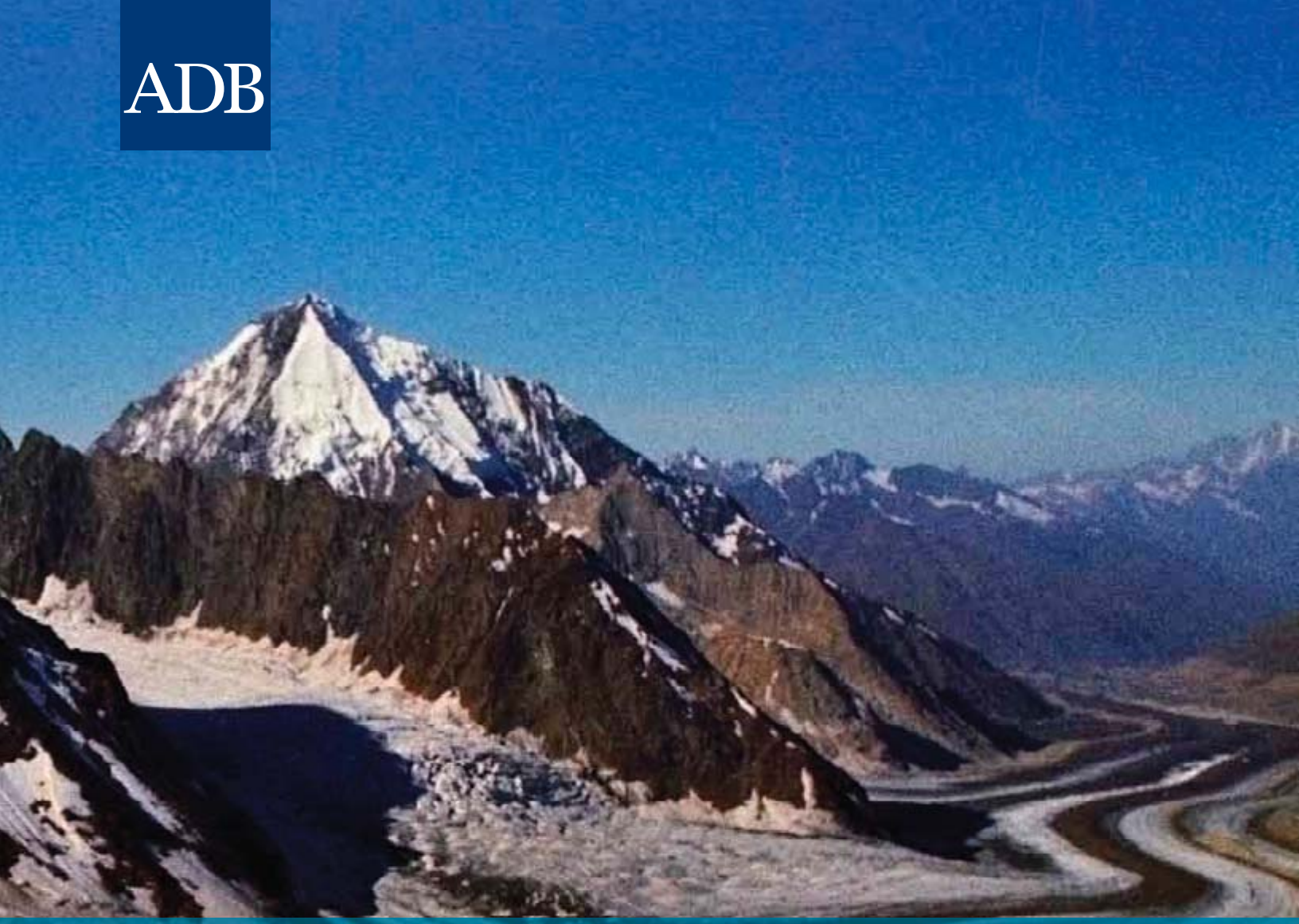
ADB



Climate Change in Central and West Asia

Routes to a More Secure, Low-Carbon Future

Asian Development Bank

Contents

For more information about the Central and West Asia Climate Change Program, contact

Peter Hayes
Senior Climate Change Specialist
Central and West Asia Department
phayes@adb.org

Robert Dobias
Senior Adviser, Climate Change Program Coordination Unit,
Regional and Sustainable Development Department
rjdobias@adb.org

Some photographs for this brief are from ADB's *Central Asia Atlas of Natural Resources*. The atlas brings readers a sense of Central Asia's beauty and wealth, the issues that the people of its five countries face in using and conserving natural resources, and efforts taken toward sustainable development.

Photo credits: Front cover, Ratushenko; Page: 1, Garth Willis; 2, Corbis ; 3, Michael Barrow; 4, Ian Mcilwrath; 5, Ratushenko; 6, Ibrahim Nassar Al-Nassar; 7, Ian Gill; 8, Maria Golovnina; 9–11, Christopher Herwig; 12, Jim Hutchison; 13, Michael Barrow; 14, Inna Mkhitaryan; 15, Ma. Adora Deguito; 16, Manana Kochladze, courtesy of CEE Bankwatch; 17, Maria Golovnina; 17, Ian Gill; 18, Jim Hutchison; 19, Ian Gill; 20, Korytnikov Stanilav; 21, Kayuyoshi Nomachi.

FOREWORD

The vast landmass of Central and West Asia is spectacularly diverse. With thousands of glaciers and numerous deserts, grasslands, and river basins, it is rich in natural resources and cultural heritage. However, this largely arid and semiarid region is at serious risk from climate change impacts, which threaten ecosystems as well as economies and infrastructure that depend on natural resources, especially water supply. These changes could undermine the hard-won gains of recent decades, making it more difficult to achieve development goals and improve the lives of many vulnerable communities.

This booklet identifies the emerging challenges, but it also highlights how partnerships and innovative forms of financing and investment can help countries reduce greenhouse gas emissions and adapt to climate change. It describes how the Asian Development Bank (ADB) is supporting the efforts of member countries to achieve low-carbon growth and become more resilient to climate change extremes and variability. It also highlights the potential of regional initiatives such as the Central Asia Regional Economic Cooperation Program (CAREC) and the Central Asian Countries Initiative for Land Management (CACILM).

