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

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ABBREVIATIONS AND ACRONYMS

BRT	Bus Rapid Transit
CCLIP	Conditional Credit Line
CCS	Integrated Strategy for Climate Change Adaptation and Mitigation and Sustainable and Renewable Energy
CCSAP	Climate Change Strategy Action Plan
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
FIP	Forest Investment Program
GCI	General Capital Increase
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas
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 Appropriate Mitigation Actions
NAP	National Adaptation Program
N_2O	Nitrous Oxide
PBLs	Policy Based Loans
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 the region.

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. With growing demands of energy driving industrialization and urban development, and vast areas of forest land being converted each year to agricultural and other uses, LAC countries must prepare to introduce low-carbon and clean energy alternatives to reduce GHG emissions, while keeping pace with demands for economic growth and better quality of life for their population. Furthermore, many of the sustainable practices that help reduce emissions in the energy, transport and forest sectors can also provide local development benefits and environmental improvements without compromising current and future demand for energy and economic growth.

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[2] 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

[1] IPCC (2007), IPCC (2008).

[2] Sustainable energy refers to a sector approach that seeks to: (i) promote universal, reliable and affordable access to energy services; (ii) support the long-run sustainability of energy projects, meeting current and future demand; (iii) ensure quality and promote economic efficiency in the provision of the energy services; and (iv) contribute to the reduction of environmental impacts, including climate change.

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, the results framework to measure the progress in achieving the commitments under the capital increase includes a specific annual lending target for climate change, renewable energy and environmental sustainability of 25% to be met at the end of the 2012-2015 period.[3]

1.4 To achieve this GCI-9 commitment, the IDB has developed the present Integrated Strategy for Climate Change Adaptation and Mitigation and for Sustainable and Renewable Energy (CCS). The objective of the CCS is to contribute to low carbon development and address key vulnerabilities to the consequences of climate change in LAC. It therefore serves as a guiding instrument to scale-up the IDB's support for actions to mitigate and adapt to climate change and sustainable and renewable energy in the region. 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.

II. DIAGNOSIS

Impacts of Climate Change, Climate Vulnerability and Adaptation Needs

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.[4] Although substantial uncertainty remains, climate models predict that more intense and frequent extreme weather events will 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 security; damage to coastal-marine areas and resources; damage to coral reefs, fish stocks, and associated ecosystem services; migration of population hit by extreme climatic events such as floods and droughts that could result on national security issues; 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

[3] IDB (2010a).

[4] 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). For a sub-regional perspective, the 2004 hurricane season in the Caribbean caused damages estimated in US$4.2 billion in the Caribbean, representing economic losses as high as 8% and 7% of GDP in Jamaica and Bahamas, respectively (ECLAC, 2005).

countries in the region have already identified and assessed the potential costs of climate impacts in specific sectors.[5] Climate impacts 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.[6] There is also increasing concern with how climate change impacts affect specific groups or population sectors, as many of the consequences accrue 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.[7]

2.2 The region must be prepared to address the serious economic and social 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 economic sectors are still being assessed, [8] 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.[9] 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.[10] 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.[11] An increased risk of extreme weather events will require concerted action to reduce negative

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[5] Total costs of climate change to the Mexican economy are estimated at 3.2% of GDP (using a 4% discount rate) to 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 2100 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 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).

[6] 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.

[7] Nelson et al. (2002), Neumayer and Plümper (2007), Aguilar (2009).

[8] Resilience refers to the "amount of change a system can undergo without changing state" (IPCC, 2001).

[9] 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).

[10] 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).

[11] 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).

impacts on urban and rural populations as well as on economic activity such as agriculture, tourism and transportation. 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. On the energy demand side, higher temperatures in some regions will change energy consumption patterns for heating and cooling, with more extensive use of energy-intensive air conditioning and heating in extreme climates.

2.3 To address climate change adaptation challenges and opportunities, LAC countries will need to target key vulnerable activities such as agriculture, water resource management, urban development, coastal zone management and biodiversity conservation (see Annex A for key climate vulnerability aspects and adaptation priorities in the region). The technical and financial means to protect these sectors will need to be developed, including the allocation of resources to incorporate climate change adaptation measures into sector planning while taking into account the protection of natural systems and biodiversity. Key challenges and response measures 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 implementation of adequate water governance frameworks to secure water availability in areas under climate stress; the adoption of engineering solutions for climate change adaptation; the promotion of policy options to increase climate change resilience in cities; and, the adoption of ecosystem-based practices to improve adaptive capacity in terrestrial and coastal environments. 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.

2.4 At the top of LAC's climate change vulnerability reduction and adaptation challenges 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, and in the case of extreme weather events causing displacements of population. 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 management practices will be aggravated by a projected decline in agricultural productivity, affecting food security and increasing poverty.

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,[12] and of reducing disaster-related losses in terms of lives and social,

[12] 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, 2007).

economic and environmental assets.[13] 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 be coordinated to develop integrated risk management strategies and action plans.

Climate Change Mitigation Priorities

2.6 Climate change mitigation actions in LAC should target the main GHG-emitting sectors: 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 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, construction of large infrastructure projects and land degradation– is the largest contributor to GHG emissions in the region. Controlling deforestation and implementing sound forest management practices in diverse forest ecosystems (i.e. rainforest, coastal wetlands, mangroves, Andean paramos and high altitude forest) 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. Some critical elements affecting deforestation and forest degradation include: land value and its impact on development practices, insecurity of land and water property rights; profitability of agricultural and forest practices; and access to markets and mobilization of international resources to protect forests and reduce deforestation. In particular, providing security of land tenure for indigenous communities and other rural populations is key to successful forest conservation and sustainable management. Also important is to minimize land conversion as a result of construction of large infrastructure projects and extractive industries.

2.7 With a share of 28% of the region's emissions, compared to 61% globally, the energy sector of LAC is the World's cleanest. This is mainly due to the high reliance of the region's power sector on hydropower, which accounts for 62% of the installed capacity and 70% of the actual power generation. Despite the relatively low carbon footprint of LAC's energy matrix, historic trends and forecasts indicate that LAC's energy consumption and GHG emissions are on the rise, with electricity demand growing at a rate of 4.8% annually over the next 10 years, and with large energy infrastructure investments programmed in the upcoming decades.[14] The short term options for covering this growing demand and investments include fossil fuels, mainly coal and natural gas. Climate change impacts, such as glacier melt and higher rainfall variability, create new risks and higher costs for the operation of hydropower plants, driving energy

[13] Hyogo Framework for Action (2005).

[14] 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).

planners to rely more on fossil fuel technologies to cover future energy demands. The rapid urbanization and motorization rates are also increasing the reliance on fossil fuels, as demand for gasoline and diesel in the transport sector increases. Some clear technological opportunities for GHG reductions in energy-consuming sectors are available and can be implemented successfully with adequate levels of finance and enabling institutional frameworks.

2.8 The LAC region has a large potential to develop sustainable and low or non-GHG emitting energy technologies, including wind, solar, hydro, geo-thermal and bio-energy. The declining costs of some technologies and their significant GHG emission reduction potential (especially wind and solar) are encouraging their rapid deployment.[15] Supply-side and demand-side energy-efficient technologies and policies, offer the most cost-effective opportunities for GHG reductions in the region's energy sector.[16] Also, sustainable transport solutions such as mass transit, non-motorized transport, transit-efficient urban development schemes, freight logistics, and railway and waterway transport offer alternatives to address the growing demand for passenger and freight transport with reductions in energy consumption and GHG emissions.

