



HOW CAN DONORS

**ADVANCE**

**CLIMATE CHANGE  
ADAPTATION?**



# AFD'S EXPERIENCE

## (AGENCE FRANÇAISE DE DÉVELOPPEMENT)



### AFD Integrates Climate Change Considerations in its Development Approach

AFD is the *Agence Française de Développement*, a public development finance institution that has worked to fight poverty and support economic growth in developing countries and the French Overseas Provinces for 70 years. AFD executes the French government's development aid policies. Through offices in more than fifty countries, AFD provides financing and support for projects that improve people's living conditions, promote economic growth and protect the planet.

AFD integrates climate change as a core component of its development and cooperation strategies: it helps its partners in developing and emerging countries address new climate-driven priorities, integrating climate change challenges in development strategies and improving resilience to its consequences. In 2009, AFD committed €2.4 billion to combat climate change, including €400 million for adaptation efforts.

Beyond a general discussion of adaptation requirements, this dossier will illustrate the real needs in four sectors – water, agriculture, urban development and infrastructure – and demonstrate AFD's experience.

### Reasons for Taking on the Adaptation Challenge

Climate change can disrupt many aspects of a country's development. Its relation to agriculture and water supply is easily grasped, but it also has less obvious effects on cities, infrastructure and industrial activity, potentially compromising all aspects of economic growth. Development efforts can play an important role in reducing countries' vulnerability to climate

change impacts and increasing their adaptive capacity.

However, development and adaptation do not mutually guarantee each other: while fighting poverty and promoting economic growth may build resilience and adaptability, projects that do not factor in climate change may well increase communities' and ecosystems' vulnerability. A country's socioeconomic profile and climatic evolutions have diverse, complex and often unknown relationships. Donors – cooperation agencies, governments,

foundations, NGOs, etc. – can improve adaptation by financing strategic plans and implementing projects that reduce vulnerability in beneficiary countries.

### A Strategic Vision Must Guide Adaptation Measures

Climate change adaptation is a relatively new field, but a few years of practical experience have already exposed

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potential barriers. The first of these concerns management of uncertainty. Current long-term climate models are global or, at best, regional, and have difficulty projecting climate change at the local level, the center of most decisions and investments. Improved diagnostic tools and local knowledge thus become a priority, so that countries can integrate adaptation in their development policies and action plans.

In anticipation of such improved models and risk assessments, countries have two main options, depending on the situation. The first is to increase the “robustness” of investments to meet the largest number of possible climatic conditions. The second is to allow for flexibility when new information becomes available, regularly re-examining previous decisions, other risks, and changes in risk perception. For example, this may mean shortening an investment’s effective lifetime. In all events, public discussion of climate issues is vital: it fosters understanding of climate change’s ramifications. It also helps determine social limits for acceptable risks and uncertainties, thus facilitating policy decisions.

A second challenge concerns the very strong relationship between adaptation and development: projects rarely aim for adaptation alone. Successful sustainable development considers climate change as a matter of course, with adaptation often translating into a variation on development as usual. These variations integrate climate variability and change, for example by modifying construction standards,

risk analyses and duration-related investment assumptions. In the end, the majority of projects branded as “adaptation” remain classic development projects and programmes with climate-adaptive components.

In some cases, such variations may prove insufficient, since climate change effects may call for breaks with traditional practices or current trends. More holistic, strategic, systematic and long-term (rather than project-based) climate change impacts studies, targeting specific countries, can help identify necessary measures – economic ones, if markets are no longer viable and new markets or diversification are needed; or land-use planning ones as some inhabited areas are abandoned, employment opportunities move, and/or the balance shifts between rural and urban areas.

Adaptation is a fundamentally trans-disciplinary subject: all sectors and fields of activity, all infrastructure and decisions depend on climate, either directly or indirectly. Thus, appropriate policy responses and actions depend on broad awareness; one should avoid restricting knowledge about climate change to a single administrative body, such as a Ministry of the Environment.

No miracle solution, single management process or generic solution exists to help societies adapt to climate change, at any level. The short experience of international adaptation efforts shows a critical need for context-specific measures: factors affecting vulnerability and adaptive capacity are

extremely local. Adaptation remains a territory-specific process of decision-making and intervention, involving a variety of actors, e.g. local officials and politicians, donors, landowners and farmers, scientists, insurers, individuals, etc., who evolve within a given context, marked by its own opportunities and threats.

Implementing effective adaptation requires a strategic vision of each country’s needs. Just as importantly, it requires periodic discussion of vulnerabilities and implementation priorities. Such discussion helps determine acceptable risk levels and ensures that as many people as possible – from civil and private society alike – engage the subject of climate change.

## Donor Engagement Goals and Methods

Given the range of possible adaptations and challenges, a donor will tend towards two approaches: protecting against climate-related risks (climate-proofing) and/or encouraging adaptation.

### ▲ Provide protection

Climate-proofing assesses the risks of initiatives underwritten by development banks and other donors. Projects designed without considering specific climate-related constraints can suffer negative consequences; they must be evaluated for vulnerabilities, and climate risk analyses must be integrated into new project design and selection processes. This increases the prospects for desired development outcomes, growth and profitability, and reduces risk for public and private investors, states, banks, private companies, local governments and other parties.

### ▲ Encourage adaptation

Donors must also encourage their partners in developing countries to adapt, assisting with public policy design and supporting projects.