This booklet was produced by the Central and West Asia Department, Safeguards and Natural Resources Unit, with support from the Regional and Sustainable Development Department and the Department of External Relations. I express my appreciation to ADB staff members and our developing member country partners in Central and West Asia, who are working closely together to face the enormous challenges posed by climate change.

We look forward to deepening these partnerships and commitments to meet urgent development needs in our region and beyond, in this climate-changing world.

Juan Miranda
Director General
Central and West Asia Department

What ADB is Doing

Central and West Asia already sees the effects of climate change, which will, if nothing is done, continue to destabilize ecosystems and hamper economic activities that depend on the natural environment.

ADB is working closely with its developing member countries to help them reduce carbon emissions while also making their economies more resilient to future climate change. Throughout Asia and the Pacific, ADB is integrating climate change mitigation and adaptation into all its development activities, and has made climate change a core operational area in its long-term strategic framework for 2008–2020 (Strategy 2020).

ADB has five strategic priorities:

- Expand the use of clean and renewable energy.
- Encourage sustainable transport and urban development.
- Manage land use and forests for carbon sequestration.
- Promote climate-resilient development, especially in water-dependent sectors.
- Strengthen policies, governance, and capacity.

ADB is also strengthening its collaboration with development partners to mobilize further resources for the environment, which include the Clean Energy Financing Partnership Facility, the Water Financing Partnership Facility, and the Climate Investment Funds.

Consequences of Climate Change

Geographically spectacular, Central and West Asia has breathtaking mountain passes, vast deserts and grasslands, and three grand, glacier-fed river basins: the Amu Darya, the Indus, and the Syr Darya. The region has lower greenhouse gas emissions than more developed parts of the world, but this is changing because of economic growth fueled by abundant oil, gas, and mineral reserves.

Central and West Asia is also exposed to climate change largely caused by greenhouse gases produced elsewhere. Its culturally diverse population relies heavily on fragile land and water resources, and taps the region's river basins to the extreme—for agriculture, for energy sources, and for production of goods for trade. This intensive use, compounded by numerous sociopolitical and economic issues, makes the region highly vulnerable to climate change.

Water

Cycles of Boom and Bust for Hydropower and Agriculture

In arid and semiarid Central and West Asia, arguably the most vulnerable natural resource is water. The Intergovernmental Panel on Climate Change (IPCC) predicts that warmer temperatures, combined with evaporation and glacial melt, will put the region's dry lands under increasing stress, so that by 2040–2050 the available water resources will have decreased by 10%–30%—threatening both the Amu Darya and Syr Darya basins. Glacier retreat and changing rainfall patterns will alter water cycles, lessening the potential to generate hydropower and irrigate fields. But the effects are unlikely to be uniform: Central and West Asia will probably go through a cycle of water boom and bust. Early in this century, as glaciers melt, water flows will increase, resulting in flooding and riverine erosion. But once these glaciers substantially retreat, the region will have considerably less water and likely experience more frequent droughts—threatening agricultural production, food security, and health as well as hydropower generation and economic output.

• The Toktogul reservoir, the Kyrgyz Republic

Glacial and Snow Pack Melt

Reduced Water Supply and Greater Risk of Floods

As a result of climate change, glaciers are retreating across Asia, but in the Himalayas they are receding faster than anywhere in the world. The International Centre for Integrated Mountain Development says that small glaciers less than 5,000 meters above sea level will probably disappear by the end of the century. Glacial melt will also make the weather more variable and extreme, affecting ecosystems, energy generation, and agriculture. It may also increase the risk of flash floods, mudslides, lake outbursts, and riverbank erosion.

In the Kyrgyz Republic and Tajikistan, glaciers in the Pamir and Tien Shan mountain ranges are retreating, and ongoing glacial melt continues to threaten water resources in the Amu Darya and Syr Darya river basins. In Afghanistan and Pakistan, glacial thinning is accelerating in the Hindu Kush mountain range, where over the past 50 years about 30% of glaciers have melted. This has resulted in the formation and enlargement of dangerous melt-water lakes whose collapse has already caused catastrophic glacial lake outburst floods that have devastated critical infrastructure investments and communities downstream.[1]

[1] Zoi Environment Network. 2009. *Climate Change in Central Asia: A Visual Synthesis*. Geneva.

• The upper reaches of the Zeravshan, Tajikistan

Ecosystems

Mountains and Grasslands Under Stress

The ecosystems of Central and West Asia face multiple threats—a combination of global warming and drying along with the effects of human activities, including pollution and overexploitation of resources. This is destabilizing the mountain ecosystems of the Hindu Kush, Karakoram, Pamirs, and Tien Shan, upsetting the delicate equilibrium between the land, the plants, and the communities that depend on them. Grasslands too are under strain: by the middle of this century natural grassland coverage and grass yields in Central Asia are projected to decline by 10%–30%. This could have serious consequences for human health since changes in ecosystems can increase the incidence of certain diseases: in Tajikistan, for example, a 1 degree Celsius increase in average air temperature since the mid-1980s has been accompanied by increased rates of malaria.[2]

[2] UNDP. 2007/2008. *Human Development Report, Central Asia*. New York.

• Houbara bustard of Central Asia

• Roads around Osh, Kyrgyz Republic, being upgraded with ADB assistance

Transport

Infrastructure Vulnerable to Extreme Weather

Climate change is also harming regional and transboundary trade. Roads can be affected by fluctuations in temperature and precipitation: they can be damaged by too little water, or can be destroyed or rendered impassable by flooding. Bridges and other forms of critical transport infrastructure can also be damaged by more intense storms and heavier rainfall. Infrastructure that is inefficient or unreliable not only disrupts the flow of goods and people but also increases the consumption of transport fuel, further contributing to greenhouse gas emissions.

