Data-Driven Solutions for Climate-Smart Cities

Global trends such as climate change, rapid urbanization, and technology disruptions are transforming the future of cities. With booming populations and stretched infrastructure systems, cities are increasingly using advanced data sources and digital technology to make more informed decisions for city planning, and for the service delivery models that underpin their development. Today, more than half of the world’s population live in urban areas, a proportion that is expected to increase to about 70 percent by 2050. Projections show that urbanization, coupled with the overall growth of the world’s population, could add another 2.5 billion people to urban areas by 2050, with close to 90 percent of this increase taking place in Asia and Africa.336

Digital technologies are equipping cities with smart tools, including mobile applications, intelligent transport systems, and open data portals, to improve service delivery and bolster social and economic inclusion. These technologies are critical in helping cities to reorganize operations, improve services, and become more efficient—from encouraging people to travel during off-peak hours and altering routes in real-time to avoid traffic congestion, to using less energy and water at different times of the day. Smart street lights, grids and metering, leak detection systems, and the internet of things are transforming the way utilities such as electricity and water are being delivered, used, and paid for. And new integrated mobility solutions that are efficient, cost effective, and sustainable are displacing conventional transport services of the past. These new models include smart traffic control systems, commuter planning tools, and smart parking systems, as well as digital payment systems and flat-rate mobility subscriptions that cover multiple modes of transport.

Smart technologies can make daily commutes faster and less frustrating. It is estimated that, by 2025, cities using smart mobility applications could cut commuting times by between 15 percent and 20 percent on average. However, the potential associated with each application is highly variable, depending on each city’s density, existing transit infrastructure, and commuting patterns. In a developed city such as New York, smart technologies save the average commuter almost 15 minutes a day.
In a developing city with more taxing commutes, workers may gain up to 30 minutes every day. Water consumption tracking, which pairs advanced metering with digital feedback messages, can nudge people towards conservation. It could reduce consumption by 15 percent in a higher-income city where residential water usage is high. In many parts of the developing world, the biggest source of water waste is leakage from pipes. Deploying sensors and analytics can cut those losses by up to 25 percent.337

As low-tech recycling programs reach the limits of what they can do, technology can further reduce the volume of unrecycled solid waste. For example, digital tracking and payment for waste disposal charges users for exactly the amount and type of trash they throw away. However, this type of application should be considered alongside other policy initiatives, particularly in emerging markets where household budgets are invariably small and informal recycling already takes place.338

The Massachusetts Institute of Technology’s SENSEable City Lab has teamed up with Cisco to create a lightweight sensing platform, called City Scanner, which attaches to urban vehicles such as garbage trucks and taxis. They are piloting this on trash trucks in Cambridge, Massachusetts, which cover large areas of the city on a weekly basis, allowing the sensing platform, which includes thermal cameras, air quality, temperature, humidity, WiFi scanner, accelerometer, and GPS sensors, to capture over 1.6 million data points. City Scanner radically reduces sensor and deployment costs, and the overarching goal is to create a new source of information for decisions regarding public health, security, and boosting new urban services. There are plans to make the captured information available to all via Cambridge’s open data portal so that citizens can better understand the environment they live in, and to allow for on-demand configuration based on citizen input.

Because smart applications primarily succeed when they are widely adopted and visibly shift behaviors, the technology needs to be accessible to large segments of the population. Smart applications are also more effective when paired with complementary policy shifts at national or municipal level, along with low-tech measures. While most infrastructure services are owned and operated by the public sector, there is an immense opportunity for the private sector to provide the initial investment in smart applications, and to implement and service the technology. In addition to the roles the public and private sectors must play in data-driven service delivery models, community engagement with citizens is also a critical element. This allows a constant feedback loop to help evaluate the effectiveness of existing delivery models and to help develop the next generation of technology-driven solutions.
As the second most urbanized region in the world, an estimated 81 percent of Latin America’s population lives in urban areas today, with almost a third of the region living in emerging, intermediate cities. With 198 of the largest Latin American cities expected to contribute 65 percent of the region’s GDP over the next 15 years, these urban areas need to fulfill their economic potential in a sustainable way, while grappling with congestion, housing shortages, bad air quality, and the need to provide basic infrastructure and municipal services such as solid waste management.

