INTER-AMERICAN DEVELOPMENT BANK
VICE-PRESIDENCY FOR SECTORS AND KNOWLEDGE
INFRASTRUCTURE AND ENVIRONMENT SECTOR

IDB INTEGRATED STRATEGY FOR CLIMATE CHANGE ADAPTATION AND MITIGATION, AND SUSTAINABLE AND RENEWABLE ENERGY

October 26, 2010

TABLE OF CONTENTS

ABBREVIATIONS AND ACRONYMS

BRT	Bus Rapid Transit
CC	Climate Change
CCAP	Climate Change and Sustainable Energy Action Plan
CCLIP	Conditional Credit Line
CCS	Integrated Strategy for Climate Change Adaptation and Mitigation and Sustainable and Renewable Energy
CDM	Clean Development Mechanism
CIF	Climate Investment Funds
CO_2	Carbon Dioxide
COP16	Sixteenth Conference of the Parties (to the UNFCCC)
CTF	Clean Technology Fund
ECLAC	Economic Commission for Latin America and the Caribbean
EE	Energy Efficiency
FIP	Forest Investment Program
GCI	General Capital Increase
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas
ICF	Institutional Capacity and Finance Sector
IDB	Inter-American Development Bank
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
LAC	Latin America and the Caribbean
LULUCF	Land Use, Land Use Change, and Forestry
MDB	Multilateral Development Bank
$MtCO_2e$	Megatons of CO_2 equivalent
MW	Megawatt
NAMA	Nationally Appropriated Mitigation Actions
N_2O	Nitrous Oxide
PBLs	Policy Based Loans
RE	Renewable Energy
REDD	Reducing Emissions from Deforestation and Forest Degradation
SECCI	Sustainable Energy and Climate Change Initiative
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
VPC	Vice-Presidency for Countries
VPS	Vice-Presidency for Sectors and Knowledge
VPP	Vice-Presidency for Private Sector and Non-Sovereign Guaranteed Operations

I. BACKGROUND AND OBJECTIVES

1.1 The Latin America and Caribbean (LAC) region is highly vulnerable to the detrimental effects of climate change. According to the most recent Intergovernmental Panel on Climate Change (IPCC) assessment reports, important changes in precipitation and increases in temperature have been observed in the region.[1] Moreover, climate ensemble models have projected a mean warming in the region by the end of the century of 1°C to 4°C and 2°C to 6°C in an optimistic and pessimistic scenario, respectively. While recognizing the uncertainty of these projections, the scientific community predicts that temperature movements of this scale could bring about significant changes to the region's natural systems, affecting crop yields and the availability of water for human consumption, energy production, and irrigation. These effects of climate change threaten to undermine long-term efforts to achieve sustainable development, affecting disproportionately the most vulnerable groups in society, including the poor and indigenous peoples. Given the above, it is imperative that LAC countries address climate change vulnerabilities and respond with adequate adaptation measures in key economic sectors as agriculture, water resource management and urban development; inaction in these sectors could have significant negative consequences for the economic sustainability of LAC nations.

1.2 Climate change mitigation policies and related sustainable development practices are needed as well. Although LAC is a relatively minor contributor to global greenhouse gas (GHG) emissions (at 12%), under current regional development trends LAC emissions are expected to grow. On a *per capita* basis, LAC contributes more to GHG emissions than other developing countries, including China and India. With growing demands of energy, industrialization and urban development, LAC countries must prepare to introduce clean energy alternatives to reduce GHG emissions. The region also has vast areas of forest land that are converted each year to agricultural and other uses, making land use change and emissions resulting from deforestation a top priority for the region.

1.3 In this context, supporting the climate change adaptation and mitigation agenda and sustainable and renewable energy in LAC is a high priority. The Inter-American Development Bank (IDB) formally recognized this priority in its Ninth General Capital Increase, or GCI-9 (IDB, 2010a). The GCI-9 establishes that the Bank will promote sustainable growth in LAC, which includes pursuing global environmental sustainability and dealing with climate change while ensuring that energy requirements for development are met. It identifies the protection of the environment, response to climate change, and the promotion of sustainable energy and food security as priorities for the IDB. It further mandates that the Bank improve its capacity to assist the region in its transition to a green economy, including the development of the institutional and regulatory frameworks to allow investments in areas such as sustainable transport, renewable energy and energy efficiency, as well as to help the region adapt to climate change impacts, particularly in sectors such as water supply, agriculture and energy. In light of the priority afforded to this issue in the GCI-9, this Results Framework to measure the progress in achieving the commitments under the Capital Increase includes a

[1] IPCC, 2007; IPCC, 2008.

specific lending target for climate change, renewable energy and environmental sustainability of 25% for the period 2012-2015 y 2015, a significant increase from a baseline of 5% during the 2006-2009 period.[2]

1.4 To achieve this GCI-9 commitment, the IDB has committed to submit for consideration of the IDB Board of Executive Directors, during the first quarter of 2011, an Integrated Strategy for Climate Change Adaptation and Mitigation and for Sustainable and Renewable Energy (CCS). The objective of the CCS is to serve as a guiding instrument to scale-up the IDB's support for actions to mitigate and adapt to climate change within LAC. Leveraging the IDB's institutional strengths and its competitive advantages, the CCS promotes the development and use of a range of public and private sector financial and nonfinancial instruments for strengthening LAC's institutional, technical, and financial capacity to address climate change. The Strategy seeks to provide guidance for the Bank's dialogue with governments, civil society, and the private sector concerning regional and national climate policy agendas. The CCS also integrates public and private financing and capacity building into a single framework for climate action, and orients the Bank's efforts to strengthen and consolidate its own capacities, readiness and comparative advantages. Finally, the CCS provides a mechanism to mainstream climate change sustainability objectives into the Bank's operations.

II. DIAGNOSIS

2.1 The LAC region is highly vulnerable to climate change in terms of physical damage and negative social impacts. Climate-related disasters –storms, floods, droughts, landslides, extreme temperatures and forest fires–have already caused vast damage and imposed a high economic cost to the region.[3] Although substantial uncertainty remains, climate models predict that more intense and frequent extreme weather events seriously impact the region's environment in the coming decades, negatively affecting the lives and livelihood of millions. Increased vulnerability to climate change is likely to include adverse effects on food security and agricultural yields; changes in water quality and quantity; decrease in energy supplies; damage to coastal zone areas; damage to coral reefs, fish stocks, and associated ecosystem services; damage to development infrastructure; biodiversity loss and loss of associated ecosystem services a result of forest loss; and increase in climate-change related disasters and infrastructure loss in urban areas. There is growing awareness among LAC countries about the economic implications of climate change, and several countries in the region have already identified and assessed the potential costs of climate impacts in specific sectors.[4] Climate impacts

[2] IDB, 2010a.

[3] Between 1970 and 2008, the costs of these events to the region have been in the order of US$81.4 billion per year (ECLAC, 2009a).

[4] Total costs of climate change to the Mexican economy will range between 3.2% of GDP (using a 4% discount rate) and 10.4% of GDP (using a 0.5% discount rate) by the year 2050 (Galindo, 2009). Chile could lose, by 2050, an estimated 0.7% of GDP per year as a result of the impacts of climate change, with as much as 15% reduction in water availability for irrigation and a reduction in power generation capacity of hydroelectric plants of up to 11% by 2040 (ECLAC and Government of Chile, 2009). The economic impact of climate change in the region as a whole (15 countries in LAC) by 2010 could range between 34.5% and 137.3% of GDP, under a low-emissions scenario and high-emissions scenario, respectively (ECLAC, 2009b). Other countries with ongoing economic studies on impacts of climate

are likely to affect the most vulnerable groups disproportionately, especially the poor and indigenous, making climate change one of the most significant development challenges of our time.[5] There is also increasing concern with gender-specific climate impacts, many of the consequences accruing disproportionately to poor, rural and indigenous women. Key issues include the women's role in coping with natural hazards and disasters, lack of access to water and forest resources, declining food crop yields and malnutrition, and loss of income generating opportunities, among others.[6]

2.2 The region must be prepared to address the serious economic impacts of climate change by promoting clear climate change adaptation measures in key economic sectors such as agriculture, forestry, water resource management, energy and transport infrastructure, tourism, health and urban development. It must also incorporate disaster risk management and climate change adaptation in national development plans and sector strategies. Although the technical and financial requirements to build climate change resilience across sectors are still being assessed, the effort will certainly be of significant proportions and will require the mobilization of innovative solutions, financial resources, institutional capacity and political will for effective action.[7] In agriculture, for example, climate change may lead to variability and reduction in agricultural production and productivity which will require innovative adaptation strategies both through changes in production practices as well as shifts in crops.[8] Changes in rainfall patterns will require adjustments to water resource management both for agricultural and urban uses, generating large investment requirements on the back of already significant requirements due to the region's deficient water infrastructure and water management systems.[9] An increased risk of extreme weather events will require concerted action to reduce negative impacts on urban and rural populations as well as on economic activity such as agriculture, tourism and transportation.[10] On the energy supply side the observed melting of glaciers affecting some countries with electricity matrices highly dependent on hydro resources will increase their vulnerability while making their generation systems less reliable in the long term.

---

change include: Argentina, Bolivia, Uruguay, Paraguay, Ecuador, Peru and Colombia. Regional studies are being prepared for Central America and the Caribbean. These studies follow the methodology used for estimating the economic impacts of climate change globally (Stern, 2007)

[5] Extreme climate events could increase poverty in Mexico by almost 2% (Ahmed et al., 2009). Climate change is expected to cause an 18% reduction in agricultural productivity in Brazil, resulting in a 3.2% increase in rural poverty (De la Torre et al. (2009). See also Kronik and Verner (2010) for an analysis on impacts of climate change on indigenous peoples in LAC.

[6] Nelson et al. (2002); Neumayer and Plümper (2007); Aguilar (2009).

[7] Recent cost projections show that for Latin America the cost of adapting to a 2°C warmer world from 2010 to 2050 is in the range of US$16.8 billion to 21.5 billion per year in the driest and wettest scenario, respectively (World Bank, 2009).

[8] A study in South America suggests that farmers are likely to shift production substantially from currently produced "cold/loving crops" to "warm-loving crops" (Seo and Mendelsohn, 2008).

[9] In LAC's agricultural sector alone, the financing requirements for adaptation are estimated at US$1.2 billion per year from the present to 2050 (IFPRI, 2009).

[10] For a detailed description of climate change impacts and priorities in LAC, and the differentiating characteristics among sub-regions and countries, see the background analytical documents developed as part of this CCS (IDB, 2010b; IDB, 2010c).

2.3 To address climate change adaptation challenges, the Bank will target key economic sectors such as agriculture, water resource management, urban development and coastal zone management. The technical and financial means to protect these sectors will need to be developed further, and that includes allocating resources to incorporate climate change adaptation measures into sector planning. Key challenges include: the adoption of integrated disaster risk management; the provision of insurance coverage against damaging events to agricultural producers and local populations; the application of technology to increase crop resistance to rising temperatures; the adoption of adequate water governance frameworks to secure water availability in areas under climate stress; and the adoption of engineering and policy options to increase climate change resilience in cities. The protection of major infrastructure investments in the energy, transportation, tourism and health sectors will be equally important, including the use of climate-sensitive and risk-mitigating solutions in the design, construction and operation of facilities (see Annex A for a brief description of key climate vulnerability aspects and adaptation priorities in the region).

2.4 At the top of LAC's climate change agenda are the impacts on agriculture. Variability in weather and elevated GHG concentrations in the atmosphere are causing higher temperatures and alterations in precipitation, directly affecting crop yields and the livelihoods of rural communities. LAC's rural poor (58 million people in LAC, constituting 46% of the rural population) are particularly vulnerable to agricultural disruptions because they are largely dependent on rain-fed agriculture and have limited access to drought-resistant livestock, seed varieties, or crop insurance. This vulnerability is exacerbated by soil degradation that affects land productivity, with extensive soil erosion, loss of organic matter, worsening of nutrient values, and salinization. Large extensions of land are at risk of desertification due to overexploitation of pastures, deforestation, and inappropriate methods of irrigation. The challenges associated with poor existing management practices will be aggravated by a decline in agricultural productivity caused by a projected climate change.