Energy

Hydropower Output Reduced by Erratic Water Flows

Many countries in Central and West Asia depend on glacial melt in the Tibetan Plateau for water flows for hydropower. The capacity of the installed hydroelectric stations of Central and West Asia's rivers has been evaluated at 4,037 megawatts (MW) in Tajikistan; 2,910 MW in the Kyrgyz Republic; 2,248 MW in Kazakhstan; and 1,420 MW in Uzbekistan.[3] Now climate change is making these flows more unpredictable and threatening downstream energy generation. At the same time, rising surface temperatures are also leading to increases in energy consumption, for example, through greater use of air conditioning and increases in water pumping. There are also political implications since changes in river flows, combined with poor water management, are aggravating conflicts over transboundary water and energy resources.

[3] Saghit Ibatullin. 2009. Water-energy research and dialogue within Central Asia. Energy Sector Coordinating Committee Meeting. Almaty.

• A hydropower plant in Tajikistan

Agriculture and Food Security

Falling Crop Yields

Climate change has serious implications for food production. As temperatures rise in the arid and semiarid areas in Central and West Asia, rainfall is expected to decline and become increasingly erratic, and water resources are likely to dry up. As the climate becomes ever more variable and extreme, the region will become increasingly desertified. Drier springs and summers will also increase the demand for irrigated water and heighten the stress on remaining water resources. At the same time, higher temperatures, longer growing seasons, and more frequent extreme climate events could result in increased populations of agricultural pests.

Warmer temperatures and elevated levels of carbon dioxide may also affect plant ecology, altering the competitive dynamic between crops and weeds. In some agricultural zones, climate change is likely to make the northern areas more productive while making other areas less productive—with serious implications for livestock and agriculture.

Falling crop yields are already adversely affecting the economies of Pakistan and Uzbekistan. And by 2050, Kazakhstan, which is a major wheat producer, may see significant decreases in productivity. Even greater decreases are predicted for Armenia, Pakistan, and Tajikistan.

This will have serious implications for human development. Several Central and West Asian countries also face severe poverty and food insecurity, and six countries already have a high incidence of undernourishment.

• Farms in Afghanistan

Five Policy Priorities

To face the challenges and risks posed by climate change, ADB will do the following:

Expand the Use of Clean and Renewable Energy

More than half of greenhouse gases in Asia and the Pacific come from the generation and use of energy. ADB is curbing the growth in energy demand by increasing energy efficiency and meeting energy needs through low-carbon options. It targets business, industry, and residences, at both national and municipal levels.

ADB is developing a range of partnerships with industry associations, domestic banks, specialized energy efficiency agencies, and energy service companies. To help countries meet their electricity needs, ADB is upgrading systems for transmission and distribution and promoting the use of renewable energy.

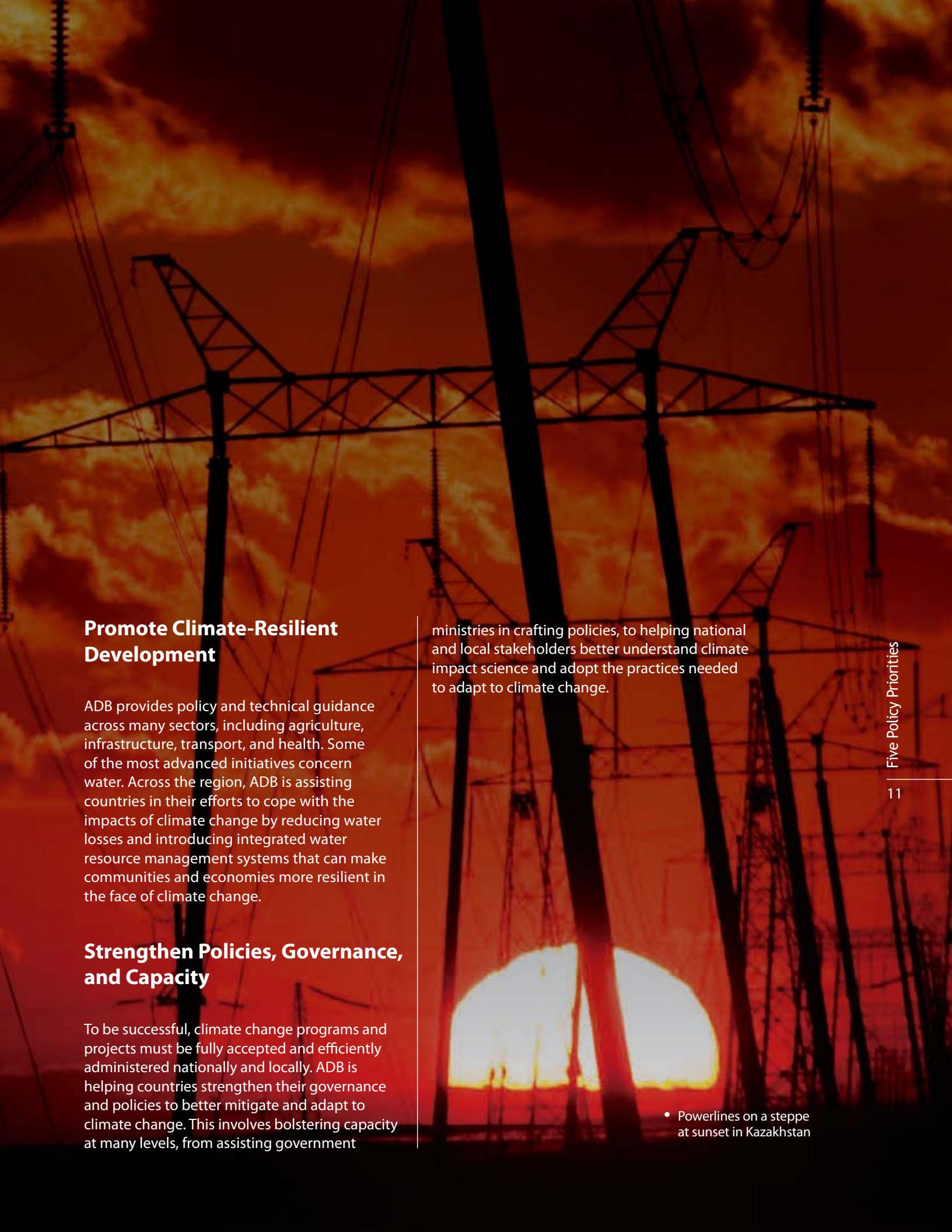
Encourage Sustainable Urban Development and Transport

ADB promotes "livable" cities that have lower carbon footprints by increasing the proportion of green space, ensuring energy-efficient buildings and water supplies, and reducing emissions of greenhouse gases from waste disposal. ADB is also helping developing member countries design sustainable transport policies. For example, the Sustainable Transport Initiative promotes investments in low-carbon, safe, and affordable systems.