Cities in the region are facing a multitude of climate challenges, including groundwater depletion in Mexico City, rising sea levels in Buenos Aires, and flooding in Barranquilla. To manage these challenges and explore the potential opportunities that climate change presents, cities in Latin America and the Caribbean are trying to become “smart cities” and plan their urban development in a sustainable manner. About 40 percent of the cities analyzed in a 2017 Inter-American Development Bank study have carried out a smart city assessment. Forward-thinking cities are developing digital solutions, exploring new approaches to city planning such as transit-oriented development, and finding innovative methods of green climate finance across sectors.
Given the region’s large-scale, rapid urbanization, cities are facing housing pressures. With roughly a quarter of the region’s urban population living in informal settlements, there is a huge imperative for cities in Latin America to invest in affordable housing. This presents a significant opportunity for green housing construction. Cities in the region are already acting on this—Bogotá has implemented a Sustainable Urban Planning and Buildings Policy; a Green Building Code; incentives for greening new and existing residential and commercial buildings; and policies for green schools, green municipal buildings, energy benchmarking, and data transparency. The private sector is also recognizing the need for green buildings and is using certification programs such as LEED to guide the way, including the Nike store and HSBC headquarters in Buenos Aires, both of which have LEED Gold certification. These developments and policies underpin IFC’s estimate of the $4.1 trillion investment opportunity in green buildings in the region’s cities.

IFC estimates an investment opportunity of almost $395 billion in the transport sector in the region’s cities till 2030, including for the rollout of electric vehicles and the modal shift towards public and non-motorized transport. More than 42 major cities in Latin America have developed mass transit systems, including Bogotá, Santiago, and Medellín, and more than 320 others have integrated bike lanes into their transport systems. A significant proportion of these projects had some private financing through PPP models.

There are significant opportunities in these sectors, as well as in renewable energy, urban water and wastewater, and municipal solid waste management. IFC estimates that the climate-smart investment potential in cities in Latin America and the Caribbean totals $5 trillion to 2030.
**GREEN BUILDINGS AND GREEN TRANSIT IN BUENOS AIRES (IFC)**

In June 2017, IFC and the city of Buenos Aires signed a $50 million loan to support the development of a low-emission, resilient urban transportation system. This was part of the Sustainable Mobility Plan, which took a holistic approach to sustainable transport in three interconnected areas: the execution of public transport projects, the creation of bicycle pathways and a bike-sharing system, and a public awareness campaign to promote the use of the systems.

The IFC project supports building efficient bus lines and infrastructure to support urban bicycle transport. IFC is also advising the city on transport, waste management, green buildings, and energy-efficiency. Through the Latin America and Caribbean Cities Platform, IFC is helping the city structure innovative engagements in these areas.

In close collaboration with the International Bank for Reconstruction and Development, IFC is supporting Buenos Aires in introducing green building standards in an iconic urban block in the heart of the city that is home to about 43,000 of the city’s poor. The new standards have been adopted in the design of low-income housing projects financed by the International Bank for Reconstruction and Development, demonstrating that sustainable buildings can be implemented in the poorest and most vulnerable neighborhoods.

**ENERGY-EFFICIENT STREET LIGHTING IN CHILE (IDB INVEST)**

IDB Invest (formerly the Inter-American Investment Corporation) financed the installation of efficient LED technology for five Chilean municipalities (Cartagena, Coyhaique, Melipilla, San Javier, and Villa Alemana) under a third-party financing model. The client, Itelecom, will use a $7 million loan from IDB Invest to install, finance, and in most cases operate and maintain 37,000 efficient LED lighting fixtures. In addition, the corporation secured $14 million in concessional funds from the Canadian Climate Fund and the Clean Technology Fund. Energy savings are expected to range between 54 percent and 67 percent, amounting to as much as $40 million in cost savings for the cities. The project uses an energy service company model, in which the cost savings will enable the municipalities to cover the payment obligations for the loan to Itelecom.
IMPROVING ACCESS TO AFFORDABLE HOUSING IN MEXICO (WORLD BANK)

