

Cities and Climate Change

A Discussion Paper
by

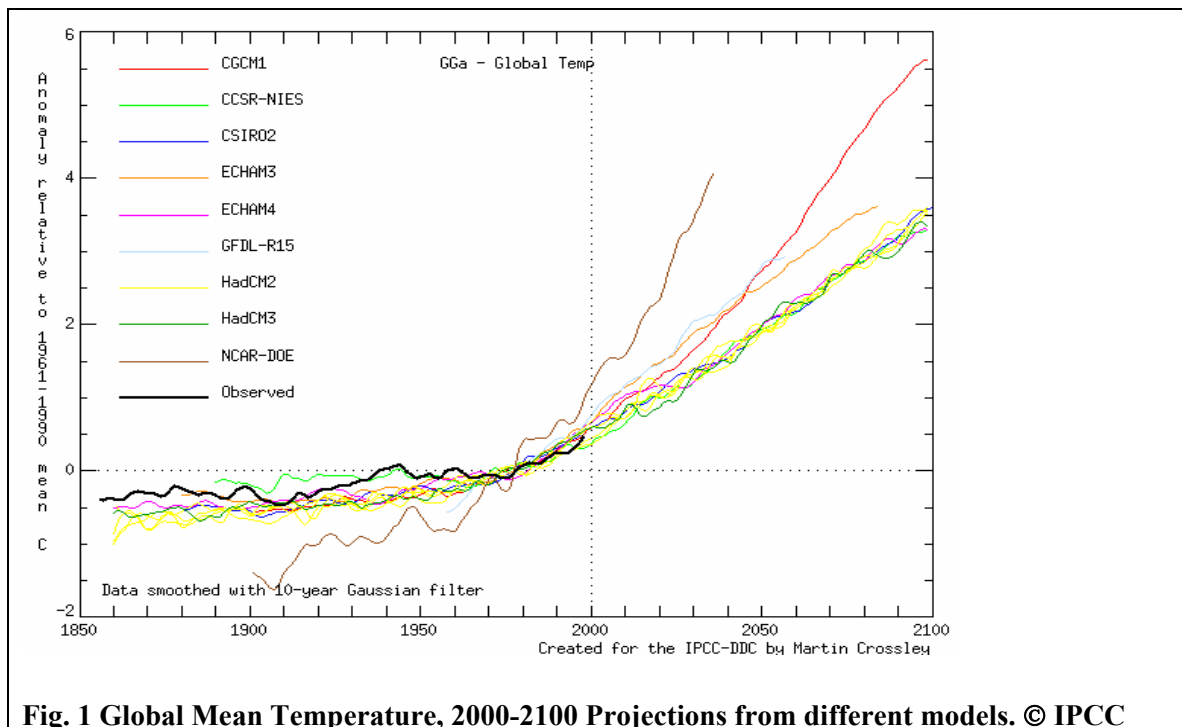
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This work was initiated as a background paper for the forthcoming World Development Report 2003, as part of the Urban Environment Thematic Group activities for FY02. Its purpose is to raise the awareness of climate change issues among the Bank's urban staff.

1. Impacts of Climate Change on Cities

The latter part of the 20th century has seen the increase in the Earth's average temperature of 0.6 C. Projections of further increase in the 21st Century vary considerably, between a minimum of 1.4C and a maximum of 5.8C (see Figure 1), depending on the level of stabilization of carbon emissions, the pace of de-carbonization of the global economy, and the patterns of demographic and economic development. Such increases represent a dramatic shift with regard to the natural variability of the planet's mean temperature, which has remained within 0.5C over the last 1,000 years. The latest report of the Intergovernmental Panel on Climate Change (IPCC) "Third Assessment Report: Climate Change 2001"¹ establishes a direct correlation between the sustained use of fossil fuels – which has occurred primarily in the industrialized countries -- the resulting accumulation of CO₂ and other gases in the atmosphere, and global warming.



¹ IPCC Third Assessment Report, Vol. 1 "The Scientific Basis" Cambridge Univ. Press, 2001

Global warming manifests itself in many different ways in the biosphere, among which those most directly relevant to the topic of this paper are the progressive rise of the sea-level and the increased intensity and frequency of climatic episodes leading to natural disasters, all representing a significant threat to urban areas in developing countries.