Manage Land Use and Forests for Carbon Sequestration

Among the most cost-effective ways of reducing greenhouse gas emissions are measures to improve the management of forests and agricultural land. ADB is helping countries gain access to climate financing in exchange for better management of these resources.

Countries can also mitigate and adapt to climate change by improving agriculture and forestry practices. ADB is providing countries with integrated technical assistance and lending that helps people protect their livelihoods from climate impacts while supplementing their incomes with new sources of revenue from carbon sequestration.



Promote Climate-Resilient Development

ADB provides policy and technical guidance across many sectors, including agriculture, infrastructure, transport, and health. Some of the most advanced initiatives concern water. Across the region, ADB is assisting countries in their efforts to cope with the impacts of climate change by reducing water losses and introducing integrated water resource management systems that can make communities and economies more resilient in the face of climate change.

Strengthen Policies, Governance, and Capacity

To be successful, climate change programs and projects must be fully accepted and efficiently administered nationally and locally. ADB is helping countries strengthen their governance and policies to better mitigate and adapt to climate change. This involves bolstering capacity at many levels, from assisting government ministries in crafting policies, to helping national and local stakeholders better understand climate impact science and adopt the practices needed to adapt to climate change.

• Powerlines on a steppe at sunset in Kazakhstan

Taking Action

Regional Programs

To respond directly to climate change needs in Central and West Asia, ADB is supporting two major regional programs. The first is the CAREC Program, which, among other activities, is developing a master plan to promote energy security, increase regional trade in electricity, and offer affordable and reliable power to households and industries. CAREC's initiatives will help reduce greenhouse gas emissions by providing access to modern, efficient energy services; upgrading energy infrastructure; and advancing technologies that are less carbon intensive. CAREC is helping raise project performance standards for greenhouse gas emissions and ensuring that transport investments will not be derailed by climate change impacts.

The second program is the CACILM, a partnership between Central Asian countries and the international development community to combat land degradation, improve rural livelihoods, and adapt to climate change. Its goal is to restore, maintain, and enhance the productive functions of land, and improve the economic and social well-being of those who depend on it. Locally, nationally, and globally, CACILM takes a comprehensive and integrated approach to sustainable land management, and seeks to introduce climate adaptation mapping and measures, focusing on water.

Country Programs

Afghanistan

To boost domestic power generation capacity, Afghanistan, with ADB support, is proposing to make more use of renewable energy sources such as wind and hydropower. The country also expects to replace firewood and animal dung (currently its primary fuel source) with liquefied petroleum gas, to rehabilitate gas fields and extend a nationwide storage and distribution network. The country also hopes to rehabilitate and expand the power transmission and distribution network, particularly in rural areas. As a result of expanding and improving water supply and sanitation services, there should be energy savings throughout the system.

Given the anticipated impacts of climate change and glacial melt in the Western Himalayas, where possible ADB will align its operations for water and hydro energy in localized river basins with risk management and adaptation practices.

• Aerial view of a city in Afghanistan

• Road project in Armenia

Armenia

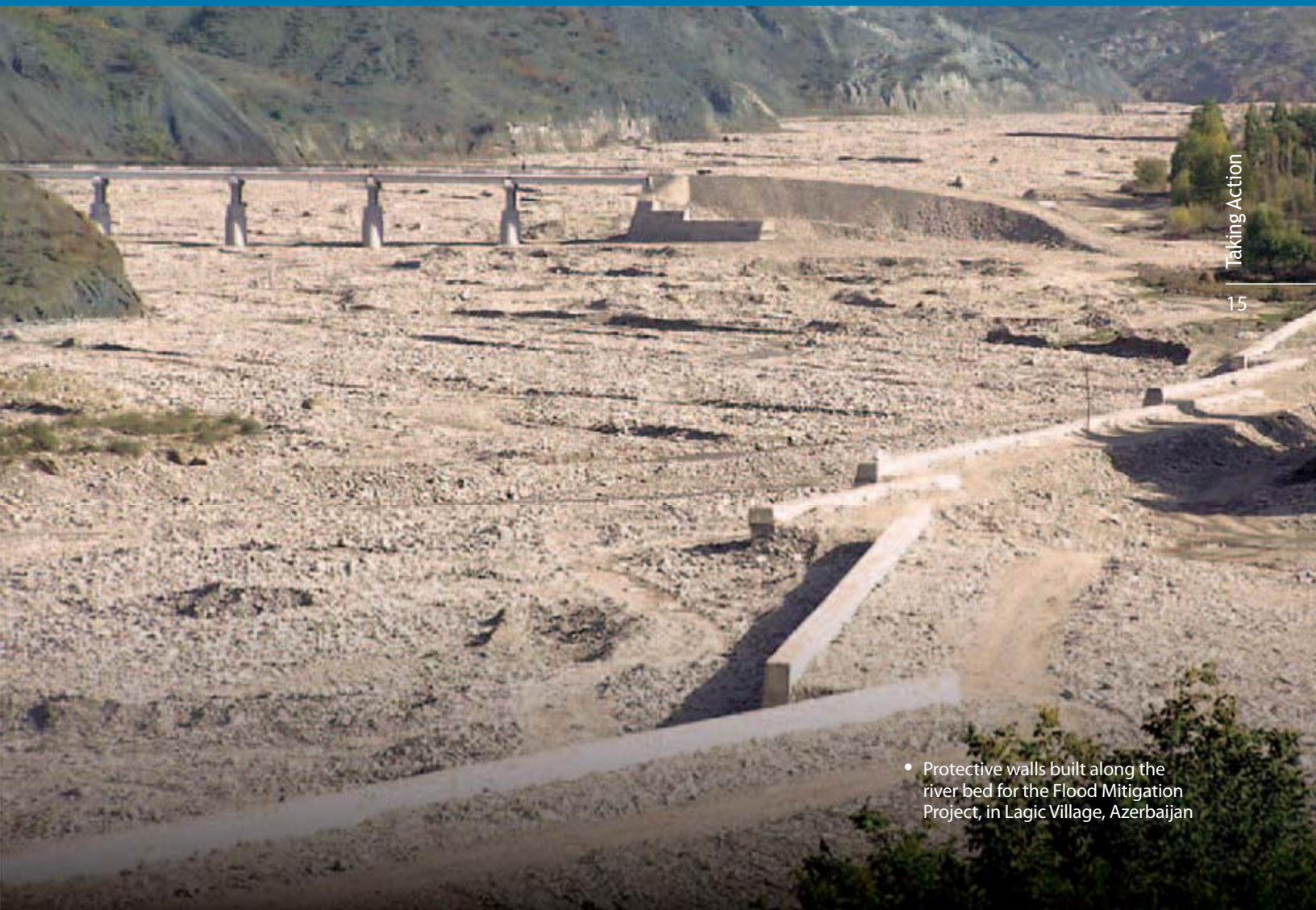
Armenia has a number of projects suitable for financing through the Clean Development Mechanism. This is a market-based arrangement under the Kyoto Protocol that allows industrialized countries to meet their commitments to reduce greenhouse gas emissions by purchasing carbon credits from developing countries. Potential projects include the Yerevan sustainable transport project, which will promote mass rapid transit and urban road-to-rail links. Other proposals include a water supply and sanitation sector project to improve services to about 576,000 people; as well as projects to improve energy efficiency for afforestation of degraded land; and to protect the unique highland Lake Sevan by reducing the withdrawal of water for irrigation and power generation.

