From Climate Data to Climate Action, Data-Driven Projects in Mexico

ICLEI Local Governments for Sustainability

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Introduction

Local governments are increasingly developing policies and programs designed to adapt, mitigate, and become resilient to climate change. Growing commitments and engagement in climate governance generate new dimensions of monitoring and evaluating climate action. Thus, there are new sources and uses for data to support local and regional climate action strategies and data-driven decision-making. Greenhouse gas (GHG) emission inventories, mitigation targets, risk and vulnerability assessments on global data platforms are some examples of how data is increasingly seen as a core component of effective climate change policy and planning from local governments.

This case study explores how two data-driven projects use local data and data-driven platforms to support climate planning and action. The project ***"Use of the EIE platform to build intelligent cities that promote the generation of homologated climate actions plans in the Monterrey Metropolitan Area (MMA)"*** showcases how climate-related data can support climate planning and monitoring by providing robust greenhouse gas

Facts & Figures

Metropolitan Area of Guadalajara

Population (2020)
5,268,642 [3]

Area
3,265 km^2 [17]

GHG Emissions (2016)
16.1 Mt CO_2e [17]

Metropolitan Area of Monterrey

Population (2020)
5,341,171 [3]

Area
6,794 km^2 [18]

Figure 1 – Map of Mexico, National Institute of Statistics and Geography (INEGI) [3]

(GHG) reduction estimates. The project ***"Public Infrastructure Prototypes (PIP) for a City of the Future"*** implemented in the Guadalajara Metropolitan Area (AMG) demonstrates how data measurements can be transformed into knowledge to support climate action, by engaging community actors that provide feedback on the uses of open data, in relation to their environment and climate change mitigation. The case study illustrates the critical components of each project and how they strive to achieve their goals, as well as the key lessons learned.

Background

Mexico is located in North America in the intertropical and temperate zones and has an area of 1.96 million km^2 with a population of 126 million (2020) [9]. The country known officially as *The United Mexican States*, is a Federal Republic composed of 32 federal entities (31 sovereign and free states and the City of Mexico). Each state is divided into municipalities that are governed by a local authority. Climate change in Mexico is expected to have widespread impacts, not only on its climate, but also on its economy and

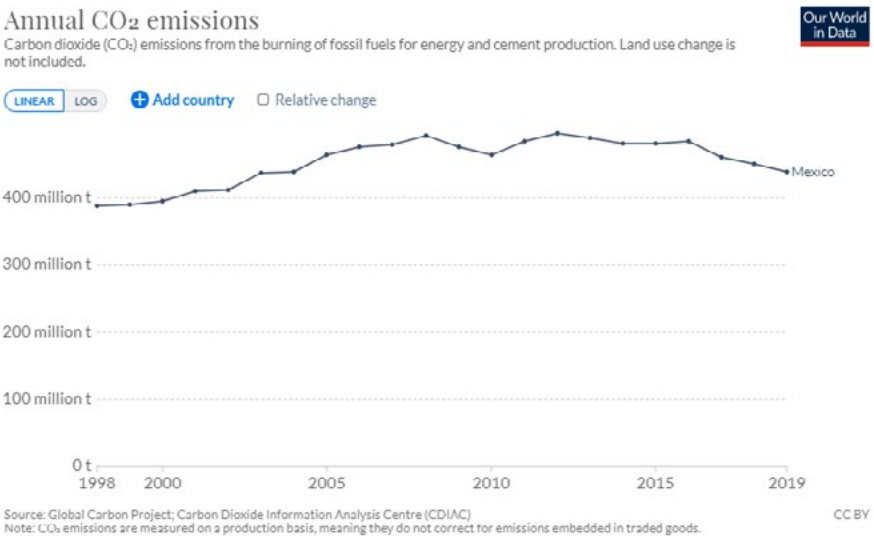

Figure 2 – Annual CO_2 emissions in Mexico 2000-2019 [16]

The country's total national GHG emissions for 2015 equaled 683 Mt CO_2e, the energy sector being the highest contributor, with most emissions coming from transportation and energy generation [2].

population. Furthermore, the effects of climate change can already be seen in its agriculture, biodiversity, the livelihood of farmers, and migration patterns; as well as water, health, air pollution, traffic disruption from floods, and housing vulnerability to landslides [1].