Sea-level is expected to increase between 10 cm and 90 cm during the 21st century – according to the different projections and models – mostly due to thermal expansion and to the loss of mass from glaciers and ice caps.² The frequency and intensity of natural disasters are also growing very rapidly world-wide. A recent analysis of great natural catastrophes since 1960 shows an increase in the decade of the 1990s with respect to the 1960s by a factor of three, with economic losses adjusted for inflation rising by a factor of nine³. This change is directly correlated with global warming.

The rapid pace of urbanization with the concentration of an ever increasing share of the population has also significantly increased the overall vulnerability of urban areas to such dangers. The location of many large cities with large populations and crucial economic assets in high-risk zones contributes to the rising attention given to the impacts of disasters induced or enhanced by climate change on the urban sector.⁴ In the case of cities in developing countries, the size and vulnerability of informal settlements, generally built in fragile areas, such as coastal zones, flood-prone planes and ravines, and geologically unstable slopes, greatly increases their vulnerability. The impacts of sea-level rise and more frequent and intense natural disasters on rural areas will likely generate an additional influx of population in the cities, as more or less permanent “environmental refugees”, thus increasing the vulnerability of cities themselves.⁵

Developing countries are considered to be particularly vulnerable to climate change, as they are mostly located in tropical and sub-tropical areas, and given higher dependency of their economies and societies to climate in the first place. Most of the largest cities in Africa, Asia and Latin America are port cities for historic reasons linked to their colonial past, and thus directly subject to the impacts of a rising sea-level. The high cost of land in the central city and or around ports has often encouraged major commercial developments on land reclaimed from the sea or river estuaries, and these will often be particularly vulnerable to sea-level rise.⁶

The IPCC Third Assessment Report’s Volume 2 “Impacts, Adaptation and Vulnerability” provides an update of the existing knowledge and the integration of field studies, results of modeling simulations, and other information available on the projected impacts of climate change on urban areas⁷. According to the IPCC report, the main threats to the urban population and to the physical assets of developing cities – that will impact them

² *ibidem*, Summary for Policymakers, p. 16

³ Munich Re., Press Release of March 15, 1999, p. 1

⁴ Munich Re. “World of Natural Disasters” CR-ROM, Geospecials/Megacities, 2000

⁵ J.Hardoy, D.Mitlin, D.Satterthwaite “Environmental Problems in and Urbanizing World” Eartscan, 2001, p. 207

⁶ *ibidem*, p. 205

⁷ IPCC Third Assessment Report, Vol. 2, chapter 7 “Human Settlements, Energy and Industry” pp. 383-416

with more or less intensity based on the actual climate changes that will unfold -- are the following ones:

- ***Sea-level rise***: This is the most fundamental challenge of global warming that urban settlements face, and it will tend to increase because of the on-going influx of people and economic assets into the coastal zones. At risk are entire parts of coastal cities and their infrastructure, beaches subject to erosion, river floors in estuarine zones subject to sedimentation, and wetlands and tidal flats subject to flooding. Groundwater is at risk of increasing salinization, and coastal aquifers at risk of decreasing, affecting fresh water supply and peri-urban agriculture.
- ***Tropical cyclones***: Increasingly frequent and intense tropical and extra-tropical cyclones will likely cause severe wind damage and storm surges which, compounded with the sea-level rise, are expected to become a severe problem for low-lying coastal regions and cities, with particular risks for ports and other coastal infrastructure.
- ***Flooding and land-slides***: the expected increase in the scale, intensity and frequency of the rainfall regimes in most developing countries will likely strain severely or overwhelm the storm-drainage systems of many urban centers. It will likely cause periodic flooding of low-lying areas as well as landslides and mud-slips of the geologically unstable slopes, often subject to informal settlements; cities built next to rivers or on reclaimed lands in river-bed planes will be prone to additional inundations.
- ***Water quality and shortage***: Floods of the urban areas will likely damage water treatment works and flood wells, pit latrines and septic tanks; sewage treatment systems and solid waste disposal areas will likely be equally affected, contaminating water supplies. Where overall rainfall will decrease, droughts will likely compromise the replenishment of the water tables and thus the normal sources of water supply for the urban areas.
- ***Heat and cold waves***: Intense episodes of thermal variability will likely severely strain urban systems, by representing an environmental health risk for the more vulnerable segments of the population, imposing extraordinary consumptions of energy for heating and air conditioning where available, and disrupting ordinary urban activities.

