

# ADB CLIMATE CHANGE PROGRAMS

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Facilitating Integrated Solutions  
in Asia and the Pacific



Asian Development Bank

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ADB  
**CLIMATE CHANGE**  
PROGRAMS

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Asian Development Bank

# Abbreviations

ADB	–	Asian Development Bank
APAN	–	Asia Pacific Adaptation Network
ASEAN	–	Association of Southeast Asian Nations
BCI	–	Biodiversity Corridors Initiative
CACILM	–	Central Asian Countries Initiative for Land Management
CCS	–	carbon capture and storage
CDIA	–	Cities Development Initiative for Asia
CDM	–	Clean Development Mechanism
CEP	–	Clean Energy Program
CFL	–	compact fluorescent lamp
CIF	–	Climate Investment Funds
CAI-Asia	–	Clean Air Initiative for Asian Cities
CMP	–	Carbon Market Program
CPS	–	Country Partnership Strategy
CO <sub>2</sub>	–	carbon dioxide
CO <sub>2</sub> e	–	carbon dioxide equivalent
E4ALL	–	Energy for All
GEF	–	Global Environmental Facility
GHG	–	greenhouse gas
IPCC	–	Intergovernmental Panel on Climate Change
MW	–	megawatt
ppm	–	parts per million
REDD	–	Reducing Emissions from Deforestation and Forest Degradation
UNFCCC	–	United Nations Framework Convention on Climate Change
SLoCaT	–	Sustainable Low Carbon Transport Partnership
STI	–	Sustainable Transport Initiative
tCO <sub>2</sub> e	–	tons of carbon dioxide equivalent
UOP	–	Urban Operational Plan

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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 *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 study, *Building Climate Resilience in the Agriculture Sector of Asia and the Pacific*, 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 (CO<sub>2</sub>), methane, and other naturally occurring greenhouse gases (GHGs), as well as human-made industrial gases trap heat from escaping into space. This keeps the earth's temperature within a life-sustaining range. Without the greenhouse effect, Earth would be much colder—an average temperature of -19° Celsius (C).

Human reliance on fossil fuels for energy has increased the amount of CO<sub>2</sub> 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<sub>2</sub>, have made things worse.

## The Fastest Heat Rise in History

Atmospheric CO<sub>2</sub> concentration was approximately 180 parts per million (ppm) during the last ice age and rose to 280 ppm by the pre-industrial era causing a 4°C average global temperature increase—the difference between an ice age and a relatively warm period for the planet.



• Glacier in Himachal Pradesh, India

Today, atmospheric CO<sub>2</sub> is more than 389 ppm and is rising fast. Combining all the GHGs, the current level of carbon dioxide equivalent (CO<sub>2</sub>e) is estimated to be about 430 ppm. If current trends continue, GHG levels will rise to 550–700 ppm CO<sub>2</sub>e by 2050 and 650–1,200 ppm CO<sub>2</sub>e by 2100, according to the Intergovernmental Panel on Climate Change (IPCC), a body that engages over 1,500 scientists and international experts to provide an authoritative scientific understanding of human-induced climate change and co-winner of the 2007 Nobel Peace Prize. Under these trends, temperatures will rise between 1.8°C and 4°C by 2100.

With the planet already in a warm period, any increase in temperature of more than 2°C over pre-industrial levels is predicted to have devastating impacts on people's lives, biodiversity, natural systems, and economic infrastructure.

## Vicious Feedback Loops

There are several known feedback loops that amplify global warming trends. For example, Arctic ice is melting. Ice acts like a mirror, reflecting nearly 90% of the sunlight and 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 the 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.

## Additional Accelerating Spirals

Oceans hold other destabilizing feedback loops. Each year, they absorb half the CO<sub>2</sub> humans release into the air. But as oceans warm, they absorb less and less CO<sub>2</sub>. This is because warm water dissolves less gas, and warming disrupts the mixing of surface and deep water





• Sunset in Boracay, Philippines

where CO<sub>2</sub> absorbing plankton reside. Thus, global warming accelerates even faster.

Another loop involves methane, that is over 20 times more potent than CO<sub>2</sub> 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—the atmosphere.

### A Listing Ship

“Global warming” may sound gradual and manageable. However, the associated climatic changes are anything but this.

According to NOAA, if CO<sub>2</sub> 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 changes, and desertification.

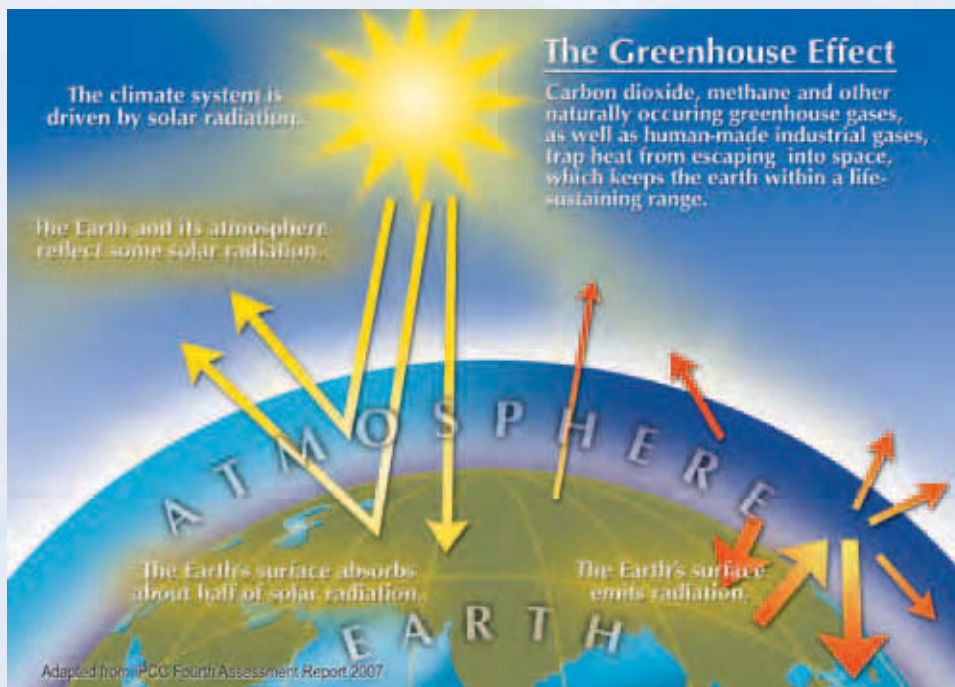
Furthermore, new research indicates that within 100 years oceans could rise by a meter. The impacts of sea-level rise—even in the lower ranges of current predictions—would be severe. Even a modest rise of 50 centimeters will cause frequent coastal flooding events, threatening the 600 million people worldwide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

As an 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; but there is today a global consensus to keep average global temperature rise under 2°C to avoid “dangerous” climate change.

The *Stern Review on the Economics of Climate Change* says this translates to stabilizing GHGs at or below 450 ppm. For this stabilization target to be achieved, action must be taken to ensure emissions peak in the next 10 to 20 years and then drop 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 that 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.*

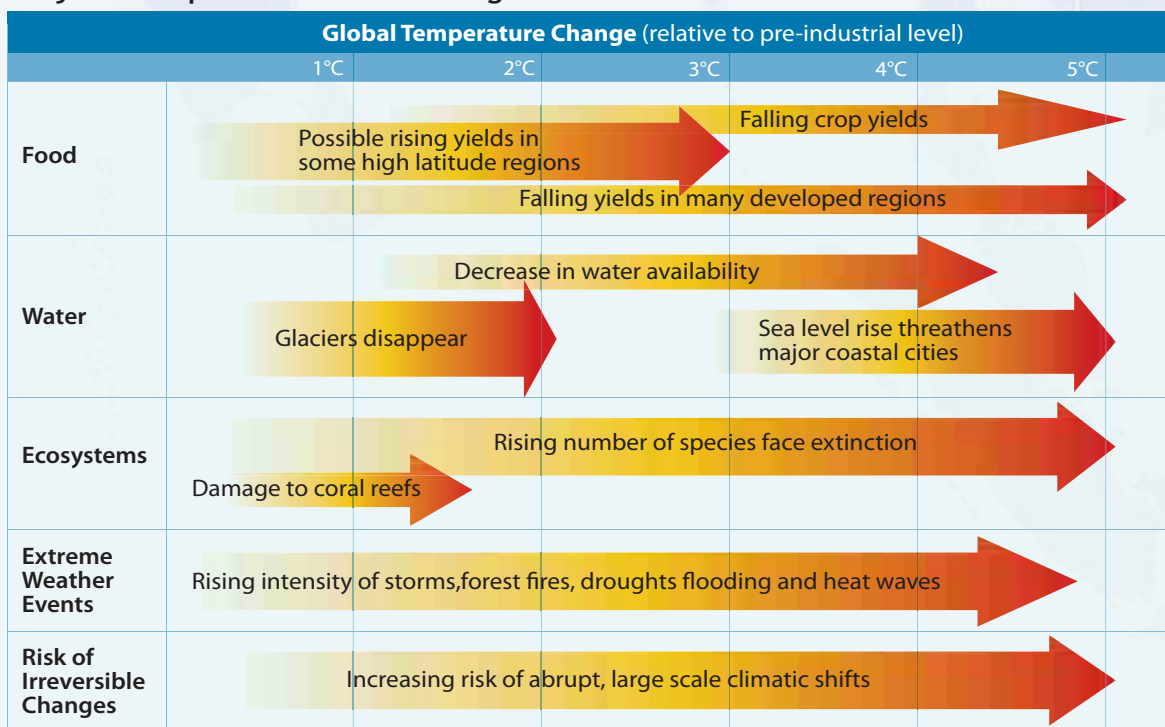
*You are a worker who migrated for a better opportunity. Now you are on the move again—not for a different job but to join the growing number of people in search of water.*

## How Business-As-Usual Practices Will Impact Asia and the Pacific

Many of the projected impacts of climate change are gradual and decades in the future. Even then, some of these impacts are already being felt in a number of real and recognizable ways in the region.

For example, small island nations of the Pacific, as do the islands of Maldives and several low-lying coastal areas, are witnessing measurable encroachment of the sea due to rising sea levels. More violent weather; erratic rainfall patterns; unpredictable monsoons; and more extreme weather events such as floods, droughts, and heat waves, are also discernibly showing up the increasing climate variability and change in Asia and the Pacific.

## Projected Impacts of Climate Change



C = Celsius.

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





• Northwest Crop Diversification Project, Bangladesh

Studies reveal these impacts to likely amplify existing food and water scarcities, biodiversity and ecosystems threats, and the susceptibility of the region to natural disasters. Climate change will also induce migration and further complicate the challenge of dealing with the risks and pressures associated with the phenomenon.

**Decrease in crop yields.** ADB's study, *Building Climate Resilience in the Agriculture Sector*, projects that by 2050, rice yields from irrigated agriculture will decline by 14%–20%; wheat, by 32%–44%; maize, by 2%–5%; and soybean, by 9%–18% because of more frequent and severe droughts and the altered reliability and timing of rainfall.

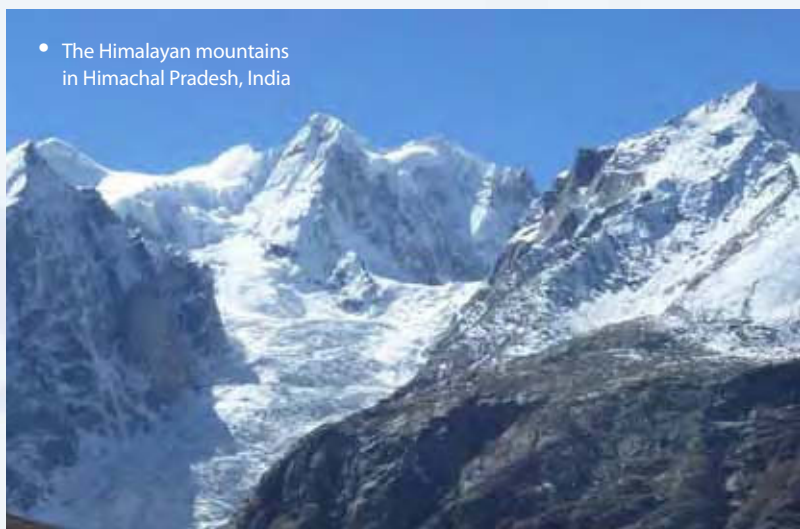
**Increasing water stress.** Water stress will intensify with the decrease in freshwater supplies due to drought and saline water intrusion. Higher temperatures and precipitation variability will alter groundwater recharge patterns. Loss of winter snowpack and glacial retreat will reduce the dry season flows of snow-fed rivers. By 2050, water scarcity will be a major problem in Central, East, South, and Southeast Asia, especially in large basins. Water shortages are expected to aggregate 40% in developing Asia by 2030, according to the 2030 Water Resources Group's study, *Charting Our Water Future*.

**Biodiversity and ecosystems threats.** Critical terrestrial, wetland, coastal, and marine ecosystems and habitats will be increasingly strained by climate change. Data from the International Center for Water Hazard Risk Management show that by 2050, some 24%–34% of coral reefs are likely to be lost due to coral bleaching. Wetlands and mangroves will be threatened by

increasing coastal inundation and saline water intrusion, and more severe and prolonged floods. Some plant and animal species will face the risk of extinction due to higher temperatures, forest fires, and shifting habitats.

**More frequent and severe climate-related disasters.** Asia and the Pacific is highly prone to natural disasters due to its geography and physical characteristics. In 1980–2009, it was the most disaster-afflicted region in the world, and had about 45% of the reported global disaster events, 85% of the resulting total deaths, and 42% of the attendant economic damage, according to the International Disaster Database (EM-DAT). With approximately two-thirds of natural disasters weather-related, extreme climatic events can magnify the susceptibility of the region to natural disasters.