## Help design strategic adaptive development policies

Most current adaptation efforts take place within relatively small projects, lacking coherence among themselves. Above all, their design and financing lack an overarching view of national- or regional-level climate change impacts and vulnerabilities. Few countries prioritize action: they often lack necessary information about potential effects, measures, costs, and so forth. Their proposals comprise lists of random projects that reflect no real adaptation action plan.

Donors can promote strategic response by funding preliminary climate-impact research, simulations and expertise - tools that can help diagnose problems, evaluate costs, and identify genuine adaptation needs that would underpin a prioritized action plan.

## Fund adaptive project implementations

Donors can also support development policies that integrate adaptation, with their consequent action plans and investments. They may also finance some efforts during the strategy and action-plan development phases. Experiential data from proven projects

helps identify which measures are worthwhile: they have a strong “no regrets” aspect, meaning they provide benefits and would pay for themselves even without a climate change policy. Examples include repairing drains, installing drought early-warning systems, integrating management for coastal areas, etc.; they also include pilot projects that test various approaches and meet the need for innovative thinking about this “new” subject – climate change adaptation.



# FINANCE

## WATER SECTOR ADAPTATION

### WATER SECTOR ADAPTATION REQUIRES VAST FUNDS

Demographic growth, urbanization, and both agricultural and industrial development place increasing pressure on waterworks and supplies worldwide; climate change further limits water's availability. While changes in hydrologic regimes and water ecologies remain highly unpredictable, scientists foresee very different global rainfall patterns in the future: tropical areas and higher latitudes will receive more rain, while the Mediterranean Basin will suffer more severe droughts.

In fifteen years, one-third of the world's people may live in regions subject to water stress – four times as many as at present<sup>1</sup>. Experts expect extreme events – great floods, droughts and water-borne epidemics – to occur more frequently. Such changes will have important consequences for societies and for activities such

as agriculture, tourism, industry and energy; they will require an integrated adaptation approach and more comprehensive water sector strategy (supply and flood management).

According to the World Bank, the net cost of **water sector adaptation will amount to US\$15 billion per year between 2010 and 2050<sup>2</sup>**, with the highest costs concentrated in sub-Saharan Africa. Each region will need to specify funding priorities for adaptation, whether they comprise islands threatened with submersion or arid lands where water stress will only increase. Examples of effective water sector actions follow on the next pages.

<sup>1</sup> According to the United Nations Development Programme 2006 Human Development Report.

<sup>2</sup> See "The cost of developing countries adapting to climate change: new methods and estimates 2009."



## EFFECTIVE ACTIONS

### 1. Assisting the Adaptation Process to Build Capacity and Resilience

Integrated Water Resource Management (IWRM) is an effective process for participatory planning and implementation. It unites stakeholders in determining how to meet increasing needs for water and coastal resources, while promoting conservation and reducing the effects of scarcity.

Working at the watershed scale, IWRM's aims to (1) develop integrated information systems to assess and analyze water resources; (2) bring together all stakeholders dependent on the water basin; (3) establish master plans, along with management and regulatory frameworks that result in multi-year investment programmes; (4) ensure long-term financing for master plans.

3 According to Working Group II of the Intergovernmental Panel on Climate Change's fourth (2007) report: "In many regions, water management is currently insufficient to meet present climate variability, so droughts and flooding produce great damage. Improving the integration information about climate variability in water management is a first step toward adapting to long-term climate change impacts."

IWRM excels as a prerequisite for dedicated financing because it situates medium- and long-term actions in a coherent plan. IWRM-derived frameworks support the following initiatives:

#### a) Improving knowledge about climate change's effects on hydrologic regimes and water ecologies:

→ Producing, assembling and disseminating socioeconomic, water and climate information, e.g. models, scenarios, exchanges, data processing, system vulnerability estimates, etc.

This knowledge becomes strategic, since it contributes to better-informed, more sustainable water resources management decisions in both public and private spheres. Estimating climate variability and reducing vulnerability is a priority, as many countries' water sectors remain at risk<sup>3</sup>.

#### b) Developing sectoral policies and master plans:

→ Providing institutional support for potable and agricultural water-demand policies; developing unconventional water resources.

→ Designing master plans to protect watersheds and water basins.

These policy and plan developments create an institutional framework that fosters action on measures recommended in this document.

#### c) Optimizing supply and demand:

→ Developing less-wasteful water distribution techniques.

→ Using pilot projects to identify ways to conserve agricultural water.

→ Implementing pricing strategies based on a good understanding of demand (gained through household surveys); raising awareness about the consequences of wasting water.

All these actions lay the groundwork necessary before infrastructure investment can proceed. In the interim, grants finance capacity-building and non-material activities, as illustrated by AFD's funding of the Niger Basin Authority example.

## FINANCING THE ACQUISITION, PROCESSING AND MODELING OF DATA FOR EFFICIENT RESOURCE MANAGEMENT IN THE NIGER RIVER BASIN

The Niger River Basin brings together nine West African countries (Benin, Burkina Faso, Cameroon, Chad, Côte d'Ivoire, Guinea, Mali, Niger and Nigeria) spread over 100,000 square kilometers. The region faces critical water stress due to very rapid population growth and high water use and demand; combined with declining rainfalls that have worsened due to climate change, this has greatly reduced available surface water.