Mexico was the first developing country to submit its Intended Nationally Determined Contribution (INDC) to the United Nations Framework Convention on Climate Change (UNFCCC). With the country's ratification of the accord, the INDC became Mexico's Nationally Determined Contribution (NDC). As part of NDC, the country commits to an unconditional target of reducing 22 percent of its GHG emissions by 2030 (based on 2013 levels). In alignment with this, Mexico's General Law on Climate Change (LGCC) mandates the elaboration of climate policy and planning instruments to national, state and local governments. Local and regional governments highlight the lack of timely access to reliable and accurate data needed throughout the different stages of climate planning. The following two projects address this issue.

1. Google's Environmental Insights Explorer (EIE) to support climate action in the Monterrey Metropolitan Area

Supported by the Action Fund, the project *"Use of the EIE platform to build intelligent cities that promote the generation of climate actions plans in the MMA"* aimed at addressing the lack of data-driven evidence available to inform climate planning in the MMA. The project was implemented through a collaboration between the *Tecnológico de Monterrey University*, the *Water Centre for Latin America and the Caribbean*, and the *Alliance for Climate Action in the Monterrey Metropolitan Zone*. In the project, *Google's EIE platform* was used as a connecting thread and tool to generate robust information for strengthening and standardizing the elaboration of climate action plans [9]. The MMA refers to the surrounding area of the city of Monterrey and eleven other municipalities of the state of Nuevo León. According to the 2020 Census carried out by the National Institute of Statistics and Geography of Mexico (INEGI), it is the second most populated metropolitan area in Mexico, with 5,341,171 inhabitants [3]. From 1980 to 2010 its population doubled, while the urban area increased by five times. This rapid urban expansion and some of the natural environment conditions are seen as opportunities to innovate in urban sustainability [9]. The project explored these potentials.

Google's EIE platform uses data sources and modelling capabilities, freely available, to help cities measure emission sources, run analysis, and identify strategies to reduce emissions - creating a foundation for effective climate action.

Figure 3 – Monterrey, Mexico. Unsplash©

1.1 Climate mitigation potential to inform planning

In 2008, the MMA generated 29 percent more CO_2 emissions per capita than Mexico City (CDMX). The main source of GHG emissions in the area is the energy consumption from the residential, industrial and transportation sectors [9]. Even though various local and regional governments have already engaged in reducing their GHG emissions through different climate instruments, they often struggle to define and select the most climate- and cost-effective mitigation actions, generally due to the lack of scientific data-driven approaches. The MMA used Google's EIE platform in tandem with local data to evaluate the potential of concrete actions for reducing GHG emissions.

The data was collected from the *"Tecnológico de Monterrey University"* Campus, located in the "Distrito Tec" in the City of Monterrey (Figure 4). The campus buildings were used to gather and model data on solar radiation, energy efficiency, and transportation routes. With the support of the university's *"Strategic Decision Core"*, researchers from the university's *Working Group on Energy and Climate Change* analyzed different GHG reduction scenarios to assess the implementation of renewable energy systems and energy efficiency measures on the campus buildings. Similarly, data from Google's EIE platform was used to calibrate a traffic micro-simulation model in an open-source software and calculate emissions from the Motor Vehicle Emission Simulator (MOVES) in Mexico. MOVES is a modeling system that estimates emissions from mobile sources at the national, local, and project level for criteria air pollutants, GHGs, and air toxics [4]. The project's aims were to optimize public transportation routes and schedules in the "Distrito Tec" by implementing electric buses and a micro-mobility system to be

Figure 4 – The Tecnológico de Monterrey University Campus Map [14]