• The Himalayan mountains in Himachal Pradesh, India



- Fire in the forest of West Papua, Indonesia



**Climate-induced migration.** Migration, according to ADB's study, *Climate Change and Migration in Asia and the Pacific*, is already widely used as a tool for adapting to changes in economic, environmental, and sociopolitical contexts in the region. Climate change can drive this trend upward and add to the complexity of population mobility in Asia and the Pacific.

For instance, of the more than 30 million displaced by climate-related disasters, such as storms and floods, in 2010, many returned home, but others did not. The projected increase in frequency and severity of these disasters, as well as the growing constraints in food and water supplies and livelihood opportunities in the climate-sensitive sectors of agriculture, forestry, and fishery can lead to significant changes in migration patterns.

While some displacements are temporary, the sudden eviction of large numbers of people from their home area can exacerbate existing pressures on infrastructure and services, undermine economic growth, enhance the risk of conflict, and spur further deterioration of social conditions.

### Implications for the Attainment of the MDGs

Climate change is likely to exacerbate the existing challenges to the attainment of the Millennium Development Goals.

In particular, the goal of halving the proportion of people living in hunger and extreme poverty between 1990 and 2015 will be harder to achieve with the projected declines in food production and

worsening water stress. In fact, ADB's study, *Building Climate Resilience in the Agriculture Sector*, projects that 9 million–11 million more children in Southeast Asia alone will become malnourished by 2050, due to the decreasing food production and increasing food prices. This is in addition to the 65 million children already malnourished across the region.

Achieving universal primary education will also be jeopardized by climate change in a number of ways. For example, agricultural production and subsistence activities, such as water collection, will become more burdensome, enough to remove children from school. Violent weather may destroy schools and prevent children from attending school. The displacement and migration of families will disrupt and limit educational opportunities.

Reducing child mortality, improving maternal health, and combating malaria and other diseases will be additionally hampered by a host of climate-related factors. Vulnerability to poor health will increase with worsening food and water scarcities. The incidence of waterborne diseases will rise with the deterioration in water quality due to floods, droughts, and saline water intrusion. Climate change and variability will also favor the spread of vector-borne and airborne diseases, and extreme heat events will increase the risk of cardiovascular and respiratory diseases.

### Vulnerable Groups

The poor are expected to suffer the most from the impacts of climate change. Left behind in the growth process and in search of livelihood and living space,



they tend to be concentrated in environmentally marginalized areas, such as drylands, uplands, flooded wetlands, coastal areas, and slums. The dangerous and deteriorating environments in which the poor live and live off of, as well as their lack of capacity to cope with the changing climate and the projected more frequent and stronger natural disasters, make them most vulnerable to climate change.

Living in areas where the impacts of global warming are anticipated to be both early and severe, including low-lying islands, high altitude zones, desert margins, and the polar regions, indigenous peoples also figure conspicuously among the most vulnerable groups. While they are known to successfully negotiate historical shifts in climate and environment by altering existing practice, shifting their resource bases, or restructuring their relationships with the environment, the unprecedented environmental transformations that will be augured in by climate change require distinct attention to be given to indigenous peoples. Their deep knowledge of the fluctuations and alterations in the natural environment and their traditional practices to adapt to these can also enrich scientific research and the adaptation measures that can be pursued.

Within the vulnerable groups, women, children, and the elderly will be hit the most. In particular, women's multiple burdens as family caretakers and primary household food producers will be aggravated by the decreasing availability of food, fuel, and water. Women are also more likely to bear the brunt of climate-related disasters as they will have less opportunity to migrate and adapt to climate change due to lack of general mobility, access to mainstream information networks and other resources, and voices in decision making. Failing health and lack of mobility will make the elderly especially vulnerable. While resulting in immediate death, malnutrition and lack of health, particularly among children and women of reproductive age, could have implications far into the future.

Overall, climate change could deepen poverty and inequality by constricting further the income and development opportunities of the vulnerable, especially women. Already among the most powerful drivers of poverty and inequality, natural disasters and environmental degradation are the mediums that will strengthen the impacts of climate change on the prevailing social maladies.



- A student waves from a school boat in Tonle Sap River, Cambodia

# The Case for Action in Asia and the Pacific

*To understand the case for urgent climate actions 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 once was a village, a metropolis now stands. New industries have risen. Population and incomes have increased. More than half a billion people have been lifted from extreme poverty over the last 2–3 decades.

But this growth has not come without a price. Intensive energy and resource consumption, coupled with rapid urbanization, have caused Asia to become a major source of GHG emissions. If current trends continue, the region will soon be the world's largest emitter. 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, as compared to 31% in 2007.

If a majority of the 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 motorized personal vehicles, 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—affecting energy security in the region and increasing transport-related CO<sub>2</sub> emissions.



- Growth in heavy industry contributes significantly to the increase of GHGs



## Poor Land Use and Water Management Practices Compound the Problem

Vegetation and organic matter in soils absorb CO<sub>2</sub> from the atmosphere and thus play a critical role in maintaining the earth's CO<sub>2</sub> 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 12% of global carbon emissions and is the largest source of CO<sub>2</sub> in many developing countries.

For example, deforestation alone accounts for more than three-quarters of Indonesia's GHG emissions. Together with the burning of fossil fuels, land-use changes explain why the People's Republic of China (PRC), India, and Indonesia are now among the world's top 15 GHG-emitting countries, although their per capita emissions still remain relatively low.

Even without climate change, competition for land and water resources is high in many countries of Asia and the Pacific. Climate change will intensify the struggle for these natural resources, exacerbating challenges to their management and increasing the risk of conflict.

## Vulnerability of Asia and the Pacific

Of all the regions of the world, Asia and the Pacific has the greatest number of people at risk from climate change impacts. More than 60% of its 4.2 billion people, comprising approximately a third of the world's population, rely on the climate-sensitive sectors of agriculture, fishery, and forestry for much of their livelihood. Despite remarkable progress in poverty reduction, the region is also home to about two-thirds of the world's 925 million absolute poor. The immense number of people likely to be affected by climate change, the prevalence of poverty, and the high degree of susceptibility to climate-related disasters account for why Asia and the Pacific is highly vulnerable to climate change.

Nevertheless, there is a huge potential for reducing the vulnerability of the region through adaptation. Adaptation can encompass a range of "hard" and "soft" measures to decrease exposure and sensitivity to risks, as well as strengthen adaptive capacity. "Hard" measures include the construction of protective structures, such as river levees, seawalls, and dams, and the elevation of roads and railways. "Soft" measures, such as the introduction of hardier crops, wetlands and soil nourishment, watershed and coral



• Flooding caused by Typhoon Ketsana, the Philippines

rehabilitation, and afforestation and reforestation, can build the resilience of natural systems and the adaptive capacity of the poor who depend on them for livelihood.

Integrating adaptation in national and sectoral development planning can serve as linchpin for diminishing the impacts of climate change on critical geographic areas, and vulnerable sectors and ecosystems.

## Cost of Inaction is Greater Than the Cost of Action

Various studies have estimated the cost of stabilizing GHG emissions to be lower than the damages that could result from climate change—or the cost of inaction. The Stern Review, an influential inquiry into the issue, updated its estimates in 2008 saying that fighting global warming would cost 2% of global gross domestic product (GDP), while non-action could lead to damages equivalent, in the long-term, to a 20% reduction in global per capita consumption. McKinsey & Company's *Pathways to a Low-Carbon Economy* in 2009 reports a lower finding: avoiding dangerous climate change could cost as little as 0.5% of global GDP.

While some uncertainties continue to be associated with the economics of climate change, ADB's *Economics of Climate Change in Southeast Asia* confirms that the benefits of strong, early climate actions outweigh the costs. For example, the benefits from avoided damage in agriculture and the coastal zones of Indonesia, the Philippines, Thailand, and Viet Nam, could reach 1.9% of GDP by 2100, as compared to the adaptation cost of 0.2% of GDP.



# ADB's Priorities for Action

**A**DB has been working on climate change in Asia and the Pacific for nearly two decades now. Earlier efforts focused on improving the understanding of climate change threats and assisting with the design of cost-effective responses. In 2008, ADB realigned and sharpened its climate change program as part of a broader agenda to promote inclusive and environmentally sustainable growth under its long-term strategic framework, Strategy 2020. The years that followed saw ADB emphasizing mitigation and adaptation as distinct components of its climate change program.

Distinguishing between mitigation and adaptation remains useful to this day, especially in organizing responses and measuring results. However, it does not speak to the need for combining efforts when a strong synergy exists between mitigation and adaptation actions. For example, in the urban, forestry, and agriculture sectors, many interventions can be made to simultaneously reduce emissions and increase climate resilience. The shifts in development patterns required to ensure environmentally sustainable growth moreover demand addressing both the causes and consequences of climate change. On both counts, more integrated



• Zhangbei Wind Project, PRC



- Mossy forest of the Cordilleras, the Philippines

approaches are of utmost importance, and have to be implemented soonest.

Building on considerable knowledge and experience, ADB is currently poised to facilitate more integrated climate change solutions in Asia and the Pacific. ADB will continue to assist in the worldwide efforts to prevent dangerous global warming, working with urgency to enable its member countries to cope with the inevitable impacts already locked into the climate system.

To achieve this objective, ADB will focus on five region-wide priorities:

- Expanding the use of clean energy
- Encouraging sustainable transport and urban development
- Managing land use and forests for carbon sequestration
- Promoting climate-resilient development
- Strengthening related policies and institutions



- Electric Vehicle battery recharging station, Shenzhen, the PRC





- Climate change is already impacting agriculture and vulnerable communities

ADB's program has been described in simple terms as "innovative finance and financing for innovation." Recognizing ADB's unique ability to channel finance and work simultaneously with the public and private sectors, the bulk of efforts will be directed to channeling finance quickly and efficiently to where it is needed most.

Making use of its comparative advantage and adapting actions to the unique needs and capabilities of its member countries, ADB will also work to generate and disseminate knowledge, filling in gaps in the region. To meet the myriad challenges in responding to the vast climate change needs in Asia and the Pacific, ADB will continue to foster partnerships with leading organizations in the region and around the world.

The following sections describe ADB's work supporting countries in their efforts to respond to climate change in the five strategic priorities outlined earlier.



- Southeast Asia accounts for more than 5% of the world's total forest



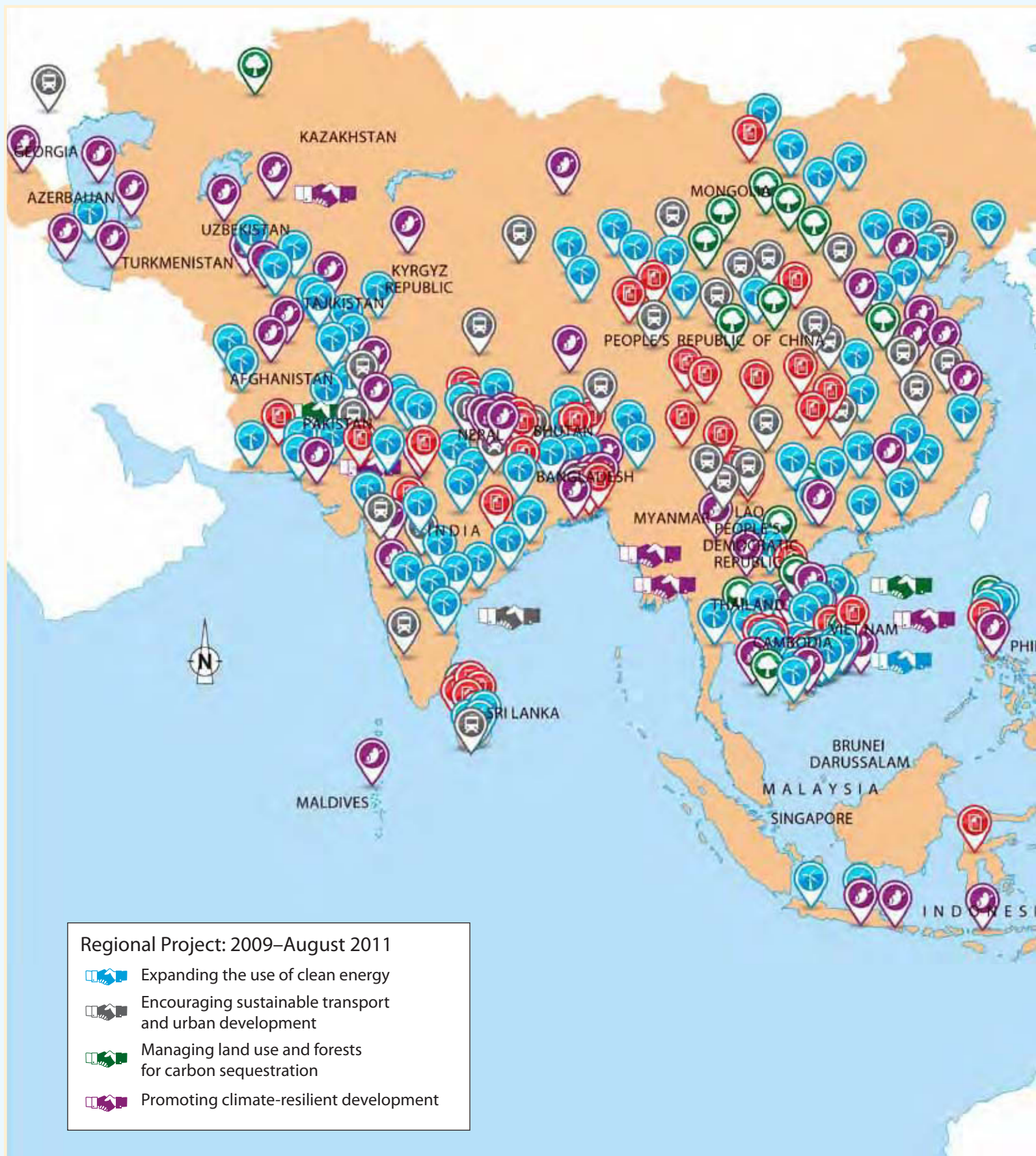
# ADB in Action

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As the only multilateral development bank devoted entirely to Asia and the Pacific, ADB can play an important role in facilitating integrated climate solutions in the region. ADB is working with urgency to achieve this by undertaking and supporting climate change-specific actions, as well as by enhancing the climate change dimension of development projects.