In addition to these major threats, the IPCC Report indicates additional risks related to the increased possibility of urban fires and severity of hail and windstorm episodes, the negative impacts on the productivity of fisheries and agriculture on which some of the urban economies partially depend, the worsening of urban air pollution exacerbated by increased ground ozone formation, and the enhanced effect of urban heat islands due to higher overall temperatures.

The indirect impacts of such climatic threats are of course much wider. They include environmental health problems due to the expected changes in geographic ranges and incidence of vector-borne and infectious diseases, allergic and respiratory disorders, nutritional disorders related to climate-related food shortages, as well as the physical

damages and institutional strains imposed on the health care system.⁸ Where the impacts will be felt, urban economic activities will be likely affected by the physical damages caused to infrastructure, services and businesses, with repercussions on overall productivity, trade, tourism and on the provision of public services.

Box 1. Coastal Cities and Small Island States

By mid-century more than 70% of the population in settlements that potentially would be flooded due to sea-level rise is likely to be located in West and East Africa, on the Southern coast of the Mediterranean, in South and South-east Asia. With a 40 cm. sea-level rise, the mid-point of the IPCC projection ranges for the end of the century, world population at risk of annual flooding is expected to increase from the current 10m of today to 22-29m by the 2020s, 50-80m by the 2050s, and to 88-241m by the 2080s.⁹ However, the biggest impacts are expected in the small island states, located in the Atlantic, Pacific and Indian Oceans.

Cities like Alexandria in Egypt, Banjul in the Gambia, Tianjin in China, Jakarta in Indonesia and Bangkok in Thailand will be affected. A 50 cm. sea-level rise on Egypt's coastal zones would affect 2m people and 214,000 jobs, and cause land and real estate losses worth US\$ 35 billion.¹⁰ In Alexandria, the Old City is safe from direct effects of sea-level rise, as it is located at 12 meters above sea-level. However, the port area and newer suburbs have been built on low land with the aid of flood defenses, and are at direct risk. Low marshes and lagoons that surround the city could be lost or seriously contaminated with salt water due to sea-level rise. Ultimately, the city could become a peninsula, surrounded by the Mediterranean, only reached by bridges and causeways.¹¹

The average number of people in Africa impacted by coastal flooding could increase from 1m in 1990 to a worst case of 70m in 2080.¹² Banjul, the capital of the Gambia, could disappear by mid-century through coastal erosion and sea-level rise. East African coastal settlements are also at risk.

In most small island states coastal planes have provided the best location for urban centers and for the concentration of population, physical assets, economic activities and services. In most Caribbean islands, for instance, more than 50% of the population live within 2 km. of the coast. On atolls, most of the important infrastructure and population clusters often are less than 100m from the shoreline. The threats induced or enhanced by climate change will severely affect this group of nations and their cities,¹³ that are becoming acutely aware of their vulnerability.

⁸ J.Hardoy, D.Mitlin, D.Satterthwaite, *ibidem*, p. 203

⁹ Nichols et al. "Increasing flood risk and wetland losses due to global sea-level rise: regional and global analyses" *Global Environmental Change*, 9, S69-S87 as quoted in IPCC Third Report, Vol. 2, Chapter 7

¹⁰ El-Raey, M. "Vulnerability Assessment of the coastal zone of the Nile Delta in Egypt to the impacts of sea-level rise" *Ocean and Coastal Management*, 37(1), p, 29-40 , 1997 as quoted in IPCC, *ibidem*

¹¹ Turner et al "Cities at Risk" BNA International , London 1990, as quoted in Hardoy et. al., *ibidem*

¹² Nichols et al. *ibidem*, as quoted in IPCC Third Report, Vol. 2, p. 515

¹³ IPCC, *ibidem*, p. 847 and 864

2. Economic Valuation of Climate Change Impacts on Cities

Out of the major threats to cities described above, only sea-level rise has a exclusive correlation with climate change, while the other four are natural disasters or climatic episodes that get exacerbated in their intensity and frequency by climate change. Thus, the major attempts at valuating in economic terms the impacts of climate change on physical infrastructure generally refer to sea-level rise, and are based on the costs needed to defend the coastal areas from destruction and damages, or for the replacement of the physical assets. For instance, the cost of protecting port facilities and coastal structures, raising wharves and quays, and reconstructing water gates and pumping stations for a 1m sea-level rise (the high point of the IPCC projection ranges for the end of the century) in 39 prefectures in Japan has been estimated at US\$ 194 billion, or about 7% of annual GDP.¹⁴