AFD granted the Niger Basin Authority €3.4 million to more effectively monitor its water supply and improve systems for integrated water resources management. This effort informed further investment, providing a long-term vision for issues pertaining to water availability and use.

## 2. Investing in Infrastructure and Adaptive Measures

The gap between water supply and demand reveals climate change vulnerabilities in much of the world, particularly arid and semi-arid areas, and requires balanced efforts to increase supply and curb demand. The following initiatives merit support:

- Improving water demand management, particularly for agricultural uses: water-saving pilot projects – once proven feasible – can increase in scale. By using incentivized pricing, such agricultural water projects usually attract subsidized loans and turn a profit.
- Improving water supply management via diversified investments, e.g.

reducing loss in water distribution networks; increasing artificial storage capacities (dams and reservoirs) and natural ones (improved retention); and developing “unconventional” water sources, i.e. reusing treated wastewater, desalinization, rainwater collection, etc.

Loan financing is generally appropriate for these “no regrets” types of projects or for national- or local-investment plan-related infrastructure, as long as beneficiary countries qualify for credit.

Beyond assisting with good water management practices, cooperation agencies must remain attentive to how well project terms and conditions respect the larger goal of water conservation. This means assessing a country’s water stress levels as well as possible,

and forecasting the project’s expected water-management efficiency. AFD’s Oujda project provides an example of no-regrets infrastructure financing.



## FINANCING LOST-WATER REDUCTION IN OUDJA, MOROCCO’S DRINKING WATER DISTRIBUTION NETWORK

With less than 1000 cubic meters of water per person per year, Morocco currently suffers from water scarcity. Already a pressing issue, climate change makes water supply an even more crucial problem<sup>4</sup>.

Responding to the challenge, AFD made a €10 million subsidized loan to the city of Oujda for detecting and repairing water system leaks and damaged pipes, updating water meters, and putting a remotely-controlled management system in place.

This project improves sustainable water resource management and the water authority’s efficiency, allowing it to secure, extend and improve services.

<sup>4</sup> According to Working Group II of the Intergovernmental Panel on Climate Change’s fourth (2007) report, in 2100 the projected drop in precipitation compared to the 1980-1990 period will often exceed 20%, providing the first indication of changing climatic conditions in the EMEA region.



*Alaotra Lake,  
Madagascar*

# FINANCE AGRICULTURE AND FISHERIES ADAPTATION

Agriculture and fisheries depend heavily on climate and weather: temperature and rainfall determine crop yields, harvest volumes and levels of pest infestations on land, while fish require certain temperatures for feeding and reproduction. Weather has an immediate effect on farming income, affecting local market prices that are often unconnected to international markets. Climate change-induced variations in weather conditions will affect farming and fisheries production, making adaptation measures necessary.

## AGRICULTURE AND FISHERIES ARE ESPECIALLY VULNERABLE TO CLIMATE IMPACTS

Numerous climate change impacts affect agricultural production: water scarcity, soil infertility, plant diseases and destructive pests.

In many places – developing countries more than elsewhere – changes in climate conditions will likely create lower yields of some existing crops and doubts about the viability of others. The World Bank's 2010 World Development Report summarizes several studies on the subject: it claims agricultural yields in developing countries could decrease by more than 20% by 2050 if CO<sub>2</sub> emissions continue rising at their present rate. Furthermore, lower yields of vitally important foodstuffs will threaten many regions' food security: wheat in Southern Asia, rice in Southeast Asia, corn in Southern Africa, and hard wheat in Northwestern Africa.

Warming oceans and seas will probably produce short- and medium-term changes to marine habitats and life cycles. Fish migrations and changes in species mix (especially in commercially valuable species) may weaken some countries'

economies. Elsewhere, evaporating land waterways and lakes will lead to scarcities and lower catches, increasing nutrition and food security risks. The share of dietary protein provided by fisheries – very high in a large number of sub-Saharan African countries – could change.

In developing countries, nearly 70% of the population lives in rural areas and depends directly or indirectly on agriculture and fishing for income and food. The serious consequences of lower agricultural and fisheries yields require thought and planning – integrating climate change impacts into policies to better withstand coming challenges.



## Several Measures Assist Agriculture and Fisheries Adaptation

### 1. Agriculture and fisheries adaptation comprises non-material and material measures. Non-material assistance measures focus on:

Building knowledge about the agricultural and fishing sectors' vulnerability to climate change.

→ Producing and disseminating information about various climate scenarios, and their specific impacts on agriculture and fisheries – indispensable knowledge for adaptation planning. This includes scenarios and models for predicting new climatic conditions and system vulnerabilities.

#### Developing climate risk management tools:

→ setting up early-warning systems and emergency plans to better manage extreme weather events.

→ providing indexed insurance based on a climate index and other parameters<sup>5</sup> (a grant could fund small-scale pilot test projects; eventually less-subsidized financing could fund insurance vehicles).

→ setting up marine ecosystem monitoring programmes and modeling impacts of variations in climate and weather.

→ consolidating fisheries certification in order to reduce the world appetite for seafood by educating consumers about marine environmental problems.

#### Developing sound agricultural policies:

→ alter farming practices to reduce emissions and adapt to climate change.

→ require dual-objective policies that encourage investment and risk-taking by farmers, while supporting and stabilizing their income.

Traditional broad measures should apply, such as public and private investment in infrastructure and research, concerted control of price variability by each sector's participants, and increased farmers' credit and land security.