Interventions in the last 3 years span a total of more than 110 projects, involving an investment of about \$10 billion in more than 45 member countries. Between 2009 and August 2011, ADB has also provided over \$245 million in more than 180 technical assistance projects to improve knowledge and capacities, support policy and institutional development, and ensure the feasibility of investments likely to be impacted by climate change.





### Country Project: 2009–August 2011

-  Expanding the use of clean energy
-  Encouraging sustainable transport and urban development
-  Managing land use and forests for carbon sequestration
-  Promoting climate-resilient development
-  Strengthening policies, governance, and capacities





# Expanding the Use of Clean Energy

## Issues

The energy sector is the biggest source of global GHG emissions, accounting for more than half of the total. Asia is the fastest-growing contributor to these emissions. From 31% in 2007, the region's share in the world's energy-related emissions is projected to rise to 45% by 2030. A massive shift to clean and efficient energy production and consumption is needed to abate the sharp growth in the region's energy emissions, and help achieve the global target of bringing down GHG emissions after 2020.

## Responses

In 2005, ADB set out to increase clean energy investments to \$1 billion per year starting in 2008. Same year it was made operational, the target was surpassed. ADB's clean energy portfolio reached \$1.75 billion in 2008, from \$0.67 billion in 2007. In 2009, ADB's clean energy investment exceeded the target again, reaching \$1.31 billion. In 2010, it rose further to \$1.76 billion. The

unabated growth in ADB's clean energy investments reflects the growing drive among ADB member countries to support economic development with clean and efficient energy use.

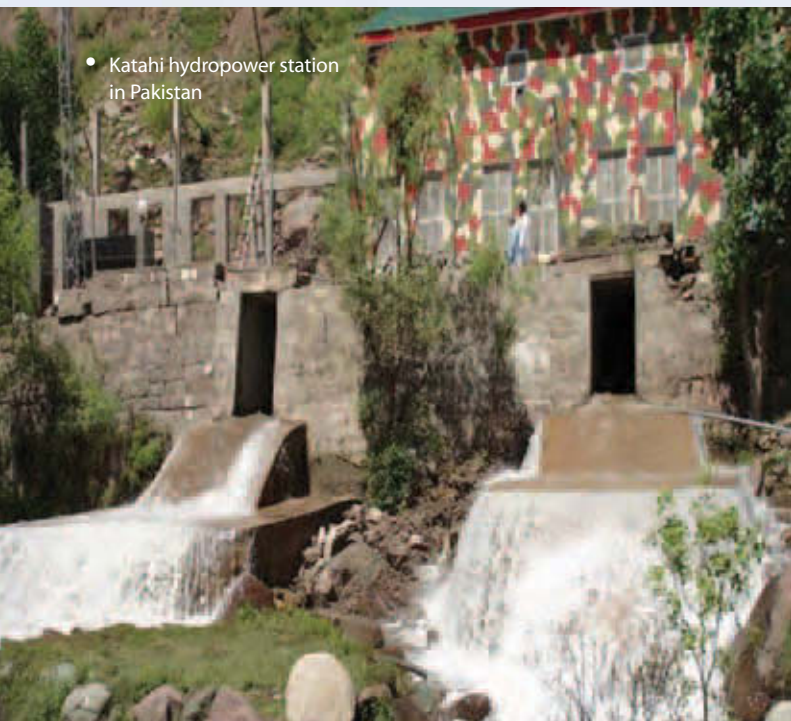
Guided by its 2009 Energy Policy, ADB will continue to expand its support for clean energy, focusing on three key areas—energy efficiency, renewable energy development, and improving access to low-carbon energy. Under ADB's Clean Energy Program (CEP), more investments will be made in smaller developing countries, and in demand side clean energy components in water supply and sanitation, transport, urban, agriculture, and other sectors. The CEP will also monitor achievements against development results including the reduction of GHG emissions. The investment target for new clean energy projects will be raised to \$2 billion annually starting in 2013.

## Demand Side Energy Efficiency

Demand side efficiency improvements are the most cost-effective emissions reduction interventions. In many cases, they pay for themselves in energy savings. They also greatly improve the efficiency of economic production and free up business and consumer resources through lower energy costs.

According to studies by ADB and The Energy and Resources Institute (TERI), the potential for efficiency improvements in the region's industry, transportation, and building sectors is huge—as high as 45% over 2009 levels. To realize this potential, less energy-intensive lighting, cooling, heating, appliances, and production systems will continue to be promoted across the industrial, commercial, and municipal sectors.

Partnering with commercial banks and energy service companies (ESCOs), ADB is helping member countries such as Pakistan to achieve greater energy efficiency in the textile industry, the People's Republic of China (PRC) in the cement industry, and Indonesia in the food industry. A private sector loan also supports the energy-efficient expansion of the Garadagh cement industry in Azerbaijan. At the municipal level in the Philippines



• Katahi hydropower station in Pakistan

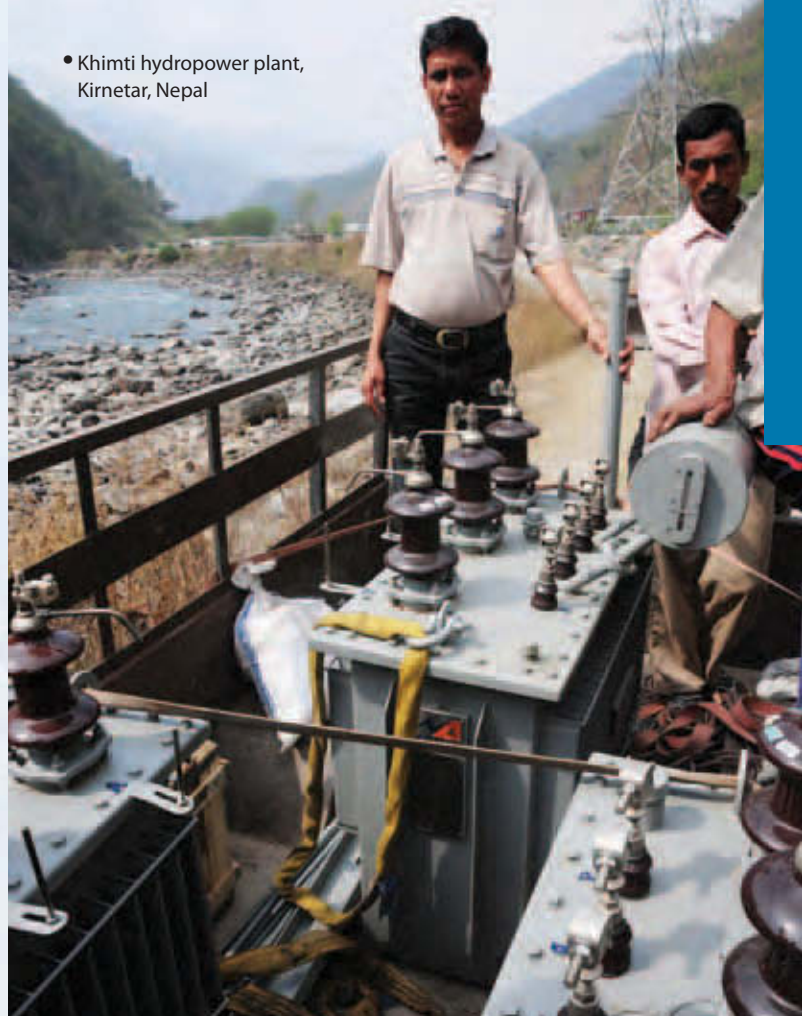


and Thailand, ADB is assisting efficient street lighting and energy efficiency retrofits in government buildings. Similar efforts are under way in the Lao People's Democratic Republic (Lao PDR) and Viet Nam.

In Ulaanbaatar, Mongolia, the coldest capital city in the world, buildings are being rehabilitated to minimize heat loss. In the PRC, energy efficiency improvements are being made in the district heating of the Inner Mongolia Autonomous Region, and by retrofitting electricity-consuming facilities in the Guangdong Province.

ADB has also been supporting the large-scale adoption of compact fluorescent lamps (CFLs) to improve energy efficiency of lighting. In the Philippines, 13 million CFLs have been distributed to homeowners to support the government's ban of incandescent lamps in 2009. In Pakistan, 30 million CFLs will be distributed, resulting in 1,100 MW of avoided power generation. With ADB assistance, Nepal also gave out a million CFLs/light emitting diodes to households in a drive to save on energy and ease up the power outages hampering economic activity in various parts of the country. Unlike incandescent bulbs, which use only 20% of its electricity to produce light and waste the rest in the form of heat,

• Khimti hydropower plant, Kirneta, Nepal



## The Philippines sets the stage for large-scale energy savings

Without action, Luzon and the Visayas islands in the Philippines would suffer from severe power outages in 2012. To respond to this threat, ADB is supporting the Philippine Energy Efficiency Project that is out to achieve the following firsts in Asia:

- First nationwide program to replace incandescent bulbs with CFLs.
- First time for an Asian country to be receiving carbon market credits for replacement CFLs.

The expected benefits from the CFL replacement component are impressive. Families can save 400 pesos a year for each incandescent bulb they replace. It will save the country \$100 million in annual fuel costs, and allow the deferment of \$450 million in new power plant construction costs. National CO<sub>2</sub> emissions will be reduced by 300,000 tons a year, enabling the Philippines to receive approximately 300,000 tons of certified emission reduction carbon market credits annually.

Aside from CFL replacement, the project will also retrofit government office buildings and public lighting systems with more efficient lighting options, and establish a super ESCO to act as a one-stop shop for energy efficiency in public buildings and facilities, and private industries.

A "CFL distribution program is like building 'virtual' power stations," according to an ADB senior energy specialist. One million incandescent bulbs replaced with CFLs, costing \$1.5 million, will reduce electricity demand by about 50 MW. It is like "building a new 50 MW power station, which costs at least \$50 million and another \$2 million–\$3 million each year to operate, and takes 3–4 years to construct."

The Philippine initiative has a high replicability in other member countries. Efforts are under way in Viet Nam to adapt the project design to country conditions.



## Reducing the energy intensity of Uzbekistan

Uzbekistan has the most industrialized and energy-intensive economy in Central Asia. It uses 60% more energy than Azerbaijan and Kazakhstan, and four times more than the world average to produce one dollar of gross domestic product. This is due to aging and dilapidated energy infrastructure, low technological base, and lack of investment.

In 2010, ADB approved a loan of \$1.28 billion for the Talimarjan thermal power plant. The loan will be used to construct two combined cycle gas turbine units that will burn natural gas to significantly lower carbon emissions by 1.2 million tCO<sub>2</sub>e per year.

Improvements in the Talimarjan power plant will also result in energy savings of 21,390 terajoules per year. Such energy savings will enable the country to expand its energy exports, benefiting Afghanistan, as well as Tajikistan and the Kyrgyz Republic that are rich in hydro resources but prone to winter energy shortages. Over the medium term, Uzbekistan is also looking to expand its energy exports to Pakistan.

The ADB loan will be complemented by cofinancing of up to \$300 million from the Japan International Cooperation Agency, and \$630 million from the Government of Uzbekistan. The project also has a special capacity development component that will support improving the management, financial, and operational performance of Uzbekenergo, the sole power sector utility in the country.



CFLs have been observed to use all electricity input to produce light thus saving about 80% of power consumption.

Energy efficiency in water supply and sanitation has also been actively promoted. Design of the projects in this sector in the last 3 years, for example, in Palau, Sri Lanka, and Uzbekistan in 2010, have integrated such efficiency measures as reducing and detecting leaks and system losses, and rehabilitating and improving physical structures and designs to decrease the power needed for maintaining the water infrastructure.

To ensure the sustainability of demand-side energy efficiency efforts, ADB will also continue to assist member countries in framing enabling legislation and developing benchmarks. The Promoting Energy Efficiency Project in the Pacific is in this mold, in addition to working for the development of a demand-driven

## Dalkia promotes district energy systems

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 provides 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. Energy savings by DES provide opportunities to reduce GHG emissions and may generate carbon credits under the Clean Development Mechanism (CDM).







- Introducing renewable biomass energy in the PRC

and private sector-based market in energy efficiency services in five countries—Cook Islands, Papua New Guinea, Samoa, Tonga, and Vanuatu.

### Supply-Side Energy Efficiency

Large capacity additions are required to meet the electricity needs of Asia and the Pacific. While emphasizing the expansion of renewable energy's share in the power sector and increasing the poor's access to modern and cleaner energy, ADB also assists in establishing more efficient power generation, transmission, and distribution—especially where smart grids or other new and promising clean technologies can be demonstrated. Appropriate policy, institutional, and investment measures to propel the growth of clean energy supplies continue to be worked out with member countries and other partners.

