHG) 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, which remains essential to reduce poverty—the goal of the Asian Development Bank (ADB). However, 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 at such a massive scale that they are affecting the entire planet.

If current trends continue, Asia and the Pacific's GHG emissions—whether from energy production, transportation, deforestation, or other sources—will soon be comparable to those of Europe and North America. If current trends continue, the region will be responsible for some 45% of all global energy-related emissions by 2030.

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

The region must find and adopt new patterns of urban development, energy production and consumption, transportation, 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 United Nations Intergovernmental Panel on Climate Change and ADB's recent *Economics of Climate Change in Southeast Asia: A Regional Review*

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 is already impacting populations 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 climate-related natural disasters, greater variability of rainfall, and other predicted impacts.

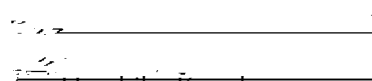
ADB's recent study on *Building Climate Resilience in the Agriculture Sector* tells us that crop yields in the region will decrease significantly for staple crops over the next 40 years with devastating impacts on food prices and child nutrition. Communities, coastal and marine ecosystems—even entire 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 GHG emissions and 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 and will reach 40% of loans approved by 2020. 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 the global carbon market, the insurance market, and many diverse sources of private funding.

In the following pages, you will learn about ADB's ongoing and emerging climate change mitigation and adaptation programs, and how we will continue to play a catalytic role in helping Asia and the Pacific 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 (CO₂), methane, and other naturally occurring greenhouse gases (GHGs), as well as man-made 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 CO₂ in the atmosphere. Human-caused 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 CO₂, have made things worse.

The fastest heat rise in history

Atmospheric CO₂ concentration was approximately 180 parts per million (ppm) during the last ice age and rose to 280 ppm by the pre-industrial era. This resulted in a 4°C average global

temperature increase—the difference between an ice age and a relatively warm period for the planet.

Today, atmospheric CO₂ is more than 387 ppm and is rising fast. Combining all the GHGs, the current level of carbon dioxide equivalent (CO₂e) is estimated to be about 430 ppm. 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 CO₂e by 2050 and 650–1200 ppm CO₂e by 2100.

The IPCC predicts temperatures will rise between 1.8°C and 4°C by 2100. With the planet already in a warm period, any increase in temperatures of more than 2°C over pre-industrial levels is predicted to have devastating impacts on human life, economic infrastructure, and the natural environment.

Vicious feedback loops

There are several known feedback loops which amplify global warming trends. 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.

The United States (US) National Snow and Ice Data Center (NSIDC) reports that summer Arctic is shrinking fast—about 10% a decade over the past 30 years. A recent study by the US National Oceanic and Atmospheric Administration (NOAA) and Department of Energy using IPCC models asserts that most of the Arctic sea ice could be gone in 30 years.

Temperature (°C)

0

-4

-8

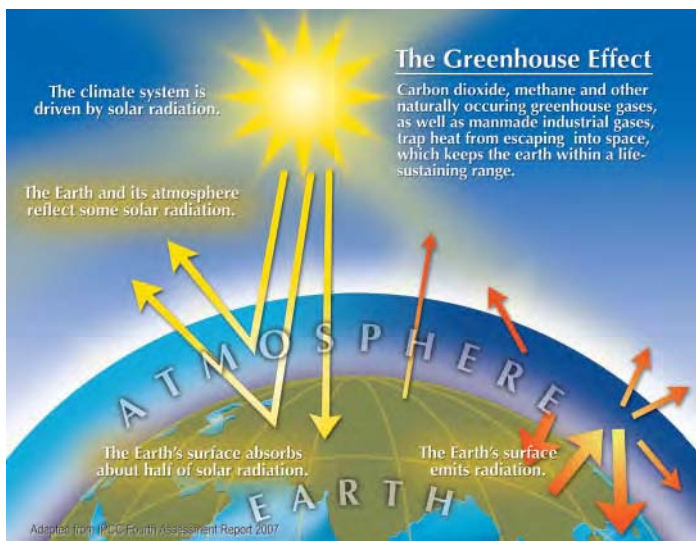


200

150

100

THOUSANDS OF



Additional accelerating spirals

Oceans hold other destabilizing feedback loops. Each year, they absorb half the CO₂ 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 CO₂-absorbing plankton reside. Thus, global warming accelerates even faster.

Another loop involves methane, which is over 20 times more potent than CO₂ 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. According to NOAA, if CO₂ is allowed to peak at 450–600 ppm, persistent decreases in dry-season rainfall could last over centuries, causing decreasing water

availability, falling crop yields, increased fire frequency, ecosystem change, and desertification.

Furthermore, new research indicates that within 100 years oceans could rise by a meter. The impacts of sea-level rise—even in the lower ranges of current predictions—would be severe. A modest rise of 50 centimeters will cause frequent coastal flooding events, threatening the 600 million people worldwide who live in low-lying areas.