2.9 Many of the energy efficiency and renewable energy technologies that are currently available represent "win-win" mitigation activities that can be supported with a relatively high level of confidence, [17] as these activities could: generate direct and indirect benefits that often exceed their costs, without compromising the level of services delivered or the region's economic competitiveness; delay the construction of new fuel processing and power generation capacity; reduce the countries' exposure to fossil fuel price volatility risks, increase energy sovereignty and contribute to the creation of "green jobs"; and, reduce the impacts on human health and biodiversity caused by the use of fossil fuels. There is an equally strong trade and economic rationale for directing support to GHG mitigation 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 environmentally sound and cost-effective activities.

2.10 However, to be effective in its low-carbon growth activities LAC will have to overcome institutional and market barriers preventing the full expansion of sustainable energy practices. With renewable energy technologies, the level of maturity of the available technologies is not homogenous across the region, and their economic performance tends to be heavily dependent on the availability of local resources. 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 incentives need to be introduced to account for positive externalities, improve economic feasibility and facilitate adoption through public and private sector investments. The

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[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). Some recent studies show that the abatement cost for renewable technologies could be as low as US$3 per avoided ton of CO_2 or even negative for wind energy (Johnson, et. al., 2009).

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

[17] In the case of energy efficiency, some analysts suggest that there is a rebound effect that erodes some of the energy savings obtained through technical efficiency improvements.

implementation of incentives should be carefully designed and evaluated, especially with limited fiscal resources or competing fiscal priorities. Some mitigation measures, especially in energy efficiency and urban transport, require in addition the promotion of changes in consumption behavior, mainly through education programs.

Cross-cutting Dimensions and Institutional Challenges

2.11 Another key concern while addressing climate change challenges is the role that urban centers have in mitigating their GHG emissions and reducing their vulnerability to extreme weather conditions. Being a heavily urbanized region (three quarters of LAC's population live in urban areas), cities in LAC account for most of the energy consumption and emissions from transport, waste, industry and housing in the region; it is in urban areas where energy saving and emission control programs are most needed, and where low-carbon solutions have the greatest potential for scaling-up. LAC's urban population is also highly vulnerable to effects of climate, and this is exacerbated by deficient land-use planning, and the deterioration of natural resources, including biological resources, soil, water, and air quality. LAC's urban concentrations, located in low-elevation coastal zones are threatened by rising sea levels and extreme weather events, and urban settlements located in high-altitude regions are vulnerable to floods and landslides. In addition, informal in urban and periurban settlements share characteristics that intensify the vulnerability of their residents to climate change, including poorly constructed buildings, inadequate zoning, deficient infrastructure, lack of safe drinking water, drainage and sanitation services, and overcrowding.

2.12 There are important synergies between adaptation and mitigation which need to be considered when designing and planning climate actions and evaluating their results. In many instances GHG emission reductions in a given sector could simultaneously increase the adaptive capacity of ecosystems. Examples include: the protection of local forests against deforestation caused by large infrastructure projects leads to increases in carbon stock, while at the same time reduces the vulnerability of animal species and local communities to extreme weather events and their impacts, including landslides and floods; improvements in seed selection and cultivation practices could increase the adaptive capacity of crops to climate variations, while reducing the need for fertilizer or heavy equipment, possibly impacting emissions; renewable energy sources in rural communities (such as waste-to-energy solutions) contribute to GHG reductions and increase resilience to changes in weather conditions by improving rural livelihoods; the rehabilitation of forest coverage in the urban fringe increases carbon capture and at the same time reduces the incidence, magnitude and impact of urban landslides and floods; energy efficiency programs in large cities help reduce energy demand and thus CO_2 emission from energy consumption, while decreasing pressure on an energy matrix affected by changes in the hydrologic regime; land use planning based on adequate mix of urban uses and open space, as well as sustainable transport measures can reduce CO_2 emissions and at the same time reduce vulnerability to extreme temperatures and impacts caused by the urban heat island effect; and water efficiency measures in urban municipalities can reduce energy consumption and emissions from water pumping and distribution, and reduce stress on local aquifers.

2.13 The ability of the LAC region to address the climate adaptation and mitigation challenges will largely depend on the capacity of national and sub-national governments and civil society to adopt adequate institutional and regulatory frameworks, as well as on the engagement of public and private sector investments. Key challenges in this regard include the need to: establish strong national climate change entities (at ministerial or sub-ministerial level) capable of developing national climate change strategies and implementing fully operational and well-funded climate change action plans; adopt short, medium and long-term GHG emission reduction and vulnerability reduction targets that can be monitored, reported and verified; strengthen cross-sectoral coordination between different national economic sectors (energy, transport, water, agriculture, etc.), and the role of the ministries of finance; strengthen sub-national governments to mainstream the climate agenda in local development, with adequate land use planning schemes, mobilization of public and private funding for local infrastructure; and strengthen stakeholders participation including public sector, consumers, professional associations, citizen groups and private banks.

2.14 The global pursuit of a response to climate change will affect the trading interests of LAC as producers will feel the effects of climate change mitigation measures taken elsewhere, even in the absence of actions by LAC governments. For transnational resources – such as protected areas, forests, watersheds, coastal and marine ecosystems – cooperation and integration among countries is crucial for achieving effective climate mitigation and adaptation results. Regional integration and cooperation could help overcome technical, financial and trade challenges by providing an adequate platform for the provision of regional public goods and new technologies. Such platforms could serve the collective interest of groups of countries or specific sub-regions in LAC.[18]

III. BANK RESPONSE AND LESSONS LEARNED

IDB's Comparative Advantage and Involvement

3.1 Over the past years the IDB has laid out the foundations for a sustained commitment to leadership and technical and financial support to climate change 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 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

[18] Some regional climate initiatives currently being elaborated, designed or executed include: the Central American and Dominican Republic Regional Strategy on Climate Change (CCAD-SICA, 2010); the Caribbean Regional Framework for Achieving Development Resilient to Climate Change (CCCCC, 2009); and the Andean Environmental Agenda (Comunidad Andina, 2007).

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.

3.2 The Bank has for many decades provided financial support for the implementation of activities in the energy, transport, water and sanitation, environment, forestry, disaster management, rural development and urban development sectors. Such investments have pursed sustainable development objectives, and in many cases have been conducive to low-carbon and climate-resilient practices. Since 2003, the IDB began incorporating the climate change mitigation and adaptation dimension in its programs, and mobilized Bank resources and multi-donor funding for technical assistance. To expand the scope of climate mitigation and adaptation activities and facilitate access to international climate finance, the IDB's Board of Directors approved the Sustainable Energy and Climate Change Initiative (SECCI) in 2007 and established non-reimbursable funds to support knowledge and capacity-building, pilots and investment grants. SECCI's main objective was to mainstream climate change actions within IDB operational divisions, and build climate resilience in highly vulnerable sectors. The high demand for SECCI funds to finance knowledge and capacity-building activities led to the US$40 million replenishment in 2009 of the climate change trust fund, doubling its original size.

3.3 Over the past years, the Bank has consistently supported the climate change mitigation and adaptation agendas in the region. It has engaged in developing and strengthening institutional and regulatory frameworks, has provided technical assistance and mobilized financial instruments for public and private sector operations. At present, the sovereign and non-sovereign windows of the Bank are expanding their pipeline and portfolio in more than twenty LAC countries, using a full array of instruments that include technical cooperation, retainers to assist public and private clients in preparing investments, and policy-based loans (PBLs). The Bank is therefore prepared to ramp-up its involvement in sustainable energy, climate change and environmental sustainability activities required to meet the 25% lending target established in the GCI-9.