Several ongoing initiatives provide a strong linchpin for furthering ADB's efforts to improve supply-side energy efficiency across the region. For example, upgrading coal-fired power plant technology to supercritical and ultra-supercritical 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. Recovery and utilization of waste heat from coal mines and coal beds has been successfully demonstrated and is set to be replicated in various parts in the PRC. Elsewhere in the region, most recently including India, Indonesia, Kyrgyz Republic, Pakistan, Sri Lanka, and Uzbekistan, significant strides have also been made to improve the coverage and efficiency of energy supply.

### Thailand harnesses solar power to bolster energy security

Thailand has abundant renewable energy sources—biomass, biogas, minihydro, solar, and wind. The use of these renewable energy sources can improve the country's energy security, save foreign exchange, and protect Thailand from global energy price fluctuations.

In 2010, ADB approved two loans that will demonstrate the commercial viability of large-scale private sector solar farms, and contribute to achieving the government's target of renewable energy to comprise 20.3% of primary commercial energy by 2022. Meeting the target will require significantly increasing renewable energy capacity to 5,608 megawatts by 2022, from the present 1,745 megawatts.

The loans, amounting to \$204.31 million, will construct three solar generation plants in central Thailand and Ayutthaya Province. The plants will generate about 140 gigawatt-hours of electricity per year. They will also reduce emissions by 130 tCO<sub>2</sub> per year, for a total of 3,250 tCO<sub>2</sub> over the plants' 25-year projected lifetime.







• Khudoni Hydro Station, Georgia

## Renewable Energy and Fuel Switching

Renewable energy sources promise environmental as well as energy security benefits. They can be particularly valuable in providing off-grid and rural communities with a range of energy services, including lighting, cooking, refrigeration, water supply for drinking and irrigation, and power supply for small businesses.

Renewable energy continues to have the lion's share of ADB's clean energy investments: 45% in 2005–2009, and 62.5% in 2010. This highlights ADB's commitment to help mitigate climate change while meeting the growing energy demand and promoting the energy security of the region.

ADB has assisted numerous run-of-river hydropower projects in recent years, mostly ranging from 5 to 100 megawatts (MW). The latest of these projects will benefit Himachal Pradesh in India, and a number of provinces in Papua New Guinea where more than 90% of the national population continues to have no access to electricity.

ADB is also a financing partner to a number of wind power projects in India, the Philippines, PRC, and Pakistan; geothermal power plants in Indonesia; geothermal heating projects in the northern PRC; and solar development projects in Bangladesh, Bhutan, India, Mongolia, and Thailand, among others. Though most of these projects continue to be funded through public sector loans, private sector investments have increased significantly over the last 3 years, accounting for about 35% of ADB's total clean energy portfolio in 2010.

In fact, the year 2010 was remarkable for clean energy development in Asia and the Pacific. The region became a preferred destination for clean energy financing, with the PRC and India achieving great progress in clean

energy development. Both countries installed wind power at levels that place them among the top five wind power-producing countries in the world. Earlier this year, the Pew Charitable Trusts announced that the PRC has surpassed the United States in clean energy investment.

While the region is poised to be a global leader in clean energy development, much still needs to be done to mainstream clean energy into the development paths of ADB member countries. With the increasing viability of renewables, ADB will continue to facilitate wider deployment of technologies by raising awareness, promoting policy and regulatory incentives to encourage their use, and putting up financing packages that share risks and lower costs.



• Wind power development is gaining momentum in the region

Through its Asia Solar Energy Initiative, ADB will work to increase the amount of solar power generated in the region by 3 gigawatts by 2013. Through the Quantum Leap in Wind, it will work to install an additional 1 gigawatt of wind power across priority developing member countries, including Mongolia, the Philippines, Sri Lanka, and Viet Nam, within a few years. ADB will also continue to develop other initiatives, such as incentivizing the use of renewable power and supporting the involvement of venture capital funds to accelerate the growth of renewable energy and other low-carbon technologies in the region.

A new area for ADB is biomass and biofuels. Biomass-based alcohol fuels and biodiesel yield lower emissions

than conventional fuels when feedstock is chosen carefully and fossil energy input is minimized. ADB will continue to support studies—as recently completed in India—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—as currently done in the PRC, Thailand, and Viet Nam.

In the PRC, ADB assists in a large biogas project that will demonstrate the commercial viability of medium- and large-scale biogas plants, and the effective utilization of biogas sludge in eco-farming in several poor rural areas in four provinces. The project will result in 98 terajoules

## ADB intensifies efforts to spur greater private capital flows into clean energy development

ADB for sometime now has been innovating financial packages to mobilize greater private investment into the clean energy sector. In 2003, it invested \$10 million in the FE Global Asia Clean Energy Fund (FEGACE) that grew to \$63.4 million in 2008, with investments of \$53.8 million in 10 clean energy projects in the PRC, India, the Philippines, Singapore, and Thailand, and a gross internal rate of return of 23%. Building on the FEGACE, five clean-energy private equity funds were launched in 2008—the China Environment Fund III, the South Asia Clean Energy Fund, the MEACP Clean Energy Fund, and the Asia Clean Energy Fund. ADB investment in each fund was \$20 million. The Mekong Brahmaputra Clean Development Fund was created in 2009, with \$15 million in ADB equity investment, a targeted size of \$100 million, and a targeted first-closing of \$40 million.

In 2010, ADB set up the \$40 million Clean Resources Asia Growth Fund and Renewable Energy Asia Fund that seeks to identify and invest in companies (i) with proven clean technologies for application in the region, (ii) that could provide the critical elements for the development of an Asia-based supply chain for clean resource technologies, and (iii) with expanding sales volume and production capacities. In May 2011, it invested \$60 million in equities in the Asia Climate Change and Clean Energy Venture Capital Initiative that will enhance the availability and affordability of technologies that address climate change mitigation and adaptation, and environmental protection. ADB complements its investment in the Asia Climate Change and Clean Energy Venture Capital Initiative with a technical assistance program that provides knowledge support to member countries on emerging market opportunities, promotes the technological competence and growth potential of investee companies, and addresses intellectual property rights issues.



In addition, ADB has also developed more financial products to accelerate private capital flows into clean energy development. For example, ADB created a \$150 million partial credit guarantee facility in India in April 2011 to support foreign and local commercial bank lending for solar power generation projects. In May 2011, it also provided Bangladesh a grant of \$3.3 million to set up a Public–Private Partnership Infrastructure Facility that will support the establishment of individual solar home systems and medium-scale renewable energy applications in rural areas with no access to grid electricity.

ADB's efforts to intensify private sector involvement in clean energy development aim to help fill the gap in mitigation financing which, by 2030, can reach more than \$100 billion a year in developing countries. With public financing and the emerging climate financial architecture unlikely to meet this need, innovative financing schemes have to be developed to leverage and speed up private capital growth in clean energy provision.



direct fuel savings per year and emissions reduction of 1 million tCO<sub>2</sub>e per year. In Viet Nam, ADB is financing a project to scale up and enhance biogas development, installing 40,000 units of improved household biogas digesters in 16 provinces and reducing emissions by 40,000 tCO<sub>2</sub>e per year from fossil fuel replacement alone. In Thailand, ADB assists in the construction and operation of a 125 MW biomass power plant that will use wood waste products as fuel and save about 4 million tons of CO<sub>2</sub> during the first 10 years of operations.

Aside from renewable energy, ADB is also promoting the use of cleaner fuels. For example, it is supporting natural gas transmission and distribution improvement projects in several countries, including Afghanistan, Bangladesh, the PRC, India, Indonesia, and Viet Nam.

### Expanding Access to Low-Carbon Technology

ADB will continue to increase the availability and affordability of new low-carbon technologies to help member countries leapfrog directly to cleaner and more advanced energy solutions with lower GHG

emissions. It will do so by continuing to help remove regulatory, trade, pricing, information and other barriers to the introduction of these technologies, and actively supporting their transfer, development, and dissemination in Asia and the Pacific. While technology transfer and diffusion will always be dominated by market transactions, well-targeted public financing will induce private investment and hasten the technology transition.

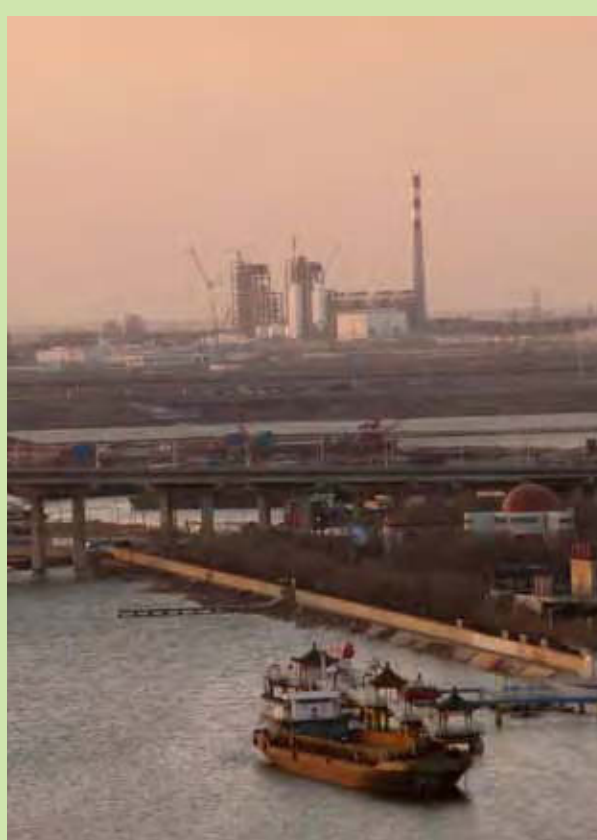
ADB is supporting the deployment of new technologies as they become technically feasible and economically viable. It has established an Asian Clean Technology Exchange that provides a marketplace for willing buyers and sellers of low-carbon technologies that can be diffused in the immensely large and rapidly expanding energy markets of Asia and the Pacific. It also works with partner bilateral and multilateral donors to mobilize large institutional investors, especially pension and sovereign wealth funds, to provide significant financing for resource efficient and low carbon technologies and infrastructure in the region.

## Tianjin IGCC Power Plant to boost low-carbon energy production in the PRC

The People's Republic of China (PRC) is the world's largest coal producer and consumer. Heavy use of coal is causing serious pollution, including sharply lowered air quality and widespread acid rain. Large coal use is also causing global concern due to rising greenhouse gas emissions. In response, the PRC launched a 3-phased, 8-year clean coal power generation program, the Greengem, which will last until 2013.

ADB is co-financing the ongoing construction of the Tianjin Integrated Gasification Combined Cycle (IGCC) Power Plant, the cornerstone of the Greengem's first phase. Plants using IGCC technology turn coal into a synthetic gas, removing impurities before burning the gas in a gas turbine. Combined with a carbon dioxide capture and storage function, the IGCC technology is now the least-cost option to cut carbon emissions from coal-fired power plants by up to 90%.

The Tianjin IGCC Power Plant is expected to generate 1,470 gigawatt-hours of electricity annually, and about 117 million cubic meters of synthetic gas which will be marketed locally for reuse in chemical production. Waste heat from the plant will also be the main source of heat and steam for Tianjin City's Harbor Industrial Park.





- Town water supply project in Mongolia

As an example, ADB is promoting carbon capture and storage (CCS). Construction of the Tianjin IGCC Power Plant, one of the region's first carbon capture and sequestration-ready installations, is ongoing. In partnership with the CCS Institute-Australia, ADB also assists its member countries in preparing CCS roadmaps to identify demonstration projects and address barriers to the commercial-scale deployment of CCS in the region. It also maintains the CCS Partnership that now coordinates the task of disseminating CCS knowledge and experience across Asia and the Pacific.

## Energy for All

More than 800 million people in Asia and the Pacific still have no access to electricity. About 1.8 billion still burn wood, dung, and crop waste to cook and to heat their homes. This persistent energy poverty has hampered efforts to reduce poverty and meet the Millennium Development Goals. Access to modern, cleaner energy is essential to cut indoor air pollution; improve infant and maternal health, education, and agriculture; and ensure inclusive, sustainable development.

## Powering the Poor: the Energy for All (E4ALL) Partnership

The E4ALL Initiative, begun by ADB 3 years ago, has transformed into a partnership project hosted by ADB and facilitated by ETC-the Netherlands and Approtech Asia. The Partnership brings together financial institutions, governments, civil society, and the private sector to share information and know-how, and jointly design projects to improve the access, especially of the poor and remote communities, to renewable and other modern clean energy supplies. It has seven working groups—Lighting for All, Domestic Biogas, Liquid Petroleum Gas (LP Gas), Enterprise Development, Pacific Region, Small Wind, and Financing.

The Partnership builds on the gains and lessons from the experience of the E4ALL Initiative, which showed a variety of effective, low-cost interventions. For example, in Orissa and Maharashtra in India, the E4ALL succeeded in improving energy access by providing a grant to 43 village entrepreneurs to set up battery charging stations that rent out solar lanterns to villagers for a nominal daily fee. In Bhutan, 35 semiliterate women were supported to train in the Barefoot College in India, and are now serving as “solar warriors” installing and maintaining the solar panels provided to 504 poor households in 46 remote villages. In Negros Occidental, Philippines, eight far-flung and poor communities are now enjoying electricity from a small hydraulic pump that also irrigates their farms and restores their dry wells.





Working on a goal of providing 100 million people in the region with clean, modern energy supply by 2015, ADB launched the Energy for All (E4ALL) initiative in 2008. The initiative has taken renewable energy development to off-grid, poor communities, and has evolved into the present-day E4ALL Partnership.