In June 2017, the World Bank committed $100 million to support the Mexico National Housing Commission’s efforts to increase access to affordable housing for low-income beneficiaries. The project is promoting compact, dense urban development by providing direct support for people buying houses. The project uses a set of qualifying criteria, such as densification and access to public and non-motorized transport, and promotes the use of water- and energy-efficient appliances; lighting; and heating, ventilation and air conditioning systems, per Mexico’s Nationally Appropriate Mitigation Actions. The project is expected to reduce overall greenhouse-gas emissions, while addressing bottlenecks in affordable housing provision and creating sustainable urban growth environment for over 27,800 beneficiaries and five local governments.

ENERGY-EFFICIENT STREET LIGHTING AND GENDER EQUALITY IN MEXICO (IDB INVEST)

In the port city of Ensenada, on the Pacific Coast of northwestern Mexico, the municipal government hired Optima Energía to update the city’s street lighting system, substituting 25,000 sodium vapor lamps for energy-efficient LED lighting. The project will reduce the lighting system’s greenhouse-gas emissions by 150,000 tons of CO₂e and save 260 million kilowatt-hours of electricity over the life of the project. While this would usually be a daunting investment for a city of close to half a million people, under Optima Energía’s business model the city is paying for the project over time, covering the costs entirely out of the savings being generated. The bulk of the loan came from the Canadian Climate Fund for the Private Sector in the Americas, a fund established by Canada and managed by IDB Invest. The loan was structured to provide incentives to improve gender equality and diversity—IDB Invest is helping Optima Energía enhance its workforce through a gender certification and internship program and lay the foundations for a more diverse work environment.

FINANCIAL INSTRUMENTS FOR ENERGY-EFFICIENT CITIES IN BRAZIL (WORLD BANK)

The Financial Instruments for Brazil Energy-efficient Cities Project is unlocking private financing for energy-efficiency projects in cities by enhancing their technical quality and reducing credit risk. The project specifically targets public street lighting and industrial energy-efficiency, recognizing their substantial potential to save energy. By improving public street lighting, which represents up to 4 percent of total electricity consumption in Brazil, cities can achieve electricity savings ranging from 50 percent to 80 percent. Over 150 projects with high returns and short payback periods have already been identified among large industrial energy users. The project establishes an energy-efficiency facility to leverage public funds, such as the Green Climate Fund and Clean Technology Fund, to attract private sector investment and roll out a new incentive framework to finance energy-efficiency. The project also provides technical assistance to the financial intermediary and implementing body, Caixa Econômica Federal, a national development bank.
"In 2018, Mexico City was the first local government in Latin America to issue forest bonds. These instruments are transparent and will directly benefit communities that belong to a conservation land, where 339 land owners have committed to preserve the forest for 30 years, with all obtained resources to directly fund projects in their communities.

Funding climate action in Mexico City is a great challenge, considering billions are required to accomplish the strategic vision of the Climate Action Program 2014–2020.”

— Tanya Müller García, Secretary of Environment of Mexico City

The capital of Mexico is one of the most populous metropolitan areas in the world; home to over 21 million people as of 2015.347 Projected to be the tenth largest city in the world by 2030,348 Mexico City will require significant public and private investment to meet its development needs. In 2017, the city contributed to 17 percent of the national economy, driven by key industries including trade, real estate, and financial services.349

As of 2015, the city released 31 million metric tons of CO₂ annually. This is equivalent to the emissions created by 6.6 million passenger vehicles driven for one year,350 contributing to the city’s ranking of 37th among the top 500 global cities for carbon footprint. Located in the Valley of Mexico, in the high plateaus in the middle of the country,
Mexico City faces significant climate change impacts. But it is not unfamiliar with resolving environmental problems with innovative solutions, having made significant advancements since it was labeled by the UN as the most polluted city in the world in the 1990s.