Azerbaijan

An ADB-supported power transmission enhancement project will enable power to be delivered more efficiently, allowing the country to reduce fossil fuel consumption and cut carbon dioxide emissions by 1.3 million tons annually. Located just outside the capital, Baku, the project aims to increase power supply to consumers in the key industrial and economic hub by constructing transmission lines and transformers. ADB has supported the completion of a draft road map for renewable energy and provided assistance to assess small hydropower potential. ADB has also completed feasibility studies for selected small hydropower projects and provided financing and technical assistance for the Flood Mitigation Project.

ADB is providing technical assistance for a proposed power distribution development investment program, which will develop a power sector road map and an updated investment master plan. With potential financing support from ADB and other sources, the program will make power supply more reliable, reduce distribution losses, and enhance energy efficiency by rehabilitating and upgrading the distribution networks in about 40 districts. Dialogue with the government will continue to explore suitable opportunities to cooperate on renewable energy.

ADB is helping improve water supply. The Water Supply and Sanitation Investment Program will increase access to a safe and reliable water supply, and improve public health through better management of water resources and sewerage services. As well as making the system more resilient to climate change, this program will boost energy efficiency by replacing and upgrading dilapidated, inefficient water distribution systems. Energy efficiency is also a priority of the Road Network Development Program, which is working to provide a safe, energy-efficient transport network.



• Protective walls built along the river bed for the Flood Mitigation Project, in Lagic Village, Azerbaijan

Georgia

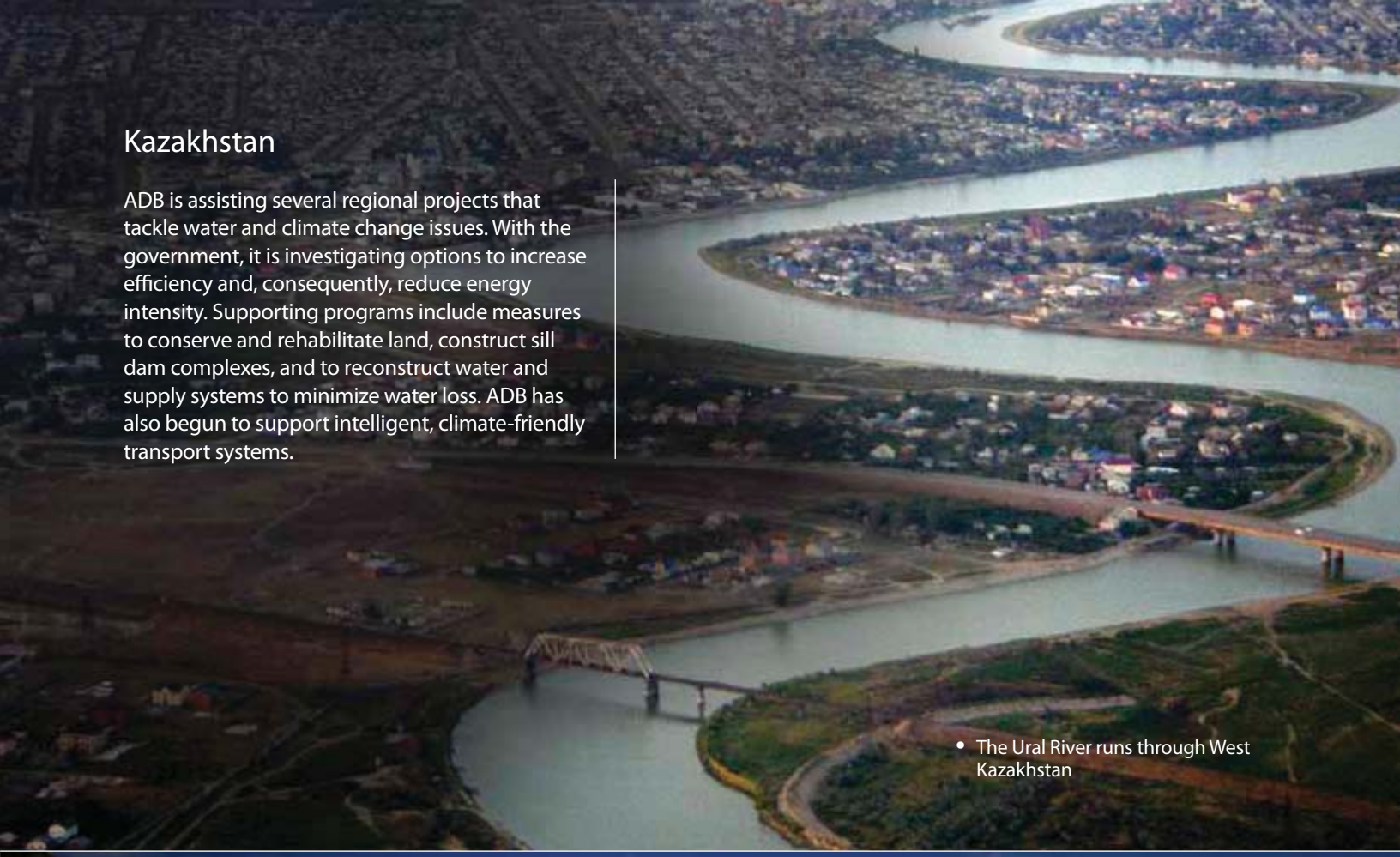
The sustainable urban transport project, currently being explored, will develop energy-efficient mass transport and possibly benefit from financing through the Clean Development Mechanism. Another project that could improve the local economy, the urban environment, and living conditions is the Municipal Services Development Project, which will upgrade municipal infrastructure and service delivery. The Georgia Urban Services Improvement Investment Program also aims to upgrade basic service delivery in provincial capitals and secondary towns.