ADB also provided a grant of \$3 million in 2011 to support a study of good practices in incorporating pro-poor and gender-inclusive provisions in energy sector policies, laws, and regulations in Bhutan, Nepal, and Sri Lanka. Study findings will inform efforts to improve the integration of gender in the design of energy projects, and promote gender-inclusive access to clean and renewable energy.



- The provision of modern, clean energy supplies in remote rural areas fosters achievement of universal primary education

## ADB's Carbon Market Program (CMP) harnesses the power of carbon pricing

Inadequate finance and capacity are fundamental obstacles for developing countries trying to adopt clean energy technologies. The CMP supports the development of GHG mitigation projects eligible under the Clean Development Mechanism (CDM) by providing carbon finance at the most critical stage—project preparation and implementation.

CMP's Asia Pacific Carbon Fund and Future Carbon Fund combined can purchase carbon credits generated up to 2020 to cofinance clean energy and other GHG mitigation projects. CMP also provides capacity building to identify and develop new projects, along with project-specific support for CDM documentation, registration, implementation, and carbon credit marketing.

As of June 2011, CMP provided technical and financial assistance to more than 70 projects in 16 host countries and identified over 60 new projects potentially eligible under the CDM. It also carried out several capacity-building workshops to help broaden the regional distribution of CDM projects, particularly among low-income countries.



# Encouraging Sustainable Transport and Urban Development

## Issues

Rapid expansion of the transport sector, largely as a result of urbanization, has accompanied Asia's remarkable economic growth. Over the last 30 years, the region has contributed 17% of the total transport-related GHG emissions worldwide. By 2030, Asia's transport emissions are expected to double, worsening the pollution that already chokes many urban areas and lowers quality of life. Fugitive GHGs, such as methane from landfills and wastewater treatment facilities, are another significant source of global emissions. With the largest and fastest-growing cities in the world, these emissions are also rising rapidly across the region.

Shifting Asia's transport and urban development toward environmental, social, and economic sustainability, with distinct attention given to reducing future reliance on vehicles powered by fossil fuels, will support global climate responses. Member countries can be motivated to make these policy shifts and

investments to generate highly important local co-benefits, including improved air quality, energy security, transport safety, and the reduction of social risks associated with greater mobility. Expanding the availability of climate financing will make such transformational investments even more attractive.

## Responses

Climate-friendly transport and urban development is an emerging area of investment for ADB.

Consistent with its Sustainable Transport Initiative (STI), ADB is making modern mass transit systems more widely available across Asia's growing cities. More efficient vehicles, biofuels, and other low-carbon technologies, as well as sound urban planning to facilitate mobility, are actively promoted. Strong integration between urban sector planning and the development of new transport modes is also emphasized.





A new Urban Operational Plan (UOP) is currently being finalized. Under the UOP, ADB will focus on improving the environment, economy, and equity in Asia's cities, the so-called 3E Agenda. An investment of \$2 billion annually is proposed to promote livable and sustainable cities, focusing on (i) environmental improvement, climate change mitigation and adaptation projects, (ii) pro-poor urban renewal projects, and (iii) provision of infrastructure for inclusive economic growth.

### Advancing Sustainable Transport Solutions

ADB launched the STI in 2008 to assist in developing effective and efficient transport solutions that can work on a large scale in developing Asia. The STI follows a three-pronged approach: avoid, shift, and improve. Avoid means reducing travel demand through better integration of land use and transport planning. Shift means changing to more efficient modes and routes. Improve means using more energy-efficient technologies. Together, these changes could help lessen dependence on personal vehicles, decrease road congestion, and reduce local air pollution and GHG emissions.

Under the STI, ADB has supported member countries' efforts to develop national transport policies and bankable projects that place a high emphasis on emission reduction, and energy use and mobility

efficiencies. Studies on urban transport systems which are better for the environment and affordable for the poor have been conducted. Initial lessons were published in *Changing Course: A New Paradigm for Sustainable Urban Transport*. Improved analytical tools to systematically integrate climate change issues and adaptation measures in transport sector development are also being developed.

New systems or improvements in the existing public and mass transit systems in a number of cities, including Bangalore, Ha Noi, Kathmandu, and Tbilisi, have been begun. Better and more sustainable transport systems are also being designed in a number of other cities like the Ho Chi Minh City, Xian, Yerevan, Davao, and Vientiane. In Lanzhou, a central link in one of the PRC's economic corridors, ADB is assisting in the development of a Bus Rapid Transit (BRT) and nonmotorized transport network to improve traffic conditions while reducing carbon emissions, air pollution, and fuel consumption.

In years ahead, the STI will expand ADB's operations in developing long-distance railways and waterways, promoting business models that are capable of realizing the potential competitiveness of these modes of transportation. Strategic investments in shortening journey distances on existing modes will be increased to reduce emissions and energy use.



• Biofuel-powered vehicle in Samoa

Aside from member countries' contributions, ADB's STI efforts are enhanced by the continued knowledge exchange among over 50 institutions forming the Partnership on Sustainable Low Carbon Transport (SLoCaT). A product of the May 2009 Bellagio Declaration on Transportation and Climate Change, the SLoCaT Partnership contributes to the ongoing climate change negotiations options and advice concerning the development of sustainable transport systems worldwide.

### Providing a more efficient, safe, and sustainable urban transport system in Kathmandu

Spurring greater and more inclusive economic growth following a decade-long conflict is a key challenge facing Nepal. Large infrastructure deficits, particularly in the transport, water, and power sectors, need to be addressed, and this is no simple task for a country that continues to be among the poorest in the world.

ADB has long been a major partner of Nepal in developing roads and basic infrastructure to foster economic activity and improve access to goods and services across this landlocked country with extremely rugged topography. In 2010, ADB has taken its assistance further by providing Nepal with \$10 million loan and \$10 million grant for the Kathmandu Sustainable Urban Transport Project. The project will provide the capital city with a more efficient, safe, and sustainable transport system that will support economic expansion, while delivering the co-benefits of better air quality, greater mobility, and less traffic congestion.

Under the project, (i) the public transport network system in Kathmandu will be reorganized, (ii) two pilot bus routes will be introduced, (iii) the use of electric or low-emission vehicles will be promoted, (iv) heritage routes will be made pedestrian-only, and (v) traffic management systems and facilities will be improved. The project is also expected to lower CO<sub>2</sub> emissions and other air pollutants in the Kathmandu valley by 20% from current levels in 2018.



## Promoting Livable and Sustainable Cities

ADB will continue to assist in facilitating adoption of the 3Rs (reduce, reuse, recycle) to improve urban environments and living conditions, and to expand income opportunities for the poor. It will address the urban infrastructure deficit in the region in a manner that will promote transitions to sustainable infrastructure and reduce the carbon footprints of cities. In addition to promoting sustainable urban transport, this would entail more vigorously pursuing the integration of energy efficiency in infrastructure designs, including those for water supply and sanitation; the adaptation of roads, bridges, and buildings and other vital infrastructure to the projected impacts of climate change; and more efficient street lighting.

An essential part of making the cities more climate-friendly is capturing fugitive methane emissions often arising from equipment leaks or evaporative processes. Methane is over 20 times more potent than CO<sub>2</sub> as a GHG. But it can be captured and converted into an energy source to replace more carbon-intensive fuels, such as coal and kerosene.

ADB's efforts to reduce urban methane emissions center on two key sources.

**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 member countries in reducing or capturing methane emissions from landfills. It recently provided a private sector loan to support the construction and operation of a waste-to-energy system in the PRC's provincial capitals and regionally important cities. Clean technologies will be utilized to treat 8,000 tons of





- ADB's new urban operational plan will emphasize transitioning to sustainable infrastructure to simultaneously build climate resilience and reduce carbon footprints



## Bangladesh takes steps to build greener and healthier cities

Bangladesh's very rapid and unplanned urbanization is giving rise to a city region, a conglomeration of a large city (city corporation), surrounding secondary towns (*pourashavas*), and adjacent peri-urban areas (urban centers) with close economic and social links but uncoordinated development. The challenge of addressing deteriorating urban environments and living conditions is mounting, as at current growth rates, the urban population of Bangladesh can double and reach 74 million by 2035.

The ADB-supported City Region Development Project, approved in 2010, will help respond to the challenge by upgrading water supply and sanitation infrastructures; improving solid waste management; introducing energy-efficient water pumps and solar-powered streetlights; and improving key roads, bus and truck terminals, and other transport facilities and traffic management systems. Drainage facilities will be rehabilitated or extended, and a small-scale pilot program to revitalize an inner-city area of historic importance will be undertaken. Review and update of urban development plans, and formulation of a framework for

coherent and environmentally sustainable regional development will also be supported.

With a loan amount of \$120 million, the project will cover the two key city regions of Dhaka and Khulna. It is expected to result in lower carbon emissions, better air and water quality, less waterlogging and traffic congestion, and stronger urban governance for climate change.



municipal solid waste daily from an urban population of 16 million. The system is expected to generate approximately 800 gigawatt-hours of electricity by 2013. ADB also supports waste composting projects in 60 towns in Bangladesh and India.

**Coal mines.** Improved drilling technologies and engines can be used to produce, capture, and use coal mine methane (CMM), which accounted 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.

The Cities Development Initiative for Asia (CDIA) and the Clean Air Initiative for Asian Cities (CAI-Asia) greatly enhance ADB's efforts to promote and develop livable and sustainable cities.

Together with the Government of Germany, ADB established the CDIA in 2007 to provide assistance to medium-sized Asian cities to bridge the gap between their development plans and the implementation of their infrastructure investments. In particular, it links medium-sized cities to the financing resources they need to design investments in public transport, solid waste management and methane capture, energy

## The PRC demonstrates multiple co-benefits from the use of rail

Rail transport in much of developing Asia has seen a declining market share. A key factor behind this is the reluctance of railway administration bodies to reform and modernize, which has made it difficult to justify large, new investments. It has also not been possible to realize the full potential of railways for long-distance transport because of restrictions in cross-border movements, as well as differences between countries.

The major exception is the PRC, which has steadily expanded its railways and reformed its railway institutions, resulting in a 60% increase in route-kilometers since 1980, and a 17,000 km high-speed passenger network under construction. The PRC's experience shows that—depending on traffic, geography, and other factors—modern railways can play a major role in enabling inclusive economic growth, with positive effects on poverty alleviation in the hinterlands.

Railways also offer significant safety advantages and have lower environmental impacts and emissions. This is especially true for rail transport systems, which use electric locomotives instead of diesel, as will be the case with the PRC's ongoing railway projects cofinanced by ADB, including the Lanzhou–Chongqing, Chongqing–Lichuan, Yichang–Wanzhou, and Taiyuan–Zhongwei railway projects. Taken together, the first three projects will reduce the country's carbon emissions by more than 17 million tons in 2032–2034. They will also result in significant fuel savings, amounting to more than CNY 1.5 million in 2013–2015, from the Lanzhou–Chongqing and Chongqing–Lichuan projects alone.

Aside from the PRC, which accounts for nearly half of ADB's recent rail portfolio, Bangladesh, India, Turkmenistan, and Uzbekistan have also invested in railway development, with support from ADB.





efficiency in buildings, and alternative energy sources, as well as construct and operate them on a sustainable basis. It also helps identify planning instruments and approaches for enhancing the climate resilience of cities. As of May 2011, CDIA has approved applications from 29 cities in 13 countries. A number of others are under consideration as the CDIA works toward meeting its target of directly working with 50 cities by end of 2012.

The CAI-Asia was started in 2001 by ADB, the US–Asia Environmental Partnership financed by the US Agency for International Development, and the World Bank. It focuses on translating knowledge to policies and actions that reduce air pollution and GHG emissions from transport, energy, and other sectors. It has helped Asian cities pay attention to ambient air quality levels and air quality management, and has built institutional capacities among ADB member countries in these fields. In 2007, ADB facilitated the creation of the CAI-Asia Center, a nonprofit organization that now serves as the secretariat of CAI-Asia.

In October 2010, ADB, together with 38 governments, the European Commission, and the Inter-American Development Bank, also launched the Global Methane Initiative to urge stronger international action to fight climate change while developing clean energy and stronger economies. The initiative builds on the existing structure and success of the Methane to Markets Partnership in promoting the reduction of methane emissions, and encouraging new resource commitments from country partners.



• Sewage treatment plant, Jaipur, Rajasthan, India

## India captures fugitive methane emissions through waste composting

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

The project is expected to reduce 20,000–28,000 tCO<sub>2</sub>e of GHG emissions annually from 17 towns. It is being developed as a programmatic CDM project, and the carbon revenue can be used to operate and maintain the composting plant.





# Managing Land Use and Forests for Carbon Sequestration

## Issues

Land-use changes account for 15%–20% of global GHG emissions, and as much as 75% of Southeast Asia's emissions. Several Pacific developing member countries are also rapidly losing their forests. Managing land use to maintain or sequester carbon is a major climate change issue in the region. ADB's Strategy 2020 advocates arresting tropical deforestation as an approach to reduce GHG emissions, with the sustainable management of lands, forests, and other natural resources providing the basis for local livelihoods, clean water supplies, and the protection of biological diversity.

New financing opportunities and incentives for sustainable forest management have been created under the UNFCCC through REDD (Reducing Emissions from Deforestation and Forest Degradation), and now REDD+ that includes forest

conservation, sustainable forest management, and the enhancement of forest carbon stocks and other ecosystem functions. REDD+ aims to transform the forests from being net emitters to net sinks. With Southeast Asia having the greatest potential for reducing emissions from avoided deforestation, REDD+ could generate sizable new financing for sustainable rural development and improved environmental management. REDD+ is expected to constitute a major new provision in any post-2012 climate agreement.