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 agreed to by all European Union members and members of the G-20 major economies to avoid "dangerous" climate change.

According to the *Stern Review on the Economics of Climate Change*, this translates to stabilizing GHGs at or below 450 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.



50

0

YEARS BEFORE PRESENT

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.

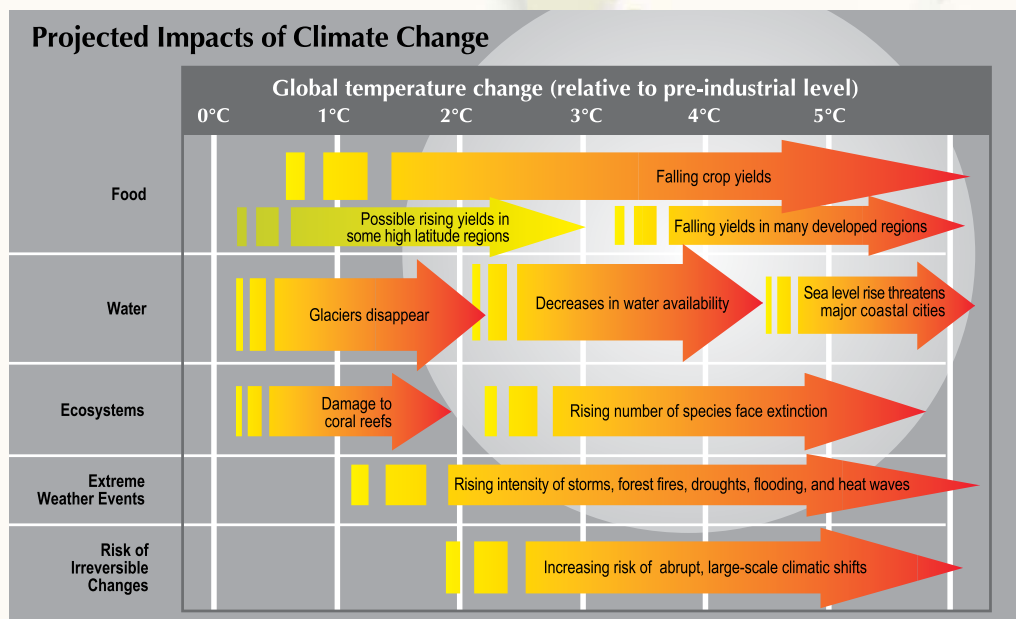
How business-as-usual practices will impact Asia and the Pacific

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, and will affect patterns of human settlement.

Crop yields. More than 60% of the economically active population is dependent on agriculture for their livelihoods in Asia and the Pacific. If current patterns of warming continue, irrigated rice production in the region is expected to decline in the range of 14%–20%; irrigated wheat, 2%–44%; irrigated maize, 2%–5%; and irrigated soybean, 9%–18% in the next 40 years.



C = Celsius; CO₂ = carbon dioxide.

Source: Adapted from the *Stern Review on the Economics of Climate Change*.

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.

Human settlement. Climate change is also increasingly affecting global migration patterns particularly in “hot spots”—specific areas where residents are at relatively high risk from climate change, including areas affected by sea-level rise, cyclones and typhoons, flooding, and water stress; especially at river deltas; in low lying small island states; and in arid regions of Central and West Asia.

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

Glacial melt. Glacial melt 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.

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

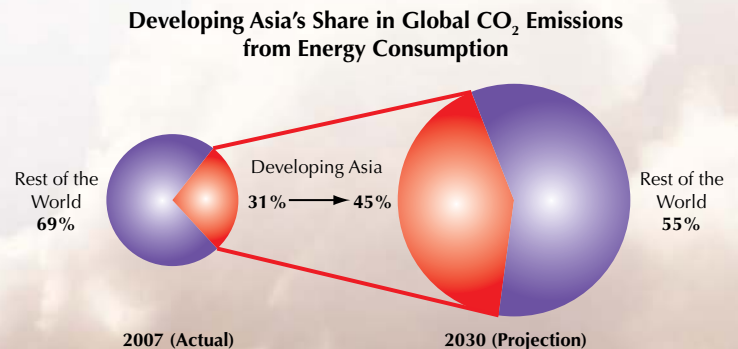
Economic growth in Asia is unprecedented. As if overnight, where was once a village, a metropolis now stands. New industries have risen. Populations and incomes have increased. Millions have been lifted from poverty.

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 increase by 100% between 2007 and 2030, at which point the region will be responsible for 45% of all global energy-related emissions (compared with 31% in 2007).

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 and oil fuel the expansion of developing Asia. Another cause for concern is the rapid growth in personalized transport which is driving up Asia's demand for oil. In 2030, oil use by the transport sector is projected to be three times bigger than it is today—decreasing energy security in the region and increasing transport sector-related CO₂ emissions.



Data Source: International Energy Agency. *World Energy Outlook 2009*.