2.5 Both climate change adaptation and disaster risk reduction are strongly rooted in development practices; both share the ultimate goal of reducing vulnerability to weather and climate hazards,[11] and of reducing disaster-related losses in terms of lives and social, economic and environmental assets.[12] Climate change adaptation and disaster risk reduction are complementary cross cutting development dimensions that must be mainstreamed into national, sector, territorial, social, economic and environmental planning. To achieve such an integrated climate risk management framework for climate-resilient development, all relevant stakeholders –national and sub-national governments, local communities, organized civil society and private sector–need to coordinate to develop integrated risk management strategies and action plans.

2.6 With regard to the region's contribution to global GHGs, historic trends and forecasts indicate that energy consumption and GHG emissions in LAC will continue to rise in the

[11] The Fourth Assessment Report of the IPCC recognized that reducing vulnerability to current climatic variability can effectively reduce vulnerability to increased hazard risk associated with climate change (IPCC, 2002).

[12] Hyogo Framework for Action, 2005.

future.[13] This growth in energy consumption and GHG emissions rates is in itself a compelling reason to increase attention to mitigation activities in the region. There is an equally strong trade and economic rationale for directing support to GHG mitigation in the region, given the significant challenges and opportunities that the transition to a low-carbon global economy will create for business and international trade, and the opportunities for implementing mitigation activities that are both environmentally sound and cost-effective. Critical areas for such mitigation activities include energy efficiency measures and renewable energy technologies. These are "win-win" mitigation activities that can be supported with a relatively high level of confidence.[14] However, mitigation options through renewable energy technology differ, since the level of maturity of the technologies available is not homogenous and their economic performance tends to be heavily dependent on the available local resource. The costs and benefits associated to some of these technologies are less clear and in many cases cannot be internalized under existing policy frameworks. Therefore, new policies and incentive schemes need to be introduced to improve their economic feasibility in order to facilitate its adoption in public and private sector investments. The implementation of incentive schemes to make financially viable renewable energy should be carefully designed and evaluated, especially when these schemes use limited fiscal resources in countries with more urgent fiscal priorities.

2.7 The Bank's mitigation activities will target the main emitting sectors in LAC: land use, land use change and forestry (LULUCF) which is estimated to contribute to 47% of GHG emissions, energy generation and consumption (28%), and agriculture and livestock (20%) (See Annex B for a brief description of climate change impacts and mitigation priorities in the region). LULUCF –characterized by extensive changes in land vegetation, destruction of forests, expansion of agriculture, and land degradation– is the largest contributor to GHG emissions in the region. Controlling deforestation and implementing sound forest management practices could reduce significantly the region's GHG emissions, as well as bring about a suite of co-benefits associated with sustainable rural development, poverty reduction, and conservation of ecosystem services, such as access to safe drinking water and the protection of biodiversity. It is therefore critical to address the most important elements that affect deforestation and forest degradation: land value, ownership and tenant rights; profitability of agricultural and forest practices; and access to markets. In particular, providing security of land tenure for indigenous communities and other rural populations is key to successful forest conservation actions.

2.8 The energy sector in LAC contributes 28% of the region's emissions due to its energy matrix, the world's cleanest. This low carbon footprint is threatened by the fact that many countries face the challenge of increasing energy demands (4.8% of expected annual rate of growth in electricity demand over the next 10 years), where short term options for

[13] Between 1970 and 2007 energy consumption rates in LAC rose at higher rates that the world average (3.15% versus 2.11%). ECLAC (2009b) estimates that LAC will have, on average, a 2.3% annual increase in per capita CO_2 emissions under a business-as-usual scenario. It is estimated that between 2008 and 2030, LAC's energy needs will expand 75%, requiring as much as US$1.5 trillion in investment in energy supply infrastructure (IEA, 2009).

[14] Some energy efficiency analysts suggest that there is a rebound effect that erodes some of the energy savings obtained through technical efficiency improvements.

covering the increasing supply include fossil fuels, mainly coal and natural gas. As a region LAC's electricity supply relies mainly on hydro resources, which accounts for 62% of the installed capacity of the region and 70% of the actual power generation, ensuring the relatively low GHG emissions. However, possible climate change impacts (glacier melt, higher rainfall variability) create new risks and costs that have to be taken into account in planning and operation of hydropower plants. Important technological opportunities for GHG reductions in energy-consuming sectors (mainly transport, water and sanitation, electric utilities) are available and can be implemented successfully with adequate levels of finance and enabling institutional frameworks. Similarly, there is a large potential to develop sustainable and low or non-GHG emitting energy sources in the region, including wind, solar, hydro, geothermal, bio-energy and nuclear. Declining costs of some technologies (especially wind and solar) are encouraging more widespread deployment of this renewable energy source, with significant GHG emission reduction potential.[15] The largest regional opportunities for GHG reductions in the energy sector are in energy efficiency, where direct benefits often exceed costs.[16] Nevertheless, the success of both renewable energy and energy efficiency programs depends on governmental action to overcome existing regulatory barriers and provide the right incentives to scale- up investments in these technologies by improving their economic feasibility in order to facilitate its adoption in public and private sector investments.

III. BANK RESPONSE AND LESSONS LEARNED

3.1 Over the past years the IDB has laid out the foundations for a sustained commitment to intellectual leadership and technical and financial support to climate mitigation and adaptation activities in the region. The Bank has key comparative advantages for bringing necessary changes and progress in LAC's climate change and sustainable energy agenda, including: (i) Board of Executive Directors composed of regional borrowing members and extra-regional lending members that are fully committed to increasing support to sustainable energy and climate change activities in the region; (ii) strong capacity to generate and mobilize knowledge and technical skills across sectors, such as infrastructure, environment, economy, social development, governance, trade and competitiveness, and; significant technical expertise building-up in the area of climate change mitigation and adaptation; (iii) strong presence in the region, with a management and technical staff working in country offices and strongly engaged with public and private sector clients from early programming to project execution; and (iv) the public and private sector windows of the Bank working under the same roof and in a coordinated fashion towards increasing technical and financial support to the region.

[15] According to an analysis performed by the Bank in selected countries in which valid information on renewable energy is available, significant GHG mitigation could be achieved by the implementation of a fraction of total renewable energy potential (including biomass and sustainable biofuels). A recent study in Mexico (Johnson, et. al., 2009) and Barbados (Castalia Strategic Advisors financed by the IDB ATN/OC-11473-BA) show that the abatement cost for renewable technologies could be as low as US$3 per avoided ton of CO_2 or eve negative for wind energy.

[16] The International Energy Agency (IEA) estimates that EE will account for more than half of the global energy related GHG emission abatement by 2030, with negative net abatement cost.

3.2 In order to address climate change in the region and to facilitate access to international climate finance for its borrowing member countries, the IDB's Board of Directors approved the Sustainable Energy and Climate Change Initiative (SECCI) in 2007 and established technical assistance funds to support knowledge and capacity-building, pilots and investment grants. SECCI's main objective was to mainstream climate change mitigation and adaptation within IDB operations, by targeting GHG mitigation actions in areas related to the energy, water and environmental sectors, and by building climate resilience in areas identified as highly vulnerable to the impacts of climate change.

3.3 Over the past years, the Bank has supported consistently the development of the climate change mitigation and adaptation agenda in the region. It has engaged in developing and strengthening institutional and regulatory frameworks to foster investments in clean energy and climate mitigation activities, has provided technical assistance for climate mitigation and adaptation projects, and has mobilized existing and newly developed financial instruments for public and private sector operations. At present, the sovereign and non-sovereign windows of the Bank work on an expanding pipeline and portfolio in more than twenty LAC countries using a full array of instruments, including technical cooperation, retainers to assist public and private clients prepare investments and debt financing, and investment and policy-based loans (PBLs). The high demand for SECCI funds to finance knowledge and capacity-building projects led to the US$40 million replenishment in 2009 of the climate change trust fund doubling its original size. These activities established the foundation for the application of a broad range of instruments, including a significant step up in lending activity.

3.4 Through the mobilization of climate-related products and services, the Bank has demonstrated its capacity to mainstream technical assistance and climate finance into its operations. The Bank's operational departments working with public and private sector clients are increasingly pursuing climate change objectives in project activities, and have started directing technical and financial resources to mainstream climate mitigation and/or adaptation activities in project design and finance. The Bank is therefore now prepared to ramp-up its involvement in clean energy, climate-related activities and sustainability required to meet the 25% target established in the GCI-9.

3.5 The Bank has also demonstrated its capacity to facilitate LAC countries' access to international sources of climate finance. Key sources of finance include: funds under the UNFCCC such as the Global Environment Facility (GEF) (particularly its climate window); carbon finance including the Kyoto Protocol's Clean Development Mechanism (CDM); the Climate Investment Funds (CIF);[17] and the Adaptation Fund. As these instruments evolve in international negotiations and agreements, the Bank will have to show readiness and deeper commitment from the organization. Other important sources of financing for climate change-related projects include equity investments by local and international project sponsors, investment funds, investment through banks and other intermediaries, and debt financing via loans, bonds and other vehicles. The Bank can play an important catalytic role in renewable energy and climate mitigation and adaptation

[17] In September 2008, potential donors pledged US$6.2 billion to the CIF over the next three years, providing an important source of interim financing for low carbon growth and climate resilience.

projects either by providing financing from its own resources or by mobilizing additional sources of financing such as those mentioned above.

3.6 The Bank has supported the access of public and private clients to carbon finance through analyses of emissions reductions potential of specific Bank loans; preparation of project design documents (PDD) and validation of projects; and development of methodologies and the analysis and support of governmental institutional capacity for promoting CDM projects. As the carbon market evolves, demands from clients increase and diversify, including: CDM's Programs of Activities (PoAs), Nationally Appropriate Mitigation Actions (NAMAs), new voluntary market schemes, innovative national and sub-national market schemes, and corporate GHG accounting systems. To meet such growing demand for sustainable energy and climate finance from the region's public and private clients, the Bank will need to increase significantly technical and financial capabilities of the dedicated staff across the Bank's operational divisions.

3.7 The GEF provides an important source of grant funding to promote global environmental benefits, including climate change mitigation and adaption initiatives. As an implementing agency of the GEF since 2004, the IDB has supported a number of projects in LAC in the areas of biodiversity, land degradation, international waters, and climate change, particularly in renewable energy, energy efficiency, sustainable transport, and sustainable forestry.[18] The GEF resources provide the Bank with an opportunity to scale-up its support to its member countries through additional technical and financial resources, and to devise innovative mechanisms for program development and resource blending. The IDB will continue to maximize its efforts to use an important part of these grant resources to leverage IDB funded projects.

3.8 The Bank has taken a lead position, in collaboration with the World Bank and the International Finance Corporation (IFC), in assisting Mexico and Colombia to prepare and submit their clean energy investment frameworks for financing under CIF's Clean Technology Fund (CTF). The CTF aims to provide concessional financing for implementation of countries' low-carbon development plans, strategies, policies, and programs, through leveraging and scaling up of public and private investment that may demonstrate, deploy, and transfer low-carbon technologies with a significant potential for long-term greenhouse gas emissions reductions. The CTF program in Mexico is highly effective at leveraging private finance for clean energy investments, where CTF funds were obtained and used to help finance the largest wind farm built in the region up until today.

3.9 CIF's Strategic Climate Fund (SCF) makes available grant and concessional finance through three programs: the Pilot Program for Climate Resilience (PPCR), that aims to integrate resilience to climate change into developing countries' national development and planning processes, with the Bank directly supporting a national program in Bolivia

[18] The current IDB-GEF portfolio amounts to over US$120 million which are leveraging IDB and other bilateral funding sources in economic development areas such as energy, agriculture, water and sanitation, tourism and transportation. In the area of sustainable energy the GEF is financing more than US$ 45 million in approved projects which are expected to reduce more than 23 million Tons CO2. Under the Fifth GEF replenishment of 2010, approximately US$ 750 million of GEF funding will be available for LAC countries in the next 4 years.

and a regional program in the Caribbean; the Forest Investment Program (FIP), that supports developing countries' efforts to reduce emissions from deforestation and forest degradation by providing scaled-up financing for readiness reforms and public and private investments in Peru, Mexico and Brazil; and the Scaling-Up Renewable Energy in Low-Income Countries Program (SREP), that allocates funding to pilot approaches to climate action, with Honduras as the first LAC country to participate in the SREP. The Bank's effective mobilization of the full menu of CIF instruments requires stepping up technical and financial resources –lending and non-lending– in line with growing demands. The CIF underscores the Bank's role as an honest broker, articulating both public and private investments in the context of the evolving international financial framework.[19]

3.10 The Bank has drawn important lessons from current efforts to enhance institutional capacity and climate policy innovation and reforms in the region. For example, the Programmatic Climate Change Policy-Based Loans (PBLs) in Mexico and Colombia, and those underway in Peru and Guatemala show that strong leadership, particularly from the Ministries of Finance, is required for effective climate policy formulation, design and implementation, and for effective credible commitment of fiscal resources towards the achievement of climate objectives. Cross-sectoral coordination for climate action is also critical, with a strong climate change national entity capable of communicating various technical demands in the climate mitigation and adaptation agenda. Similarly, when supporting policy reforms in sustainable energy, such as those approved already in Peru, Panama and Barbados, strong leadership from finance authorities and effective cross-sectoral coordination have proved critical for the implementation of the reforms.