Georgia has significant renewable energy potential, particularly in hydropower, only 18% of which is currently harnessed. Some of this could be exported to more fossil fuel–reliant neighboring countries such as Armenia, Azerbaijan, and Turkey. Another project under preparation seeks to assess the investment needed in transmission facilities. Power losses will be reduced by improving operational efficiency, thereby reducing overall greenhouse emissions.

• Khudoni Hydro Station, Georgia

Kazakhstan

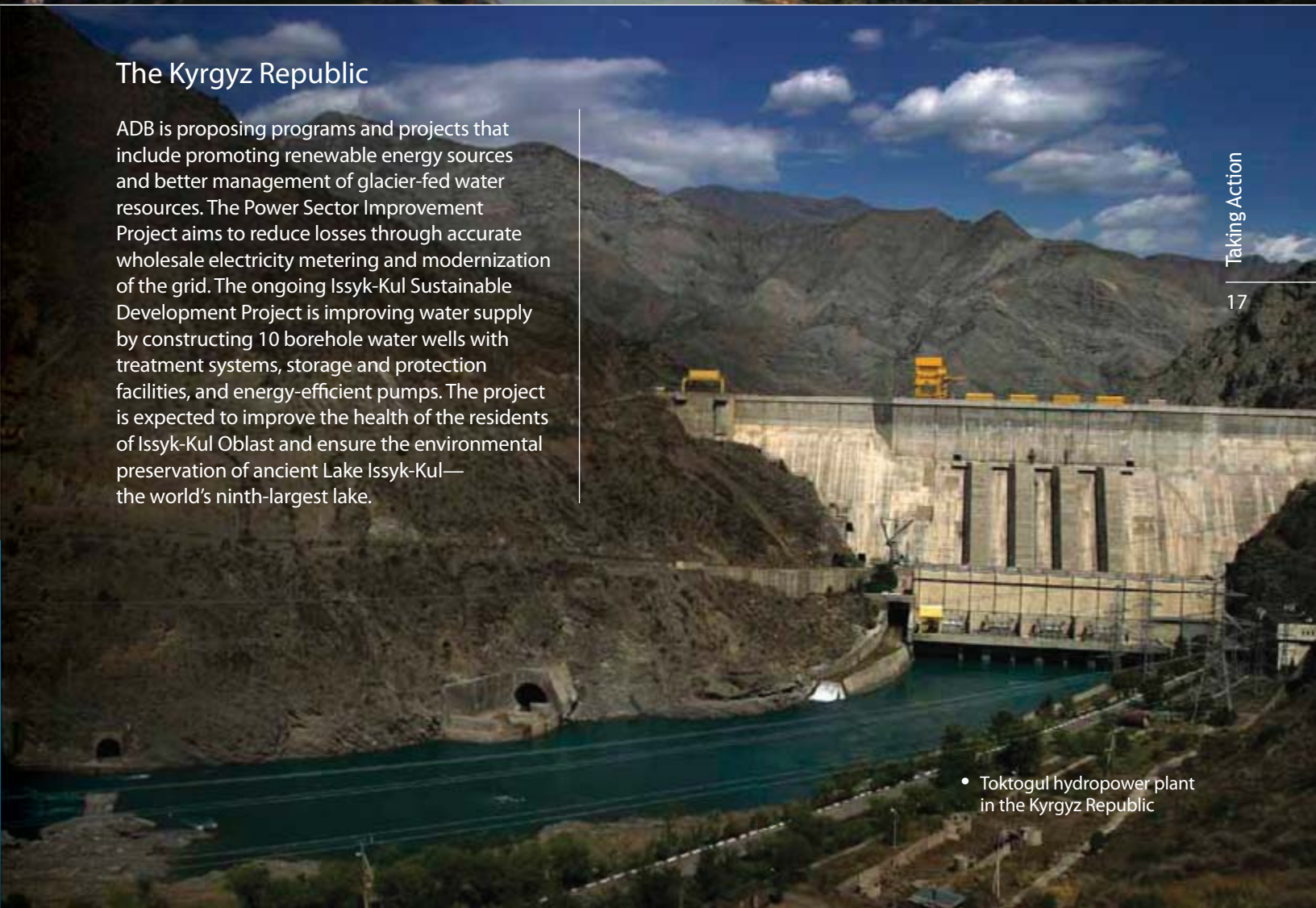
ADB is assisting several regional projects that tackle water and climate change issues. With the government, it is investigating options to increase efficiency and, consequently, reduce energy intensity. Supporting programs include measures to conserve and rehabilitate land, construct sill dam complexes, and to reconstruct water and supply systems to minimize water loss. ADB has also begun to support intelligent, climate-friendly transport systems.