International Climate Programs and Finance

3.4 The Bank has demonstrated capacity to facilitate 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);[19] and the Adaptation Fund. As these instruments evolve in international negotiations, the Bank will have to stand ready to adopt and promote them in LAC. Elements of international negotiations, such as those contained in the Copenhagen Accord endorsed by some countries in the Conference of the Parties in COP15, and which were further pursued at COP16 include: the need to stabilize global emissions by 2050 to ensure a maximum of 2°C increase above pre-industrial levels; pledges from developed countries for fast-track and long-term funding; the need to establish monitoring, reporting and verification (MRV) systems for tracking emissions in developing countries; and, a more prevalent role to REDD and REDD+ activities.

[19] 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.

3.5 The most recent developments under the UNFCCC and the outcomes from the COP16 show a promising path for the Bank's proactive involvement in LAC's climate change agenda. COP16 produced results that provide a platform for strengthening the Bank's role as a provider of technical and financial assistance, including: (i) the establishment of a Green Fund, with representation of LAC countries and significant participation of the Bank along with other MDBs; (ii) a REDD+ framework that will provide a wide range of opportunities for forest-related activities, particularly relevant to LAC; (iii) the adoption of Nationally Appropriate Mitigation Actions (NAMAs), voluntary mitigation targets and low-carbon development strategies or plans by developing countries for which financial and technical assistance will be required; (iv) the establishment of the Cancun Adaptation Framework and the preparation and adoption of national adaptation programs (NAPs) to enhance adaptation capabilities of most vulnerable countries, which will require methodological and technical guidance, as well as finance; (v) the support of technology transfer mechanisms for climate adaptation and mitigation; (vi) the continuation of the CDM independently of the Kyoto Protocol, with improved and standardized baseline methodologies and new sector approaches, expected to dynamize the regulated carbon markets and open new opportunities for supporting public and private sector clients; (vii) a stronger role to the Adaptation Fund as the only dedicated multilateral adaptation fund, with the Bank as one of its implementing agencies; and (viii) a more agile and reformed GEF, with improved operational procedures.

3.6 The Bank has supported the access of public and private clients to carbon finance. It has assisted in: analyses of emissions reductions potential; the preparation of project design documents (PDD); validation of projects; development of CDM methodologies; and analysis and support of governmental institutional capacity for promoting CDM projects. As the carbon market evolves, demands from clients will increase and diversify, especially for assistance in CDM's Programs of Activities (PoAs), NAMAs, new voluntary market schemes, innovative market schemes, and corporate GHG accounting systems. To meet this growing demand, the Bank will need to increase significantly its technical and financial capabilities and its staff across its operational divisions.

3.7 The GEF provides an important source of grant funding to promote global environmental benefits, including climate change mitigation and adaptation initiatives. As an implementing agency of the GEF since 2004, the IDB has supported activities in the areas of biodiversity, land degradation, international waters, and climate change, particularly in renewable energy, energy efficiency, sustainable transport, and sustainable forestry.[20] The GEF resources provide the Bank with an opportunity to scale-up its support 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 these grant resources to leverage its lending portfolio.

3.8 Coordination among multilateral development banks (MDBs) and international organizations is important for mobilizing the necessary technical and financial resources.

[20] The current IDB-GEF portfolio amounts to over US$120 million which are leveraging IDB and other bilateral funding sources in areas such as energy, agriculture, water and sanitation, tourism and transportation. In the area of sustainable energy the GEF is financing more than US$ 45 million in projects. 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.

Strong collaboration with MDBs 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 climate agenda. 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 the CIF's Clean Technology Fund (CTF). The CTF provides concessional financing for implementation of the countries' low-carbon development plans, strategies, policies, and programs. Through the CTF, the Bank was effective at leveraging private finance for a wind farm project in Mexico, the largest of its kind developed in the region until today.

3.9 The 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 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 with programs 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 program. 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.

3.10 Other examples of joint collaboration between the IDB and other MDB's include the collaboratively work with the World Bank on a regional dialogue on adaptation policies in the water sector; the Partnership on Sustainable Low-Carbon Transport (SLoCaT) with the Asian Development and the African Development Bank; and, an informal energy and climate change group with several MDB's to enhance collaboration and seek consensus on a number of relevant climate finance areas. 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.

Supporting Government Priorities, Regional Dialogue and Finance

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 The Bank has drawn important lessons from current efforts to enhance institutional capacity and climate policy innovation and reforms in LAC. The Programmatic Climate

Change Policy-Based Loans (PBLs) in Mexico, Colombia, Peru and Guatemala, and underway in Trinidad and Tobago, show that strong leadership, particularly from the Ministries of Finance, is required for effective climate policy formulation, design and implementation, and commitment of fiscal resources towards the achievement of climate objectives. Cross-sectoral coordination for climate action is also critical, with a strong national entity capable of communicating various technical demands in the climate mitigation and adaptation agendas. Similarly, when supporting policy reforms in sustainable energy, such as those approved already in Peru, Panama and Barbados, strong leadership from finance authorities and cross-sectoral coordination have proved important for the implementation of reforms. Through many of these programs, the Bank has successfully assisted countries in their revision of price structures of fuels and electricity, thus fostering the efficient use of energy and the adoption of mechanisms that protect low-income segments of the population against such price changes.

3.13 Supporting policy dialogue on sustainable energy and climate change policy in the region has proved to be essential for a successful engagement with LAC government authorities. Through its Regional Policy Dialogue initiative, the Bank convenes high level policy makers to regional and sub-regional meetings to discuss and deliberate on key analytical and technical topics. The Dialogue´s Climate Change and Disaster Risk Management Network engages national climate change leaders around planned sessions addressing technological challenges of low-carbon growth, policy instruments and public and private finance climate actions. Other networks of the Dialogue provide a cross-sectoral platform for discussing specific issues relevant to sustainable energy, climate mitigation and climate resilience. Such networks cover the following policy areas: energy; transportation; water and sanitation; social protection and health; innovation, science and technology; trade and integration; and chief economists and finance ministries.

3.14 The IDB experience confirms that current levels of climate finance are insufficient to develop sustainable energy and other climate investment activities. Private project sponsors and public sector institutions face high initial capital costs and insufficient long-term financing and operate in a financial environment that lacks 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 activities. 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 activities to a commercial level.[21] The region requires support for the development of tools, standards and protocols to help companies, especially small and medium-sized enterprises (SMEs), to facilitate green procurement, GHG emission accounting, emission reduction technologies and climate adaptation measures.[22]

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[21] For example, the Bank helps local financial institutions develop “green line” procedures and eligibility criteria for on-lending to support appropriate energy efficient and renewable energy projects.

[22] The Greenpyme program provides technical assistance to SMEs in the areas of energy efficiency, renewable energy and carbon credits.

3.15 The cross-sectoral nature of climate-related issues requires internal coordination and alignment with Bank´s strategies and policies. Compliance with existing policies and their directives, including the Environment and Safeguards Compliance Policy (OP-703), the Operational Policies on Gender and Equality in Development (GN-2531-10) and the Indigenous Peoples (OP-765) is key to achieving many of the objectives stated in this CCS. Such is the case of OP-703, which establishes requirements on mainstreaming environmental-related activities in country programming, or safeguard environmental policies for program and project design and approval.[23] A new set of strategies is being submitted for consideration by the IDB Executive Board early in 2011, including strategies on Institutions for Growth and Social Welfare (GN-2587), Competitive Global and Regional Integration (GN-2565), Social Policy for Equity and Productivity (GN-2588) and Private Sector Development (GN-2598). These strategies are also supportive of the Bank's climate change priorities and objectives. For example, these strategies will provide support for institutional development programs for the delivery of innovation, science and technology; support to competitive regional integration platforms for the promotion of regional infrastructure and regional public goods; support to social programs to improve the livelihood of local communities and their environmental sustainability; and, enhanced access to private finance and investment in clean energy.