3.11 A critical aspect of Bank's support to climate change agendas in the region is the ability to incorporate early on, during country programming and country strategy activities, climate change mitigation and adaptation priorities, as well as the identification of opportunities for public sector interventions and private sector investments. During the past two years, the Bank has successfully incorporated climate change discussion into programming activities in a handful of countries, which has allowed the expansion of climate-related investments and growth on technical assistance portfolio. However, this exercise has to be systematized and supported further.

3.12 Concerning the role that the Bank can play in improving knowledge and information generation related to climate vulnerability, a key lesson is that linking science to national and sector policy development is essential. Relevant climate-related information stemming from climate modeling, vulnerability and impact assessments, adaptation scenarios and risk analyses should be factored into the policy development and implementation (e.g. formulation, planning, resource allocation, programming and evaluation). There is also a strong need for programmatic approaches to climate adaptation to facilitate area-wide and cross-sector integration for vulnerability reduction, as opposed to isolated project-level solutions. At the same time, it would be important to support the implementation of demonstrative adaptation pilot projects from which one

[19] The COP15 Copenhagen conference in December 2009 led to new global proposals such as the Copenhagen Green Climate Fund under the Copenhagen Accord, which includes the provision of new short-term financing for climate change mitigation and adaptation activities.

could draw results on costs and benefits of adaptation measures at the local (sub-national) level.

3.13 Supporting policy dialogue on sustainable energy and climate change policy in the region has proved to be essential for a successful engagement of LAC government authorities. For that purpose, the Bank coordinates the Sustainable Energy, Climate Change and Disaster Risk Management Network, provides a cross-sectoral discussion platform for decision makers addressing climate adaptation and resilience challenges. It has represented an adequate platform to engage top decision makers from the energy, environment and climate change sectors in policy discussions concerning their current and future sustainable energy and climate change programs.

3.14 Strong collaboration of the Bank and multilateral development banks and agencies such as the World Bank, the United Nations (UN) and others is a critical enabling factor to the success of the Bank's agenda in support of the region. Coordination among Multilateral Development Banks (MDBs) and international organizations is important for mobilizing the necessary technical and financial resources, and for generating complementarity among the internationally-funded programs in the region. The IDB works collaboratively with the World Bank on a regional dialogue on adaptation policies in the water sector in LAC. It also chairs the Partnership on Sustainable Low-Carbon Transport (SLoCaT) which involves the Asian Development and the African Development Bank. CIF design and implementation is also a good example of strong MDB collaboration. While these initiatives seek to develop a common approach and harmonize efforts to tackle specific climate change challenges, increased Bank support to collaborative programs is needed to guarantee effective coordination and synchronized work among MDBs in the medium-term.

3.15 IDB experience in the region confirms that current levels of climate finance are insufficient to develop sustainable energy and other climate investment projects in LAC. Private project sponsors and public sector institutions face high initial capital costs and insufficient long-term financing, and operate in a financial environment that does not provide the necessary incentives for investors to enter new markets. On the whole, local financial intermediaries lack relevant expertise and capacity to analyze and structure project finance appropriately which typically results in relative high transaction costs and high interest rates that discourage potential borrowers. There is ample opportunity to improve financial instruments and generate incentives to support energy efficiency, renewable energy and other climate-related projects. Successful initiatives would combine access to finance from the IDB and financial intermediaries with programs that build the capacity of project developers, local financial intermediaries, and other private market actors to scale up these projects to a commercial level[20]. Such an approach will become particularly relevant to the private sector's engagement with the drivers of deforestation and adaptation. With regard to the application of sustainability criteria in industry and services, the region requires support for the development of tools, standards and protocols to help companies, especially small and medium-sized companies, to facilitate green procurement, GHG emission accounting, emission reduction technology

[20] For example, SCF/FMK helps local financial institutions develop "green line" procedures and eligibility criteria for on-lending to support appropriate energy efficient and renewable energy projects.

and climate adaptation measures[21]. The IDB will seek to facilitate proactive and concerted efforts by business and policy leaders working together to strengthen market-based solutions and achieve the scale and reach of investment required to meet the large demands of climate change action.

IV. AREAS FOR BANK INTERVENTION

4.1 Meeting the investment needs of sustainable energy and climate change mitigation and adaptation requires the development of specialized capacity. The IDB will strengthen and consolidate its own capacity, readiness, and comparative advantages to facilitate the mainstreaming of sustainable energy and climate change objectives into its operations, and will equip itself to become a catalyst for clean development in the region.

4.2 The IDB will pursue the following five strategic lines of activity to respond effectively to the growing demand for climate change action and development of sustainable energy:
(i) strengthen the Bank's knowledge base; (ii) strengthen institutions and private and public sector capacity; (iii) develop instruments to mainstream climate change mitigation and increase resilience of Bank-funded projects; (iv) identify and develop lending and technical assistance for climate action in key sectors,; and (v) scale up investments, address financial gaps and leverage private sector investments.

A. Strengthen the Knowledge Base Priorities

The Bank will focus on building technical capacity and knowledge regarding climate change adaptation and mitigation and sustainable energy, by providing and facilitating guidance, support and knowledge to its clients, as well as to its staff.

4.3 The Bank will create the conditions to enable the identification, generation, application and dissemination of knowledge to strengthen the institutional, technical and financial capacity of the Bank and its clients, and be better prepared to face the challenges associated with climate change and sustainable energy. This knowledge will also provide guidance for Bank dialogue with governments, civil society and the private sector in relation to the achievement of regional and national targets on climate policy. This strategic line will address sector-specific research and policy needs of the multiple sectors participating in the climate change agenda, including energy, water resource management, agriculture and livestock, land use and forestry, transport, health, urban development, coastal management and disaster risk management. It will also address the need for deeper understanding of the multiple dimensions of climate change policy and decision-making, including environmental science, economics, politics, technology, technical dialogue, development of strategic alliances and partnerships, and outreach and

[21] For example, the IIC's Greenpyme program provides technical assistance to SMEs in the areas of energy efficiency, renewable energy and carbon credits.

communication. The Bank will prioritize the pursuit of activities to increase the generation, systematization and dissemination of knowledge in the climate change field, including support for the development of:

- *Studies on the economics of climate change, social dimensions and social vulnerability to climate change.* The Bank will continue to provide support to develop national studies of economic impacts of climate change and basic research on this area. It will support studies that incorporate gender, poverty, ethnic and local community dimensions of climate change vulnerability, impacts, mitigation and adaptation, as well as effects of climate change on economic development and human health.
- *Tools and instruments to assess GHG impacts and mitigation reduction potential, climate vulnerability and risk management.* The Bank will seek to promote the development of analytical tools for developing GHG inventories and assessing alternatives for GHG emission reductions in key sectors and technologies. It will also support the development of climate change vulnerability, social impact and risk assessments that integrate the full range of socioeconomic, biophysical and environmental impact variables (including, among others, indigenous and ancestral knowledge), including the development of risk sharing and innovative transfer mechanisms to address loss and damage.
- *Networks, partnerships and platforms to address climate mitigation and adaptation challenges*. The Bank will incorporate the latest developments in climate change knowledge into its activities and support: existing regional networks and innovation centers; new web platforms for knowledge sharing on carbon finance and carbon markets involving key stakeholders in the public and private sector; knowledge partnerships with the private sector, including the identification and management of climate risks and the development of new markets, technologies or business models; and partnerships with regional environmental and development institutions, and civil society to exchange experience and knowledge systematically to achieve more informed strategic and operational development.

B. Strengthen Institutions and Public and Private Sector Capacity

The Bank will leverage its unique position in the region to strengthen institutional frameworks to better respond to climate change and sustainable energy challenges

4.4 The Bank will support the development of institutional and technical capacity in borrowing countries through the promotion of policy and institutional frameworks that support all aspects of climate change mitigation and adaptation, with a balanced focus on both public and private sectors. Key areas of intervention include:

- *Development and implementation of national and sub-national climate change strategic action plans.* The Bank will assist countries' public national and sub-national entities in the development of Strategic Climate Change Action Plans in tandem with existing Bank country assistance strategies and programming exercises.

- *Strengthening institutional capacity and supporting the development of policy and regulatory frameworks.* The Bank will support the development of strong national regulatory frameworks and policies based on international standards that will facilitate investments in clean energy and vulnerability reduction. The Bank will continue to utilize policy-based and investment loans in climate change to advance institution- building and policy reform in climate change.
- *Strengthening of national and sub-national authorities.* The Bank will promote capacity-building programs for national climate authorities and climate change focal points within the various sector ministries. This includes support to key sector ministries (environment, energy, transport, agriculture, water and sanitation, urban development, industry and others), as well as ministries of finance which play an increasingly important role in budget allocation and promotion of climate mitigation and adaptation investments. The Bank will also promote institutional strengthening of sub-national authorities (provincial, state, municipal), creating the necessary capacities for the development of climate change action plans and the implementation of climate mitigation and adaptation actions at a local level.
- *Support to national and local funding institutions, commercial banks, and other financial intermediaries to access and develop financial instruments to promote carbon finance, energy efficiency and renewable energy technologies*. The Bank will continue to provide technical assistance on GHG accounting, climate risk assessment, carbon project development, and the development of financial instruments in projects to reduce GHG emissions. It will also support capacity-building of national business organizations, especially those that support public-private cooperation.
- *Strengthen civil society participation and ownership of climate change-related decision making.* The Bank will support institutional strengthening of civil society and local/community level organizations to reduce climate impacts and enhance local adaptive capacity, engaging all relevant local stakeholders (i.e. local communities, tribal/indigenous groups, women and youth) in the design, implementation and monitoring of climate mitigation and adaptation actions.

C. Develop Instruments to Mainstream Climate Change in Bank-funded Operations

The Bank will develop instruments to mainstream climate change mitigation in its operations support comprehensive GHG reporting and improve climate resilience of the projects it finances.

4.5 The Bank will seek that its projects take into account currently available technological options and management practices that can help reduce climate impacts. In addition, the Bank will promote sector-specific principles for climate mitigation objectives, such as:

- In the case of *fossil fuel power generation projects*, the Bank will be selective in regard to the type of technology proposed for funding, seeking to balance the environmental and economic benefits and achieve internationally recognized GHG emissions performance standards. .
- In the *industrial sector*, several options for mitigating industry-generated GHG emissions will be analyzed when selecting a project for Bank financing. These

include: adequate consideration of sector-wide options for GHG emission reductions, industrial process-specific options for GHG emission reductions, and operating procedures applied at the industrial plant level.

- *In the area of waste management*, the Bank will fund solid waste and wastewater projects that consider proper gas control/capture/elimination and use (for electricity generation, when possible), emissions mitigation through waste minimization, re-use and recycling, fuel efficient waste collection and transport systems by means of improvements in routes, frequency of service, transfer of waste and equipment use.
- In the case of *agriculture, transport and dams projects* that generate direct and indirect land use change, that is, conversion of land with high carbon storage content, the Bank will take into account the projects' GHG emissions and environmental impacts.
- *To promote sustainable transportation*, the Bank will support the identification and financing of sustainable low-carbon transportation solutions for passengers and freight. IDB will support the development and financing of road infrastructure investments, including projects and programs for maintenance of existing infrastructure and to improve accessibility of remote communities for sustainable development.

4.6 The Bank will develop sectoral technical notes containing orientation and best practices for the development of projects in the energy sector and other GHG-intensive industries.[22] The Bank will also screen the projects it supports for energy efficiency opportunities early in the project cycle and offer assistance for energy audits, pilots and scale-ups, and energy management training. Lending and technical assistance programs in climate-sensitive sectors will be consistent with existing Bank Environmental and Social Safeguards, as well as those referring to Indigenous Peoples and Gender.

4.7 The Bank will develop GHG reporting mechanisms to measure climate performance of the Bank's own investments and operations. It will also develop the capacity to improve climate resilience of existing and new projects, and assess the possible use of carbon offsets. These instruments will be developed as part of the implementation of the CCS.