## Responses

ADB is supporting the region's sustainable forest management and conservation, as well as agricultural land-use improvements to promote soil carbon sequestration. This helps targeted member countries to prepare for and gain access to REDD+ and the emerging forest carbon market. Efforts focus on Indonesia, the countries of the Mekong Basin, Nepal,



• Forest in Manado, Indonesia

Papua New Guinea, the Philippines, Solomon Islands, and Vanuatu. Support is being programmed in coordination with other multilateral and bilateral programs, such as the Forest Carbon Partnership Facility, the UN-REDD Program, the Climate Investment Funds' Forest Investment Program, and the Global Environmental Facility.

### Jumpstarting REDD+

ADB has considerable experience relevant to enabling member countries to participate in REDD+ financing. The Forests for Livelihood Improvement Project in Viet Nam supports an investment of over \$90 million to prevent forest loss and degradation over more than three million hectares of forest. In Indonesia, ADB has provided technical assistance to the Ministry of Environment to design forestry-based Clean Development Mechanism (CDM) projects.

ADB is also supporting five pilot projects—two regional and three country-level projects—to develop member countries' experience with REDD+ approaches. The Biodiversity Corridors Initiative (BCI) in the Greater Mekong Subregion and the Heart of Borneo (HoB) Initiative focus on reducing deforestation and supporting the livelihood of forest communities. The Integrated Natural Resources and Environmental Management (INREM) will protect and restore biodiverse forest watersheds in the Philippines. The Jiangxi Sustainable Forest Ecosystem Development Project and the Forestry and Ecological Restoration in Three Northwest Provinces Project in the PRC are promoting sustainable forest management and enhancement of forest carbon stocks.

In 2010, ADB focused its support for these projects on establishing the baselines and methodologies for measuring and reporting changes in carbon sinks, as well as for verifying and reporting approaches for REDD+ and other norms required to generate financing from the voluntary and regulated forest carbon market.

### Facilitating Programmatic Forest Investments

ADB is also helping Indonesia and the Lao PDR to prepare forest investment programs that will promote transformational change in the forest sector or sectors driving deforestation. The CIF's Forest Investment Program has provided resources for each of these countries to develop their forest investment plans in coordination with multilateral development banks. The CIF is a multi-donor facility that presently supports

## ADB to help expand the markets for ecosystem services

Natural systems, such as forests, wetlands, and coral reefs, provide many important and economically valuable services that are rarely captured by markets. These ecosystem services continue to decline due to resource degradation often caused by weak property rights, perverse policies, and other market forces. Market-based mechanisms are currently being developed to sustain the provision of these services and the financing needed for the management of natural systems from which they are derived. These market mechanisms, broadly called payments for ecosystem services (PES), send the price signals for resource conservation and provide income opportunities for the poor.

To promote the expansion of markets for ecosystem services in Asia and the Pacific, ADB is implementing the regional technical assistance (RETA), Capturing Economic Benefits from Ecosystem Services. The RETA seeks to raise awareness of the benefits of PES in responding to environment and development goals, demonstrate related market and associated policy and institutional mechanisms for PES transactions in selected sites, and identify levers for incorporating PES into ADB investments. It is integrally linked to ADB's efforts to intensify the drive for sustainable natural resource use and management which, in turn, can significantly reduce emissions particularly in the agriculture and forestry sectors. The growth of PES in the region will also optimize the potentials of many member countries to gain from the emerging forest carbon market.







- Stone-mulch fields prevent erosion and promote crop growth in the dry areas of Gansu Province, the PRC

45 developing countries in piloting transformations in clean technology, sustainable management of forests, increasing energy access through renewable energy, and climate-resilient development.

### Improving Dryland Productivity and its Ability to Sequester Carbon

Across Central Asia, in the PRC, and in Mongolia, ADB is also financing dryland farming projects that, among other goals, aim to increase organic material in dry soils to improve land productivity and enhance the ability to sequester CO<sub>2</sub>. A project in Uzbekistan is advancing integrated land and water management in nine districts. Sustainable farming and improved environmental management practices are being introduced through a number of projects covering several provinces and the autonomous regions of Inner Mongolia, Ningxia and Xinjiang in the PRC, and the rangelands of Mongolia.

In coordinating the activities of the Central Asian Countries Initiative for Land Management (CACILM), ADB finances the CACILM Multi-Country Partnership Framework Support Project. CACILM is a multi-donor partnership initiated by ADB and the global mechanism of the United Nations Convention to Combat Desertification (UNCCD) in 2006. It works toward reversing land degradation that is endangering the livelihood of nearly 20 million rural people in Central Asia. Five countries—Kazakhstan, the Kyrgyz Republic, Tajikistan, Turkmenistan, and Uzbekistan—participate in CACILM.

### Greater Mekong Subregion (GMS) Core Environment Program is promoting CO<sub>2</sub> sequestration

Current CO<sub>2</sub> 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 GMS Biodiversity Corridors Initiative (BCI), ADB assists in efforts to sequester carbon in the economic corridors through enhanced conservation, reforestation, and afforestation while reducing poverty and promoting rural development and biodiversity conservation.

Currently, BCI supports investments in Cambodia, the Lao PDR, and Viet Nam totaling \$70 million. Targets under the current phase include improving the management of 2,280,000 ha of land in between protected areas in the three countries, training nearly 14,000 people from local to national levels, and increasing peoples' livelihoods by between 40%–55%. With support from ADB's Climate Change Fund, the potential to access global carbon market finance under the emerging REDD+ framework is also being explored.





# Promoting Climate-Resilient Development

## Issues

Over the past decade, Asia and the Pacific has experienced a rapid decline in income poverty, and social indicators have also improved. Asia is currently recovering from a major economic slowdown, although growth remains at a slower pace than before the crisis. However, as the region's development continues to be insufficiently inclusive, the threats posed by climate change will be overlaid on the deteriorating state of the environment, and will amplify the many faces of poverty and inequality.

More people are at risk from climate change in Asia and the Pacific than in any other region in the world. Those who are already the most economically or socially vulnerable, especially women and children, will suffer first, and most extensively. Failure to devise appropriate adaptation measures will result in severe social costs and threaten further progress in poverty reduction.

Achieving climate-resilient development involves responding to the physical, social, and economic impacts of climate change in all aspects of development planning and investment. Solutions will range from building the resilience of natural systems and the poor and vulnerable communities to alterations in infrastructure and technology that can maintain production in the face of climate-induced adversities. Improved urban planning and coastal protection require special attention. The extensive experience of the disaster risk management community, which encompasses many approaches applicable to climate change, should be tapped to fast-track integrated disaster and climate risk management responses.

## Responses

ADB supports country-driven adaptation programs in three primary ways: (i) by promoting the integration of adaptation and disaster risk reduction into national development plans and ADB country partnership strategies; (ii) by helping to build the resilience of



• Kampong Phluk, Cambodia



- Electricity is critical for many people's jobs

vulnerable sectors, such as agriculture, energy, transport, health, and water, including the preparation of climate-resilient sector road maps; and (iii) by assisting member countries in climate proofing projects to ensure their outcomes are not compromised by climate change and variability or by natural hazards. Priority is given to the least-developed countries and highly vulnerable segments of society.

### Assessing Climate Change Risks and Vulnerabilities

ADB has responded to the growing demand by member countries for assessment of climate change risks and vulnerabilities and adaptation options. For example, it assisted Sri Lanka in preparing sector vulnerability profiles that facilitated the development of the country's national adaptation strategy and climate change policy. It supported vulnerability and risk assessments in the agriculture sector of Viet Nam and Thailand, the upland river basins in the Philippines, the Citarum river basins in Indonesia, rural infrastructure in the Lao PDR, environment in Samoa, and key development sectors in Nepal. ADB also supported Central and West Asian member countries in the preparation of vulnerability and risk atlases that will feed into climate change policy and strategy formulation. It also assisted in the preparation of the climate risk profiles of the Cook Islands, the Federated States of Micronesia, and Palau.

Several groundbreaking climate impact and vulnerability studies have also been completed. Findings from these studies continue to enhance knowledge, and strategies and actions in building climate resilience across many countries. For instance, the *Economics of Climate Change in Southeast Asia* estimates the economic, environmental, and social costs of climate change impacts and presents a strong case for adaptation in key sectors of Indonesia, the Philippines, Thailand, and Viet Nam. The study, *Building Climate Resilience in the Agriculture Sector*, assesses the impacts of climate change on agriculture, food security, and health, and recommends additional

### ADB studies assist in developing least-cost response options

A number of studies have been undertaken by ADB to support the development of least-cost mitigation and adaptation options in Asia and the Pacific. Part 1 of the *Economics of Climate Change in South Asia* dealt with options for cleaner technologies. Part 2 of the study evaluates the costs and benefits of adaptation options.

The *Economics of Climate Change and Low Carbon Growth Strategies in Northeast Asia* assesses the impacts of climate change on health, agriculture, and water. ADB's technical assistance (TA) project, *Strengthening the Capacity of Pacific Member Countries to Respond to Climate Change* also includes a study on the *Economics of Climate Change in the Pacific*. A report on the ADB Institute's study on *Low Carbon Green Growth* is currently being finalized.

The *Economics of Climate Change in Southeast Asia: A Regional Review* was published in 2009. To enable adoption of the study recommendations, a TA project, *Strengthening Planning Capacity for Low Carbon Growth in Developing Asia*, is currently being undertaken. Parallel analyses are also being conducted in the Lao PDR, Indonesia, and Viet Nam on the investment and financial flows addressing climate change impacts in the water, agriculture, and energy sectors.





investments in agricultural research, irrigation improvements, climate-resilient rural infrastructure, health, and education. *Climate Risks and Adaptation in Asian Coastal Megacities* estimates the costs and presents adaptation options for Bangkok, Ho Chi Minh City, and Manila.

### Mainstreaming Climate Resilience in Core Development Planning

In Bangladesh, Cambodia, Nepal, and Tajikistan, as well as in the Pacific countries of Papua New Guinea, Samoa, and Tonga, ADB worked with other multilateral development banks in country-led processes to design Strategic Programs for Climate Resilience (SPCR). The SPCR will pilot and demonstrate ways in which climate resilience may be integrated into core development planning and implementation. Financed by the Pilot Program for Climate Resilience under the Climate Investment Funds (CIF), this is emerging as an important model for enabling the most vulnerable least-developed countries to achieve continued poverty reduction despite an adverse climate.

A \$110 million CIF financing of Bangladesh's SPCR was approved in early 2011. A subproject, the Climate Change Capacity Building and Knowledge Management, is under way to support information generation and dissemination, develop knowledge products, and operate an adaptation Information and Knowledge Management (IKM) network in Bangladesh. The country IKM network will feed into a global learning program that will synthesize knowledge and experience in climate resilience building.

The CIF has also approved preparatory financing for the SPCR of other countries, and at the regional level in the Pacific.

### Developing and Pilot-Testing Adaptation Tools and Methods

ADB has been developing adaptation tools and methods to help address the complexity and uncertainty of the factors that define climate risks and vulnerability, particularly at a project scale and in specific socioeconomic contexts. These tools and methods assist ADB project staff and those of member country partners to manage climate change risks throughout the project cycle. They include (i) a risk screening tool (RST) that enables rapid all-hazards risk assessment at project preparation stage; (ii) sector briefs on adaptation measures; and (iii) technical notes on "how to do climate proofing," assess climate risks, evaluate impacts and adaptation costs, and prioritize responses.

The RST was pilot-tested in Nepal in 2009. A review of the pilot experience revealed that the RST substantially increased the project processing teams' understanding of climate and disaster risks. The RST also proved to be a helpful, user-friendly tool for climate and disaster risk assessment, and for the identification of risk management and adaptation for measures.

The first in a series of technical notes, *Guidelines for Climate Proofing Investment in the Transport Sector: Road Infrastructure Projects*, was published in August 2011. The publication helps fill the gaps in guidance materials



• Rice planting in the Lao PDR



and information sources for climate proofing investment projects in the region. It discusses, in detail, the possible impacts of climate change on the transport sector and the adaptation options available, and presents a step-by-step presentation of a methodological approach to assessing climate vulnerabilities and adaptation needs and options. The preparation of similar guidelines for other sectors, including agriculture, energy, and water supply and sanitation, are under way.

A study to guide the integration of the health impacts of climate change into critical sectors was also completed in August 2011. The study, *Accounting for Health Impacts of Climate Change*, reveals four basic pathways through which climate change may affect health—water quality and quantity, food production, temperature increases, and extreme weather events. It presents a methodological approach for ensuring that the health impacts of climate change are taken into account in the design of projects in disaster risk reduction and in the water and agriculture sectors.

### Increasing the Climate Resilience of Vulnerable Sectors

In Asia and the Pacific, sectors at high risk from climate change include agriculture and natural resources, urban development, health, water resources, transport, and energy, especially hydropower. Member countries need help to develop the necessary policy, institutional, and investment responses for each of these sectors to ensure that adaptive measures are implemented, and resilience to climate impacts is improved. Integrated approaches within, as well as across, the different sectors must also be developed to ensure that multiple development benefits are delivered through climate change interventions.

Below are some examples of ADB's ongoing efforts to increase sector resilience and enhance the development effectiveness of its own and member countries' climate actions.

**Food security and agriculture.** ADB adopted a 3-year Operational Plan for Sustainable Food Security in Asia and the Pacific in 2010. Under the Plan, strategic investments focus on improved productivity and production, enhanced connectivity of key activities in the food supply chain, and increased resilience of food systems to shocks due to climate change and volatile food prices. Important measures related to climate change and food security include the generation and dissemination of knowledge products on good agronomic practices, adaptation and replication of postharvest technologies that minimize losses, provision



of adequate storage facilities especially during drought and flood situations, and scaling up of water-saving technologies and good water management. Continuing studies on climate variability and its impact on cropping patterns, structures of income and employment, and agriculture sector adaptation are being done.