IV. STRATEGIC LINES FOR BANK INTERVENTION

4.1 The present CCS is designed to serve as IDB's strategic instrument for scaling-up support for climate mitigation and adaptation activities, contributing to low carbon development, environmental sustainability and climate vulnerability reduction in the region. To this end, the IDB will strengthen and consolidate its own capacity, readiness, comparative advantages, and will equip itself to become a catalyst for clean development in the region, responding effectively to the growing demand for climate change mitigation action and climate resilience. The Bank will pursue the following five strategic lines of activity: (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 activities; (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.

4.2 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

[23] The OP-703 requires an environmental impact classification of all Bank-financed operations so that the appropriate environmental assessment or due diligence requirements are selected.

guidance for Bank dialogue with governments, civil society, academic/scientific community, 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, fiscal management, 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 communication. This strategic line will cut across the other areas for Bank intervention by guiding the development of knowledge activities related to institutional strengthening, to the mainstreaming of climate change, to sector specific assistance and to the scaling up of investments. The Bank will prioritize the pursuit of activities to increase the generation, systematization and dissemination of knowledge in the climate change field, including:

- *Data collection of key information for climate change research and decision making, development of databases, data homogenization and sharing.* The Bank will support efforts oriented to: information generation, collection and management for the analysis of climate change impacts, as well as final energy use, to assist decisionmakers; the development of databases to improve access to information; standardization and homogenization of data to facilitate multi-sectoral and/or multinational studies; establishment of platforms to document existing knowledge; and, sharing of information among public and private sectors, international organizations, MDBs, research institutions and academia.
- *Studies on climate change including economic and social dimensions.* The Bank will continue to provide support to studies on climate change mitigation and adaptation including sectoral analyses (for example, current situation of the sector and potential for mitigation and adaptation actions, factors influencing deforestation and land use change, ecosystems, climate financing funds etc.), and analysis of the economic impacts of climate change. These will include modeling exercises that consider long-term as well as near-term future scenarios. It will also support studies that incorporate gender, poverty, ethnic, cultural and local community dimensions of climate change vulnerability, impacts, mitigation and adaptation; assessments of the development co-benefits of climate change mitigation, as well the as effects of climate change on economic development, human health and migration.
- *Tools and instruments to assess climate impacts and mitigation potential, climate vulnerability and risk management and to screen investment projects for sustainability*. The Bank will seek to promote the development of analytical tools or the adoption of existing tools for building GHG inventories and assessing alternatives for GHG emission reductions in key sectors and technologies. It will also support the development of climate change vulnerability assessment and modeling, social impact and risk assessments that integrate the full range of socioeconomic, biophysical and environmental impact variables (including, among others, indigenous and ancestral knowledge), encompassing the development of risk-sharing and innovative transfer mechanisms to address loss and damage. To improve the evaluability and

sustainability of investments, the Bank will support the development of analytical tools to integrate social, economic and environmental considerations.

- *Networks, partnerships and platforms to address climate mitigation and adaptation challenges*. The Bank will incorporate the latest developments in climate change knowledge into activities that support: existing and new regional networks, innovation centers, round tables and new web platforms for knowledge sharing and transfer on sustainable energy, climate change and climate financing among key stakeholders in the public and private sector, as well as civil society; collaboration with other international financial institutions and MDBs in outreach and in the design and development of knowledge materials and training programs; 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.

4.3 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 sub-national, national, sub-regional and regional 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 strengthening of climate change entities and cross-sectoral coordination and collaboration among ministries and institutions for the development of national regulatory frameworks and policies based on international standards that will facilitate LAC's articulation and compliance with international agreements, as well as access to international funding for climate mitigation, vulnerability reduction and adaptation. The Bank will also continue to utilize policy-based and investment loans in climate change and sustainable energy to advance institutional building and policy reform and innovation.
- *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, public health and others), as well as ministries of finance and ministries/departments of planning, which play an increasingly important role in

budget allocation, fiscal policies, and promotion of climate mitigation and adaptation investments. The Bank will also promote institutional strengthening of national and 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.

- *Strengthening public and private companies*. The Bank will assist public and private companies in identifying and accessing international financing for climate change actions (including regulated and voluntary carbon markets), designing and implementing corporate social responsibility schemes that integrate climate mitigation and adaptation objectives, pursuing and achieving green building certification, and designing and implementing climate adaptation plans to protect public and private infrastructure.
- *Support to national and local funding institutions, commercial banks, and other financial intermediaries to access and develop financial instruments*. The Bank will continue to provide technical assistance on GHG accounting, climate risk assessment and management, carbon project development, and development of financial instruments in projects to reduce GHG emissions. It will support capacity-building of national business organizations, and public-private cooperation.
- *Strengthen civil society and academic/scientific sector participation and ownership of climate change-related decision making.* The Bank will support institutional strengthening of civil society and its local/community organizations, and academic/scientific sector to reduce climate impacts and enhance local adaptive capacity, engaging all relevant local stakeholders (local communities, tribal/indigenous groups, women, youth, and scientific institutions) in the design, implementation and monitoring of climate change actions. It will also promote South-South cooperation, education programs, training and outreach on climate change impacts, mitigation and adaptation options such as carbon markets, REDD programs, and adaptation and adoption of new technologies/practices.

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 activities it finances.

4.4 The Bank will seek that its activities support and promote currently available technological options and management practices that can help reduce climate impacts. Lending and technical assistance programs in climate-sensitive sectors will be consistent with the Bank's Environmental and Social Safeguards, as well as those referring to Indigenous Peoples and Gender. In addition, the Bank will promote sector-specific principles to meet 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 and combustion (for electricity or heat generation, when possible), emissions mitigation through waste minimization, re-use and recycling, and fuel efficient waste collection and transport.
- 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 for project preparation and design.
- To promote *sustainable transportation*, the Bank will support the identification and financing of sustainable low-carbon transportation solutions for passengers and freight both in urban and rural settings.

4.5 The Bank will develop sectoral technical notes containing orientation and best practices for the development of activities in GHG-intensive industries, where the Bank anticipates substantial work. It 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.

4.6 The Bank will develop criteria and indicators to track climate change mitigation and adaptation of its own investments and operations, in line with international best practices and in collaboration with other MDBs. The IDB's Environmental and Safeguards Compliance Policy (OP-703) includes a provision that IDB-supported operations that produce significant quantities of GHGs will annually quantify direct GHG emissions, in accordance with the emissions estimation methodologies of the IPCC or other internationally accepted methodology. For this purpose, the Bank will develop a GHG reporting mechanism to quantify and report on the carbon footprint of such operations. In addition, the IDB will ensure that investments in infrastructure (such as transport, water and energy) and other areas that may be sensitive to the impacts of climate change are designed to withstand those impacts. To this end, it will develop the capacity to assess the vulnerability of the projects it finances to climate variability and change, including developing a better understanding of vulnerability assessment and risk management instruments available to improve climate resilience. These activities 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.

4.7 The Bank will direct financial resources for lending and technical assistance activities to reduce climate change impacts and vulnerability of both natural and human systems, 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, 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.[24] A first set of sectors or areas of intervention focuses on activities recognized as key drivers of the climate policy agenda, and for which significant technical and financial resources are required. The results the Bank seeks to achieve in those sectors include: decrease in land use change of pristine or high ecosystem service value landscapes and deforestation which is the largest contributor of GHG emissions in the region; increase and improvement in hydrologic resource protection and water resource management, a highly-vulnerable sector to climate change impacts; and promotion of sustainable agriculture, including security of land tenure and sustainable management of natural resources that translates into increased rural productivity and enhanced livelihood of rural populations.