D. Expanding Lending and Technical Assistance in Key Sectors

The Bank will increase its lending and technical assistance programs in climate-sensitive sectors, mainstreaming climate change mitigation and adaptation in the design and implementation of its operations.

4.8 The Bank will strengthen its commitment to the region by directing financial resources for lending and technical assistance activities to reduce climate change impacts and vulnerability, and will help governments and the private sector advance the necessary policies and programs while taking advantage of technological and economic opportunities to improve sustainability. Based on the Bank´s comparative advantages,

[22] These technical notes may evolve into climate change sector guidelines to be adopted by the Bank's administration.

and in response to key regional priorities and needs, the Bank will focus on key sectors or areas of intervention to direct financial and technical support in the region.[23] A first set focuses on activities recognized as key drivers of the climate policy agenda, and for which significant technical and financial resources are required. Those sectors include: land use change and deforestation which is the largest contributor of GHG in the region; hydrologic resource protection and water resource management, a highly-vulnerable sector to climate change impacts; and agriculture, which translates into severe impact on rural productivity and the livelihood of rural populations.

4.9 A second set of sectors focuses on key physical infrastructure that the Bank has financed extensively throughout the region, but which require a shift towards more environmentally sustainable and climate-friendly solutions. Such sectors include energy, transport and sanitation. Although these sectors show large investment gaps which by themselves justify the commitment of Bank resources, the shift towards more environmentally sustainable and climate-friendly programs and technology demands a much stronger engagement of the Bank in these sectors. In the case of the energy sector, the region has a strong potential for renewable energy and emission reductions in the sector, but requires additional support for carrying out the necessary investments, both technical and financial. In the transport sector, the shift to more sustainable solutions in public transportation system also requires a large influx of technical and financial resources that governments and private sector cannot mobilize on their own. With sanitation infrastructure, large opportunities for emission reductions are lost due to lagging investments in infrastructure, mainly in waste collection, treatment and recycling.

4.10 Finally, since LAC is an eminently urban region, the Bank needs to adopt an integrated urban sustainability program to assist city governments and stakeholders´ efforts to articulate the full range of sector priorities into coherent policies and programs. City clients are increasingly adopting urban/environmental sustainability and climate resilience principles, programs and targets, requiring a strong mobilization of resources. The Bank is in a unique position to provide cross-sectoral services for city-clients, with integrated products aimed at improving urban governance and the quality of life of urban citizens.

4.11 The following priority sectors will be supported under this Strategy (for a description of key impacts, policy options and Bank instruments that should be considered for these sector interventions, see Annex C):

- *Land use, land use change and forestry (LULUCF).* The Bank will support lending and technical assistance projects that reduce emissions by addressing the drivers of deforestation and forest degradation, including overcoming barriers and challenges in the areas of governance, market development for the public goods and services provided by forests, and carbon finance under regulated and voluntary markets. Some of the activities to be supported include: promotion of forest management practices for timber production; support for the effective

[23] Priorities regarding climate change vary within the region (sub-regions, countries, etc.), depending on geographic conditions, economic and development factors, and other factors. The Bank will identify specific needs and levels of intervention for investment and technical assistance in the different countries or groups of countries as part of the development of the Climate Change Action Plan of the CCS.

establishment of protected areas and biodiversity protection; enhancement of natural heritage through sustainable tourism development; improve management of forest concessions, tenure regularization, and demarcation of indigenous land, including considerations of traditional use and management practices; provision of incentives for private individuals and firms to recover degraded forestlands and protect existing forests; establishment of forest monitoring systems to prevent or minimize the impact of forest fires and diseases; support for local communities, women's groups, and indigenous people in the provision of ecosystems services for biodiversity and goods (timber and non-timber forest products); support for development of private-public partnerships, with a focus on local communities and indigenous peoples, including information sharing on carbon finance and voluntary and regulated carbon markets in forestry activities, and integration of local development strategies in broader land use management schemes; develop new investments opportunities under REDD+ programs; and facilitate the development and financing of national investment plans in the forest sector, particularly under the platform of CIF´s FIP.

- *Agriculture and livestock.* Consistent with its food security activities, the Bank will promote sustainable agriculture practices among farmers to adapt to climate change impacts. For this purpose, the Bank will promote the provision of agricultural services to monitor, control and eradicate pests and diseases, strengthen the countries´ capacity to develop or adopt technological innovations, facilitate farm investment on soil conservation and land fertility, and increase efficiency of water resources use at farm level. The Bank will also direct support to improve the modeling and forecasting capabilities for assessing climate vulnerability and risk in agriculture, and will direct support to programs that promote the adoption of profitable, environment-friendly technological innovation and practices, especially small landholders, to ease their adaptation process to climate change. The Bank will work with the public and private sectors of the region to ensure that the use of best agriculture practices, methane capture mechanisms for the livestock sector, and energy self supply are fully integrated in the business models of the sector, and will promote the appropriate trade policies to facilitate investments in these areas. Lending and technical assistance in this sector will go together with policy dialogue to ensure adequate frameworks exist to promote the efficient use of farm resources for adaptation purposes.

- *Water resource management and sanitation.* The Bank will support technical assistance and investment programs that mainstream climate change adaptation and mitigation priorities in water and sanitation sector operations, including: climate adaptation measures for reducing disaster risk in water and sanitation projects, including assistance to assess vulnerability and risk associated with climate variability and change, investments in climate-proof physical infrastructure (structural flood defenses and drainage), better local water management practices (conservation and recycling), climate adaptation programs and climate/disaster risk management schemes, and programs to raise institutional consciousness among regulators in order to incorporate climate adaptation requirements in public and private utilities; and emissions mitigation measures such as increasing the operating energy efficiency of water and sanitation utilities, use of passive or active methane capture systems that

minimize GHG emissions in landfills and wastewater treatment plants, and adoption of new prevention, re-use, recycling and composting initiatives.

- *Sustainable energy.* The Bank will strengthen its sustainable energy portfolio through lending and technical assistance on:
    - energy efficiency, starting with lower-net-cost interventions ("low-hanging fruit"), including support for overcoming barriers that prevent the expansion of EE programs; and
    - renewable energy by supporting wind, solar, hydro, geothermal, marine, waste to energy (e.g. incineration and gasification) sustainable energy (such as nuclear) and bio-energy (biomass cogeneration such as bagasse, rice husks and wood chips from residual timber processing).

  Such activities will be undertaken while addressing the financial challenges (high up-front cost technology) and institutional barriers (particularly regulatory issues). The Bank will support the identification of RE and biofuel potential, pilot RE projects with IDB resources and GEF grant resources, foster fuel switching projects,[24] and promote scale-up of successful RE experiences to obtain an environmentally sound exploitation of the renewable resources in the region. Development of biofuels may include the construction of biofuel plants that meet sustainability criteria, assessments of biofuel potential, feasibility studies, assessments of socio-economic and environmental sustainability, and identification of the most competitive feedstocks. The aim is to sustain innovative solutions for approximately 40 million people currently without access to electricity in LAC.

  The Bank will promote innovative financial instruments for the adoption of sustainable energy solutions such as "green" financial products for financial intermediaries (sustainable lines), and support regional integration of energy markets to cover current deficits and improve the long-term sustainability of energy supply.

- *Sustainable urban transport.* The Bank will promote sustainable transportation focusing on the Avoid-Shift-Improve framework, which highlights the importance of reducing/avoiding travel needs by shifting to more efficient modes of transport and improving technologies and transportation systems to reduce CO_2 emissions. To this end, the Bank will provide technical support and investments for: land use planning and transport oriented development; development of less carbon intensive modes of transportation on a CO_2/km-travelled basis, such as Bus Rapid transit (BRT), Metro, freight and passenger rail and non motorized transport; regulatory measures to improve the performance of transportation systems, traffic demand management, freight transport and logistics; innovative technologies in vehicles and fuels; and incorporation of co-benefits associated with more efficient means of transportation including congestion reduction, health benefits from increased physical activity and reduced air pollution. To address climate adaptation needs, the Bank will work together with its member countries in the development of risk analysis methodologies for the reduction of vulnerability of transport infrastructure and the implementation of

[24] A fuel-switching project consists of replacing a high-emitting fossil fuel with another lower-emitting fossil fuel in electricity generation.

preventive and complementary measures for ensuring a reduction of impacts associated to climate related events.

- *Integrated urban development and climate-resilient cities.* The Bank will support national and local city governments[25], as well as urban communities, organizations, and private sector entities operating in urban areas, in the development and implementation of policies and programs that promote integrated and sustainable urban and environmental management towards GHG emission reduction and climate resilience. The activities and investments to be supported include the promotion of: urban-planning schemes (i.e. land use/zoning, land rights, etc.) that take climate resilience and disaster risk reduction into account; building designs and standards that support the capacity of buildings to withstand extreme weather; building standards and materials that increase energy efficiency; comprehensive and multi-sector approaches in land use planning, aiming at reducing the carbon footprint of the cities; integrated urban management schemes that will link the provision of urban services (energy, transport, water and sanitation) to GHG mitigation objectives; and green housing mortgages to increase private sector mortgage originations.

E. Scaled-Up Investments, Addressing Financial Gaps and Leveraging Private Sector Investments

The Bank will develop financial mechanisms that will allow for the scaling up of investments, addressing of financial gaps and leveraging private sector investments.

4.12 The Bank will develop the necessary mechanisms for scaling up low-carbon and climate resilient investments, drawing upon the full range of existing instruments including loans, grants, guarantees, investment grants, technical cooperation projects but also assessing the feasibility of carbon finance, and green programmatic lines- adapted to each sector- and country-specific gap analyses and tailored to client needs. The Bank will seize country-specific opportunities, such as lending in local currency or applying NAMAs and NAPAs to direct financial resources to mitigation and adaptation priorities.

4.13 To meet the scale and extent of investments needed, the Bank will enhance the use of existing private sector instruments such as loans guarantees, and will explore risk-sharing mechanisms. Leveraging adequate capital levels will require creating cooperation and synergies between public and private sector financing and generating incentives for private companies that engage in sustainable activities and climate change mitigation and adaptation actions.

4.14 The Bank will maximize the use of international resources, particularly grant and concessional loans from the CIF, GEF, Adaptation Fund, Kyoto Protocol, and new UNFCCC mechanisms emanating from the Copenhagen Accord and COP16, to pilot financial instruments in new climate-related areas such as energy efficiency, renewable

[25] The IDB is currently developing its Sustainable Cities Initiative to promote comprehensive and sustainable urban development in LAC cities including improvements to environmental quality, climate resilience, fiscal responsibility and good city governance.

energy and insurance. The Bank will also seek to expand access to REDD finance, as these resources become available.

Climate change affects common risk factors considered in project finance such as equity, interest rate, foreign exchange, and commodity price, among others. Therefore, the IDB will continue to gain a better understanding of climate-associated risks for project finance, how to manage them, and review risk analysis of the portfolio to include projections of future climate conditions beyond historical patterns.

V. IMPLEMENTATION OF THE STRATEGY

5.1 Climate Change Action Plan. Subsequent to the approval of the CCS by the IDB Board of Executive Directors, the IDB Group will develop a Climate Change and Sustainable Energy Action Plan (CCAP). This Plan will be approved by Bank Management and distributed to the IDB Board for information. The CCAP will detail the activities to support the Strategy's five strategic lines of action. The CCAP will also integrate a system of targets for IDB lending for low-carbon energy and climate resilience, in line with the Results Framework for the General Capital Increase (GN-2518-20, Annex 1).

5.2 The CCAP will detail the activities to address specific internal and external needs. These activities will be clustered in programs and systems such as: a system for tracking and monitoring climate change within IDB operations; a program to mainstream sustainable energy and climate change mitigation and adaptation objectives in country strategies; climate change research support program; and a climate change knowledge management program. These activities will seek to generate a more robust operational program for the public and private sectors.

5.3 ***Coordination and consultation with member countries, civil society, the donor community and international organization***. The Climate Change Strategy will undergo a 90-day public consultation process that includes a web-based consultation and on-site regional and sub-regional consultations to gather inputs from civil society. In addition, the CCS will incorporate feedback gathered at the UNFCCC Conference of the Parties in Mexico (COP16, November-December 2010) and other international fora.

5.4 ***Timeframe for development of the CCS and approval.*** Management will submit the CCS for approval by the Board of Executive Directors during the first quarter of 2011.