Mitigation and Adaptation Plans

The city has laid out a roadmap to coordinate and execute 102 actions derived from seven strategic priorities contained in the Local Climate Action Strategy 2014–2020 and the Mexico City Climate Action Program 2014–2020, which seek to reduce Mexico City’s exposure to the effects of climate change. These priorities include energy transition, containing urban sprawl, building resilience, sustainably improving natural resources, and enhancing the environment. The current Action Program aims to improve the quality of life and facilitate sustainable, low-carbon development in the city, targeting mitigation of 10 million metric tons of CO₂e by 2020. This would represent a 30 percent decrease in emissions in comparison to the baseline scenario.

The Action Program also aims to build the city’s resilience and adaptation capability, paying particular attention to the 5.6 million residents most vulnerable to extreme weather events such as flooding. Mexico City is already implementing measures to address its expected exposure to vector-borne diseases and forest fires as a result of extreme temperatures and flooding by 2025, including vaccination programs, development of crisis management systems for early warning and evacuation, and hazard-resistant infrastructure design and construction. The local government is also engaging in flood management measures such as municipal water efficiency retrofits and investment in water supply infrastructure.

Achieving these targets and strategic priorities could present opportunities for private investment. Some key actions outlined in the program include modernizing solar-powered public lighting in the city’s 16 boroughs, creating a fleet of electric taxis, rehabilitating green spaces to contain urban sprawl, constructing bike parking lots, and treating and using waste as an alternative fuel. The city has already demonstrated success through its 2008–2012 plan, which resulted in the mitigation of 7.7 million metric tons of CO₂e (10 percent above the target and equal to the emissions generated by the annual energy consumption of over 831,000 American homes). It has also mainstreamed climate change as a priority for municipal agencies.

To ensure accountability, Mexico City has designed a measurable, reportable, and verifiable virtual platform for the city’s government agencies to report their progress on relevant actions, known as the Monitoring System of the Mexico City Climate Action Program 2014–2020. According to the 2016 progress report, the city achieved 46 percent of its 2018 goals by October 2016, and had mitigated 3.1 million metric tons of CO₂e. Institutionally, both the mitigation and adaptation agendas are being driven from the highest levels, with the city appointing both a Minister of Environment and a Chief Resilience Officer.
Priority Sectors for Investment

**WATER** $6B

Investment in water management and infrastructure is both a priority and an urgent need for Mexico City. The city’s water shortage has resulted in problems such as the over extraction of groundwater and the subsequent ground subsidence. The city is encouraging the private sector to help provide water access to the 21 million inhabitants without reliable tap services through projects such as La Quebradora Water Park. This water treatment complex combines infrastructure with public space to recycle water and alleviate shortages. It features water treatment facilities and basins for catchment and flood prevention, public buildings, plazas, and recreational areas. A PPP project seeks to increase the water treatment efficiency of the Cutzamala System through a $134 million investment in constructing, operating, and maintaining a new pivot module, and improving the three existing modules by rehabilitating the filtration process and improving the sludge system. Ensuring adequate water supply without further draining its aquifer, as well as repairing and upgrading its water infrastructure to reduce the leakage rate from the current 35 percent will require significant investment in Mexico City, signaling an opportunity amounting to almost $6 billion by 2030.