4.8 A second set of sectors or areas of intervention 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 in LAC, which by itself justifies increased commitment of Bank resources, the shift towards more environmentally sustainable and climate-friendly programs and technologies (ecosystem-based approaches) demands a much stronger engagement of the Bank. In the energy sector, the region has a strong potential for renewable energy and energy efficiency, but requires additional support for carrying out the necessary investments, both technical and financial, as well as attention to environmental impacts. 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 cannot mobilize on their own. With sanitation infrastructure, large opportunities for emission reductions will be pursued by targeting investments in infrastructure, mainly in waste collection, treatment and recycling.

4.9 LAC is an eminently urban region, therefore the Bank will adopt an integrated urban sustainability program to assist city governments and stakeholders' efforts to articulate the full range of sector priorities into coherent urban policies and programs, with the explicit goal of reducing GHG emissions, build climate resilience and improve the environmental sustainability of urban operations. 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.

4.10 The following priority sectors will be supported under this Strategy:

[24] Priorities regarding climate change vary within the region (sub-regions, countries, etc.), depending on geographic settings, socio-economic development conditions 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 implementation of the CCS.

- *Land use, land use change and forestry (LULUCF).* The Bank will support lending and technical assistance activities 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. Sustainable practices to be supported include: promotion of forest carbon sequestration and emissions reductions, forest conservation and carbon stock enhancement, forest management practices (timber and non-timber forest products); enhancement of natural heritage through sustainable tourism development; improved management of forest concessions; tenure regularization, security and demarcation of indigenous land and related rights and assets; provision of incentives for private individuals and firms to recover degraded forestlands and protect existing forests; forest monitoring systems to prevent or minimize the impact of forest fires and diseases; assist communities, women's groups, and indigenous people in the provision of ecosystems services for biodiversity and goods; development and implementation of private-public partnerships, with a focus on participation, empowerment, and benefits-sharing for local communities and indigenous peoples; development of new investments opportunities under REDD+ and other forest conservation financing programs; and facilitation of the development and financing of national investment plans in the forest sector, particularly under the platform of the CIF's FIP and other multilateral and bilateral climate change mitigation programs.

- *Agriculture and livestock.* In order to enhance food security in LAC, the Bank will promote sustainable agriculture practices among farmers to mitigate and adapt to climate change and its impacts. For this purpose, the Bank will: promote the provision of agricultural services to monitor, control and eradicate pests and diseases consistent with the conservation of endemic biodiversity and natural ecosystems; strengthen local, national and regional capacity to develop and adopt technological innovations that improve sustainability and productivity of agricultural operations and reduce GHG emissions (genomic research to develop improved seeds, crop rotation practices, and improved efficiency in the use of water and fertilizers); facilitate farm investment on soil conservation and land fertility; and increase efficiency and sustainability of water resource use at farm, landscape and watershed levels. To ease the climate adaptation process of the sector, the Bank will also support improved modeling, forecasting and related research and capabilities for assessing climate vulnerability and risk in agriculture, and will direct support to programs that promote the adoption and refinement of profitable, environment-friendly technological and ecosystem-based innovation and practices, especially among small landholders. The Bank will work with public and private sectors to ensure that the use of best agriculture practices, less carbon intensive modes of livestock production, 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. The Bank's lending and technical assistance will go together with policy dialogue to ensure adequate frameworks, institutions, and economic incentives to promote and achieve sustainable and efficient use of farm resources.

- *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, through necessary assistance to assess and reduce vulnerability and risks to both built and natural infrastructure associated with climate variability and change; investments in climate-proofing natural (e.g. watershed conservation, protection or restoration of natural coastal buffers, etc.) and physical infrastructure (structural flood defenses and drainage consistent with maintenance of ecosystem services); research, development and implementation of better local water management practices (such as conservation, recycling and ecosystem-based adaptation), climate adaptation and climate/disaster risk management programs to raise institutional consciousness among regulators in order to incorporate climate adaptation requirements in public and private utilities; emission mitigation measures by increased operating energy efficiency of water and sanitation utilities; and, 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 in the areas of: energy efficiency, including energy audits to identify and determine energy saving potential (e.g. residential, industrial and government buildings), training on energy efficiency practices and technologies, design and planning of energy efficient buildings and renewable energy, such as wind, solar, hydro,[25] geothermal, waste to energy (e.g. incineration and gasification) and bio-energy (including biofuels[26] and biomass cogeneration such as bagasse, rice husks and wood chips from residual timber processing). These activities will be undertaken while addressing the financial challenges (high up-front cost technology) and technical and institutional barriers (particularly regulatory issues). The Bank will support research and training on energy efficiency and renewable energy technologies, which could include fuel switching projects.[27] The Bank will also 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 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 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

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[25] Bank operations such as large hydroelectric projects undergo classification and close scrutiny following the Environmental and Social Safeguards Compliance Policy (OP-703).

[26] 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.

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

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 assessment of the co-benefits associated with more efficient means of transportation and congestion reduction, including health benefits and reduced air pollution. The Bank will work in the development of risk analysis methodologies for the reduction of vulnerability of transport infrastructure and the implementation of preventive and complementary measures for ensuring a reduction of impacts associated to climate related events.

- *Ecosystems management and biodiversity.* The Bank will support ecosystem management/ conservation programs in a wide range of natural environments (including coral reefs, marine and freshwater ecosystems, littoral zones, forest, savannahs, grasslands, etc.). It will support activities such as: establishment and management of protected areas and biosphere reserves; implementation of ecosystems conservation and restoration projects; establishment of multinational partnerships to conserve and manage ecosystems and biodiversity, including actions to increase resilience to observed and anticipated impacts of climate change; development of activities to increase the resilience and adaptation of natural systems to changes in climate conditions (for example by improving native vegetation protection systems and reinforcing connectivity); design and implementation of programs to improve the economic and social conditions of communities near protected areas and biosphere reserves; and programs promoting equitable and fair sharing of benefits from ecosystem goods and services with local communities, community participation and outreach programs. The Bank will promote sustainable tourism as part of its broader ecosystems and biodiversity conservation practices.

- *Integrated urban development and climate-resilient cities.* The Bank will support national and local city governments, as well as urban communities, organizations, and private sector entities operating in urban areas, in the development and implementation of policies, programs, tools and technologies that promote integrated and sustainable urban and environmental management that lead to GHG emission reduction and climate resilience. [28] 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 and urban design 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; and integrated urban management schemes that link the provision of urban services (energy, transport, water and sanitation) to GHG mitigation objectives.

- *Disaster risk management and climate change.* The Bank will promote programs to integrate adaptation to climate change and disaster risk management through:

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

vulnerability assessments of geographical areas and critical infrastructure such as hospitals or water treatment plants; preventive measures to mitigate potential impact of disasters; management of disaster risks related to natural hazards by identifying these risks, and reducing vulnerability to them through the improvement of methods to anticipate, mitigate and recover from their impact; appropriate assistance in response to disasters to revitalize development and avoid risks; and, public and private financial instruments for risk coping and management.

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.

4.11 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 activities 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, promoting the creation of national funds, financial support for SMEs, or applying NAMAs and NAPs to direct financial resources to mitigation and adaptation priorities. In addition, the Bank will promote collective action by providing financing for public regional goods that effectively respond to transnational challenges for climate change action.