On the other hand, the incremental nature of the intensity and frequency of violent climatic episodes due to climate change is hard to disaggregate from the “base-line”, even if scientific evidence has proven the correlation of their intensity and frequency with the recent increase in atmospheric temperature, as stated above. Data on economic losses associated with catastrophic events show that in constant 1999 US\$ they have increased worldwide from an average of US\$ 71.1 billion in the 1960s to an average of US\$ 608.5 billion in the 1990s.¹⁵ Although the economic impacts of these catastrophic episodes are relatively evenly split between developed and developing countries, when related to respective GDP the economic losses are significantly higher in developing than in developed countries¹⁶. Average economic losses in developing countries due to climate change were tentatively estimated at 2 to 9 percent of GDP by the IPCC in its Second Assessment Report, but the variability of the underlying assumptions is considered high.

Box 2. Natural Disasters: What Percentage is Due to Climate Change?

In 1982, Peru’s GDP declined by 12%, half of which was attributable to the El-Niño –related floods of that year. Between 1989 and 1996 China experienced losses from natural disasters averaging 3.9 percent of GDP annually. Flooding in Mozambique in 2000 caused direct and indirect losses of about 6 percent of GDP.¹⁷ Damages and losses from Hurricane Mitch equaled 80 percent of GDP in Honduras and 49% in Nicaragua in 1999.¹⁸

These figures have not been disaggregated to show losses that occurred in the cities as opposed to the rural areas. Nor can we ascertain how many of these disasters or how much of their intensity are due to the inducing or enhancing effect of climate change. However, they help us to understand the order of magnitude of the problem that cities in developing countries are facing on account of climate change. Further detailed analysis is however needed.

¹⁴ Mimura N. and H. Harasawa, eds. “Data-book of Sea-level Rise 2000”, Center for Global Environmental Research, NIES, Tsukuba, as quoted in IPCC Third Report, Vol. 2, p. 396

¹⁵ Freeman, K. “Infrastructure, Natural Disasters and Poverty”, in “Managing Disaster Risk in Emerging Economies”, A.Kreimer and M.Arnold, eds. WB 2000

¹⁶ M.Sharma et al. “Reducing Vulnerability to Environmental Variability” Environment Strategy Background Paper, WB 2000, p. 5

¹⁷ *ibidem*

¹⁸ FAO “The State of Food Insecurity in the World, 1999” as quoted in IPCC, *ibidem*, p. 409

3. Adaptation of Cities to Climate Change

Cities and human settlements in general have adapted through history to climate variability, but the intensity and pace of the present and forthcoming climate changes induced by the continued and on-going use of fossil fuels is already and will increasingly be a major challenge to many of them. Determinants of adaptive capacity include the availability of financial resources, of technology, specialized institutions and human resources, access to information and the existence of legal, social and organizational arrangements¹⁹, all assets that are typically scarce in developing countries and cities. In cities with a proven vulnerability to climate change, investments will likely require:

- ***“hardening up” of the infrastructure systems, including storm-drainage systems, water supply and treatment plants***
- ***protection or relocation of solid waste management facilities, energy generation and distribution systems***
- ***hydro-geological consolidation works***

Coastal cities will likely need to invest in heavy physical infrastructure projects specifically related to sea-level rise, such as:

- ***sea-surge protective barriers and dams***
- ***reconstruction of harbor facilities***
- ***flood barriers and Tsunami-prevention facilities.***²⁰

Such expenditures represent a significant burden for the public sector, for private utility companies, and indirectly for the urban economy as a whole.

Permanent changes to local ecosystems induced by climate change, such as the salinization of the ground-water or of river estuaries, might also alter the local economic base, and adaptation to those changes may be difficult, but essential, to achieve. An integrated adaptation response might therefore involve in addition to coastal zone protection the creation of new breeding grounds for fish, the expansion of irrigation agriculture, the implementation of new public health measures, and the avoidance of creating risks of larger disasters from extreme events by appropriate land-use planning and building codes that internalize climate change constraints.²¹ While private investments will undoubtedly have to come into play, the public sector will have the overall responsibility for the adaptation plans and for managing such transitions.