Targeted measures should supplement the broader ones, promoting innovation in fields as varied as soil conservation, water management, species cultivation, and plant genetics and associations, since each area relies on the others.

When global warming results (in all likelihood) in more variable precipitation – the key determinant for yields in most scenarios – risk management in this area will need more attention. Crop and stock diversification provides another direction: low-cost farm insurance should also be developed.

#### Strengthening agronomic research's primary role in adaptation by promoting the most resilient agricultural and fishery production systems:

This entails, crucially:

→ Selecting species that are better adapted to new climate conditions – i.e. resistant to drought, flooding, high temperatures, salinity, etc.

Testing different crop varieties on a given type of land can provide a wider agricultural production spectrum, allowing the most resistant ones to emerge and contribute to food security.

In developing countries, fisheries and aquaculture research institutes must be strengthened: a critical lack of data impedes work on fish stocks' identification, availability and catches at present. Research on fish should help the industry diversify along different strata as ecosystems change with the climate.

#### Developing more resilient farming and fishing practices:

→ Conservation agriculture using no-tillage planting techniques, i.e. direct-seed mulch cover (a new approach).

No-tillage planting reduces labor, halts soil erosion, improves soil fertility and stabilizes or increases yields, even on poor soils. It also reduces fuel consumption by reducing machinery use. Increased organic material content results in better soil structure and porosity; it also improves water infiltration and retention. This builds soils' resilience to extreme events, limits erosion and contributes to adaptation by mitigating some negative climate change effects. This "ecologically intensive" technique is "win-win," since it provides co-benefits for development, adaptation and mitigation.

→ restoring aquatic ecosystems that have been seriously damaged by overfishing and pollution: set up fisheries to use management plans, more-strongly regulate access rights, and extend Marine Protected Areas. A second phase would promote climate-change-resistant species and the lowest-carbon fishing technologies (industrial versus small-scale ships, carbon-efficient fishing equipment and propulsion systems).



<sup>5</sup> This type of insurance covers all insureds in a region when specific conditions occur, such as insufficient rainfall. It avoids moral hazard and adverse selection by linking farmers' indemnities to an objective index that is correlated with losses.

## INNOVATIVE “AGROECOLOGY” TECHNIQUES HELP FARMERS IN MADAGASCAR

AFD granted €11 million to Madagascar to implement a new agricultural approach that balances productive development with environmental protection: agroecology. By the time it ends in 2013, the project – covering 2,600 hectares in the Lake Alaotra watershed – will have taught farmers new techniques that increase farmland productivity and protect an endangered ecology, halting the spread of erosive activity that threatens waterworks and agricultural facilities. The initiative demands much training to disseminate techniques effectively: 450 classes will take place during the project’s lifetime.

AFD’s no-tilling planting project in Madagascar illustrates this type of non-material assistance; it generally calls for highly-subsidized financing or grants.

### **2. The following material measures can be financed through loans:**

- Infrastructure to protect against floods, such as dikes.
- Agricultural infrastructure and waterworks that improve water management, such as drains and gutters.

→ Conservation agriculture over large areas in countries that have a conservation-oriented national policy.

→ Agroforestry.

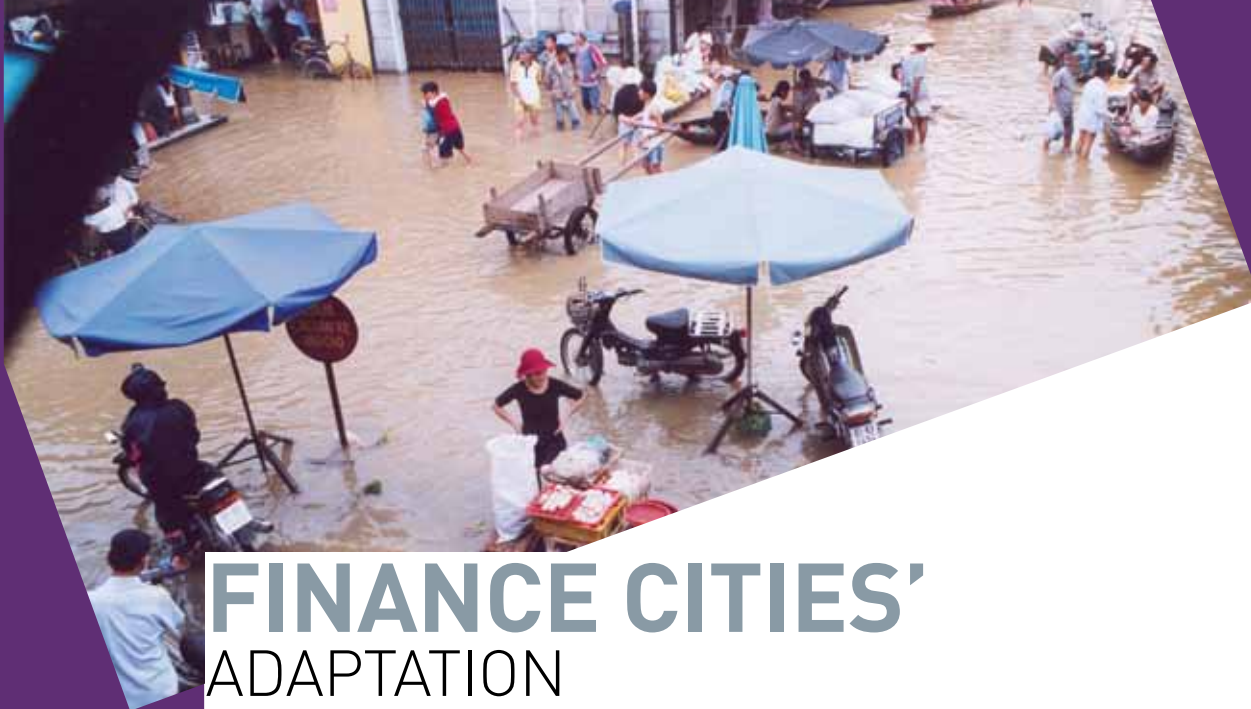
Credit financing may be pertinent for these types of projects, if linked to large-scale implementations of national or local investment plans, assuming the countries and beneficiaries qualify for credit.