4.12 The Bank will maximize the use of international resources, particularly grant and concessional loans from the CIF, GEF, Adaptation Fund, as well as instruments under the Kyoto Protocol (including CDM) and new UNFCCC mechanisms originating from COP16 in Cancun and COP17 in Durban, to pilot and scale-up financial instruments in new climate-related areas such as energy efficiency, renewable energy, carbon markets, and insurance. The Bank has acted as an implementing entity of the CIF which serves as an effective model for transparency, collaboration and scaling up of climate action. Building on this positive experience, the IDB is looking forward to defining the Green Climate Fund, which will support projects, programs, policies and other activities in developing countries using thematic funding windows. The Bank will also seek to: expand access to REDD and climate adaptation finance as these resources become available; assist countries to identify and access additional international funds for climate financing; and collaborate with other MDBs to play a catalytic role and leverage additional resources.

4.13 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. Leveraging adequate capital levels will require creating cooperation and synergies between government authorities and public and private sector financing - at both sub-national and national levels - and generating incentives for private companies that engage in sustainable

activities and climate change mitigation and adaptation actions. To meet the scale and extent of investments needed, the Bank will increase its use of current private sector instruments, including credit guarantees, corporate and project finance, direct and syndicated loans, co-financing, green financing facilities, equity and investment funds to promote private investment in low-carbon and climate resilient activities. New types of risk sharing, national and sub-national public private partnerships, hybrid instruments and other innovations will be introduced to foster low-carbon development.

V. IMPLEMENTATION OF THE STRATEGY

5.1 Subsequent to the approval of the CCS by the IDB Board of Executive Directors, Bank management will develop the Climate Change Strategy Action Plan (CCSAP). The CCSAP will detail the activities to support the Strategy's five strategic lines of action, as well as the timeframe and resources required to address specific internal and external needs. The CCSAP will monitor the Bank output contributions in line with the Results Framework of the General Capital Increase (GN-2518-20, Annex 1).

5.2 The CCSAP will include a system for tracking and monitoring improvements in climate change mitigation and adaptation within IDB operations, including financial indicators and GHG accounting and reporting. The CCSAP will also promote other activities such as; mainstreaming sustainable energy and climate change mitigation and adaptation objectives in country programming and country strategy development; climate change research support in relevant policy areas; and climate change knowledge management and dissemination. These activities will strengthen the technical and operational basis for the implementation of the CCSAP.

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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 the region 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[1]

2.1 ***Agriculture.*** Recent estimates reported by IFPRI (2009) indicate that the annual requirement of financing for climate change adaptation in the agricultural sector in Latin America is on the order of US$1.2 billion from the present to 2050. The major part of that amount is for access roads (US$650 million), with the remainder for agricultural and livestock research (US$400 million) and expansion of irrigation systems (US$150 million). 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.

2.2 The direct economic impacts of climate change on agriculture in the region are significant. An analysis conducted by ECLAC (2009)[2] in Colombia, Chile, Ecuador, Paraguay, and Peru indicates that climate change could pose a substantial threat to the agricultural productivity of South American countries, as up to 66% of the continent's area could be affected by land degradation. Similarly, the impacts of

climate change on productive sectors in Mexico are expected to affect the economic performance of agriculture negatively, producing a significant decrease of crop yields by 2100 (Galindo, 2009).[3] Maize yields could be on average over 35% below 2007 levels, with Baja California Sur, Campeche, Chiapas, and Guerrero among the states that will suffer yield losses due to increases in temperature.

2.3 In already food insecure areas of LAC 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, as well as large-scale forced population migration. The consensus in a recent literature 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 (Parry et al., 2007).[4]

2.4 The introduction of adaptation measures to maintain or increase productivity (through changes in production practices), as well as the protection of land and its natural ecosystems are critical for the long-term sustainability of the sector's biological and forest resources. Research in genetics and biotechnology is essential for responding to challenges such as increased temperatures, increased droughts, and threats from pests and diseases. Also, the development and implementation of risk management and protection instruments (through coverage to producers against catastrophic events), and the introduction of financial innovations (e.g. short-term and long-term financing) are critical for meeting working capital needs and addressing food security in the region.

2.5 ***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.

2.6 The Andean sub-region deserves particular attention in regard to climate change effects on water resources, since runoff from glaciated basins (in Argentina, Bolivia, Chile, Colombia, Ecuador, Peru, and Venezuela) is an important contributor to the regional water budget. Glaciers play an important role as freshwater "regulators" in associated watersheds, ensuring year-round water flows for agriculture, drinking, power generation, and ecosystem maintenance. Climate change model simulations indicate that lower-altitude glaciers in the Andes (which supply water to approximately 70 million people) could disappear within a few decades, with potentially serious impacts on people's lives and livelihoods, and on sensitive ecosystems.

2.7 Severe water stress is expected in eastern Central America, where the availability of water and generation of hydropower will be greatly affected. Additionally, an increase in frequency and intensity of tropical storms, such as hurricanes, can result in significant human loss as well damages in water and sanitation infrastructure. In

areas such as Guatemala's Motagua valley and Pacific slopes, in the eastern and western regions of El Salvador, in Costa Rica's central valley and Pacific coastal region, in the northern, in the central and western intermontane regions of Honduras and in the peninsula of Azuero in Panama, severe water stress is expected to cause significant impacts on water supply and hydropower generation (IPCC, 2007).[5]

2.8 In the Caribbean, small islands which already have a limited water supply are highly vulnerable and are expected to experience increased water stress due to climate change. Even though there is a high level of uncertainty about climate scenarios for the Caribbean (ECLAC, 2009), several scenarios for the region project reduction in rainfall expected to occur during the summer season, resulting likely in unmet demand during low rainfall periods. While precipitation is expected to increase during the winter, this increase will probably not compensate for summer shortages, and this is mainly due to lack of storage capacity and high runoff during storms. In addition to reduction in water supply, sea-level rise, soil and aquifer salinization, and flooding, are expected to negatively affect coastal agriculture (IPCC, 2007).

2.9 Improving water governance, through adequate institutional frameworks, policies, and actions that reduce vulnerability to climate change, is critical. A number of measures can be taken in this regard: introducing effective water resource management practices within a clear institutional framework that is sensitive to climate; mainstreaming climate change adaptation into water management practices by integrating climate change risks for the water sector into key national and local development plans; implementing adaptation measures; and enhancing information and knowledge management, since water resource management affects other sectors, such as energy, health, and food security.

2.10 ***Energy production and distribution***. The energy sector in LAC is highly vulnerable to the effects of climate change, as a significante proportion of its generation comes from renewable sources sensitive to climate variations. In particular, hydropower, which accounts for 53% of installed capacity in the region, is threatened by a reduction of water flows and changes in rainfall patterns that affect the hydrological cycles. These changes will be accentuated in the Inter-tropical Convergence Zone affecting countries located in this area. Anticipated impacts of climate change on the hydrological regimes pose a risk not only to the health of natural systems but also to energy production and distribution infrastructure and to poor communities living in disaster prone areas.

2.11 In the Andean sub-region for instance, natural systems such as high mountain ecosystems might not be able to cope with rapid hydrological changes resulting in their irreversible deterioration and the loss of their capacity to provide essential services such as water storage and regulation, consequently affecting hydroelectric generation. In addition, as rates of warming are expected to increase with altitude, inter-tropical glaciers and water systems fed from these will be highly vulnerable affecting also dependant energy systems. There is an additional factor that may also affect the water-recharge stability of Andean glaciers: the Amazon basin. According to results from latest research, significant changes in precipitation

patterns over the Amazon may affect the amount of humidity that is carried to the Andean mountainous system, which in turn would affect glacier run-offs. Hydrological changes in the Amazon basin will have also serious implications for hydroelectricity in Brazil, which is not only the biggest hydro-electricity generator in the LAC region but also the biggest energy producer of the region with 36% (e.g. 456,000 GWh) of LAC total annual generation (OLADE, 2009).[6]

2.12 In the Mesoamerican sub-region (e.g. from Mexico to Colombia), regional models are sending mixed signals. However, a common trend of models' outputs indicate that the northern Mesoamerican area would become dryer towards middle of the century contrasting with the coastal regions of Panama and Costa Rica in which wetter conditions are expected. In general terms, climate system models indicate for this sub-region an increase in extreme conditions (e.g. historically dry areas will become even dryer). This will have grave implications for hydroelectricity production, particularly for energy planning in this sub-region, as water availability will present a significantly higher seasonal variability.