Given the highly variable impacts of climate change on agricultural production across the region, ADB is also promoting the expansion of food trade from food-sufficient countries to food-insufficient ones as an additional measure to strengthen the resilience of the region's food supply. For example, ADB is supporting the ASEAN+3 rice trade initiative through which the 10 Southeast Asian countries plus Japan, the PRC, and the Republic of Korea have agreed to set up a permanent mechanism for an emergency rice reserve and an endowment fund to support its operation.

**Water resources management.** ADB is presently doing a study titled *Asia's Water Future: Issues and Options*. The study will provide (i) a macro view of the availability of accessible freshwater over the next 20 years; (ii) forecasts of the impact of water use policies and practices on food and energy production, and on industrial growth and domestic use, particularly in light of climate change and variability; (iii) a clear description of the economic value of these impacts on growth and development; (iv) issues of water governance, including the missing roles of the private sector and farm communities in policy formulation and regulation; (v) solutions for demand-side management, including the role of science and technology in maximizing efficiencies; (vi) business models for private investment and management; and (vii) effective intergovernmental collaboration for managing transboundary water resources.

Country water assessments are also being undertaken to specify the policy reforms that will be promoted. The central design feature in ADB's genre of water

## Integrating climate resilience into agriculture and water sector projects

Though varying in extent and timing, floods and droughts are expected to become more frequent and severe due to climate change. To address this likelihood, ADB has emphasized the integration of climate resilience building in the design of projects in the agriculture and water sectors.

In Bangladesh, the Second Crop Diversification Project is testing and disseminating climate-resilient high-value crop varieties, cropping patterns, and technologies that will ensure higher returns per hectare for the farmers in the southwest and northwest regions, which have some of the country's poorest people and least economically developed areas. The Participatory Small-Scale Water Resources Sector Project supports the development of inclusive and efficient water management cooperative associations that will engage in flood management, drainage improvement, water conservation, and command area development in 46 of the country's 61 districts. The recently approved Khulna Water Supply Project will ensure that the drinking water for the country's third largest city will not be jeopardized by the expected greater saline water intrusion due to sea-level rise. It will replace groundwater with surface water as the main source of water supply for the city, locate intake facilities in higher elevations, and build an impounding reservoir for freshwater storage.

In Cambodia, the Water Resources Management Sector Development Program will enhance water and food security through increased efficiency in irrigated agriculture, improved management of water resources, and the development of livelihood and payment for ecosystem services schemes.

In Nepal, the Community Irrigation Project develops and rehabilitates small irrigation systems to help farmers in poor communities adapt to long periods of drought. The project also fosters the devolution of the management of small irrigation systems to make them more responsive to varying conditions at the local level. Another project, the Emergency Flood Damage Rehabilitation, seeks to minimize the devastating impacts of floods and reduce flood risks by supporting capacity building and developing a flood forecasting system and early warning system in the Koshi River area.

In India, the Assam Integrated Flood and Riverbank Erosion Risk Management Investment Program will institutionalize comprehensive risk management systems to cope with critical water disasters in areas along the path of the Brahmaputra River. Benefiting 1 million people, the program will establish a sound planning framework and introduce innovative, cost-effective and sustainable riverbank protection measures. It will also support institutional development and capacity

building, and strengthen the participation of women and vulnerable groups in integrated disaster risk reduction.

In Indonesia, water resources management infrastructure and institutions in the Citarum River Basin (CRB) are being upgraded. CRB provides 1,400 megawatts of hydroelectric power, irrigates almost 400,000 hectares of agricultural land, and supplies 80% of Jakarta's water supply. Competition for CRB's resources has increased significantly over the last 20 years, causing acute water stress and depletion of aquifers. Climate change is compounding these stresses, and poses increasing risks to the health, livelihood, and disaster vulnerability of poor communities. Ongoing efforts will make CRB the first river basin in Indonesia to incorporate climate change resilience into integrated water resources management.

In Palau, the Water Sector Improvement Program is improving the resilience of the country's water resources by creating and strengthening of the Palau Water and Sewer Corporation that will also enable significant efficiency improvements. The program also seeks to provide a safe, reliable, and sustainable water supply and sanitation services while reducing nonrevenue water from the baseline of 43% to less than 25% by 2015.

In arid Central Asia, ADB is helping member countries address anticipated future climatic conditions by developing adaptation measures that include drought-resistant crops, improvements in irrigation efficiency, integrated water resources management, rehabilitation of degraded forests and pasturelands, and watershed protection.

A study on the impacts of glacial melt on the Indus-dependent water and energy resources has recently been completed, and recommendations are being finalized to deal with the competing irrigation, water supply, and hydropower demands likely to be amplified by climate change. Risk management measures and harmonization of adaptive policies and practices will also be promoted in countries sharing the Indus River, including Afghanistan, India, and Pakistan.







- Efficient water use will help address the worsening water scarcities associated with climate change

projects and programs for the next 10 years is efficiency gains. While ADB is still finalizing its Water Operational Framework for 2011–2020, efforts are continuing to assist member countries in building the resilience of their water resources.

**Urban development.** ADB's proposed Urban Operational Plan (UOP) will focus on the 3E agenda of improving the environment, economy, and equity in Asia's cities. The UOP will present an approach to realize the objectives of Strategy 2020: Promoting Livable Cities and Addressing the Urban Infrastructure Deficit. To reduce the carbon footprint of Asia's cities and improve urban quality of life, ADB will assist member countries in designing and implementing environmental improvement, climate change mitigation and adaptation and pro-poor urban renewal projects. Provision of sustainable infrastructure for inclusive growth will be vigorously pursued.

Working toward the achievement of the 3E agenda will require different structures for project preparation and finance. Greater private sector participation is needed. ADB is poised to take its urban operations into new climate-related investment areas and partnerships with the private sector in the years ahead.

**Climate proofing projects.** ADB has been climate proofing infrastructure projects right away at preparation stage. This has enabled the integration of resilience measures in project design and implementation, and in the operation and maintenance phase.

For example, the engineering and construction designs and materials of the highly complex Padma Multipurpose Bridge, Bangladesh's longest bridge, are being adapted to the recurrent flooding, siltation, and riverbank erosion likely to be amplified by climate change. Engineering adjustments, capacity building and information generation, and environmental and green planning are being done to climate proof Cambodia's Rural Roads Improvement Project.

In the Sustainable Rural Infrastructure Development Project in the Northern Mountain Provinces of Viet Nam, pilot subprojects are being implemented to demonstrate cost-effective approaches for increasing the climate resilience of rural infrastructure, including design modifications to address the need for maintaining the ecological and hydrological functions of the watersheds, and capacity development for risk planning and knowledge management. Climate proofing the Second Solomon Islands Road Improvement Project has entailed engineering and construction adjustments; the selective relocation of roads to avoid flood risks; the establishment of maintenance procedures involving the communities in labor-based, equipment-supported techniques; and capacity development, including a community education and awareness campaign on environmental practices that will support the upkeep of the project.

In Timor-Leste, climate proofing the Road Network Development Sector Project has involved engineering and bioengineering adaptation measures, including the construction of earthen levee banks with "riprap" protection for coastal roads at risk of erosion from extreme waves and the reforestation or revegetation of unstable slopes in the mountainous agricultural areas.





### Protecting biodiversity and critical ecosystems.

ADB continues to play a major role in protecting biodiversity and critical ecosystems, particularly those straddling national boundaries. In addition to the Core Environment Program and Biodiversity Corridors Initiative, both in the Greater Mekong Subregion, and the Heart of Borneo Initiative encompassing Malaysia, Indonesia, and parts of Brunei Darussalam, ADB facilitates regional cooperation and programming to protect the Coral Triangle, the Amazon of the Seas. The Triangle has the richest marine biodiversity, harboring 75% of all known coral species, more than half of the world's reefs, 40% of the world's coral reef fish species, and six of the world's seven species of marine turtle. It also supports the largest tuna fishing industry in the world that generates billions of dollar in global income each year, and provides livelihood and food security for an estimated 120 million people.

ADB has five projects under the Coral Triangle Initiative, cofinanced by the Global Environmental Facility (GEF). These are focused on regional cooperation on knowledge management and policy and institutional development, management of coastal and marine resources in the Coral Triangle of the Pacific and Southeast Asia, and integrated water resources management of the Agusan River Basin in the Philippines.

ADB has also provided continuing support to country-level initiatives on biodiversity conservation and ecosystem strengthening. Most recent projects supported by ADB, with cofinancing from the GEF, include Indonesia's Citarum Watershed Management and Biodiversity Conservation Project; and the PRC's Integrated Ecosystem Management and Environmental Protection of Baiyangdian Lake Catchment, and Forestry and Ecological Restoration Project in Three Northwest Provinces (formerly Silk Road Ecosystem Restoration Project).

### Addressing Social Dimensions

Climate change actions, particularly those promoting adaptation, are about helping people cope with increasing threats to their livelihood, health, safety, and well-being. This must include adequate attention to the needs and participation of the poor, especially women, children, the elderly, and indigenous peoples.

**Women.** Recognizing that despite constraints, women are active climate change adaptation agents, ADB has supported member countries' initiatives to enhance women's participation in climate actions. A new project, Improving Gender-Inclusive Access to Clean and Renewable Energy in Bhutan, Nepal, and Sri Lanka, will increase access by poor rural women to



- Clean, accessible water has changed lives in Parsa, Nepal



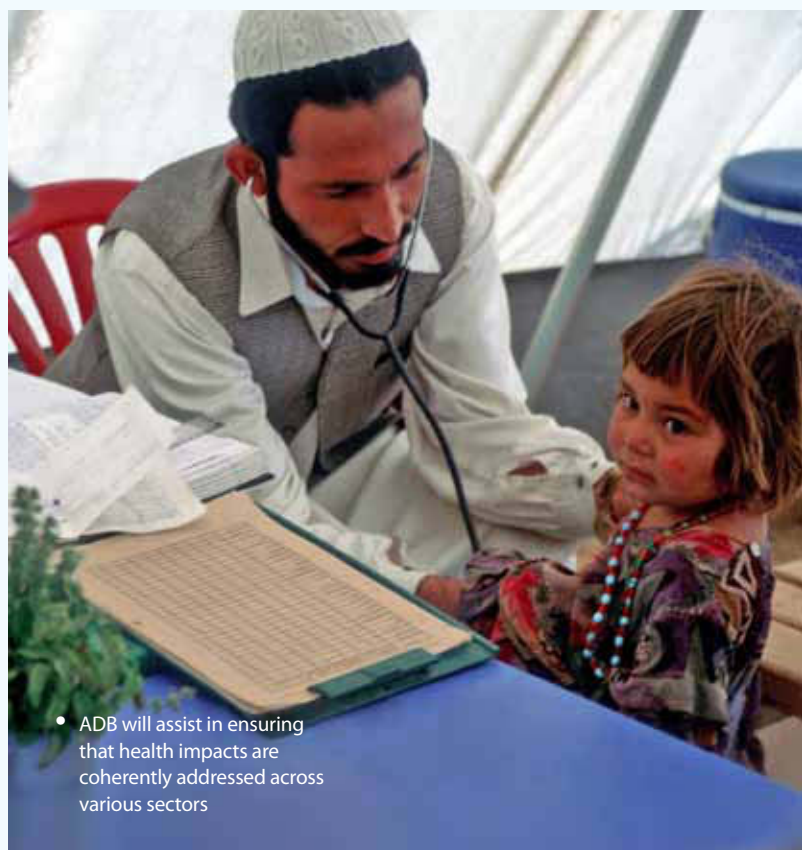
- ADB supports initiative to enhance women's participation in climate actions

affordable and reliable clean and renewable energy sources and technologies. The ADB-supported GMS bioenergy project and Viet Nam biogas project provide alternative fuels and stoves in remote, poor rural areas. The Cambodia Rural Roads Improvement Project, the GMS Biodiversity Conservation Initiative, and the Lao PDR's Rural Access Improvement Projects are increasingly involving women in agroforestry and other livelihood activities. Taken together, these projects strengthen the adaptive capacity of women by providing them with more income and employment opportunities, as well as by improving their health through reduced workloads and the development of less polluting fuel, cooking, and energy sources.

**Health.** Building on the findings from the study, *Accounting for Health Impacts of Climate Change*, ADB will actively promote the integration of health in the design of projects in the agriculture and water sectors, as well as in disaster risk reduction. ADB will also foster close collaboration between the relevant ministries and agencies of partner governments to ensure that the health impacts of climate change are coherently addressed across the various sectors where they are likely to emerge. It will also incorporate the findings and recommendations of the study into the ADB agriculture and water adaptation sector briefs presently being developed.

**Migration.** The scale and scope of climate change-induced migration, according to ADB's study, *Climate Change and Migration in Asia and the Pacific*, cannot be presently specified. However, it is possible to identify the areas likely to be affected. In-depth research on migration is now being done by ADB.

Policy options will be drawn up to address causes and consequences, and harness the potential of migration as an adaptation measure. Institutional, capacity, and resource gaps will be identified. Cross-country policy dialogue and cooperation will be promoted to develop regional preparedness in addressing climate-induced migration and reducing associated risks, including the worsening of existing pressures on infrastructure and services, economic displacement, and social conflict.