In some developing cities, relocation of resident population and economic activities to less vulnerable parts of the urban areas, or “managed retreat”²², will likely have to take place over time, and this would require a mix of market incentives and public sector

¹⁹ I. Burton, M. Van Aalst “Come Hell and High Water – Integrating Climate Change Vulnerability and Adaptation into Bank Work” ESSD Climate Change Series, WB 1999

²⁰ IPCC, *ibidem*, p. 405

²¹ I. Burton, M. Van Aalst, *ibidem*, p. 6

²² IPCC, *ibidem*, p. 405

planning and investments. Increased awareness of the vulnerability to climate change would induce private firms to seek relocation, and the differential costs of insurance and re-insurance, where applicable, would represent a powerful incentive to do so. However, this would not apply to the informal sector or to SMEs, that do not have the necessary resources. Replacement of productive assets at the end of their life-cycle may create opportunities for adaptation through upgrades or relocation, and land-use planning should channel new residential developments and productive investments towards less vulnerable areas. However, residents of poor and informal settlements and slums – unless assisted -- would lack the tenure and resources to vacate the vulnerable areas in exchange for safer ones.

In a context of scarce financial and technical resources, and of competing developmental priorities, investments related to the adaptation of cities -- their physical infrastructure, local economy, basic urban services and residential settlements -- to the impacts of climate change will hardly be popular. They will only be possible if there is a increased understanding of urban vulnerability, and the ability to demonstrate that in many cases the investments will be targeted at aspects of urban development that require urgent attention in the first place, such as informal settlements, and critical infrastructure such as water supply and drainage systems, that may well be already stretched to the limit.

Management and institutional aspects of climate change adaptation can be just as challenging, if not more, than the financial ones. These include the generation of reliable and comprehensive assessments of risk vulnerabilities for the exposed cities, and the dissemination of such information; the establishment of early warning systems and evacuation plans, including emergency preparedness and neighborhood response systems; the improved efficiency of water supply management, by minimizing leakages and instituting market-based pricing mechanisms; improving health education and institutional capacity in urban environmental management; and regularizing property rights for informal settlements and other measures to allow low-income groups to buy, rent, or build good quality housing on safe sites.²³ That is to say, priorities that ought to be anyway addressed, and that become more important in view of the climate change threats.

4. Mitigation of Green-House Gas Emissions in Cities

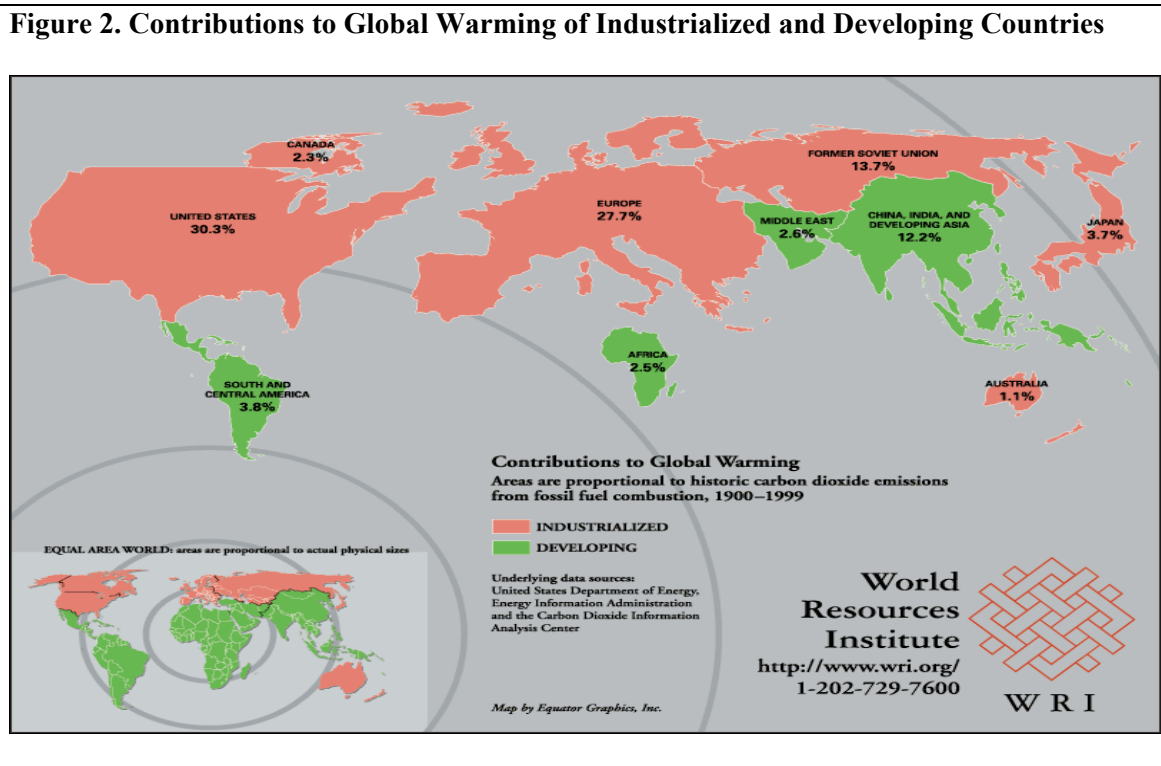
Cities in developing countries can also contribute to the mitigation of global Green-House Gas (GHG) emissions, i.e. reduce the volume of tons of CO₂, methane and other gases that they emit and get trapped into the atmosphere. Overall, though, the contribution of developing countries to global emissions world-wide is low, and is currently estimated at approximately 21 percent of the total, or 35% if we include the transition economies of the former Soviet Union (see Figure 2).