## REDUCING VULNERABILITY TO FLOODING IN VIETNAM



Agriculture dominates the Vietnamese economy, representing 22% of its GDP and 50% of its assets in 2008. AFD made a €12 million subsidized loan to Vietnam to set up an investment programme to build and refurbish agricultural facilities and waterworks in Ninh Thuan Province, one of the poorest and most arid. As it contributes to economic growth and improves living conditions for the province’s

rural residents, the project will also improve watershed management – especially important in a context of resource scarcity: reservoirs and impoundments will help reduce flood and drought risk.



Flooded city in Vietnam

# FINANCE CITIES' ADAPTATION

## CITIES LIE AT THE CENTER OF CLIMATE CHANGE CHALLENGES

If climate change has gradually appeared on national and international agendas since the 1990's, there is no doubt today that it also belongs on local ones. Indeed, cities – which concentrate half of the world's population and the bulk of economic activity – are responsible for 75% of greenhouse gas emissions and consume 75% of the world's energy. While they contribute heavily to climate change, cities are equally subject to its effects. Their locations and their denser populations, activities and infrastructure networks – transportation, water and energy, etc. – make cities especially vulnerable to climate change impacts.

- Historically, a large proportion of cities arose near rivers and lakes or in coastal areas and deltas – areas especially prone to flooding, storms, erosion, subsidence and sea level rise.
- Cities are equally exposed to urban flooding that occurs during violent and intense rainfall. Artificial (and thus often waterproof) ground aggravates this risk.
- Heat waves, accentuated by the density-driven phenomenon of urban “heat islands,” increase health risks in cities.
- Some cities in developing and emerging countries experience harsh droughts.

Furthermore, climate and energy issues arise from local decisions and actions more than from national ones. We see this in social activities (housing, leisure, education, healthcare) and economic ones (work, transportation, production, warehousing, and so on) carried out by individuals and businesses in specific territorial contexts (e.g. geography, population, economy and culture). This strongly local bias legitimizes an equally local approach to the issues.

**However, risks linked to climate change are less novel in cities than elsewhere, and climate change itself is never the only factor affecting future outcomes.** Climate change impacts accentuate pre-existing constraints tied to rapid or uncontrolled urbanization: current pressures on resources and the environment, strong demographic and economic growth in vulnerable areas, and so on.

## CITIES LIE AT THE CENTER OF CLIMATE CHANGE CHALLENGES



### **Ever-accelerating Urbanization and Uncertainty Hamper Heavy Adaptive Infrastructure Investment**

In recent decades, developing countries have faced a large-scale challenge: rapidly accelerating urbanization, resulting from an unprecedented combination of massive rural exodus and high demographic growth. At the same time, the progressive spread of decentralization and local autonomy policies places cities at the heart of development issues, despite their limited financial resources and manpower, making it difficult for them to meet all needs. Today, urban development remains something that urban actors cannot fully anticipate. At the same time, local officials must integrate and manage increasingly complex problems in planning: the environment and climate change, but also heritage preservation, economic growth, social integration, and so forth.

Since half of the urban centers that will exist in developing countries in 2030 have not yet been built, decision-makers must not only find ways to resolve current growth challenges, but – above all – to lay the groundwork for a sustainable urban

future. Megacities must adapt to new climate-imposed constraints, as must the small towns and cities where most population growth will occur. For the latter, the challenge lies in encouraging local governments to begin sustainability efforts now, incorporating a long-term vision into their often-costly infrastructure plans.

When it comes to adapting to climate change, long-term climate models cannot provide sufficiently precise or reliable predictions of local-level climate activity or extreme events. This means that the design and implementation of adaptation programmes must allow for uncertainty, posing difficulties for major transportation, housing and infrastructure works.

## EFFECTIVE ACTIONS

### **Encourage a Strategic Response**

Rather than concentrating their financing on “hard” urban infrastructure projects specifically dedicated to adaptation, donors should encourage local governments to integrate climate change adaptation into their development strategies and interventions.

This seems the more logical route because few “pure” adaptation projects exist; climate change is just one sustainable development consideration that cities manage through proven risk prevention. In the end, most urban projects carrying the “adaptation” tag

closely resemble classic sustainable-development efforts; they have simply been updated with current knowledge about climatic changes.

### **1. Give Priority to Strategic Adaptation Planning**

In this context, donors have a major role to play in encouraging cities to address climate change risks. The goal is to make today’s urbanization more sustainable, and at the same time build resilience and increase the flexibility of urban infrastructure.