- ADB will assist in ensuring that health impacts are coherently addressed across various sectors



# Strengthening Policies, Governance, and Capacities

## Issues

Countries in the region have pledged to reduce their levels of GHG emissions as precursors to nationally appropriate mitigation actions (NAMAs) that are expected to be recognized under the post-2012 climate regime. Likewise, all of ADB's least-developed member countries have prepared their national adaptation programs of action. Having such plans in place, including measurable results, will facilitate access to financing. Much policy, governance, and institutional strengthening is needed to translate these plans and pledges into action. Many member countries have requested ADB's assistance in refining their policies, building the necessary capacities, and identifying the substance and financing needed to implement them.

## Responses

ADB makes use of its development policy and poverty reduction dialogue—as well as targeted policy and institutional interventions—in member

countries to support the integration of climate change considerations into development plans and actions, including ADB's own regional and country partnership strategies. Through regional cooperation activities, ADB has been working with member countries to address transboundary issues or share experience in tackling common challenges. The private sector's role in addressing climate change continues to be enhanced and better integrated into ADB's climate actions.

## Integrating Climate Change into Country Partnership Strategies

Country partnership strategies (CPSs) align ADB's assistance with the development needs and priorities of its member countries. A review of the 16 CPSs updated in 2008–2010 reveals that all identify climate change as a development issue, and half are responding to country-specific adaptation needs, including the PRC, Cook Islands, Kiribati, Nepal, Palau, Sri Lanka, Tajikistan, and



- ADB integrates climate change considerations into development plans and actions



- ADB works with other multilateral development banks and agencies



Vanuatu. While the climate change interventions outlined in each CPS respond to the unique needs and capabilities of each member country, climate change is addressed as a cross-cutting concern in all the new CPSs.

ADB's target to update the CPSs of 16 more DMCs in 2012 will provide ADB with an avenue for further enhancing climate change mitigation and adaptation in its country operations.

### **Improving the Capacity of Member Countries to Respond to Climate Change**

ADB provides technical assistance to support the efforts of national and local governments in building adaptive capacity, as well as to assist in policy development and strengthening institutional capacity for climate change.

In the Lao PDR, for example, ADB helps design appropriate adaptation strategies and enhance the resilience of rice farmers and rural infrastructure in five southern provinces. In Bangladesh, ADB provided a grant for the project, Supporting the Implementation of the Bangladesh Climate Change Strategy and Action Plan (BCCSAP). The project has developed a road map for building BCCSAP implementation capacities within the Ministry of Environment and Forests and other line agencies, including for project preparation, and policy and strategy formulation.

In Nepal, the project, Strengthening Capacity for Managing Climate Change and the Environment, supports the training of government officials and other stakeholders, the design of a funding mechanism

for environmental management, the preparation of a community-based vulnerability assessment and adaptation planning tool, the formulation of action plans to mainstream climate change and environmental management in subnational administrations, and public education and awareness activities.

In Sri Lanka, ADB's assistance in developing the national adaptation strategy has also improved technical and institutional capacities for designing projects to implement the strategy. Project preparation efforts are ongoing in several line agencies on a portfolio of priority projects that were identified under the strategy.

Pacific developing member countries' capacities also continue to be enhanced under the projects, Strengthening the Capacity of Pacific Member Countries in Climate Change, and the Regional Partnerships for Climate Change Adaptation and Disaster Preparedness. Continuing policy development, climate change institution building, and capacity enhancement among Central and West Asian member countries are also being supported under the project, Enabling Climate Change Interventions in Central and West Asia.

### **Enhancing Knowledge Exchange and Regional Cooperation on Climate Change**

Due to its relative newness in the development arena, knowledge gaps continue to exist in the various aspects of adaptation, especially in the design and implementation of programs and projects. To help fill these gaps, ADB joined the UN Environment Programme, the Japan International Cooperation

Agency, and other donor agencies in setting up the Asia Pacific Adaptation Network (APAN) in October 2009. APAN assists in building climate resilience in vulnerable human systems, ecosystems, and economies by mobilizing knowledge and technologies for adaptation capacity building, policy setting, planning, and practice.

ADB's technical assistance for APAN is focused on identifying country-specific needs for adaptation knowledge, and improving the availability and accessibility of this knowledge through the production and dissemination of good adaptation practices, knowledge sharing and joint learning activities, and an online mechanism. APAN is the newest of several climate change-related knowledge networks and hubs supported by ADB, which also include the Climate Change Knowledge Hub in the PRC; the Clean Energy Knowledge Hub in India; the 3R (Reduce, Reuse, Recycle) Knowledge Hub in Thailand; and the Water Knowledge Hubs in multiple locations.

ADB also harnesses the potential of existing regional economic cooperation programs and platforms to enhance regional cooperation on climate change. The Central Asia Regional Economic Cooperation (CAREC) Program enables eight member countries—Afghanistan, Azerbaijan, the PRC, Kazakhstan, the Kyrgyz Republic, Mongolia, Tajikistan, and Uzbekistan—to discuss transboundary issues especially on water, and to incorporate climate change in the development of CAREC's economic and transport corridors.

Regional cooperation on climate change is remarkably high in the Greater Mekong Subregion (GMS) because of the implementation of the Core Environment Program/Biodiversity Corridors Initiative (CEP/BCI) that among other things is working to develop a North–South Carbon Neutral Transport Corridor. Risk and adaptation assessment of the BCI pilot sites and the agriculture sector, the enhancement of co-benefits from ecosystem restoration, poverty reduction, and community-based preparedness for climate change are among the other key activities supported by ADB in the GMS.

Within the Brunei Darussalam–Indonesia–Malaysia–Philippines East ASEAN Growth Area, ADB is assisting with the design of a regional environmental program that will develop the capacities of member countries and support regional efforts toward strengthening the climate resilience of vulnerable ecosystems. ADB also coordinated the preparation of the Coral Triangle Initiative that was recently approved for co-financing by the Global Environmental Facility.

In the Pacific, ADB participates in various subregional forums and discussions, for example, the Pacific Climate Change Roundtable, to enhance and coordinate with other initiatives its subregional climate change programs.

### **Pacific developing member countries prepare national and regional hazard and vulnerability databases**

Many island countries in the Pacific have not been able to hedge against disasters because insurance against such events has been either unavailable or prohibitively expensive. 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 World Bank and ADB are working together to establish mechanisms to help Pacific developing member countries mitigate financial risk from the impacts of major natural disasters, and help finance natural disaster recovery. ADB's Regional Partnerships for Climate Change Adaptation and Disaster Preparedness Project assists with 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 disaster risk reduction and will be critical to the future development of a Pacific regional catastrophe insurance scheme.





# Modalities

## Mobilizing and Innovating to Meet Financing Needs

ADB can help mobilize and channel public funds to its developing member countries, facilitating significantly increasing flows of private capital into low-carbon and climate-resilient investments. The global carbon market is expected to further expand, and ADB will step up efforts to help developing countries in Asia and the Pacific gain access to these resources.

By 2030, estimated financing needs of developing countries for climate change mitigation will exceed \$100 billion per year, with adaptation costs in the range of \$75 billion–\$100 billion per year (World Bank 2009). Current international financing mechanisms and commitments will be inadequate to meet this demand.

Developed countries have pledged to fast-track resources of \$30 billion a year from 2010 to 2012, with a further target of \$100 billion per year by 2020.

ADB will scale up its own financing, and will assist member countries in accessing additional public concessional funds while ensuring that they make the most of private finance. ADB will also continue to develop new carbon finance products and increase the flows of carbon funds to the region, especially the least-developed countries. ADB will work with contributing countries and institutional investors to develop climate-related debt instruments that can provide attractive, socially responsible fixed-income investments. With its growing track record in clean-energy private equity funds, ADB will seek to address “capital gaps” by supporting clean

• Ngermeaus, Rock Islands, Palau



energy infrastructure development and early-stage venture capital funding. ADB also plans to provide risk mitigation products and guarantees to help address the risks associated with climate change investments. Finally, more effective and proactive disaster risk management financing will be developed as an important element of adaptation efforts.

### Generating and Disseminating Knowledge

Strong technical assistance programs in the sectors to be most affected by climate change will be used as platforms for developing and disseminating knowledge about effective responses to climate change. As a fundamental development concern, there is a continuing need to improve understanding of the region and country-specific challenges and opportunities presented by climate change.

ADB has supported numerous regional and country studies on climate change. While broader analysis will continue, increased emphasis will be placed on developing guidelines for key sectors, covering mitigation and adaptation actions. This will strengthen understanding of how to achieve synergies across the five priority areas for ADB intervention. Project designs for traditional sectors of ADB support will be developed focusing on transport and other sectors that clearly show the benefits of incorporating climate change considerations. ADB will also continue to meet demands for timely knowledge, policy advice, and capacity enhancement in member countries on climate change issues and concerns.

### Fostering Partnerships

Partnerships are essential to meet gaps in ADB's own capacity, and they are particularly crucial in furthering regional cooperation on climate change. ADB will continue to work closely with multilateral and bilateral partners, government, the private sector, and civil society to expand capacities and outreach in achieving climate change objectives.

Existing partnerships for financing—such as the Climate Investment Funds, Clean Energy Financing Partnership Facility, Water Financing Facility, Urban Financing Partnership Facility, and Poverty and Environment Fund—will be strengthened, and new ones will be formed.

Partnerships for continued enhancement of program design, implementation, and monitoring and evaluation of results ensuring the participation of all the key stakeholders will also be continually built and nurtured.

Partnerships for knowledge development and dissemination involving the academe and research institutes supported by knowledge hubs will continue to be established and enhanced.

ADB also looks forward to nurturing close ties with communities and local governments who will be its most important partners particularly in climate change adaptation efforts.



- Contractors and consultants examine an outline of the proposed route of a new railway in Uzbekistan



# Looking Ahead

Countries in Asia and the Pacific are moving aggressively to address climate change. With the most populous and fastest-growing economies in the world, countries of this region understand the urgency of stabilizing the global climate to their continued economic growth. It is clear that continued poverty reduction will be severely hindered unless extreme climate change is mitigated and without proactive attention to help the most vulnerable communities adapt to already unavoidable impacts.

As country and regional partners become more engaged with one another to respond to climate challenges, organizations, such as ADB, stand at a critical juncture. Scientists say that the next 10–20 years will make or break global efforts to control atmospheric concentrations of greenhouse gases. In addition to supporting emerging regional climate regimes, continued cooperation with 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 member countries 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 will be done by advancing initiatives in coordination and partnership with others, communicating good practices and lessons learned, and catalyzing private sector capital, both in the form of start-up venture capital and longer-term climate-friendly development bonds and funds.

The Climate Investment Funds (CIF) are continuing to evolve as an important model for future financing. With \$4.3 billion in cofinancing from the CIF's clean technology window or the CTF, plans are now in place to mobilize \$36 billion more for country-led, low-carbon growth—from various sources, including the private sector. Thirteen countries worldwide, including Indonesia, Kazakhstan, the Philippines, Thailand, and Viet Nam in ADB's region, are participating in this massive clean technology investment drive. Programs in Bangladesh, Cambodia, Nepal, Tajikistan, and a regional effort in the Pacific will bolster adaptation

- Forest in mountainous Himachal Pradesh, India





• Lahendong geothermal power plant in Manado, Indonesia

actions with more than \$500 million from the Pilot Program for Climate Resilience of the CIF. Also under the CIF, more than \$100 million will be mobilized to support reducing emissions from deforestation and land degradation in Indonesia and the Lao PDR. Through the \$120 million Future Carbon Fund, ADB is also providing opportunities for its member countries to take advantage of the carbon market well beyond 2012, paying up front for anticipated post-2012 carbon credits to help projects fill their financing gaps.

Another area in which ADB is financing innovation is clean energy access. With 800 million people in the region lacking access to electricity, it is imperative that energy access be addressed. Options are improving

to ensure that such power is supplied through low-carbon means so that both development and climate change goals can be achieved.

On adaptation, ADB will continue to develop regional, national, and local responses to the adverse impacts of climate change. Among the highest priorities are to strengthen cooperation between disaster risk management and climate change responses to increase sector resilience and climate-proof projects, and work with scientific partners and governments to make local climate impact prediction more practically useful. ADB will support more downscaled and dynamic climate modeling and regional data sharing to improve water resource management in climate hotspots. It will also support emerging areas of interest, such as climate-induced migration, gender and climate change, community-based approaches to building climate resilience, and private sector-based instruments such as insurance products.

In all these efforts, ADB welcomes partnerships with both developed and developing nations, as well as with leading institutions around the world. ADB is 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 support continued poverty reduction and long-term prosperity.

ADB Climate Change Team  
November 2011



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## **ADB Climate Change Programs: Facilitating Integrated Solutions in Asia and the Pacific**

Over the past decade, Asia and the Pacific has made significant progress in achieving the Millennium Development Goals. However, accelerating climate change is threatening to reverse these gains, and those who are already economically and socially vulnerable are likely to suffer soonest and most. To enable member countries cope with the inevitable impacts already locked into the climate system, as well as to transition them to low-carbon economies, the Asian Development Bank (ADB) is working with urgency to put in place integrated solutions that will address both the causes and consequences of climate change in the region.

In 2009 to August 2011, ADB's climate change-related interventions span a total of more than 110 projects, involving an investment of about \$10 billion. During the same period, ADB has also provided more than \$245 million in technical assistance to improve knowledge and capacities, support policy and institutional development, and ensure the feasibility of investments related to climate change.

### **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 reduce poverty and improve the quality of life of their people. Despite the region's many successes, it remains home to two-thirds of the world's poor: 1.8 billion people who live on less than \$2 a day, with 903 million struggling on less than \$1.25 a day. ADB is committed to reducing poverty through inclusive economic growth, environmentally sustainable growth, and regional integration.

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

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