BIBLIOGRAPHY

- Aguilar, L. 2009. Climate Connection, Women and Climate Change: Vulnerabilities and Adaptive Capacities. State of the World.
- Ahmed, A., N.S. Diffenbaugh and T.W. Hertel, 2009. Climate Volatility Deepens Poverty Vulnerability in Developing Countries, Environmental Res. Lett. 4 034004, doi:10.1088/1748-9326/4/3/034004.
- De la Torre, A., P. Fajnzylber and J. Nash. 2009. Low Carbon, High Growth: Latin American Responses to Climate Change. World Bank, Washington DC.
- ECLAC. 2009a. Cambio climático y desarrollo en América Latina y el Caribe: una reseña. Santiago de Chile.
- ECLAC. 2009b. Economics of Climate Change in Latin America and the Caribbean: Summary. Santiago de Chile.
- ECLAC and Government of Chile. 2009. The Economics of Climate Change in Chile. Santiago de Chile.
- Galindo, L.M. 2009. *La economía del cambio climático en México: Síntesis*. SEMARNAT-SCHP, México.
- IDB. 2010a. Report on the Ninth General Capital Increase in the Resources of the Inter-American Development Bank. AB-2764. Washington, DC.
- IDB, 2010b. Analytical Framework for Climate Change Action (printed version). Washington, DC.
- IDB, 2010c. Analytical Framework for Climate Change Action (draft long version). Washington, DC.
- Intergovernmental Panel on Climate Change (IPCC), 2002. *Impacts, Adaptation and Vulnerability.* Geneva.
- Intergovernmental Panel on Climate Change (IPCC), 2007. Impacts, Adaptation and Vulnerability, Vol. 2 of Climate Change 2007 (Fourth Assessment Report). Geneva.
- Intergovernmental Panel on Climate Change (IPCC), 2008. Climate Change and Water. Geneva.
- International Energy Agency (IEA), 2009. World Energy Outlook 2009. Paris. International Food Policy Research Institute (IFPRI), 2009. Climate Change: The Impact on Agriculture and Costs of Adaptation. Washington.
- Johnson, Todd; Alatorre, Claudio; Romo, Zayra; Liu, Feng; Low-Carbon Development for Mexico. The World Bank, Washington DC.

- *Kronik, J. and D. Verner. 2010. Indigenous Peoples and Clim*ate Change in Latin America and the Caribbean. World Bank, Washington DC.
- Nelson, V., K. Meadows, T. Cannon, J. Morton and A. Martin. 2002. Uncertain Predictions, Invisible Impacts and the Need to Mainstream Gender in Climate Change Adaptations, *Gender and Development*, 10(2): 51-59.
- Neumayer, E. and T. Plümper. 2007. The Gendered Nature of Natural Disasters: The Impact of Catastrophic Events on the Gender Gaps in Life Expectance. *Annals of the Association of the American Geographers* 97(3): 551-566.
- Seo, S. N. and R. Mendelsohn. 2008. An analysis of crop choice: Adapting to climate change in South American farms, *Ecological Economics* 67: 109-116.
- Stern, N. 2007. *The Economics of Climate Change: The Stern Review*. Cambridge: Cambridge University Press.
- World Bank. 2009. Economics of Adaptation to Climate Change. Washington DC.

Annex A

Climate Change Vulnerability and Adaptation Priorities

1. Background and rationale

1.1 The geographic location and socio-economic context of Latin America and the Caribbean (LAC) makes it highly vulnerable to the effects of climate variability and change, making adaptation a top priority for the region. Observed and anticipated climate change (CC) effects threaten to undermine long term efforts to achieve sustainable development (*e.g*. Millennium Development Goals, MDG). Indeed, as CC effects superimpose on existing vulnerabilities, the poor suffer from threats to their livelihoods and a further increase in inequalities. Nature and scope of adaptation activities must not be isolated but implemented in the context of sustainable development and planning across sectors. To this aim, there is an urgent need to move from an adaptation project-based approach to a programmatic approach, linking science to national and sectoral policy, so that relevant climate related information such as vulnerability and impact assessments, adaptation scenarios and risk analyses can be factored into the policy cycle stages (e.g. formulation, planning, resources allocation and programming). Likewise, the implementation of cross-sectoral demonstrative adaptation actions that are replicable should become a priority as they also generate information related to costs and benefits of adaptation at the local level (sub-national scale) where impacts are directly suffered.

2. Overview of vulnerability and impacts of climate variability and change by sector

The last IPCC report[1] highlights some of the key climate change issues, summarized below by sectors:

2.1 ***Agriculture.*** Climate change variability and elevated GHG concentrations in the atmosphere are causing higher temperatures and alterations in hydrological precipitation and transpiration cycles, directly affecting crop yields and the livelihoods of rural communities. Another factor determining the vulnerability of the agricultural sector is soil degradation, caused by extensive soil erosion, loss of organic matter, worsening of nutrient values, and salinization. Vast extensions of land are at risk of desertification due to overexploitation of pastures, deforestation, and inappropriate methods of irrigation. In already food insecure areas of Latin America, such as Central America, the downturn in food production caused by climate change, in particular grain yields, is likely to be accompanied by an increase in the prevalence of malnutrition and its associated negative health outcomes. The consensus in a recent literature reviewed by the World Food Programme indicates that climate change will have a negative impact on agricultural productivity resulting on increased commodity prices and a higher incidence of hunger and malnutrition. For instance, the risk of hunger is projected to increase between 10-20% by 2050 with most of the affected population living in developing countries, particularly children in Central America, Sub-Saharan Africa and South Asia.[i] Thus, the introduction of adaptation measures to maintain or increase

[1] Working Group II contribution to the fourth assessment report of the Intergovernmental Panel on Climate Change.

productivity through changes in production practices, as well as the protection of land and its natural ecosystems is critical for the long-term sustainability of the sector's biological and forest resources.

2.2 ***Water resource management***. Approximately 14% of the LAC population, two thirds of which live in rural areas, have no access to safe drinking water. Currently observed vulnerabilities in the region are likely to increase because of the combined effects of existing water deficits, growing demand for water, and expected changes in precipitation patterns and water availability in many basins. Severe water stress is expected in eastern Central America, where the availability of water and generation of hydropower will be greatly affected, and in the Andean region, which is heavily dependent on glaciated watersheds to cover day-to-day water demand. In the Andean countries, the effects of climate change are exacerbated by natural phenomena, such as La Niña and El Niño, which affect precipitation and river flows. Improving water governance through adequate institutional frameworks, policies, and actions that reduce vulnerability to climate change is critical.

2.3 ***Energy and transport infrastructure***. The vulnerability of energy and transport infrastructure to climate change has the potential to result in serious limitations in LAC's energy supply and land and marine communications in the near future. Fossil fuel power generation plants, pipelines, and transmission lines are exposed to extreme changes in weather conditions, requiring climate risk mitigation and adaptation measures on existing infrastructure and the application of new climate safeguards on newly planned infrastructure. Power generation from renewable sources, such as hydropower, is currently threatened by a reduction of water flows and changes in rain patterns in the Andean, Caribbean, and Central American regions. Land and marine transportation networks are increasingly vulnerable to flooding, erosion and tidal and storm surges, as well as material temperature stress. Adaptation measures to protect or enhance the resilience of energy and transportation facilities and networks should be built into infrastructure planning and design.

2.4 ***Tourism***. Many countries in LAC rely on the tourism sector for their livelihoods and economic growth, especially those in the Caribbean, where tourism and travel contribute 14.8% of GDP (World Travel and Tourism Council, 2008).[ii] In extreme cases, some tourism infrastructure (hotels, ports, airports, utilities and access roads, among others) could become unusable for significant periods because of climate change impacts. It is therefore critical that every existing and proposed tourism development plan and tourist infrastructure project incorporate the necessary sector vulnerability assessments and climate adaptation measures, including the short, medium, and long-term investments required to reduce climate risks.

2.5 ***Health***. Regional impact assessments of climate change on the health sector show that the main concerns are heat stress and increased incidence of disease, including malaria and dengue, as well as cholera and other waterborne diseases (Githeko and Woodward, 2003).[iii] Malaria continues to pose a serious health risk in Latin America, where a little over 30% of the population lives in tropical and subtropical regions, with potential risk of transmission. The annual parasite index (API) – the standard indicator for measuring incidence of malaria – ranges from 0.01 confirmed cases of malaria for every 1,000 inhabitants in El Salvador to

16.8 in Suriname.[iv] The costs associated with health services in the region's countries, including treatment and social security payments, are likely to increase. Models have predicted that a significant increase in the number of people at risk of dengue due to changes in the geographical limits of transmission would be most likely in Brazil, Ecuador, Mexico, and Peru (Hales et al., 2002).[v] Airborne diseases are also a growing concern in large cities, where higher concentrations of CO_2 and fluctuations in temperature and rainfall are causing increased chronic incidence of respiratory problems and pulmonary diseases.

2.6 ***Climate Vulnerability and Resilience in Urban Development and Housing***. As three quarters of LAC's population live in urban areas, vulnerability to climate change need to be fully integrated in current and future urban planning activities. Coastal cities are threatened by rising sea levels, as fifty percent of LAC's urban agglomerations with populations greater than five million are located in areas intersecting the Low Elevation Coastal Zone. High-altitude urban concentrations are highly vulnerable to extreme weather events, such as floods and landslides. In addition, informal settlements in cities share characteristics that intensify the vulnerability of their residents to climate change, including poorly constructed buildings, inadequate infrastructure, lack of safe drinking water, drainage, and sanitation services, and severe overcrowding with negative public health consequences.

2.7 ***Climate change vulnerability and disaster risk management***. Climate change increases the risk of disasters by modifying the number, intensity, magnitude, and frequency of a broad spectrum of climate events, and by increasing the variability of climate conditions, generating new threats in areas where populations have never had to confront them. Existing mechanisms to confront disasters are based on past vulnerabilities and historical registries of hydro-meteorological threats. New practices, strategies, and instruments to address climate risk in are required.

[i] M. Parry, A. Evans, M. Rosegrant and T. Whileer. 2009. *Climate Change and Hunger: Responding to the Challenge*. World Food Programme. Rome)

[ii] World Travel and Tourism Council, 2008. *The Travel and Tourism Competitiveness Report* 2008. World Economic Forum, Geneva.

[iii] Githeko, A. K., and A. Woodward. 2003. International Consensus on the Science of Climate and Health: the IPCC Third Assessment Report. In Climate Change and Human Health: Risks and Responses, eds. A. J. McMichael, D. H. Campbell- Lendrum, C. F. Corvalan, K. L. Ebi, A. Githeko, J. D. Scheraga, and A. Woodward. World Health Organization, Geneva.

[iv] Pan American Health Organization/ World Health Organization. (2008). Malaria in the Americas 2005-2007. Washington DC: PAHO/WHO

[v] Hales, S., N. de Wett, J. Maindonald, and A. Woodward. 2002. Potential Effect of Population and Climate Change Models on Global Distribution of Dengue Fever: An Empirical Model. *Lancet*, 306:830-34.