In addition, the on-going political debate between industrialized and developing countries as to the historical responsibilities for the current and projected warming of the atmosphere makes it so that the latter request of the former to take upon themselves the

²³ IPCC, *ibidem*, p. 405-406

bulk of the mitigation burden in the decades to come. Concerns over the potentially damaging impacts on national economic growth of mitigation measures if self-financed – notably in the fields of energy generation and consumption and of transportation-- are at the basis of this stance of many developing countries.

However, the reduction of GHG emissions has a globally beneficial effect wherever it may occur, and given the commitment of some industrialized countries -- that is being currently negotiated internationally – to reduce their national global emissions in the future, the relatively lower costs of GHG emission reductions in developing countries provides the rationale for international carbon emissions trading. This can represent an opportunity for “win-win” investments in cities in developing countries, providing that the projects thus financed have sound local objectives in addition to global ones.



The direct sources of global emissions in cities include energy generation, vehicular use, industrial and point-source use of fossil fuels, and the burning of bio-mass. The indirect sources include electrical energy use for public lighting, transport, industrial, commercial and house-hold consumption, such as cooking, lighting, heating and cooling. These will determine the overall urban energy demand, and thus the level of global emissions outside the urban boundaries, wherever energy generation is dependent upon the use of fossil fuels. Some examples of interventions that combine significant local benefits with GHG emissions abatement, and can thus generate revenues for developing cities:

- **Building materials and energy efficiency:** aimed at reducing the energy needs for heating, lighting and cooling of buildings, but also at increasing the efficiency in the use of building materials and of the building cycle itself;

- ***Transport demand management***: aimed at reducing the total volume of CO₂ emissions by mobile sources, by promoting greater ridership of mass transport systems, pedestrian zones, non-motorized transportation, and the use of more fuel-efficient vehicles and environmentally-friendly fuels;
- ***Methane recuperation from land-fills***: given the highly damaging nature of methane emissions to the atmosphere, methane recuperation from land-fills and related power generation is a viable investment with good economic returns;
- ***Cleaner energy generation***: switching from coal to natural gas in power plants, promoting the use of gas and clean energy sources to replace biomass, and the cogeneration of heat and electricity represent important opportunities for carbon sequestration while favoring significant local pollution abatement.

5. Financing of Adaptation and Mitigation Projects in Developing Cities

The United Nations Framework Convention for Climate Change (UNFCCC) was also established to forge international cooperation in the mitigation of further climate change, and therefore its provisions and implementation mechanisms mainly address opportunities for GHG emissions abatement. The Global Environment Facility (GEF) was set up to assist part II countries with four global challenges: biodiversity conservation, ozone depletion, international waters protection, and climate change. In the latter area, GEF focuses exclusively on the implementation of projects that have GHG emission abatement objectives, as the financial mechanism of the UNFCCC.

On the other hand, adaptation issues have been given relatively less attention in the last decade of the 20th century. This may however be rapidly changing as the impacts of climate change are beginning to be significantly felt. There are now clear signs of an increased pressure from developing countries to obtain assistance from industrialized nations with adaptation projects and with the related costs.