Poor land use practices compound the problem

Vegetation and organic matter in soils absorb CO₂ from the atmosphere and thus play a critical role in maintaining the earth's CO₂ 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 CO₂ in many developing countries.

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 (PRC), 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 is critical. Various studies estimate that even if atmospheric CO₂ concentrations are kept below dangerous levels through concerted international action, adapting to 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 and industry in response to floods, storm surges, water shortages, cyclones, and other impacts of climate change.

Unfortunately, the majority of developing 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 coral rehabilitation, watershed reforestation, river levees, wetlands nourishment, and the introduction of hardier and more resistant crops. Over the longer term, coastal protection measures may be required for small islands, and dams may need to be raised or reinforced to withstand increased runoff from glacial melt and more severe 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 long-term strategic framework, *Strategy 2020*, ADB responds to climate change as part of the broader agenda of promoting environmentally sustainable growth in Asia and the Pacific. Addressing climate change is also critical to achieving inclusive economic growth—another strategic agenda under *Strategy 2020*—as the adverse impacts are predicted to disproportionately affect the poor and women.

Consistent with the Clean Energy Investment Framework of multilateral development banks (MDBs), ADB has been scaling up its climate change actions since 2005. To further the mainstreaming of climate change into its core financing operations, each of ADB's five regional departments—covering Central and West Asia, the Pacific, South Asia, East Asia, and Southeast Asia—has recently prepared Climate Change Implementation Plans (CCIP) to better align climate-related investments and associated policy and institutional support with the priorities of ADB's developing member countries (DMCs).

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, technology, capacities, and knowledge.

Core priorities of ADB's climate change program are

- scaling up clean energy, including expanding the proportion of renewable energy supply in Asia and the Pacific as well as promoting energy efficiency;

- promoting low-carbon, climate-resilient transport and urban development;
- investing in climate-resilient development;
- furthering sustainable land use and forest management; and
- supporting associated policy and institutional strengthening.

ADB will increasingly leverage private sector funds, the carbon markets, private insurance, and concessional finance for its DMCs beyond traditional loans and grants to support climate-friendly economic growth. This investment in both “hard infrastructure” and “soft” capacity building measures will encourage the spread of transformative technologies throughout the region. Experiences gained by ADB and its partners are being shared through publications, media outreach, cooperation with regional knowledge hubs, training events, and other modes of dissemination.

Through the ADB Climate Change Fund (CCF), capitalized initially from \$40 million in ADB's net income, we are already supporting 44 projects that support the integration mitigation, adaptation, and reduced emissions from deforestation and degradation (REDD) further into ADB's country programming, and make these actions more affordable and competitive. With partners from other MDBs, ADB is working to program and disburse the Climate Investment Funds (CIF). ADB is an executing agency of the Global Environment Facility (GEF) and can assist DMCs in accessing resources for both mitigation and adaptation measures through this partnership. A number of technical assistance grants—some financed by bilateral development partners have also been mobilized to increase capacity in ADB for integrating climate change into its programming.



INDIAN OCEAN

- Site Specific Project
- National Program
- Regional Program

AREA: Jilin Province
FOCUS: Waste to energy

AREA: Liaoning Province
FOCUS: Coalmine methane

IC OF
EA

JAPAN

Province
energy

NORTH PACIFIC OCEAN

AREA: Northern Luzon
FOCUS: Wind power

AREA: Countrywide
FOCUS: Mainstreaming economic
analysis of adaptation

INES

Countrywide
energy efficiency

REPUBLIC OF
PALAU

AREA: Countrywide
FOCUS: Climate adaptation

R-LESTE

AREA: Koroie
FOCUS: Climate proofing

AREA: Selected sites
FOCUS: Waste to energy

MARSHALL ISLANDS

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

AREA: Countrywide
FOCUS: Energy efficiency

TONGA

REPUBLIC OF
THE FIJI ISLANDS

AREA: Countrywide
FOCUS: Energy efficiency

AREA: Countrywide
FOCUS: Energy efficiency

COOK ISLANDS

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.

The challenge to mitigate 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 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 such emissions in Asia. Thus, the foundation of ADB’s mitigation strategy is to help economies in the region become as energy efficient as possible and increase their use of low-carbon energy options. Current activities are guided by ADB’s Energy Policy, which emphasizes energy efficiency, renewable energy and access to energy, as well as energy sector reforms, capacity building, and governance.

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.

According to recent studies by ADB and The Energy and Resources Institute (TERI), the potential for efficiency improvements in the region is huge—as high as 45% over current levels—for the industry, transportation, and building sectors.

To support demand-side measures in DMCs, ADB identifies energy efficiency options and prepares financial assistance and guarantees through collaboration with industry associations, domestic banks, and specialized energy efficiency agencies and energy service companies. ADB also assists DMCs in framing enabling legislation and efficiency standards.