**TRANSPORT** $9B

Since the 1990s, Mexico City has overhauled its transport sector, the largest source of its emissions (45 percent of total emissions), to create a better connected, coordinated, and accessible urban landscape. The Climate Action Program seeks to continue its transformation of the city’s transport sector by modernizing the subway system, developing inter-modal transport schemes, and launching new bus rapid transit lines. Together, these initiatives aim to reduce air pollution, congestion, and energy use, and are expected to reduce current total emissions by 10 percent by 2020, saving 2.7 million kilowatt-hours of energy. As a member of C40 Cities, Mexico City has also signed the Declaration on Clean Buses, pledging to incorporate low-emission bus fleets. According to Mexico City’s Minister for Environment, the city is succeeding in catalyzing a modal shift towards clean and public transportation through its bus and bike lanes, with the latter witnessing 30,000 trips a day with more than 200,000 users. The city seeks to expand on this success with a green corridor created through the deployment of 100 new electric buses and 22km of new bicycle lanes throughout the city.
The city’s Ministry of Environment opened a Non-Motorized Mobility Strategy Office in 2008 to encourage a modal shift to biking. The office was mandated to build better biking infrastructure, integrate biking into the transit network, and build a cycling culture in the city. The city’s public bike-share system, Ecobici, has become the fourth largest initiative of its kind in the world, expanding from 85 stations in 2010 to 444 in 2018. With a coverage area of 32km, Ecobici services have been used 36 million times since 2010. The city is also developing a non-motorized transit policy with support from the UN Environment country office and World Resources Institute Mexico. This will address institutional arrangements, the policy framework, and implementation, and is expected to be completed by the end of 2018.

Given Mexico City’s focus on reducing emissions from transport, IFC estimates an investment opportunity of $2 billion in public transport and $7 billion in rolling out electric vehicles in the city, creating a total investment opportunity of $9 billion in the transport sector to 2030.

Mexico City’s population is expected to grow by 35 percent between 2016 and 2030, and will require an estimated 50,000 new homes each year to meet housing needs. The city’s Environment Ministry published new regulations for green construction in 2016, with measures for energy-efficiency in retrofits and new buildings. New energy-efficiency standards and project funding for green design and implementation, financed by the Municipal Energy-efficiency Project with the World Bank, are expected to be applicable in Mexico City once complete. The city has also launched the voluntary Sustainable Buildings Certification Program, which encourages owners and tenants to reduce property emissions related to waste, water, energy consumption, and transport through tax reductions, reduced bills, and increased rental yields from green premiums. To meet these green building policies and targets, IFC estimates an investment opportunity of almost $18 billion in Mexico City to 2030.
Financing and Policy Instruments

To help finance the mitigation and adaptation targets outlined in the Climate Action Program and meet the identified $7.2 billion funding need, the city government established a Climate Change Fund as part of the Public Environmental Fund. This fund is the main instrument to finance climate action in the city, as mandated by the 2011 Climate Change Law. It works as a trust that receives an annual budget from Mexico City’s government and is able to receive national and international donations. It funds both mitigation and adaptation projects, and integrates revenues from other funding instruments that target strategic areas such as sustainable transport, water administration, and energy-efficiency. The fund has allocated about $7.3 million to climate action since 2016.382

Mexico City launched Latin America’s first green municipal bond in 2016.383 The $50 million issuance was oversubscribed 2.5 times over, and will fund sustainable investments in energy-efficient lighting, transport, and water infrastructure projects for the city. A second green bond was issued in November 2017, and a third is being prepared in the Mexican Stock Exchange as of August 2018.384

Each sector and level of government in the country is responsible for planning, implementing, and supervising its projects without an overarching PPP agency.385 The national government is supporting such projects through a national Public Private Partnership Law that seeks to provide legal clarity to all parties, and is complemented by regulations and guidelines for project evaluation.386 In addition, the Federal Ministry of Finance has also launched a Promotion Strategy for Public Private Partnerships in Mexico, which seeks to encourage participation in PPPs in a transparent manner.387 Mexico City itself has had some success with green PPPs. One of these is its metrobus project, which reduced carbon emissions by 300,000 tons in its first six years of operation, and by 110,000 tons annually since then. It has resulted in a 15 percent shift from private cars to public transport.388

The Mexico City government is providing public servants with information and tools to encourage green procurement for public sector activities through its Environmental Management System. Twenty-five percent of all public procurement by the city’s government has been sustainable and green since October 2016.389 As the city moves towards achieving its green procurement target outlined in the Climate Action Program, there is significant opportunity for the private sector to provide these green products.

In addition, Mexico City is working with the C40 Cities Finance Facility to improve its project financing capacity, particularly the financial structure of the electric bus corridor it seeks to create in the green corridor for mobility.390