• The Ural River runs through West Kazakhstan

The Kyrgyz Republic

ADB is proposing programs and projects that include promoting renewable energy sources and better management of glacier-fed water resources. The Power Sector Improvement Project aims to reduce losses through accurate wholesale electricity metering and modernization of the grid. The ongoing Issyk-Kul Sustainable Development Project is improving water supply by constructing 10 borehole water wells with treatment systems, storage and protection facilities, and energy-efficient pumps. The project is expected to improve the health of the residents of Issyk-Kul Oblast and ensure the environmental preservation of ancient Lake Issyk-Kul—the world's ninth-largest lake.



• Toktogul hydropower plant in the Kyrgyz Republic

Pakistan

ADB helped formulate a draft climate change road map to supplement the broader national climate change plan formulated by the Task Force on Climate Change. ADB recently supported a study by the International Centre for Integrated Mountain Development (ICIMOD) on the impacts of climate-induced glacial melt on the Indus River Basin and on the effects downstream on irrigation and energy investments, and other critical sectors. Through the Energy Efficiency Investment Program (formerly Sustainable Energy Efficiency Development Program), ADB is providing technical assistance to the government to establish a dynamic energy efficiency policy and business environment. This 10-year program integrates energy security and climate change into a common strategic platform and encourages policies that provide a foundation for a transition to sustainable low-carbon growth.

The program aims to integrate energy efficiency into national planning and public investments. This should boost energy security and help cut greenhouse gas emissions by an estimated 30%. The program has started by replacing inefficient incandescent bulbs with efficient, high-quality compact fluorescent lamps (CFLs) in about 30 million households. A Clean Development Mechanism program, the National CFL Project is expected to reduce peak energy demand by over 1,000 MW and reduce greenhouse gas emissions by 7 million tons of carbon dioxide equivalent. Future tranches of this program will finance industrial energy efficiency, support energy-efficient buildings and appliances, and rehabilitate thermal power plants. Two other programs, on power distribution and transmission, are expected to relieve bottlenecks and constraints, improving overall efficiency while reducing the need for excess power generation, thus lowering overall greenhouse gas emissions.

The Renewable Energy Development Sector Investment Program is funding small and medium-sized hydropower plants in Khyber Pakhtunkhwa and Punjab provinces. This and other interventions could include Clean Development Mechanism projects involving renewable energy, utilizing hydropower and biogas from biomass waste or from dedicated plantations on marginal land.

ADB is promoting compressed natural gas as an alternate, more efficient transport fuel. ADB is also providing technical assistance to frame a national transport policy and has proposed a technical assistance loan to the Punjab provincial government for the Lahore rapid mass transit system, encompassing a long-term plan to finance, construct, and operate mass rail lines that will connect with other forms of transport.

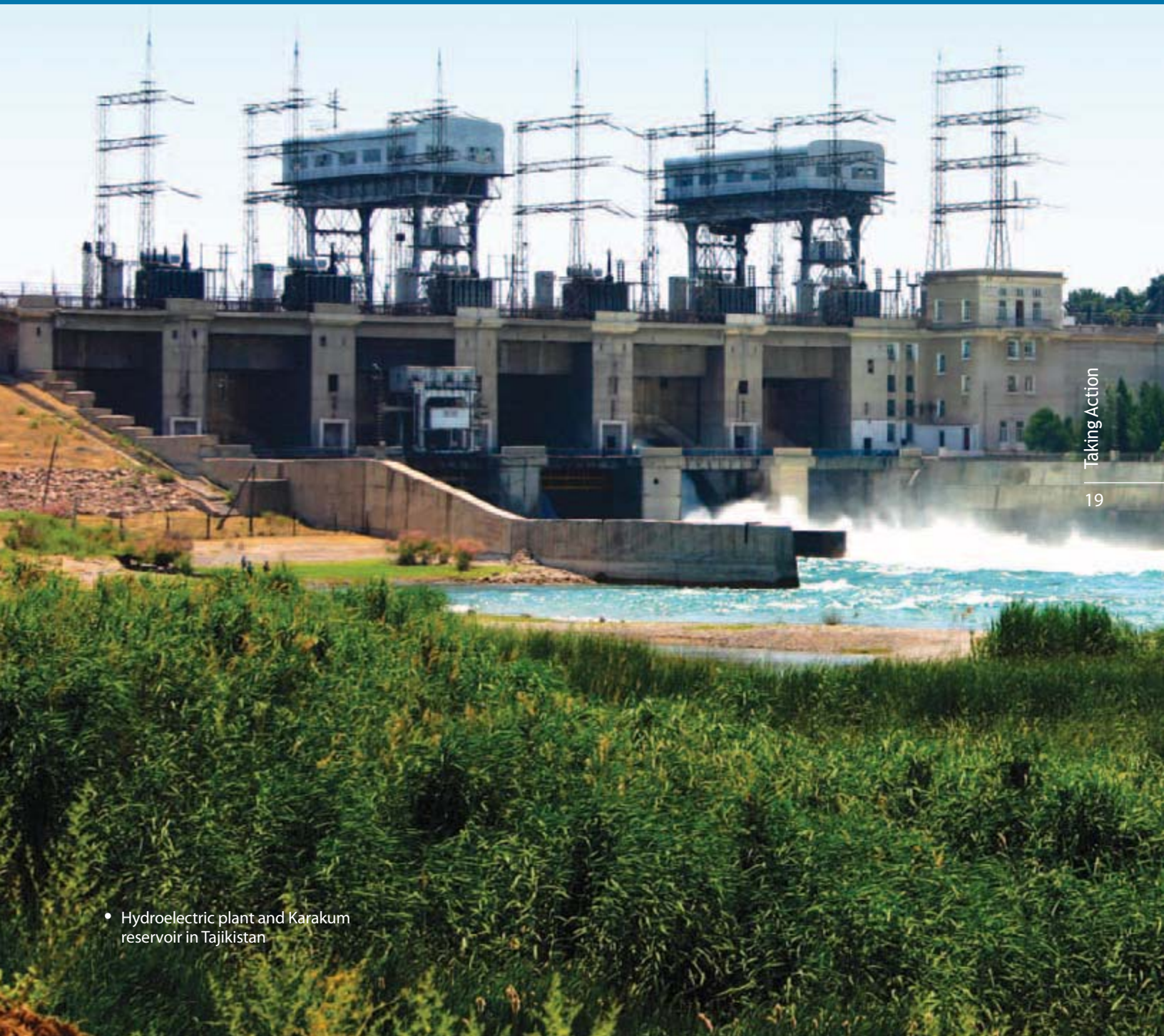
The Sindh Cities Improvement Investment Program and the Punjab Cities Improvement Investment Program both aim to enhance the governance and management of basic urban services, including water and waste management. This improvement will involve integrated investments in institutional reforms and priority infrastructure, including the construction of sanitary landfill sites, where waste is isolated until it is neutralized and safe. This will reduce the release of methane—a gas whose greenhouse effect (global warming potential) is at least 20 times greater than that of carbon dioxide.