ADB’s Energy Efficiency Initiative is helping clean energy grow

The Energy Efficiency Initiative (EEI) was launched in 2005 to increase clean energy investments to \$1 billion per year starting in 2008. We have developed country-specific strategies to promote clean energy, have catalyzed projects in six Asian countries, and have begun mobilizing additional resources in a number of smaller countries. A financing facility with a targeted size of \$250 million is funding investments and grant assistance for advocacy, institutional capacity building, and project preparation. In 2008, investments exceeded the target by more than 50%. With its 2009 Energy Policy, ADB increased its annual investment target to \$2 billion starting in 2013. ADB expects to meet this target by developing a larger Clean Energy Program that assists clean energy project development in non-energy sectors, including transport, water supply and sanitation, and urban development.



In the PRC's Guangdong Province, Pakistan, and the Philippines, ADB is assisting comprehensive demand-side efficiency projects that are upgrading equipment in commercial and public buildings and industrial enterprises. In Nepal, Pakistan, the Philippines, and Viet Nam, ADB is considering financing the replacement of about 54 million residential lighting fixtures to energy-saving bulbs.

Supply-side energy efficiency

To meet the electricity needs of the region, large capacity additions will be required. ADB is actively encouraging DMCs to adopt available cleaner technologies, such as supercritical and ultra-supercritical boilers, which can increase generation efficiency by more than 20% and result in significant savings of coal and GHG emissions over the 20–30 year life of each plant.

In addition, recovering and using waste heat can dramatically increase overall energy efficiency. ADB has financed

several waste heat recovery projects in the PRC and is currently implementing a boiler rehabilitation project in Mongolia. ADB is also assisting in efforts throughout the region to upgrade transmission and distribution systems, thereby significantly cutting energy losses. Since 2001, there have been projects in several countries, including the PRC, India, Pakistan, and Viet Nam.

Further, ADB is supporting the deployment of new technologies as they become technically feasible and economically viable. As an example, ADB is promoting carbon capture and storage (CCS), including a project in the PRC that will produce a comprehensive roadmap for CCS development. ADB and partners have also launched a fund to support geological investigations and environmental studies into potential CO₂ storage sites, as well as capacity building and community awareness programs.



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

Securing adequate finance and capacity is a fundamental obstacle for developing countries trying to adopt cleaner energy technologies. The Carbon Market Initiative (CMI) supports the development of GHG mitigation projects by providing carbon finance at the most critical stage—project preparation and implementation. CMI's Asia Pacific Carbon Fund and the recently established Future Carbon Fund combined can purchase 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, CMI offers developing member countries marketing support for their carbon credits to be sold in the global carbon market.

Renewable energy and fuel switching

Renewable energy sources promise environmental as well as energy security benefits. With the increased viability of renewables, ADB is facilitating wider deployment of technologies by raising awareness, promoting policy and regulatory incentives to encourage their use, and promoting financing packages that share risks and lower costs. Renewable energy can be particularly valuable in off-grid and rural communities to provide a range of energy services, including lighting, cooking, refrigeration, water supply for drinking and irrigation, and power supply for small businesses.

ADB has assisted numerous run-of-river hydropower projects in recent years, ranging from 5 to 100 megawatts (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 the northern PRC. In Thailand, ADB is providing a partial credit guarantee to



build a 125 MW biomass power plant that will use wood waste products to provide fuel for the next 25 years. ADB's Energy Efficiency Initiative (EEI) and Carbon Market Initiative (CMI) are actively involved in helping to make renewable energy work for the region.

ADB is also supporting projects that promote cleaner fuel. For instance, ADB is supporting natural gas transmission and distribution improvement projects in several countries, including Bangladesh, the PRC, India, and Indonesia.

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. ADB will support studies to assess the impacts of biofuels development, particularly on food security, the net energy balance of crops, and the environment. Where the benefits indicate that biofuels are appropriate, ADB will support their development.

Technology transfer and diffusion

ADB is focusing on enhancing the availability and affordability of new low-carbon technologies to help DMCs leapfrog directly to cleaner and more advanced energy solutions with lower GHG emissions. ADB is doing so through a new emphasis on technology transfer and diffusion, one of the key elements of the Bali Action Plan under the United Nations Framework Convention on Climate Change (UNFCCC).

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

ADB is developing new approaches for scaling up access to modern, clean energy among the poor. In 2009, ADB launched the Energy for All Partnership which brings together financial institutions, governments, civil society, and the private sector with the aim of providing access to modern energy to 100 million people in Asia and the Pacific by 2015. Six working groups—on household biogas, solar lanterns, liquefied petroleum gas (LPG), financing for energy services, energy enterprise development, and the Pacific region—bring together key stakeholders to share information and know-how and jointly develop scaled-up projects that can be funded by ADB, other development partners, and the private sector.