This is however a highly controversial issue. It can be argued that the damages that developing countries are and will be facing are ultimately caused by the sustained use of fossil fuels by industrialized countries over the last 150 years, on account of the accumulated carbon emissions trapped in the atmosphere. Consequently, it can be argued that the costs of adaptation can be presented as “reparation costs” that industrialized countries ought to be paying for. None if this is reflected in the spirit or the letter of the UNFCCC agreements, and many industrialized countries are keen not to confront these issues, for obvious reasons.

Financial provisions for vulnerability and adaptation in the UNFCCC are currently limited to 2 percent of project investments in developing countries resulting from the trade of Carbon Emission Reduction (CER) certificates. Such trade will start only when the Kyoto Protocol will be ratified, and when the Clean Development Mechanism (CDM) will hence be functional. Ratification of the Protocol is expected to be completed by 2002 or 2003, and national regimes for emissions reductions will then need to be put in place.

The World Bank's Environment Strategy also refers to the creation of a Variability and Adaptation Facility (VAP) to be financed by donor governments in the near future.²⁴ Some industrialized countries (European Union, Canada, Iceland, Norway, New Zealand, Australia and Switzerland) are currently considering the establishment of a Special Climate Change Convention Fund or Adaptation Fund, to be administered by GEF, that would make some financial resources available to developing countries for adaptation purposes. The overall endowment of the Fund would be of €450m per year and its likely effectiveness should begin in 2005²⁵. The Least Developed Countries (LDCs) would be the first beneficiaries, as their GHG emissions (1 percent of the total) would not entitle them to any significant gains from the CDM for emissions trading, while their adaptation needs are often the largest.

In the case of mitigation, on the other hand, given the overall purpose of the UNFCCC, financial resources and mechanisms are already in place that can be accessed by the public and the private sector to contribute to the abatement of GHG emissions, with targeted interventions in land-use planning, urban transport, energy generation and efficiency and urban environmental management.

The UNFCCC has established Activities Implemented Jointly (AIJ), also known as Joint Implementation (JI), as the formal mechanism for the collaboration between an industrialized and a developing country in the implementation of projects that have GHG abatement objectives. The partner industrialized country provides the financial and technical assistance for the project which takes place in the partner developing country.²⁶

The GEF Operational Programs (OP) in the Climate Change area are all highly relevant to cities, and co-finance development projects that combine significant local objectives with global ones, for which GEF provides grants equivalent to the "incremental costs". These are OP 5 "Removal of Barriers to Energy Efficiency and Energy Conservation", OP 6 "Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs", OP 7 "Reducing the Long-Term Costs of Low Greenhouse Gas Emitting Energy Technologies", and the more recent OP 11 "Promoting Environmentally Sustainable Transport"²⁷. The WBG-GEF portfolio consists of 62 projects, for which \$6.2 billion have been mobilized -- \$730m from the GEF and the rest from WBG, donors, private investors, and government counterparts.²⁸

Finally, in the wake of the Kyoto Protocol ratification and of the effectiveness of the CDM, the Prototype Carbon Fund (PCF) has been established by the World Bank as a pilot operation to test carbon emissions trading and to channel financial resources as well as information and capacity building to developing countries on issues of GHG emissions abatement. PCF places a major emphasis on the development of renewable energy projects, such as wind, small hydropower, solar direct and photovoltaic, landfill gas, refuse-derived fuel, and others. However energy efficiency projects, such as building and

²⁴ Environment Strategy, Annex F "Climate Change", p. 175, World Bank 2001

²⁵ Personal communication with Alan Miller, GEF, January 28, 2002

²⁶ see www.unfccc.int/program/aij

²⁷ see www.gefweb.org/operational programs

²⁸ Environment Strategy, *ibidem*, p. 174

appliances efficiency, are also financed under the PCF, which is promoting a greater share of such projects in its portfolio.²⁹ The capital of the PCF is currently \$145m.

The analysis of the World Bank/GEF portfolio in the area of climate change provides an encouraging example of the kind of pro-active work that the Bank could be engaging in the not so distant future, were the Adaptation Funds mentioned above to become available. In both areas the Bank could then focus on assisting its client cities by designing programs and projects aimed at the relevant local developmental priorities, and incorporating the climate change objectives – be they of mitigation or adaptation – that would be supported by concessional financing, at no cost to the client.