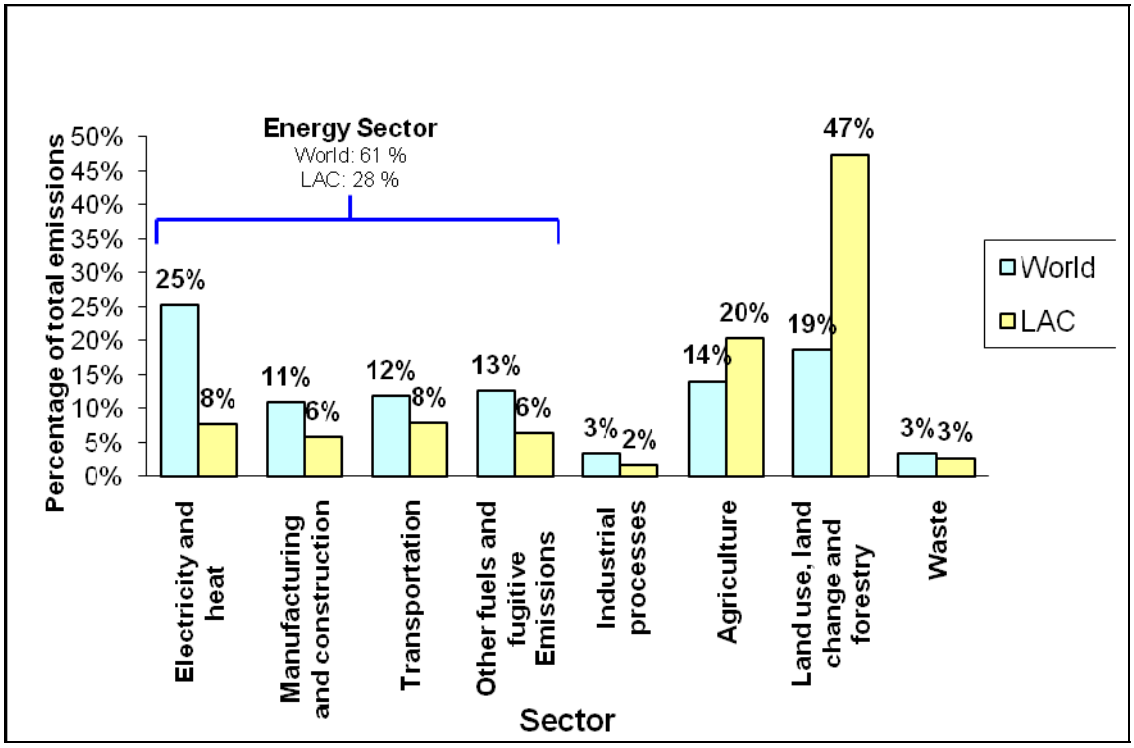
Annex B

Climate Change Impacts and Mitigation Priorities

1. Background and rationale

1.1 LAC accounts for 12% of global GHG emissions. Compared to the world as a whole, LAC generates more GHG emissions (as a percentage of its total GHG emissions) in two sectors: land use change (47% in LAC vs. 19% globally), as a result of emissions from intensive deforestation, and agriculture (20% in LAC vs. 14% globally), from non-CO_2 emissions, mainly from intensive and inefficient use of fertilizers and methane emissions from cattle raising. Energy-related emissions in LAC (electricity and heat, manufacturing, transportation, industrial, and other) account for a significantly smaller percentage of LAC's total GHG emissions: 28% in LAC versus 61% globally.

Figure 1
Comparison of LAC's and World's GHG Annual Emissions by Sector



Source: World Resources Institute .2009 Climate Analysis Indicators Tool, version 6.0.
Note: Emissions included in the figure are carbon dioxide, methane, nitrous oxide, perfluorocarbons, hydrofluorocarbons, and sulfur hexafluoride. Total GHG emissions in 2000 were 4,697 $MtCO_2$ (LAC) and 40,809 $MtCO_2$ (world).

1.2 Curbing GHG emissions represents a great challenge for public and private investment. The International Energy Agency (IEA) has forecasted that between now and 2030, LAC's energy needs will expand 75%, requiring as much as US$1.8 trillion in investment in energy supply infrastructure, much of which (85%) will have to come from private sources.

A significant increase in international finance to promote low-carbon technologies will be needed. In addition, the private sector will have a major role to play in country-level efforts to address global climate change. Governments, multilateral development banks, and the international community should be prepared to facilitate private incentives, enhance technical capacities and innovation, and improve access to finance for climate-friendly investments in order to facilitate the transition toward more climate-resilient, low-carbon growth in the region.

1.3 As we see below, most of the GHG emissions in LAC are originated in expansive processes of land use change/conversion, mainly from forest use and other natural uses, to agriculture and other activities in the rural areas. However, generated much of the Climate change impacts produced by energy consumption in LAC takes place in cities. LAC is more than 75% urbanized, and therefore its cities produce a large amount of pollutants. However, cities offer opportunities to mitigate the emission of GHGs through measures that prevent their generation, modify their behavior and improve technologies for urban activities. The adoption of improved urban-planning schemes aimed at reducing the carbon footprint of cities (i.e. sustainable transport, integrated land-use planning, adoption of compact city growth patterns, etc,) makes mitigation approaches in cities all the more relevant.

2. Overview of opportunities for climate change mitigation action in specific sectors

The Bank will target the following GHG-emitting sectors in LAC for mitigation intervention:

2.1 ***Land use, land use change and forestry (LULUCF):*** LULUCF accounts for 47% of LAC's GHG emissions, and includes intensive land vegetation change, destruction of forests, expansion of agriculture, and land degradation. From 2000 to 2005, the region lost 4.5 million hectares of forest cover.[i] When forests are cleared in preparation for cattle pasture and crops or logged for commercial trees, the carbon held in trees and some of the carbon in soil is released to the atmosphere. For the entire tropics the estimated emissions from deforestation averaged 1.5 billion tons of CO_2 per year for the period of 1990-2005, 17% of global greenhouse gas emissions. Highest emissions were from Latin American (0.71 billion tons of CO_2 per year). Addressing the most important decisions affecting deforestation and forest degradation –land value and ownership rights, profitability of agricultural and forest practices, and access to markets– is critical. A mitigation strategy in the area of LULUCF could target forest lands where the economic return from agriculture is not high, and therefore are not under extreme pressures from competing alternative uses, and where land owners will likely respond positively to incentives for forest conservation and adoption of low-impact activities. These areas account for 39% of all forest resources in LAC. One concern over creating incentives for forest conservation is that this will lead to greater agricultural intensification if agricultural producers substitute intensified input use on existing lands for expanding production on new lands. This may shift GHG emissions from forest degradation to agricultural production limiting the mitigation benefits. In promoting forest conservation, the Bank will consider the alternative activities of producers carefully assessing the net effect on emissions.

2.2 ***Energy generation and consumption***. A short description of opportunities follows:

- Electricity generation from fossil fuels. Power generation accounts for a relatively low proportion of emissions in LAC (7% of LAC's total GHG emissions) given the dominant use of hydroelectricity in the region and, consequently, the low use of fossil fuel-fired power plants. Although LAC has enjoyed many decades of growth with relatively clean power compared to the world's average, with the most recent economic crisis there has been a shift away from hydroelectricity toward electricity generated from burning natural gas and coal, which will definitely increase the carbon intensity of the region's power sector. The IEA estimates that LAC's per capita energy-related emissions will grow by 10% in 2005–2015 and by 33% during the period 2005–2030.[ii] This shift has been driven by concerns over the past few years about the need to increase the region's diversity of energy options as a means to improve its energy security. Reductions in water availability due to changing hydrologic conditions resulting from climate change have destabilized the supplies of hydroelectric power upon which the region has traditionally depended.

- Transportation. The transportation sector accounts for 8% of total GHG emissions in the region. LAC's emissions from transportation have increased over the past decade at a faster rate than those from any other energy-consuming sector because of fast urbanization, high rates of motorization, an aging vehicle fleet, and fuel combustion patterns. If one considers direct CO_2 emissions from energy consumption in the region, the transportation sector is the largest contributor of CO_2 emissions, for in 2007 it contributed as much as 35% of LAC's total CO_2 emissions –the highest rate in the world. Road transportation accounts for 90% of transport emissions in the region, with half produced by passenger traffic and the other half by freight travel. Through the promotion of sustainable transportation, the region can move toward a more sustainable low-carbon transportation path. Travel needs can be avoided or reduced through better integration of land use and transport-planning policies and transport demand management measures For passenger transportation, emission reductions can be achieved through shifting from private vehicles to mass transit (Bus Rapid Transit –BRT– and rail-based systems) and to non motorized transport (improvement and expansion of footpath and bicycle networks, bicycle taxis or pedicabs, and so on). For freight transportation, emission reductions can be achieved through shifts from truck to rail and inland waterways. Improvements in transport efficiency are also important to mitigate impacts (i.e., application of fuel economy standards, new technologies in public and private transport, improvements in infrastructure, and capacity building in local institutions).

- Water and sanitation. The water and sanitation sector makes a relatively small contribution to LAC's GHG emissions (3% of the total in LAC). But even if their contribution to climate change is small by comparison with other sectors, the supply of water, wastewater treatment, and solid waste collection are energy-intensive operations whose demand for energy will increase as service provision improves and

coverage expands to keep pace with increasing urbanization and economic growth. Furthermore, methane emissions from landfills in LAC are expected to increase by 30% between now and 2030 as a result of (a) an increase in solid waste generation associated with an increase in income; (b) an improvement in final disposal practices, with a movement from open dumps to sanitary landfills; and (c) a lack of a regulatory framework that would guarantee proper landfill gas management practices. Mitigation measures in the water and sanitation sector are principally focused on: (i) limiting emissions in solid waste treatment and disposal by capturing and utilizing the methane generated at landfills; (ii) reducing the amount of degradable and recyclable material entering landfills supporting reduction, re-use and recycling activities; (iii) reducing emissions in wastewater treatment plants by implementing advanced aerobic treatment technologies combined with capturing and using methane or nitrous oxide; and (iv) reducing emissions in water utilities by increasing their operating and energy use efficiency.

2.3 ***Energy Efficiency***. Energy efficiency (EE) measures, defined as a reduction in the energy used for a given energy service or level of activity, are the cleanest, quickest-to-implement, most reliable and stable, and most cost-effective component available to increase the performance of any energy matrix, and it also provides GHG reduction and economic benefits. EE measures can be applied on the supply side (through efficiency in generation, transmission, and distribution) or on the demand side (through reducing energy demand by means of specific end-use devices and systems). The reduction of energy demand through EE measures could delay the construction of new power generation capacity, increase market competitiveness, and reduce fossil fuel consumption and associated emissions of local and global pollutants. This can be generally achieved without compromising the level of services delivered or the region's economic competitiveness.

2.4 Some energy efficiency analysts suggest that there is a rebound effect that erodes some of the energy savings obtained through technical efficiency improvements. Although some consumers and businesses will increase their demand for energy services as the cost of the service declines, empirical evidence suggests that the size of the rebound effect is very small to moderate, with the exact magnitude dependent on the location, sector of the economy, and end-use. Most of the direct energy savings from technical improvements in energy efficiency in OECD countries remain even after the direct rebound effect is accounted for. Nevertheless, policy makers and energy efficiency proponents should account for a small to moderate rebound effect in projections of the overall energy savings due to energy efficiency policies and programs. This is in fact recommended in a handbook on energy efficiency program evaluation methodologies (SRC International 2001).[iii]

2.5 Although many factors influence the viability of EE programs for a particular country (climate, structure of sector energy consumption, technology and industrial structure, and energy intensity[iv]), opportunities for energy savings and emission reductions through EE measures are present across the region, with some large countries (Mexico and Brazil) already benefitting from large EE programs. EE opportunities are present across many sectors, including the power sector (new generation, cogeneration, and transmission and

distribution), transportation, buildings (public and private), industry, agriculture, and water supply.

The success of EE programs largely depends on whether governments provide the right incentives to help overcome existing barriers to implementation of these programs. Key barriers include: high fuel and electricity subsidies, which discourage investments in EE; financial barriers such as lack of capital for investments in new energy-efficient equipment or technologies; and lack of information to consumers, vendors, manufacturers, and policymakers about the availability of EE technology and its benefits. Incentives to overcome these barriers can take many forms, ranging from tax rebates and subsidies to regulations requiring specific efficiency standards for vehicles and appliances to information campaigns.

2.6 ***Renewable Energy***. LAC has considerable potential for renewable energy (RE) generation. RE sources (hydro, wind, solar, marine, bio-energy, and geothermal) could make a far greater contribution toward meeting energy needs in the LAC region than existing trends suggest. Enhanced renewable energy implementation and use could lead to substantial GHG reduction at a relatively low cost. IDB estimates show that the mitigation potential (in megatons of CO2e of avoided emissions) of developing just 10% of the total renewable energy potential in 15 LAC countries through geothermal, wind, and hydropower would be 158 $MtCO_2e$ per year.[v] This would represent 80% of total CO2 emissions from the power sector in the selected countries. The implementation of RE technologies in the power sector brings additional benefits in terms of energy security, reduced dependence on fossil fuel and exposure to high price volatility, and reduced pollution and public health improvements. Primary limiting factors affecting LAC's current and future ability to promote the use of RE in the region are lack of institutional capacities, inadequate governance structures, and inadequate regulatory frameworks to facilitate a cleaner energy matrix. The region's traditional, short-term-focused energy framework, which is based on a least-cost energy-planning model, must be aligned with a longer-term, cleaner, sustainable energy-planning model. This entails a greater effort regionally and in each nation, supported by capacity-building programs, technology transfers, and financing, taking into account the diverse country conditions, legal frameworks, and cost structures underlying the viability of RE. The primary RE technologies that are well suited for LAC include the following:

- *Hydropower*. Hydropower remains an abundant renewable energy resource and is relevant for meeting the region's electricity demand trends. Most notably, in some of the region's countries, such as Brazil, Colombia, Ecuador, and Peru, the realization of a relatively small percentage of total available potential could entirely cover electricity demand, and, in most countries in the region, it could represent an important share in energy supply. However, changes in hydrologic cycles will affect the hydropower potential of existing and future energy infrastructure. Therefore, governments will have to incorporate climate variables into their energy planning schemes.