ADB is looking to establish a Low Carbon Technology (LCT) Market Place, which would bring together enterprises that can effectively exploit the full potential of LCTs in the immensely large and rapidly expanding energy markets in Asia and the Pacific. Through this innovative approach, ADB hopes to address a major hurdle—the high front-end costs that make new technologies unaffordable to developing countries.

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 oil-based fuel consumption and GHG emissions. Other impacts include a declining quality of life in the region's cities because of congestion and local air pollution.

To address these problems, ADB is promoting a three-pronged strategy: *avoiding* or reducing travel demand



through better integration of land use and transport planning, *shifting* to more efficient modes of transport, and *improving* existing forms of transport. Together, these changes could help reduce dependence on individual vehicles, thereby improving mobility, decreasing congestion, and minimizing local air pollution and GHG emissions.

Throughout the region, ADB is helping develop national transport policies and bankable projects that place a high emphasis on emissions, energy use, and mobility efficiencies. Specifically, efforts are progressing to improve existing mass transit systems or design new systems in a number of cities, including Ha Noi, Ho Chi Minh City, Lanzhou, Tbilisi, Xian, and Yerevan. ADB is also working on pilot urban transport projects in Davao, Kathmandu, and Vientiane to develop sustainable and integrated transport solutions.

ADB is also financing studies for sustainable urban transport systems that are better for the environment and more affordable to the poor.

ADB and partners establish new global low-carbon transport partnership

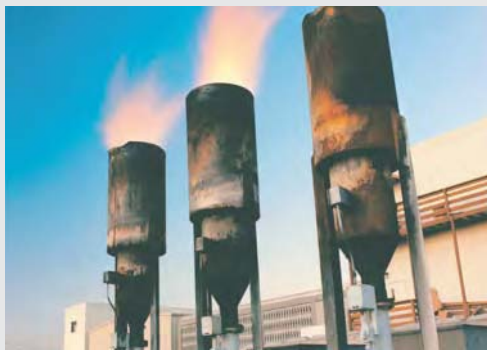
ADB is one of over 30 members of the recently-launched Sustainable Low Carbon Transport (SLoCaT) Partnership, along with the United Nations Department of Economic and Social Affairs (DESA), African Development Bank, and Inter-American Development Bank. The Partnership aims to actively contribute options and advice on the development of sustainable transport systems worldwide to inform the international climate change negotiations. It will also play an active role in the upcoming sessions of the United Nations Commission on Sustainable Development. Its establishment follows the May 2009 Bellagio Declaration on Transportation and Climate Change, which called for overhauling transport systems with more sustainable, low-carbon solutions and approaches.

Initial lessons were recently published in *Changing Course: A New Paradigm for Sustainable Urban Transport*, which describes proven approaches for more effective management of the region's cities over coming years and informs ADB's emerging program in sustainable transport.

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 CO₂ as a GHG. By capturing and using methane, developers can help mitigate climate change by converting sequestered methane to a less powerful GHG and 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 accounts for 12% of global anthropogenic 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 landfills. There are nine waste-to-energy projects in the 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 accounts for 6% of global anthropogenic methane emissions in 2005. CMM offers significant safety benefits, plus it can be profitable. ADB has already assisted two CMM projects in the PRC, one in Shanxi Province and another in Liaoning Province.

Agriculture and livestock. These emissions totaled 51% of all global anthropogenic methane emissions in 2005. Emissions from these sectors are projected to increase by 17% between 2005 and 2020, with developing countries experiencing the largest percentage growth.

ADB has been involved in a large biogas utilization project in the 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

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

Approximately 75% of global GHG emissions are generated by cities or for city consumers. ADB's Cities Development Initiative for Asia (CDIA) is working with medium-sized Asian cities to implement needed investments in public transport, solid waste management and methane capture, energy efficiency in buildings, and alternative energy sources. In particular, the multi-donor initiative helps bridge the gap between city development planning and implementation of infrastructure investments. CDIA develops urban investment projects in the framework of existing city development plans.

promoted by the US Environmental Protection Agency. The M2M Partnership aims to capture fugitive methane emissions and steer them toward energy efficiency.

Promoting sustainable land use and forestry

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.

Significant opportunities will be created through the likely expansion of the regulated carbon market to include REDD approaches. In Asia and the Pacific, a number of countries (e.g., the southern PRC, Indonesia, Papua New Guinea, and countries of the Mekong Basin) are poised to be major beneficiaries.

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 REDD approaches.

The CCF is supporting pilot activities meant to develop new approaches for using REDD and land use management to mitigate GHG emissions, while conserving biodiversity and supporting the livelihoods of local communities. The five pilot activities include two regional cooperation initiatives and three investment projects cofinanced by the GEF.

ADB is also assisting dry-land farming projects across Central Asia and in the PRC and Mongolia. The aim is to increase organic material in dry soils to improve land productivity and enhance the ability to sequester CO₂.

Greater Mekong Subregion core environment program is promoting CO₂ sequestration

Current CO₂ emissions due to forest loss in the Greater Mekong Subregion's (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 (BCI), 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.