6. Implications for World Bank, PSI and Urban Development

A number of key strategies call for the integration of climate change in the World Bank Group's work: the Energy and Environment Strategy "Fuel for Thought" published in 1999, the Environment Strategy "Making Sustainable Commitments" published in 2001, and the Urban Transport Strategy "Cities on the Move", forthcoming in 2002. Climate change is also classified as a Corporate Public Good priority, and is part of the Millennium Development Goal of ensuring environmental sustainability. However, while the Bank is quite active through its lending operations in the mitigation of future climate change, vulnerability and adaptation objectives have little relevance in the portfolio.

The most comprehensive review to date of the Bank's performance in this area is to be found in "Come Hell or High Water – Integrating Climate Change Vulnerability and Adaptation into Bank Work" by Ian Burton and Maarten van Aalst, Environment Department Paper N.72, 1999. The review finds the level of integration quite modest, and provides numerous examples of projects that have failed to internalize obvious climate change risks, at the detriment of the Bank's clients, and of the institution's reliability.

Among the examples provided by the review, the case of an emergency loan for the potable water service recovery and restoration of flood protection for the city of Georgetown, Guyana, after the 1997/98 El Niño episode, is relevant. Despite the fact that a large part of the city is below sea-level, and that the emergency loan was addressing damages due to the destruction caused by a climatic episode the intensity of which was enhanced by global warming, no new assessment of the risks was made in project design – as it is often the case in emergency operations -- which makes the investment particularly vulnerable to further climate induced damages.

In the absence of concessional financing for adaptation, it is understood that Bank clients will be unwilling to borrow for climate change, but the authors argue that the Bank -- besides promoting more awareness of climate change concerns -- should in the very least³⁰:

²⁹ PCF Annual Report 2001, p. 17

³⁰ I. Burton, M. Van Aalst "Come Hell and High Water – Integrating Climate Change Vulnerability and Adaptation into Bank Work" ESSD Climate Change Series, WB 1999, p. 35

- ***address climate change concerns in the Country Assistance Strategies:*** Currently CASs do not generally cover such risks. Especially for those countries that are known to be particularly vulnerable, the CAS could highlight activities to be avoided or discouraged, as well as new activities designed to take advantage of new opportunities opened up by climate change.³¹
- ***minimize the vulnerability of the Bank’s own portfolio to climate change:*** Based on the examination of the Bank’s portfolio in a sample of countries with known vulnerability³², the study shows that an average of 37 percent of the projects are at some degree of risk, either because of their location or design or for not having taken into account the climate change impacts on water flows, sea-level rise, or other issues.
- ***maximize the role of the Bank’s portfolio on vulnerability and adaptation:*** As part of the same portfolio review, the authors found that 43 percent of the projects could help to reduce the countries vulnerabilities to climate change by incorporating adaptive considerations in their design, such as the heights of bridges and embankments, the frequency of coastal storms, or other “no regrets” measures.³³

These recommendations seem of particular relevance for PSI, home to the three sectors in charge of the majority of the Bank’s infrastructure investments in the cities of the developing world: Energy and Mining; Transportation; and Water, Sanitation and Flood Protection. They are also of relevance to Urban Development, a PSI theme, that carries the overall responsibility for assisting client cities with their development strategies, improving urban livability and reducing urban poverty, through physical investments and policy guidance. The Disaster Management Facility (DMF) and the Cities Alliance are working on closely related issues. The first, as it addresses concerns of disaster awareness, preparedness and reconstruction; the second, as it focuses on the elimination of urban slums and informal settlements, that are built in vulnerable locations.

About 30 percent of the Bank’s overall investments, or \$6 -7 billion, take place in urban areas every year, while only 5 percent are directly handled by the Urban Sector Units³⁴. Urban projects, in addition to internalizing the climate change mitigation and adaptation concerns in the design of their physical components, could also provide opportunities to ensure that such integration occurs as well in the other sectors projects in the urban areas.

Some short-term measures that could begin to address these issues could include:

- the collection and validation of information on specific vulnerability to climate change of the urban areas of countries at risk;
- the review of a sample of active projects in the urban areas in such countries, to identify opportunities for minimizing risks and including “no regrets” measures;
- the dissemination among urban and infrastructure staff of practical information on mitigation measures in the urban context, and on available financial mechanisms.

³¹ *ibidem*, p. 19

³² Bangladesh, Ecuador, Guyana, Papua New Guinea, Samoa and Zimbabwe

³³ I. Burton, M. van Aalst, *ibidem*, p. 18 table 3.2

³⁴ R. Gilbert “Investing in Cities for Better Lives for the Poor”, OED, draft January 2002, p. 1.