- *Wind energy*. Favorable wind conditions for wind technology deployment have been identified in the Tehuantepec region of southern Mexico, the Patagonia region of Chile and Argentina, the northern coastlands of Colombia and Venezuela, some interesting Central American "hot spots," and some areas of Brazil. Current total installed capacity of wind energy in LAC is only 840 MW (0.5% of total capacity in LAC), with wind projects operating mainly in Brazil, Mexico, and Costa Rica. Breakthroughs in wind technology and significant cost reductions are improving the prospects for expansion of wind energy sources. Significant barriers for wind power development include: lack of stable, long-term, transparent regulatory conditions; unsuitable infrastructure in ports and access roads; lack of heavy machinery availability and transmission facilities to harvest real wind potential; scarce financial mechanisms tailored to wind power projects; and limited technological knowledge.

- *Solar energy*. Solar energy represents an important renewable energy alternative in LAC. According to existing studies on solar resources, some countries and areas in LAC (specifically, Mexico and most of the countries in Central America, the Caribbean, northern regions of Colombia and Venezuela, Peru, Bolivia, and northeastern Brazil) show irradiation values greater than 45 kilowatts per square meter per year, which would be considered exceptional for commercial resource exploitation. Solar thermal technologies, such as Concentrated Solar Power (CSP) or solar water heaters (SWH), and solar photovoltaic (SPV) panels for energy generation have proven to be cost effective; both types of technology provide adequate energy solutions under specific conditions. Large photovoltaic applications or SPV in distributed power systems can be found in rural electrification projects in the Caribbean, Brazil, Mexico, Chile, and Argentina; Large city-oriented SWH programs can be found in Barbados, Brazil, Chile and Mexico. However, on-grid applications of solar energy have proven to be feasible particularly in areas where solar radiation and power prices are high, like the Caribbean and some areas of México. Nevertheless, photovoltaic and CSP sources still face high technology costs and intermittency in the supply of energy, both conditions limit solar power development in the region. The solution to solar energy storage is still pending, with major technological development still required to scale-up such systems.

- Geothermal energy. Geothermal energy represents an important potential source of base load heat and power. However, low knowledge and lack of local technical expertise, complemented by high project development costs, particularly from exploration drilling and lack of suitable financing mechanisms have hindered project implementation and have limited power production projects under operation to use local endogenous sustainable geothermal resources. However, reductions in the cost and technology improvements of geothermal technology are making geothermal energy an increasingly attractive source of energy (thermal and electrical) for the region. Currently, geothermal energy is used as an energy source only in Mexico, Nicaragua, Costa Rica, and El Salvador. Mexico is a leader in implementation of geothermal technology in the region, having the third-largest installed capacity worldwide. It is remarkable that many countries, particularly in Central America, can achieve a large portion of their power supply from geothermal resources. Geothermal

energy could also make an important contribution to the electricity supply (power) and energy balance (thermal) in all countries of the Andean region (Bolivia, Chile, Colombia, Ecuador, Peru, and Venezuela).

- *Bio-energy*. LAC is uniquely suited for bio-energy production given its abundance of sun, water, and available land. Bio-energy is a way to use solar energy through the growth of biomass in crops, plants and trees. New bio-energy sources, most of them derived from agricultural or forestry processes, such as rice husks, livestock bio-slurry, peanut shells, any kind of bagasse waste and wood derivates like chips or pellets, could bring clean growth to the sectors accordingly: agricultural and forestry sector, improve productivity and create jobs. Among the products of the bio-energy systems, bio-fuels, bio-fertilizer and biogas are the most common. In the case of biofuels, they can be used for transport (in the form of a liquid fuel) and in industries (to generate electricity). It is estimated that by 2025, a reduction of 105 $MtCO_2e$ could result from production of ethanol, mainly of Brazilian origin, and that a reduction of 27 MtCO2e could be realized through production of biodiesel during that same period. In the case of biogas, this resource can be used in the industry to achieve significant energy efficiency goals. But also in the rural sector, can improve energy use, socio-economic development and agricultural productivity as well as heath conditions for families in distributed domestic applications. Recognizing the direct and indirect implications (social and economic) of bio-energy programs for food security, land use, biodiversity, health and water resources is critical. LAC countries must be prepared to meet sustainability criteria for bio-energy projects.

- *Waste-to-energy (WTE).* WTE technologies have been around for a while in Europe, Japan and the USA, reaching high environmental standards in terms of emissions control and increasingly becoming a key source of energy generation. In many of these countries the treatment costs have been declining making it competitive with landfilling practices. Taking into account the limited space available for landfilling in several metropolitan areas of LAC and the rising costs of energy, WtE is becoming an option in the region as well. The IDB will be in charge of financing some environmental and economic feasibility studies in order to provide our clients with a better understanding of these treatment alternatives.

- *Marine energy*. Despite the fact that marine energy technologies are still in experimental phases, with few developments at commercial scale, marine energies (marine currents, tides, and waves) represent a very interesting energy supply alternative whose potential has barely been investigated. Hypothetically, in Chile, the realization of approximately 13% of the country's marine (wave) energy potential could meet the entire present national electricity demand.

2.7 Agriculture and livestock. GHG emissions from the agriculture and livestock sector include methane emissions due to enteric fermentation (from ruminants), management of animal fertilizers, and irrigated rice cultivation; nitrous oxide emissions; residues from the management of soils and nitrogen fertilization of various crops; and emissions of CO_2 resulting from the burning of pastures and agricultural wastes. The agriculture sector is the

greatest source of methane and nitrous oxide emissions in Latin American and Caribbean countries. National GHG emission inventories report various sources of methane, but livestock represents more than 60% of total methane emissions throughout the region. Methane and nitrous oxide emissions are particularly important in national inventories of GHG emissions because they have a forcing impact greater than that of CO_2.

In the livestock sector, the principal contribution of GHGs is due to methane emissions, primarily from cattle (both beef and dairy), poultry and swine. Emissions from the livestock sector represent between 62% and 96% of the total emissions of methane in LAC (another lesser source of emissions is the cultivation of rice by flooding). National inventories of GHG consider emissions of methane from enteric fermentation, that is, the digestion of forage and feed by ruminants, as well as the emissions resulting from animal feces, which account for a small proportion of methane emissions compared to enteric fermentation.[vi]

---

[i] Food and Agriculture Organization, "Global Forest Resources Assessment 2005: Progress towards Sustainable Forest Management," Forestry Paper no. 147, Rome, 2005.

[ii] International Energy Agency (IEA), *World Energy Outlook 2009*.

[iii] From. "The Experience with Energy Efficiency Policies and Programmes in IEA Countries, Learning from the critics, IEA Information Paper". Howard Geller, Southwest energy efficiency project, Boulder, Colorado, US, and Sophie Attali Ice Consultants, Paris, France, August 2005.

[iv] Energy intensity is a measure of the EE of a nation's economy. It is calculated as units of energy per unit of GDP. High levels of energy intensity indicate that a country needs more energy consumption to generate one dollar of GDP, and low levels indicate that the country needs less energy consumption to generate one dollar of GDP.

[v] Solar energy and marine technologies were not included in the analysis because of lack of data and immaturity of the technology, respectively. In all LAC countries except Peru, a 10% realization of renewable energy does not require a higher installed capacity than current capacity.

[vi] The warming power of methane is twenty one times higher than that of CO_2, and the warming power of nitrus oxide (N_2O) is 310 times higher than that of CO_2.

Annex C
Sector Impacts, Opportunities, Policy Options and Bank Instruments for Climate Action

ENERGY

Impacts/ mitigation-adaptation opportunities	Policy Options / strategic instruments	Bank instruments (Lending)	Bank instruments Technical Cooperations (TC's)
Operational Inefficiencies: High energy-related costs in LAC electricity utilities, mainly in those operated by diesel and heavy fuel oil. Unreliable service, blackouts, poor operation and maintenance, high technical and non technical loses, poor billing systems. Lack of policy and regulation to promote the possibility for Independent Power Producers (IPPs) or Small power producers (SPPs) to sell power to the grid. Lack of policy, regulation and incentives to promote energy efficiency (EE), energy conservation (EC) and the use of renewable energy (RE), including Bioenergy (BE) and waste to energy (WTE). Generation plants, pipelines and transmission lines are exposed to extreme changes in weather conditions.	Increase operating efficiency in electricity utilities. Improve electricity billing systems; reduction of non technical loses; improve metering systems; enhance local capacity to improve the efficiency of the utilities. Promote changes to the energy matrix to optimize the use of its natural resources, including RE alternatives.	Public and private sector RE and EE investment. Innovative financial instruments for the adoption of sustainable energy solutions, such as the "green" financial product for financial intermediaries.	Assessments of financial and operational assessments of utilities. Assessments of the potential of EE, EC and RE including BE and WTE. Implementation of lower-net-costs interventions ("low-hanging fruit") on EE. Promote pilot implementation and demonstration projects in RE and EE projects. Support pre-feasibility and feasibility studies of energy projects. Institutional strengthening and capacity building.
Carbon emissions reduction: High carbon emissions electricity generation facilities using fossil fuel.	Measures to reduce carbon emissions.	IDB investment projects in RE, EE and efficient use of energy are reducing carbon emissions in LAC. Facilitate LAC countries' access to international sources of climate finance such as CIF (particularly CTF and SREP).	Assess the potential of EE, EC and RE including BE and WTE. Promote pilot implementation and demonstration of RE and EE projects.

Impacts/ mitigation-adaptation opportunities	Policy Options / strategic instruments	Bank instruments (Lending)	Bank instruments Technical Cooperations (TC's)
Rural electrification Insufficient energy coverage in rural areas.	Investments in rural electrification coverage including EE and RE. Regulatory measures to promote investments on innovative EE and RE projects to provide access to energy on rural areas.	Investments in energy for isolated places, to include the use of RE technology.	Prefeasibility and feasibility studies of RE and lower emitting fossil fuel energy projects. Institutional strengthening and capacity building to overcome financial and regulatory barriers associated with investments on RE.
Sustainable hydro plant for power generation Untapped potential of hydro power.	Incentives to increase investments on sustainable hydro projects.	Sustainable investments on hydro power projects, applying the necessary environmental policy guidelines and safeguards. Facilitate LAC countries' access to international sources of climate finance such as CIF.	TCs to promote environmental and social standards on the development of hydro projects. Prefeasibility and feasibility studies of hydro projects. Institutional strengthening and capacity building to adapt to the effect of climate change on water availability.
Transmission and distribution Saturation of power due to lack of transmission lines and/or requirements to extend interconnection between countries.	Promote and support regional inter-connections.	Investments supporting regional inter-connection systems, i.e.the Central American electrical interconnection system (SIEPAC).	TCs to finance prefeasibility and feasibility studies of energy projects.
Efficient use of oil and gas Lack of efficient use of fossil fuels.	Measures to guarantee efficiency in fossil fuel energy plants. Incentives to switch from high emitting fossil fuel to lower emitting fossil fuel in energy generation.	Investments to improve sustainability of fossil fuels programs.	Capacity building programs. TCs to assess biofuel potential and socio-economic and environmental sustainability, and identification of the most competitive feed stocks. Prefeasibility and feasibility studies on feed stocks for bioenergy production.