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 toward 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 development, technical capacity and knowledge, institutional development, knowledge transfer, and investment planning.

These efforts include analyzing the national and local consequences of climate change and identifying 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 Adaptation Programmes of Action (NAPAs). Fourteen countries in Asia and the Pacific are eligible for support through the Least Developed Countries Fund administered by GEF. As an executing agency of GEF, ADB can help prepare and implement NAPAs.

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.

ADB's Disaster and Emergency Assistance Policy 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. The Disaster and Emergency Assistance Policy (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.

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, the 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.

Water resource 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 and irreversible loss of glaciers—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 (CTI) that will mobilize

Regional study is examining climate change adaptation costs

In 2009, ADB completed 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 adaptation costs Stern Review Team. The study analyzed the climate change adaptation costs and options facing five economies in Southeast Asia—Indonesia, Philippines, Singapore, Thailand, and Viet Nam. The study concluded that, by 2050, losses in the economic value of land affected would range between \$6.69 billion and \$22.1 billion for regular flooding, and between \$0.46 billion and \$6.68 billion for extreme flooding.



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, increased severity and frequency of storms, accelerated glacial melting, sea-level rise, and other climate change-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 development project in Kosrae, Federated States of Micronesia.

ADB is building on this work by developing and applying methods for climate-proofing the transport sector. These pilots will be used to develop guidelines which can be applied to other transport projects and plans. A full range of adaptation measures are being examined, including engineering solutions, environmental management, and improved information and policy implementation.

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 resource management infrastructure and institutions over the next 15 years under



Coral Triangle Initiative addresses impacts to coastal ecosystems

The Coral Triangle Initiative (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 \$63 million in grant funding from the GEF and is designing three projects to address coral reef conservation, land-based pollution threats to coastal ecosystems, and to support climate change adaptation for coastal areas and low-lying islands. In support of the CTI Program, ADB and the GEF



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 infrastructure 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 and collaboration, 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. ADB also recently published a study, on *Building Climate Resilience in the Agriculture Sector*.



ADB is also actively supporting the UNFCCC and Kyoto Protocol processes and has pledged to contribute to the Nairobi work programme on impacts, vulnerability, and adaptation to climate change. ADB is also participating in the development of regional knowledge networks on adaptation.

ADB is piloting its climate and disaster risk screening tool, a rapid risk assessment tool for ADB project officers. Risk screening is a context-specific approach to systematically support decision making that integrates climate adaptation and disaster risk reduction measures within developmental and poverty reduction plans, programs, and projects.

are working with the coral triangle countries as well as other CTI founding partners—the Governments of Australia and the US, and the nongovernment organizations, namely World Wide Fund for Nature, The Nature Conservancy, and Conservation International. While mobilization of resources from a variety of sources to support new activities under the CTI is still ongoing, commitments or pledges in excess of \$300 million have been generated to date.

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, including climate adaptation-oriented measures relating to biodiversity conservation, integrated water resource management, and food security issues. The current target is to mobilize about \$1.4 billion toward 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.

Promoting energy efficiency (Pakistan)

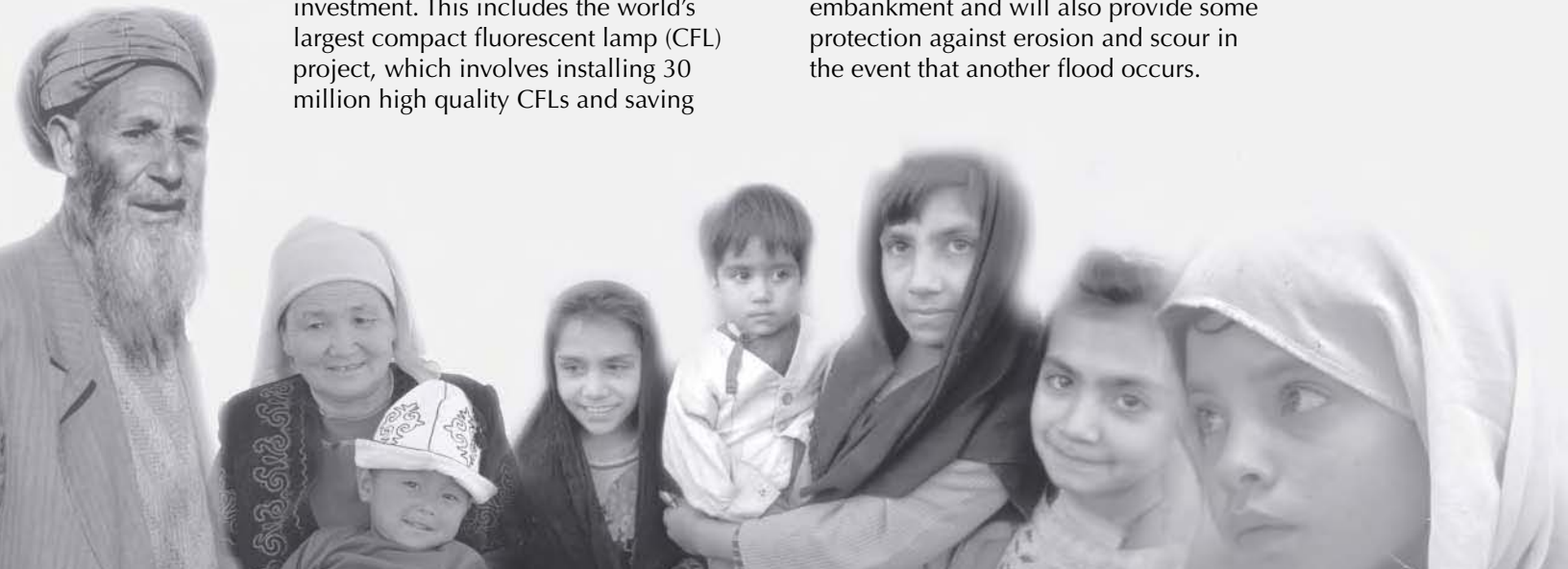
ADB is helping the Government of Pakistan transform the energy sector by promoting energy security and efficiency through analysis, capacity building, and investment. This includes the world's largest compact fluorescent lamp (CFL) project, which involves installing 30 million high quality CFLs and saving