2.13 The Caribbean region is also expected to be seriously affected by climate change. Although most of its energy generation installed capacity is thermal (e.g. hydroelectric installed capacity is less than 1%), changes in sea-level rise, rainfall patterns and extreme events pose a risk to energy infrastructure in coastal areas and may limit the expansion of renewable sources of energy such as small hydros due to water non-stationary conditions. Energy matrixes in Small Island Development States such as Jamaica or Dominica will be highly affected as they have a significant contribution from hydros to satisfy base demand.

2.14 According to OLADE (2009) the LAC region presents a hydroelectric installed capacity of 131,000 MW, equivalent to approximately 21% of the region's available potential. The (82%) majority of that capacity is concentrated in five countries, namely Brazil, Venezuela, Mexico, Argentina and Colombia located in areas in which significant changes in hydrological cycles are anticipated, making adaptation a key priority for these regions. Specifically, adaptation measures for the energy sector should start by the so-called 'no regrets' actions such as energy efficiency programs for example. Other actions aimed at reducing vulnerability to observed and anticipated impacts of climate change in the energy sector include: (i) capacity building, (ii) development of tools to support decision making and planning processes and (iii) local interventions on the ground (e.g. infrastructure) that respond to climate change anticipated impacts while satisfying actual and projected hydroelectric demand. In addition to these, some other measures like the transfer of technology that allows an efficient use of natural resources, the customization of climate and weather data for specific energy sector needs, the integration of a climate risk approach into operational decisions, including if required, the installation of early warning systems, will become more relevant for the daily management and planning of hydroelectric power plants.

2.15 ***Transportation systems***. Observed and anticipated impacts of climate change on hydrological cycles in the LAC region pose a great risk for infrastructure investments. Historically, IDB has been the lead financial institution in the region

on transport infrastructure investments. On average, between 1961 and 2008, around 31% of IDB's total investment portfolio has been dedicated to finance infrastructure, from which close to 37% has been prioritized towards transport infrastructure. Given the relevance of transportation systems as the axis for economic development in the region, it becomes imperative that the Bank contributes to guarantee that made investments are climate resilient using to this aim the best available technology to better understand the nature and magnitude of anticipated climate change impacts.

2.16 Indeed, vulnerability of transport infrastructure to climate change has the potential to result in serious limitations in LAC's land and marine communications in the near future. Land and marine transportation networks are increasingly vulnerable to flooding, erosion and tidal and storm surges, as well as material temperature stress. In particular, regional trade networks can be seriously affected, bringing detrimental consequences to their functionality and expected lifetime for what strategic maintenance and operation programs will be required. Changes to average temperatures will alter hydrological cycles and the magnitude of extreme events such as hurricanes or intense rainfall events which have great potential for destroying years of infrastructure investments such as ports and their access roads, highways and bridges among others.

2.17 In the Caribbean region for instance, sea level rise will pose an additional threat, given that a large percentage of transport investments is located in the coastal perimeter. This might be the case also for other countries in the region with coastal areas. Therefore, the process for implementing adaptation measures to protect or enhance the resilience of transportation facilities and networks should start by generating detailed vulnerability and risks assessments aimed at considering key design and planning factors in the transport sector investments applied to each geographical location and identifying 'hot-spots'.

2.18 ***Ecosystems management and biodiversity***. Anticipated impacts of climate change on ecosystems and biodiversity will have profound economic consequences in the LAC region if due adaptation measures are not taken into consideration. As natural systems cannot cope with rapid changes in climate conditions, they deteriorate, affecting the quality and quantity of the environmental services they provide. For instance, high mountain ecosystems play a key role in the storage and regulation processes of water resources for what adaptation actions should start by promoting conservation strategies that take into consideration expected changes in hydro meteorological trends and reducing impacts from non-climate stressors as a way to reduce vulnerability to observed and anticipated impacts.

2.19 Likewise, coastal ecosystems such as mangrove forests, coral reefs, wetlands including marshes and swamps play both an economic and protective key role against climate-derivate events such as storm surges. For instance, the bleaching of coral reef, exacerbated by recorded unusual high sea surface temperatures in the Caribbean basin will affect the distribution and health of existent fisheries in the Caribbean region and coastal zones of Central America. Therefore adaptation activities should be aimed at fostering initiatives to protect these systems from

external non-climate stressor as a way of increasing their adaptive capacity towards rapid changes in climate. In some cases adaptation actions could include research on specific coral types that could withstand higher sea surface temperatures and their direct on-site placement.

2.20 ***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).[7] 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.

2.21 In the case of coastal tourism, countries can be impacted by tropical storms and sea level rise; this can be the case for Caribbean islands, the Caribbean coast of South America, Central America, Mexico and Uruguay. Increased sea water temperature is expected to contribute to the degradation of natural coastal defenses such as mangroves and coral reefs, accelerate beach erosion and coastal flooding and inundation, which can lead to a reduction of coastal tourism. Additionally water shortages due to sea water intrusion and reduction in precipitation, as well as an increase of vector-borne diseases can also lead to a decline in tourists. Furthermore, Caribbean islands and countries with a coast on the Caribbean are highly vulnerable to extreme events, such as tropical storms, which, among others, result in an interruption of transport and communication. Extreme events also result in significant human and socio-economic losses. For instance, hurricane Emily in 2005 resulted in losses for the tourism sector of US$100 million[8]. Climate change impacts on environmental attributes, such as coral bleaching and beach erosion can alter the selection of destinations by tourists. In Barbados, for instance, surveys have shown that tourists select the country for its terrestrial features; especially the beach characteristics and more than 80% of the surveyed tourists would be unwilling to return if sea level rise resulted in a reduction of beach.[9]

2.22 Vulnerability to risks of hazards such as storms and hurricanes can be reduced through adequate land management and spatial planning. However, for adaptation options to be effective, they need to be anticipated by decades given, for instance, that housing infrastructure typically last 50-100 years.[10] With constraints in financial resources for long-term adaptation measures that have immediate costs but longer-term benefits, risk management strategies that have both near and long-term co-benefits should be considered an alternative. Also, data requirements, investments and policy changes necessary for adaptation will take decades to implement this there is a need for immediate action for areas that are already being impacted by changes in climate and those that are expected to see significant changes in the short to medium term. Tourism sector stakeholders should also aim to address mitigation and adaptation simultaneously. Examples of win-win situations could be considered improving the efficiency of water systems, which can simultaneously reduce the demand of energy of the sector as well as water use.

Adaptation measures for the tourism sector include, but are not limited to, update of building codes according to new and projected climate conditions (e.g. building codes for cyclone-proof building design and structure), implementation of updated building codes water conservation plans, product and market diversification, implementation of early warning systems, construction of reservoirs, and desalination plants, risk transfer mechanisms such as insurance, among others.[11]

2.23 ***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.