AGRICULTURAL SECTOR

Impacts/ mitigation-adaptation opportunities	Policy Options / strategic instruments	Bank instruments (Lending)	Bank instruments (TC's)
Policy and Institutional Framework: (i) public policy measures required to address the vulnerability of the sector to climate change impacts, (ii) inappropriate economic/financial incentives and market failures prevent the implementation of sustainable production practices, (ii) lack of trained personnel, and (iii) inadequate information base.	Policy and legal reforms: (i) public expenditure switching to assess climate vulnerability and risk in agriculture through appropriate technologies, practices and investments; (ii) realign private sector subsidies to promote sustainable agriculture systems (iii) improve property rights to promote the protection of land and natural ecosystems; (iv) strengthen free trade regimes and (vi) train human resources.	(i) systems to collect and analyze location specific climate, agronomic, economic and social information to assist decision makers on climate change actions.; (ii) support the development of national strategies to promote sustainable agricultural systems, (iii) facilitate access to international funds including for example GEF and CIF's PPCR.	- Producer Support Estimates - Aggregate Climate Emissions - Improve the modeling and forecasting capabilities to assess climate vulnerability in agriculture - Promotion of production practices and technologies oriented to climate change mitigation and adaptation - Use of innovative alternatives to support small-scale farmers to improve productivity - Extension programs aiming at improving production practices and increasing productivity among vulnerable groups
Water/Soil Management: (i) increased risk of extreme weather events such as flooding and drought, (ii) joint effect of growing demands for water supplies for domestic use and irrigation drier conditions in many basins, and (iii) extensive soil erosion, acidification, loss of organic matter.	Policy and legal reforms to: (i) establish a system of clear and transparent water property rights; (ii) efficient water pricing; and (iii) develop "water markets."	Build new infrastructure to: (i) flood control measures to capture rainwater during rainy seasons in areas prompt to droughts, (ii) rehabilitation and modernization of irrigation systems to improve the efficiency on water use, (iii) develop water registry, metering systems (iv) voucher systems for extension services aimed at an efficient water and soil management.	- Water use master plan - Design of water rights/pricing systems. - Design of voucher systems - Promote the use improved water management systems
Risk Management (i) climate variability is causing	Public – private partnership with the insurance sector to establish	Establish system for risk management including: (i) data collection stations,	Studies of country risk and needs assessment for

devastating impacts on agricultural productivity and the livelihoods of rural communities, (ii) most vulnerable to climate change are especially the poor and indigenous peoples, and (iii) innovation is required in financial instruments to address the impacts of climate change and make agricultural insurance more accessible by affected groups.	framework to define roles and promote market development.	(ii) storage facilities, (iii) use of innovative agricultural crop insurance schemes to cope with the effects of climate change.	risk mitigation against climate change impacts.
Research and development (R&D) Plant and animal genetics: Increased investment in crop and livestock researchwill be needed to overcome climate change impacts associated with increased heat, drought and threats from pests and diseases.	Establish legal and regulatory framework for use of GMO's.	Support public research on breeding crops/livestock for stress tolerance; developing better practices for sustainable crop and livestock management.	- Design of regulatory framework and traceability systems to promote the implementation of environmentally friendly practices. - Partnerships with the private sector to encourage investments on research and development - Partnerships with the academia and research centers to foster technology innovations and outreach and dissemination of these alternatives

FOREST SECTOR

Impacts/ mitigation-adaptation opportunities	Policy Options / strategic instruments	Bank instruments (Lending)	Bank instruments (TC's)
Reduce CO_2 emissions related to deforestation and forest degradation on **public owned forests** by controlling access and protect public lands (mainly in the Amazon Basin and Guyana Shield Countries).	Public sector capacity assessments to deal with deforestation and forest degradation. Gap analysis studies to understand the priorities of the country. Develop a coherent Bank's strategy or initiative on forestry. Support the establishment of protected areas, land titling and demarcation of indigenous lands and other traditional communities.	Increase the availability of, and access to financing the establishment of protected areas Support policy and institutional reforms to tackle deforestation and forest degradation Finance direct public and private sector investments under REDD+ programs to recover degraded forestlands Facilitate access to international sources of financing such as the FIP and GEF	Policy dialogues to engage countries in the issue of deforestation and degradation, and TCs for public sector capacity assessments to deal with deforestation and forest degradation.
Reduce CO2 emissions by providing incentives for **private individuals and firms** to recover degraded forest lands and protect existing forests (mainly in Central and South America).	Support policy reforms to address the most important factors affecting deforestation and forest degradation such as land value, ownership rights and access to markets. Promote markets for global environmental public goods (including participation in carbon markets. Foster the development of markets and/or funds to compensate private landowners for investments to protect and sustainably manage forests (i.e. carbon funds).	Support policy and institutional reforms to promote forest management practices, protected areas and forest concessions Increase the availability of, and access to financing for capacity building, and design and implementation of economic incentives for protected areas Increase the availability of and access to financing to deal with private forests protection and management and support access to financing for forest conservation enterprises	TCs to find ways to effectively and efficiently fund the management of protected areas, TC's to support sustainable forest management techniques and alternative livelihoods of adjacent communities,
Develop the building blocks for member countries to participate in markets for		Support policy dialogues to engage countries in the issue of markets for	TCs to build and assess public and private sector

global environmental public goods (carbon) (cross-cut all type of forest frontiers).		global environmental public goods (carbon) Finance direct private sector investments Facilitate the development and financing of national investment plans, particularly under the platform of the FIP and GEF.	capacity to participate in carbon markets and payments for ecosystems services schemes, TCs to promote the development of private-public partnerships focusing on information sharing on carbon finance and carbon markets in forestry activities, and TCs to support local communities, women's groups, and indigenous people in the provision of ecosystem services

WATER AND SANITATION SECTOR

Impacts/ mitigation-adaptation opportunities	Policy Options / strategic instruments	Bank instruments (Lending)	Bank instruments (TC's)
Operational Inefficiencies The effects of climate change are exacerbating current observed vulnerabilities on water availability resulting on a critical need for improvements on water resource management given the: (i)high energy-related costs in LAC water utilities, representing 30 to 40% of their operating budgets, and (ii)igh energy-related costs in wastewater treatment, representing 25 to 50% for individual treatment plants,	Increase operating energy efficiency in water utilities and wastewater treatment plants to reduce vulnerability to climate change. Improve water management systems (user registration, billing systems, etc.) to measure energy efficiency/savings.	Increase the availability of, and access to financing for replacing old pumps, substituting old motors with new most efficient ones, etc. Promote financing and scale up of energy related projects directly to private sector clients and through financial intermediaries. Facilitate access to international funds including among others GEF and CIF.	TCs to finance implementation of energy efficiency programmes that include: Capacity Building on Energy Management and Energy Efficiency Training Energy Efficiency Audits (EEA) Evaluation and recommendations for plant maintenance TCs to finance capacity building in leak detection, rehabilitation and analysis of the components of Non Revenue Water TCs to implement waste-to-energy (WTE) projects to reduce the consumption of fossil fuels
Methane emissions High methane emissions from open dump sites and landfills.	Support development of integrated waste management, with passive or active methane capture and burning systems in landfills (according to feasibility based on volume of waste and other variables) Support development of Landfill-gas-to energy (LFGTE) projects, with a built-in energy generation/provision for consumption in local or	Increase public and private sector financing for solid waste management, with the construction of an active methane capture and flaring system for new landfills and other methane emitting sites, such as agricultural and livestock companies.	TCs to finance capacity building recycling activities TCs to assess methane capture and biogas potential of agribusiness and livestock clients.

	municipal uses. Support the preparation of CDM projects Promote and support new recycling and composting initiatives, aiming at reducing disposable waste		
High methane emissions from lack of wastewater management.	Promote and support new technologies that minimize GHG emissions (methane capture) and energy generation in wastewater treatment plants Support the preparation of CDM projects	Financing construction of Waste Water Treatment Plants designed to capture green house gases	TCs to promote the use of passive or active methane capture systems to minimize GHG emissions
Extreme **pressure on existing and future sources of water**	Promote conservation of water resources through demand management mechanisms		TCs to promote policies/activities for management and conservation of water resources on the demand side. TCs to promote access to basic services and community-based watershed management
High **vulnerability of water management systems** to extreme climate	Provide financing for climate-resilient infrastructure (structural flood defenses, drainage, irrigation systems)	Build infrastructure with designs that account for climate change (i.e. meteorological events variability; higher probability of extreme events; change in run-off caused by glaciers melting; etc.)	TCs to finance studies on how to account for changes in design criteria in terms of return rates for meteorological events and establishing new insurance frameworks TCs to assess vulnerability and risks associated with climate variability and change TCs to raise institutional

			capacity to incorporate climate adaptation in water utilities
Lack of effective communication strategy to promote and implement climate change mitigation and adaptation actions.	Improve public outreach and communication with stakeholders in water and sanitation sector.		TCs to promote knowledge dissemination of climate change impacts, creating *dialogue among different actors and promoting* capacity building, communication strategy for changing unsustainable practices and institutional consciousness (e.g. regulators).

TRANSPORTATION SECTOR

Impacts/ mitigation-adaptation opportunities	Policy Options / strategic instruments	Bank instruments (Lending)	Bank instruments (TC's)
LAC's emissions from transportation have increased over the past decade at a faster rate than those from any other energy-consuming sector and the region's direct CO_2 emission from energy consumption in 2007 was the highest in the world. This results from: (i) rising demand for both passenger and freight transportation; (ii) rising levels of motorization, congestion, transport related air pollution and GHG emissions, noise pollution, and traffic accidents; and, (iii) inefficient transport systems.	Support to integrated strategies and transportation planning that considers urban development, traffic safety and security, environmental considerations.	SGO/NSG Investment loans, PDLs, CCLIPs, SWAPs, PBLs can be used to finance infrastructure and equipment in urban transport projects, bicycle paths, pedestrian paths, integrated systems, traffic control systems, institutional development, etc. Facilitate access to international funds such as GEF and CTF.	Pre-feasibility and feasibility studies and specific project preparation - economic, technical, social and environmental studies
	Promotion of smart growth practices and transit oriented development		Programs and measures that enhance local planning, control and oversight capacity. E.g. development of transportation master plans.
	Design and implementation of policies that enable transportation demand management such as congestion and parking pricing, road tolls, car free days, fuel taxes, and other.		Information gathering and management to assist in: (i) the development of low-carbon transportation methods and (ii) risk analysis methodologies for the reduction of vulnerability of transport infrastructure.
	Improvement of urban transportation efficiency and cleaner transportation modes via bus route reorganization, integration of transportation modes and systems, implementation of Bus Rapid Transit and Metros, development		Institutional development and capacity building to achieve improvements in transport efficiency and implement climate change mitigation and adaptation measures.

	and promotion of passenger non-motorized transportation.		
	Improvement of freight transportation efficiency and cleaner transportation modes such as rail and waterways, implementation of intermodal facilities and logistics platforms, etc.		Cleaner technologies and fuels.
	Promote and support the uptake of cleaner fuels and vehicle technologies.		Identify credit opportunities
	Improve public outreach and communication with stakeholders regarding sustainable low-carbon transportation.		Developing and applying GHG accounting methodologies.
	Provide financing for low-carbon transportation solutions, as well as planning, management and measures that improve resilience of infrastructure, systems and operations to the impacts of climate change.		
	Support the reform of policies and legal frameworks as to enable the uptake of sustainable low-carbon transportation.		

URBAN DEVELOPMENT AND HOUSING

Impacts/ mitigation-adaptation opportunities	Policy Options / strategic instruments	Bank instruments (Lending)	Bank instruments (TC's)
Mainstreaming climate change.	Issue included in the IDB´s Urban and Housing Development Policy (OP-751). Develop city strategies and CCAPs		Financing of pilots to design and implement city strategies and CCAPs
Communities exposed to rising water levels and floods.	Develop city strategies and CCAPs to promote resilience and adaptation Develop land use and planning instruments to prepare cities for climate change disasters	Include issue in urban development and housing loans.	Design pilot projects with TC funds for mitigation and adaptation strategies for rising water levels in cities Financing of city strategies and CCAPs to reduce vulnerability and promote adaptation actions.
Energy consumption in cities continues to rise, increasing the costs for citizens and government.	Develop city strategies and CCAPs to promote energy efficiency and address consumption patterns Develop building materials and designs with low carbon footprint	Include issue in urban development and housing loans. Start applying Leadership in Energy and Environmental Design (LEED) standards in our IDB loans Promote IDB's financing of projects related to energy efficiency design, construction and adaptation of commercial buildings following environmental certification standards such as LEED and ISO 14,001. Promote direct engagement of private sector mortgage originators in a green housing program including support for "green mortgage" programs.	Financing of city strategies and CCAPs, urban planning efforts, and new designs and building materials to lower carbon footprint. Design of a green housing program to be replicated by financial intermediaries including mortgage originators.
Reliance on fossil fuels decreases the quality of life in cities and increases health problems.	Develop city strategies and CCAPs to promote sustainable urban and environmental management	In our current and future portfolio, include incentives to use energy efficiency building methods as part of the low-income housing value chain.	

Storms hit unprepared cities and substandard housing.	Fine-tune the issue included in the Disaster Risk Management Policy (OP-704) Develop land use and planning instruments to prepare cities for climate change disasters	Include issue in urban development and housing loans.	Financing for land use planning and urban-planning schemes that take into account climate resilience and disaster risk reduction particularly among informal settlements.