approximately \$70 million in energy costs. Replacing incandescent bulbs with CFLs in the residential sector, over the long term, will help transform the domestic lighting market phase out low-efficiency lighting technologies. ADB and the Government of Pakistan are also developing a 10-year roadmap and investment plan for the energy sector totaling \$8.5 billion, including \$980 million to boost clean energy investment.

GHG Mitigation Benefits. Together, these energy efficiency investments will offset 7.3 million tons of CO₂ each year, generating \$13 million in CDM credits up to 2012. ADB's 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 compounded 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)

Ulaanbaatar is the coldest capital city in the world, yet there are more than 450 pre-cast apartment blocks in the city without thermal insulation. The energy for heating these inefficient buildings is supplied by coal-fired power plants, which account for approximately 90% of total energy sector carbon emissions in Mongolia. As part of ADB's Cities Development Initiative for Asia, ADB is supporting the Ulaanbaatar Urban Rehabilitation Project to rehabilitate buildings to increase efficiency and minimize heat loss. In the PRC, ADB is providing \$100 million to the Guangdong Provincial Government to retrofit existing electricity-consuming facilities.

GHG Mitigation Benefits. Pilot building retrofits in Mongolia have saved up to 70% of heat energy per year, reducing coal consumption by more than 185,000 tons and CO₂ by more than 287,000 tons annually. The first tranche of the project in Guangdong has the potential to reduce up to 150,000 tonnes of CO₂ equivalent (tCO₂e) per year.

Supporting bus rapid transit in Lanzhou (PRC)

A Bus Rapid Transit (BRT) is a form of public transport system that aims to approach the service quality of rail transit while reaping the cost savings of a bus transit. This is achieved by making improvements to existing infrastructures, vehicles, and scheduling. In Lanzhou,

a central link in the West Longhai–Lanzhou–Xinjiang Economic Corridor, ADB is providing assistance for the Urban Transport Project. The project includes BRT and non-motorized transport network development.

Hunan flood management sector project (PRC)

The PRC's river basins play a crucial role in supplying water to rapidly growing cities located in floodplains, providing irrigation water, hydropower, and waterway navigation. However, rapid economic growth and increasing concentration of urban and rural populations in the floodplains also increase risk from hazards, exposure, and vulnerability to floods. In Hunan Province, ADB will help provide flood protection for strategic and priority flood-prone areas and investigate potential for flood insurance for those residing in each of the Province's four main river basins. To date, civil works for structural flood protection have commenced for 11 subprojects. About 10.4 kilometers of embankments have been completed for five core subprojects.

Jiangxi Sustainable Forest Ecosystem Development Project (PRC)

Jiangxi Province has the second largest area of forest in the PRC. ADB is investing \$40 million to improve forest management practices and establish a baseline for future revenue that will help reduce GHG emissions and conserve biodiversity under a new global climate agreement. Forests will be planted on more than 65,000 hectares by 2015.



Pacific

Preparing a regional hazard risk and exposure database (regional)

Many Pacific island countries have not been able to hedge against disasters because of a lack of adequate information on risk exposure. ADB 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 adapt to climate change variability. 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 (Cook Islands and the Federated States of Micronesia) adopted the National Guidelines for Mainstreaming Adaptation to Climate Change, which 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.

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, Papua New Guinea, Samoa, Tonga, and Vanuatu—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 at 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 tCO₂e 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.