Various tools can help develop adaptive strategies, such as the local Climate Change Action Plan, Agenda 21, or the Environmental Approach to Urban Development created by ADEME (the French Environment and Energy Management Agency).

These tools generally entail a four-step process. The first step diagnoses the area under consideration through a vulnerability assessment, a greenhouse gas inventory, an energy consumption profile, and then identifies the public policies that could be modified. The diagnosis gives impetus to the second step: a participatory process that defines short-, medium- and long-

term objectives for combating climate change, while identifying strategic directions and urban development principles. The third step transcribes these findings into urban planning documents and determines an effective action plan, defining priorities and integrating them into the city's investment programme. The last step sets up evaluation and monitoring systems to follow the plan over time, so that it may be reassessed as circumstances change.

These steps help curb the multiplication of small, isolated projects removed from a coherent vision of the whole. These approaches must be



multi-sectoral, since climate change adaptation touches many fields of activity: risk management, urban development, water, construction, and so on. The transdisciplinary nature of the steps often makes them complex for local governments to execute.

Key success factors for these strategies are strong programme leadership and an efficient organization of the municipal teams. This can be guaranteed either through a steering committee that includes representatives of the relevant departments (i.e. transportation, housing, energy, etc.), or through a city official appointed as "climate leader" who directs the representatives of

each department with the support of his or her upper management.

Once the strategic direction is defined, action plans can include "soft" measures, drawing on:

→ Risk management, e.g. prevention systems, risk mapping, risk-awareness campaigns, coastal management, and early warning systems for storms, floods and heat waves.

→ Information and public awareness about reducing consumption, e.g. lower water use during drought, and reduced private vehicle use to combat urban heat islands.

→ Urban planning regulation and stricter rules enforcement, particularly in informal settlements and areas not authorized for construction.

→ Building design, e.g. improved construction standards for flood resistance, insulation, and so on.

Just as with the strategic steps cited earlier, these measures usually require budgetary financing, most often subsidized.

## 2. Finance Urban Infrastructure and Facilities

Donors should concentrate on key infrastructure projects that often qualify as "no regrets" efforts, such as drainage systems, storm water management, water reservoirs, drinking water supply, and efforts to rehabilitate informal settlements. Such projects meet present needs and strengthen urban resilience in the face of climate change.

Investment priorities must consider existing as well as new construction: cost-benefit analyses may help assess

the merits of new building versus adaptation of existing facilities.

When building new districts or rehabilitating informal settlements, cities can take some additional inexpensive measures, such as increasing ground permeability, adding green space, and channeling surface water. Similarly, better-adapted buildings designed with natural ventilation or passive solar exposures can reduce living costs.

Other measures, such as flood protection via higher bridges, improving roads' permeability, building houseboats or stilt houses, or even relocating people to new homes, require larger investments and thorough risk assessments.

### First and foremost, donor support for climate adaptation must build capacity.

Strategic thinking during the initial assessment and environmental design planning phases will not only filter out small, low-impact proposals, but will improve financed project quality, programme coherence, and urban resilience. In financing existing or new infrastructure and urban facilities, donors should focus on "no regrets" projects and other lower-cost measures.

## FINANCING URBAN PROJECTS IN TWO VIETNAMESE CITIES HIGHLY THREATENED BY CLIMATE CHANGE: DA NANG AND CAN THO

Vietnam is one of the countries most threatened by further climate change: it has already experienced sea level rise, flooding, heavy storms, water salinization and other impacts. A one-meter increase in sea level would affect 10.74% of the country's urban areas<sup>6</sup>. Increasing urbanization raises the risks: current urban sprawl and population growth place rising numbers of people, goods and infrastructure in harm's way. Vietnamese cities must address these issues in their development strategies, as do the cities of Da Nang and Can Tho, where AFD finances high-priority urban infrastructure and facilities projects via subsidized €10 million loans to each municipality.

AFD's two-part investment programme aims to improve urban living conditions while helping each city prepare for future climate effects: the first part of the programme builds capacity through technical and strategic assistance, and the second builds resilience by financing adaptive infrastructure projects. The technical assistance component encourages local officials, urban investment funds and loan beneficiaries to better address climate vulnerabilities in their urban projects.

### **This technical assistance supports the following efforts:**

→ Upgrades to internal project validation by establishing standards, and analyzing risks and siting of adaptive infrastructure projects.

→ City officials' strategic planning that addresses climate change effects. For Da Nang, this includes having external consultants provide a local action plan that analyzed the city's activities through a climate change lens. For Can Tho, it involves setting up a workshop where international urbanism experts and professionals gathered to develop urban planning scenarios.

This kind of fundamental, in-depth work – conducted during project implementation – enhances city officials' thinking about the quality of financed projects and their resilience to climate change impacts, so they can more effectively integrate scale and siting in their development planning. Such preparation assists both current projects and future ones, since present and potential concerns are included in a comprehensive strategy for climate change adaptation.



6 According to S. Dasgupta et al. (2009) in "The Impact of Sea Level Rise on Developing Countries: a Comparative Analysis"



# FINANCE

## INFRASTRUCTURE SERVICES ADAPTATION: TRANSPORTATION, ENERGY, TELECOMMUNICATIONS

### INFRASTRUCTURE MUST BE ADAPTED FOR CLIMATE IMPACTS

Services provided through infrastructure – energy, transportation, telecommunications and water – form the basis of development dynamics, structuring space over long periods and affecting both human organizations and ecosystems.