2.24 Cities in the region should develop their capacity to reduce their vulnerability and implement adaptation measures in vulnerable sectors. However, worldwide climate change policy making at the urban level has focused on mitigation of greenhouse gases, and in general very limited consideration for adaptation. A limited amount of cities are now starting to include both mitigation and adaptation. Mexico City, for instance, recently incorporated adaptation actions as part of the city's action plan[12]. An additional challenge for achieving urban sustainability is the fact that many of the services necessary for life such as water and food, are usually generated outside the city limits, which creates the need to link rural and urban actions. To increase their resilience to climate, cities need to mainstream climate change and disaster risk management into urban development planning as well as prepare action plans for adaptation to climate change that include: (i) an analysis of the natural hazards to which they are exposed, (ii) adequate land use planning, (iii) integrated water resources management, (iv) disaster risk management, (v) the implementation of appropriate building codes that consider the potential impacts of climate change, and (vi) the identification of financing and risk transfer mechanisms.

2.25 ***Disaster risk management***. According to IPCC (2007), climate change has the potential to alter the frequency and magnitude of extreme events among them, heat waves, hurricanes, and intense rainfall events, increasing hereby, existing risk of communities living in disasters' prone areas. Therefore first response actions towards long-term adaptation should include the five main elements of an effective disaster management system, namely: (i) risk identification, (ii) emergency preparedness, (iii) institutional capacity building, (iv) risk mitigation and (v) catastrophe risk finance.

2.26 In particular, risk identification should include hazard and socio-economic vulnerability maps using not only historical data but also ensembles of climate scenarios so that future trends of selected climate variables can be assessed. As the

occurrence of a disaster is not only dependent on the exposure to a specific hazard but also of existent socio-economic vulnerability, adaptation actions should start by identifying basal causes of vulnerability in order to design mechanisms to increase communities' means to adapt to changing climate conditions. Vulnerability to climate change is a dynamic function that depends on exposure, sensitivity and systems' adaptive capacity, this latest being highly dependent on development indexes, for what an effective way to reduce disaster risks are to close existing development gaps.

2.27 Long-term adaptation actions should start with the development of comprehensive Disaster Risk Reduction (DRR) strategies prioritizing disaster prone areas in particular countries located in the Inter-tropical Convergence Zone in which significant changes in climate dynamics are anticipated. In this context, priority has been given to a community based adaptation approach including safety nets, as a way of raising awareness and preparedness in communities and integrating their responsibilities and roles with local authorities roles in the aftermath of a disaster. Communities are the first line of response when disaster happens, for what they should be involved in any national-conceived response mechanism.

2.28 In the context of long term adaptation, financing mechanisms to reduce vulnerability not only be focused on emergency response, but also on the promotion of preventive risk management and risk reduction strategies, including risk sharing and innovative transfer mechanisms such as insurance schemes or other means to address loss and damage associated to climate change, and assist longer-term efforts for economic diversification.

2.29 ***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).[13] 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.[14] 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).[15] 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.

In the longer term, many of the health consequences of climate change are likely to relate to the increased frequency of extreme weather events (including those relating to the El Niño-Southern Oscillation) and the associated ecological disruption. Heavy rainfall places physical and managerial stresses on water supply and drainage systems –systems that in many parts of LAC are already overstretched

due to rapid urbanization– increasing the risk of contamination and the concentration of pathogens in the water-supply. Extreme weather events of the kind predicted by climate models –such as heavy rainfall and flooding– can cause the contamination of water supplies, which may in turn lead to outbreaks of water-borne diseases such as cholera, cryptosporidiosis and leptospirosis. At their most extreme, as well as causing injury and loss of life, climate-change-related natural disasters, such as storms, floods, droughts and sea-level rises may lead to large scale population-displacement putting additional strains on health systems and increasing the incidence of communicable diseases, malnutrition and psychological disorders.

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[1] The Intergovernmental Panel on Climate Change (IPCC) – 2007 (*Impacts, Adaptation and Vulnerability*, Vol. 2 of Climate Change 2007, Fourth Assessment Report, Geneva) highlights key vulnerable sectors. Such list has been expanded according to LAC climate vulnerability and adaptation priorities identified during the development of the CCS.

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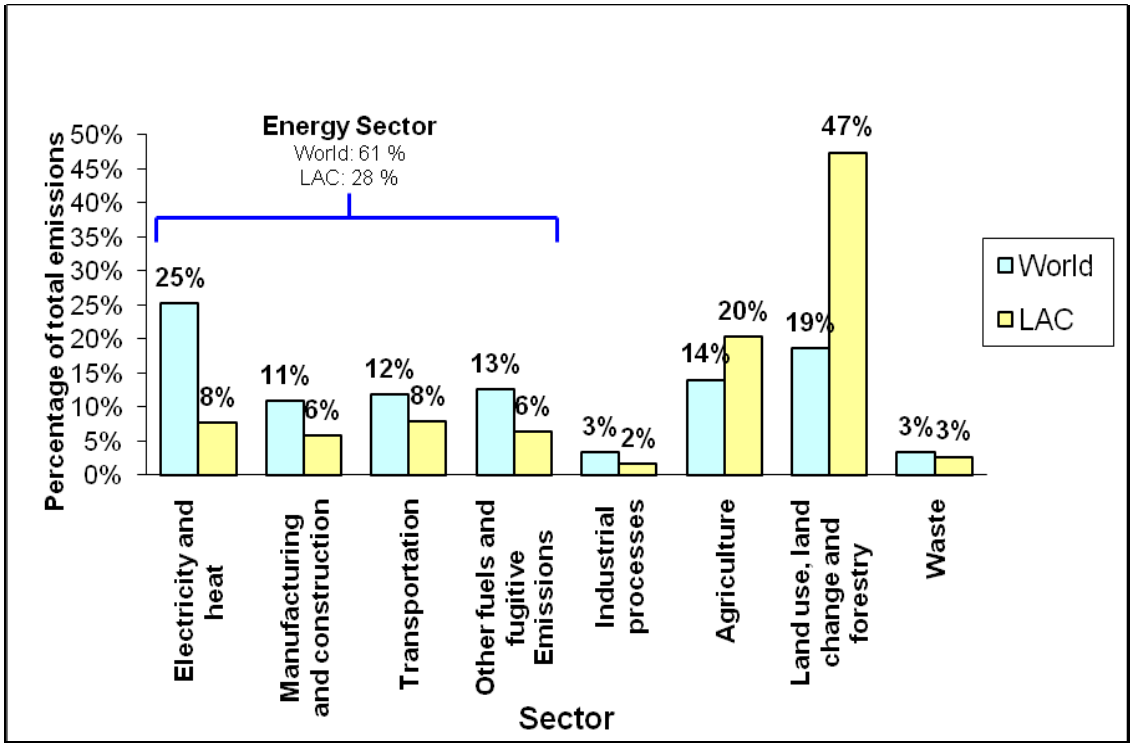
Annex B
Climate Change Impacts and Mitigation Priorities

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

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.[1] 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 America (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 and other sources.* 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.[2] 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. Some countries might be interested in assessing and/or developing other sources of clean energy.

- *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

- *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 an increase in solid waste generation associated with an increase in income, improvement in final disposal practices with a movement from open dumps to sanitary landfills, and 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).

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 (Geller and Attali, 2005).[3]

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[4]), 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 CO_2e 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.[5] This would represent 80% of total CO_2 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 $MtCO_2e$ 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 LAC 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.

2.8 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.[6]

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

[2] International Energy Agency (IEA). 2009. *World Energy Outlook 2009*. Paris, France.

[3] Geller H., and S. Attali. 2005. "The Experience with Energy Efficiency Policies and Programmes in IEA Countries: Learning from the critics". IEA Information Paper. Paris, France.

[4] 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.

[5] 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.

[6] 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.