• Road project in Pakistan

Tajikistan

In one of the country's most flood-prone areas, the Khatlon Province Flood Risk Management Project is helping Tajikistan take a holistic, coordinated approach to better manage recurring flood risks. Funds will rehabilitate 8.3 kilometers of flood protection embankment along the glacier- and rain-fed Pyanj River. The project will also develop and disseminate a flood risk map, strengthen flood warning systems, prepare a flood preparedness and evacuation plan, and strengthen flood forecasting capacity by rehabilitating the weather forecasting network.

The Community Participatory Flood Management component will help households better assess and monitor the risks of floods and other hazards and prepare for recovery. The project will also strengthen riverbanks and carry out selective reforestation to better protect settlements. Other ADB projects will improve the efficiency of power transmission and expand the use of renewable energy through the development of mini-hydro schemes.



• Hydroelectric plant and Karakum reservoir in Tajikistan

Turkmenistan

In addition to regional projects, programs are expected to include improving the irrigation of areas downstream of the Amu Darya River, whose water flow the country shares with its neighbors. Discussions will continue on introducing energy-efficient generation technologies and exporting power to neighboring countries.

• The Karakum Canal, Turkmenistan

Uzbekistan

With expected financing from the carbon market, ADB will fund the construction of two 370–450 MW combined-cycle gas turbine units at the Talimarjan Thermal Power Plant, which will enhance the efficiency of electricity generation. The project also promotes energy security and facilitates regional energy trade. Once completed, it is expected to generate 8,000 gigawatt-hours per year and increase power generation efficiency from 31% to over 50%, while reducing greenhouse gas emissions annually by 1.2 million tons of carbon dioxide equivalent.

ADB is also supporting the Water Supply and Sanitation Services Investment Program and the Surkhandarya Water Supply and Sanitation Project. Both will develop safe, affordable, and reliable piped-water supply systems by rehabilitating and expanding water supply, sanitation, and sewerage systems. This will include replacing pumping equipment and improving efficiency in wastewater treatment plants, making the distribution system more efficient and resulting in clean-energy gains.

Other projects include the Amu Zang Irrigation Rehabilitation Project, which will ensure fairer water distribution and install new, more-efficient pumps to reduce energy use and increase resilience to climate impacts. The Land Improvement Project is introducing integrated land and water management to arrest land degradation. Two possible Clean Development Mechanism projects are being considered: one on waste management and another on rail transit.

• The Amu Darya River in Karakalpakstan, Uzbekistan

Future Partnerships

Climate change poses multiple hazards to the health, safety, and livelihoods of people across the globe, but especially to those who live in poverty. While rapid economic expansion has often benefited the poor in Central and West Asia, future growth could be constrained by climate change. The rapidly growing economies will need to embark on innovative low-carbon development, while taking steps to adapt to climate change extremes and variability.

To help the region meet this challenge, ADB cultivates and welcomes collaborative partnerships with developed and developing nations, as well as with leading knowledge institutions.

Climate Change in Central and West Asia: Routes to a More Secure, Low-Carbon Future

Stretching from snow-clad mountain ranges to vast arid deserts and grassy steppes, ADB's Central and West Asian countries are Afghanistan, Armenia, Azerbaijan, Georgia, Kazakhstan, the Kyrgyz Republic, Pakistan, Tajikistan, Turkmenistan, and Uzbekistan. Geoclimatic and environmental factors make this region highly vulnerable to the risks and hazards of climate change. For example, accelerated glacial melt has serious implications for agriculture, water supply, and energy generation—problems exacerbated by overexploitation of natural resources. Countries may find it difficult to shift to low-carbon growth, since many have abundant fossil fuel and tend to use energy inefficiently.

ADB is responding to these climate hazards and low-carbon pathways with a comprehensive strategy that strengthens policies, governance, and capacity support; expands the use of clean and renewable energy; encourages sustainable transport and urban development; promotes development that will be more resilient to climate change, especially in water-dependent sectors; and manages land use and forests for carbon sequestration. ADB's support is helping its developing member countries face the challenges of climate change and, with partners, is providing innovative solutions, while continuing to work to reduce poverty.

About the Asian Development Bank

ADB's vision is an Asia and Pacific region free of poverty. Its mission is to help its developing member countries substantially reduce poverty and improve their people's quality of life. 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, of whom 903 million struggle on less than $1.25 a day. ADB is committed to reducing poverty through regional integration and economic growth that is inclusive and environmentally sustainable.

Based in Manila, ADB is owned by 67 member countries, 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.

Asian Development Bank
6 ADB Avenue, Mandaluyong City
1550 Metro Manila, Philippines
www.adb.org
Publication Stock No. ARM102010

Printed in the Philippines