A primary production factor in every economy, infrastructure underpins essentials such as food, healthcare and education. Access to infrastructure services is a basic human right; ensuring their resilience in the face of climate change, a basic necessity.

Climate change will affect demand for infrastructure services. For example, an increase in average temperatures, or the duration, frequency and intensity of extreme temperatures, will change overall demand for energy production. More fundamentally, climate change will affect economies and urban development, with important repercussions for the types and location of service demand.

Transportation, energy, telecommunications (and water<sup>7</sup>) services are especially vulnerable to

climate change because they often depend on climate-dependent natural resources. Many services require water to function, e.g. hydro-power generation or cooling of thermal power plants. Others are designed to avoid or drain water, e.g. roads and drainage networks. Climate change effects on the water cycle will influence these and other services.

Changes in wind and sun regimes will affect renewable electricity production and its location. In many developing and emerging countries, people depend almost entirely on biomass for their energy needs, another vulnerable point. In Africa, for instance, traditional biomass used for cooking and heating represents more than fifty percent of final energy consumption. Biomass production from forests and agricultural waste is especially exposed to drought, flooding and higher temperatures.

<sup>7</sup> Please refer to water section of this dossier for its specific treatment.

Furthermore, infrastructure services form highly interconnected systems: the proper functioning of each sector – energy, transportation, telecommunications and water – depends on the others. This increases the risk of serial failures: a small problem in one place can rapidly create a much larger and more serious problem elsewhere. Most importantly, infrastructure has a long lifespan, and implicitly structures land use, lifestyles and other decisions for long periods. These effects persist beyond the infrastructure’s useful life, particularly in the case of transportation networks – just as climate change itself will have its greatest impact in the long term.

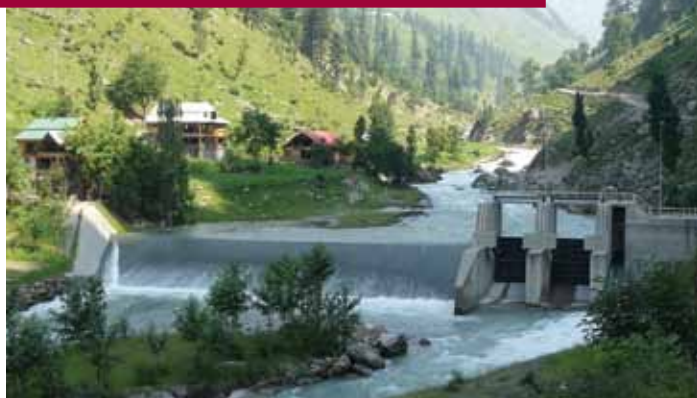
Particularly severe climate change impacts will affect infrastructure in poor countries, especially inter-tropical, arid or semi-arid regions (e.g. Sub-Saharan Africa) where their effects will be most violent, and where money for adaptation is scarce. Within such highly threatened countries, infrastructure will prove most vulnerable in specific areas, e.g. along coasts and rivers, in mountainous areas, in sensitive ecosystems, etc.

Adapting infrastructure services for a changing climate requires a comprehensive strategy, one that simultaneously addresses service resilience and changing demand – demand that itself depends on many factors, including climate change.

Building resilience requires reducing exposure to known risks – floods, erosion, landslides, melting ice and permafrost, violent winds, and so forth – or even to uncertain ones, by strengthening resistance to a wide range of possible climate events. Measures that guarantee repairs to infrastructure or reduce the gravity of damage, such as risk-sharing and insurance, contribute as well.

Resilience also means reducing end-user demand for services: lower consumption means less dependence on climate-affected natural resources.

Jaggran 1 dam,  
Pakistan.



## EFFECTIVE ACTIONS

### Infrastructure Adaptation Requires “Soft” and “Hard” Measures

Infrastructure services adaptation comprises “soft” (non-material) and “hard” (material or investment-related) measures.

#### 1. Non-material, or so-called “soft adaptation” measures focus on:

→ Disseminating information, raising awareness and setting up participatory approaches in decision-making –

stressing concerted consultation with stakeholders as the crucial point.

→ Improving governance structures and institutional organization to coordinate response: addressing transdisciplinary climate change issues and service interdependence in the design and implementation of adaptation programmes.

→ Developing information, monitoring and prediction systems to project possible climatic evolutions, especially at the local level; creating and regularly updating vulnerability maps that identify the principle areas or sectors at risk based on such projections.

→ Conducting scientific and technical research and development, (e.g. in materials durability and resistance to higher usage levels, or the adaptability and resilience of the most exposed structures, etc.); socio-economic evaluations that consider new risks and uncertain situations; and public information sessions that foster understanding of climate change and the need for action.

→ Designing sectoral and macroeconomic public policies (e.g. land-use planning), to integrate adaptation concerns and anticipate possible climate-change-driven variations in demand.



→ Designing adaptation programmes, and prioritizing and implementing investments.

→ Reducing end-user demand: the least vulnerable energy and transportation services are unneeded ones (they also pollute and cost the least).

→ Adapting or initiating crisis management and insurance systems for each sector individually and across all sectors.

→ Training and capacity-building in all the fields mentioned above.

In most cases, these types of “soft measures” will require budgetary financing, most often subsidized.