Semi-literate women are pioneering a community-based approach to provide remote villages with solar-powered lighting (Bhutan)

Hydropower drives 100% of Bhutan's electricity grid and is a major export to India. But some 4,000 households—representing about 400 villages—are in such isolated locations that the only economic solution is to provide them with off-grid power systems like solar home lighting and micro hydropower systems. The government supports solar programs but lacks manpower and resources. With the help of a \$1 million grant from ADB's Japan Fund for Poverty Reduction, a team of "barefoot engineers" helped install solar panels on the rooftops

of 504 households in 46 villages covering 13 districts and rehabilitated older units that had fallen into disrepair.

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

- describe the current climate change action plan in Bangladesh and Nepal, and actions needed to further develop their respective action plans;
- identify gaps between the current and future stock of adaptation and mitigation activities and proposed measures to fill those gaps; and
- identify possible activities for ADB consideration in accordance with existing climate change adaptation and mitigation funding.

Strengthening the water sector's resilience to climate change in Khulna (Bangladesh)

This ADB poverty reduction project will enhance the Khulna Water Supply Project through a support project, Strengthening Resilience of Water Sector in Khulna to Climate Change. The project will provide structural and non-structural climate-proofing measures to water systems, in the face of sea-level rise and saltwater intrusion, more intense cyclonic activity, and flash floods.



Southeast Asia

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 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.

Reducing Emissions from Deforestation and Forest Degradation (Greater Mekong Subregion)

Current CO₂ emissions due to forest loss in the GMS North–South and East–West Economic Corridors are estimated at 5 million tons per year, growing at about 5% per annum. Under the BCI, ADB is examining opportunities to generate future financing from carbon markets to continue and expand the work of the BCI through a landscape-based approach to biodiversity conservation and sound land and forest management in the GMS. Planned activities include establishing REDD pilots in the Lao People's Democratic Republic, Thailand, and Viet Nam, in coordination with the Forest Carbon Partnership Facility (FCPF), and establishing frameworks for securing carbon finance.

Augmenting adaptive capacity (Cambodia and Lao PDR)

Through selected technical assistance interventions, ADB is augmenting the efforts of national and local governments in Cambodia and Lao PDR. In Lao PDR, ADB is conducting a study on flood risk vulnerability in five southern provinces to design appropriate adaptation strategies and enhance resilience of rice farmers and rural infrastructure. In Cambodia, ADB is cooperating with the World Bank to implement a “pilot program for climate resilience” with a view to mainstream climate risks in national and sectoral development planning, and support key adaptation interventions in the agriculture, water resources, and rural infrastructure sectors.

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 tCO₂e per year.



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 tCO₂e 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 the 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.

Turning Ideas into Action

It is increasingly clear that as Asia goes, so goes global success in addressing climate change. With the most populous and dynamic economies in the world, Asia and the Pacific holds the key to stabilizing the global climate. Furthermore, continued poverty reduction will be severely hindered unless extreme climate change is mitigated and without proactive attention to helping the most vulnerable communities adapt to already unavoidable impacts.

As a new global treaty is being negotiated, we stand at a critical juncture. Scientists say the next 10–20 years will make or break global efforts to control atmospheric concentrations of greenhouse gases. Without strong action, a 2°C average temperature rise will be exceeded, with a high risk of triggering dangerous, large, and, in some cases, irreversible changes to the climate system. A post-2012 agreement under the UNFCCC will be pivotal in fostering coordinated global action. At the same time, countries can do much 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 posed by climate change, as well as to help take advantage of opportunities created for improved economic productivity and ecosystem management. This can be accomplished by advancing initiatives in coordination and partnership with others and catalyzing private sector capital both in the form of start-up venture capital and longer term climate-friendly development bonds and funds.

The newly operational Climate Investment Funds provide an important potential model for the future. Implemented in cooperation with the World Bank and other regional development banks, ADB is helping to scale-up assistance to developing countries for both mitigation and adaptation measures. ADB has also launched a Sustainable Transport Initiative that is using grant and concessional finance to help

finance low-carbon personal and public transport development. Through the \$120 million Future Carbon Fund, ADB is also extending opportunities to take advantage of carbon finance to its DMCs well beyond 2012, paying upfront for anticipated post-2012 carbon credits to help projects fill their financing gaps.

Another area in which ADB is financing innovation is energy security. Many measures to improve energy security in Asia and the Pacific also result in GHG emission reductions. 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, national, and local responses to the adverse impacts of climate change. One of the highest priorities is to strengthen cooperation between disaster risk management and climate change to increase sector resilience and climate-proof projects, and work with scientific partners and governments to make local climate impact prediction more meaningful. ADB will support more downscaled climate modeling and regional data sharing to improve water resource management in climate hotspots. ADB will also support emerging areas of interest, such as climate change-related 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, the Asia and Pacific region can transition to a climate-resilient and low-carbon sustainable development pathway that will allow for continued success in poverty reduction efforts.

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Climate Change ADB Programs—Strengthening Adaptation and Mitigation in Asia and the Pacific

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'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.