## **2. Material, investment-related, or so-called “hard adaptation” measures focus on:**

→ Making “no regrets” investments that reinforce resilience while generating economic, social and/or environmental benefits (co-benefits) independent of climate change outcomes. Examples include energy diversification (which supports energy security and the environment by promoting renewables); energy efficiency (reduces dependence on resources affected by climate change); watershed management (to reduce erosion and silting that affect dams and hydropower generation); improving agricultural yields for biomass energy production (often includes optimizing water and fertilizer use and farming methods); early-warning systems for extreme weather events (doubling as civil security communication services); etc.

→ Investing in precautionary measures when risks are unclear and uncertainty prevails, to build robustness to face as many climate changes as possible; such investment may also aim for flexibility, with periodic review to integrate new knowledge about climate changes and the public’s perception of them. This “progressive adaptation” approach often splits investments into modular parts and promotes decision reversibility. Examples include diversifying or decentralizing energy sources that may prove more costly than centralized or networked solu-

tions, because of lost economies of scale; reinforcing a structure’s foundations (such as a dam) but not the rest, to avoid over-spending, “maladapted” dead-ends and reduced room to maneuver; etc.

→ When risks are clear, investing in preventive measures in the context of development and land-use planning adaptation policies, at additional costs that are economically justified by a reduction of risk, and which do not necessarily bear any co-benefits. Examples include protective works such as dikes; raising the height of dams; fortifying bridges, buildings, roads, energy and telecommunications networks; early-warning telecom systems; etc.

Loans are usually appropriate for “no regrets” measures or those linked to a national or local investment plan, assuming the country’s and beneficiaries’ debt levels qualify. If not, highly subsidized loans or grants are generally needed. However, some precautionary measures can produce short-term savings and require no additional financing. For example, a proposed large investment may be reduced in scope while waiting for an assessment of its medium- or long-term utility, e.g. funding crossing sills to ford a river for a few days every ten years is more cost-effective than building bridges that fall down every ten years as in the Vanuatu example.



## REDUCING AFRICA’S VULNERABILITY STRATEGICALLY AND REGIONALLY VIA THE AFRICA INFRASTRUCTURE COUNTRY DIAGNOSTIC

The Africa Infrastructure Country Diagnostic programme (AICD) disseminates research and knowledge to improve understanding about Africa’s infrastructure and needs. Its goal is to help public decision-makers create policies, determine investment plans, and monitor their implementation. The World Bank set up the AICD programme five years ago, receiving regular funding from several donors including AFD. To date, AICD’s works have established an original, exhaustive and precise map of African infrastructure conditions – energy, transportation, telecommunications, water supply, sanitation, irrigation – and their contribution to the continent’s poverty reduction and economic growth. AICD’s analysis examines public spending levels and future investment needs – comparing each sector’s performance and providing valuable databases and key references for all stakeholders, public or private. With AFD’s support, the AICD programme should soon include a macroeconomic and regional analysis of climate change impacts on settlements, production and consumption: this will help determine future infrastructure demand, vulnerability, investment priorities and associated costs. This more systematic approach to infrastructure adaptation challenges will prove crucial for strategic investment planning, reducing climate impact and related vulnerabilities.

## VANUATU, BURKINA FASO AND THE MALDIVES: EXTREME EVENTS INSPIRE “PROGRESSIVE ADAPTATION”

**Vanuatu** has experienced more frequent and violent cyclones over the last ten years. Since 1999, when Cyclone Dani caused immense damage to the archipelago’s infrastructure, destroying several river-crossings in particular, local officials conducted more systematic analyses of climate change-related threats to vital infrastructure. AFD supports their efforts in several ways, notably by financing a programme that builds river-crossing sills to replace bridges that are regularly damaged by cyclones. For a few days each year – during huge floods – the sills are impassable, but given the limited overall damage they sustain, they are more effective.

**In Burkina Faso**, an exceptional 10,000-year flood reached the Bagré Dam on the Nakambe River (White Volta) in 1994, two years after it opened. The hydroelectric/irrigation dam had been designed to withstand such high water, and was undamaged. However, several years later, studies found that the design was based on rather old climate data. A review of more recent hydrological data revealed that the 10,000-year flood level was, in fact, one that recurred over a much shorter period. Therefore, the dam had to be fortified and made safe. AFD financed the dam’s adaptation works, completed in 2009. This example highlights the need to conduct more detailed climate analyses before investing in large infrastructure projects.

**In the Maldives**, a non-climate-induced catastrophe – the December 2004 tsunami – led to adaptation efforts. Among other damages, the tsunami seriously damaged a quarter of the islands’ port infrastructure, depriving people of their principal transportation means. The fishing industry – a primary source of income – was extremely disrupted. Many of the ports had been constructed quickly and at low cost with inferior traditional techniques, e.g. dikes and quays built by piling coral debris and sacks of sand on the sea floor. As a reaction, the Maldives government launched a repair and reconstruction programme for the damaged ports, with AFD funding and more advanced, durable building techniques that provide greater resilience to climate hazards.

This dossier was prepared in conjunction with IDDRI (*Institut du Développement Durable et des Relations Internationales*), an independent research and policy institute. IDDRI examines sustainable development issues that require international coordination, such as climate change and biodiversity loss, focusing on global governance, international negotiations and cooperation between developed, developing and emerging countries.

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