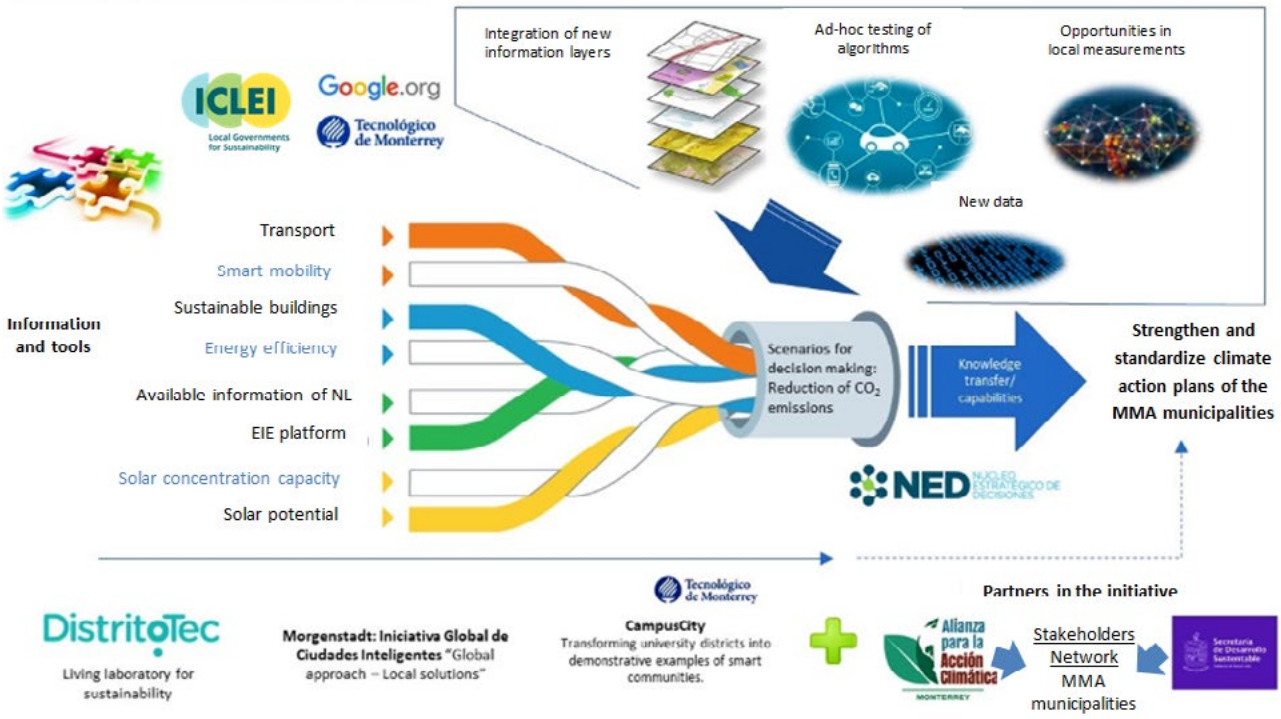

Figure 5 – Project Model [14]

operated through a public Mobility as a Service (MAAS)[1] system.

1.2 Validation and monitoring to support local climate action

As much as an effective and meaningful design is key to achieve the most GHG emission reductions, the monitoring stage is critical to track progress and assess the accomplishments. In line with this, the project used Google's EIE platform to compare, monitor and validate data on sustainable buildings, solar potential, and low-emitting transportation strategies. GHG emissions were collected from local sources and then integrated to the platform for validation and evaluation. Integrating data from different sources allowed to accurately identify the best options among the tested photovoltaic technologies. The outcomes of these analyses were later applied to further improve the prediction ability of Google's EIE platform to assess the potential of energy generation through different solar technologies. Similarly, Google's EIE platform was used in tandem with the traffic micro-simulation model to monitor the implementation of selected sustainable mobility options, as the system can model GHG emissions prior- and post-implementation. The use of the integrated data allowed the evaluation of the achieved GHG reductions to further define a proposal of a smart mobility system for the university's main transportation route.

1.3 Collaborative approaches towards setting and achieving data-driven climate targets

The project was framed in a collaboration among various key stakeholders from the government, private, public, and academic sectors. The results of the estimates on mitigation potential were presented to local and regional representatives for feedback. This exercise served to identify the strategies considered most appropriate in view of existing barriers highlighted by the authorities, such as legal frames and regulation, existing infrastructure that are not compatible with proposed actions and associated costs, informal planning, delays, etc. These engagements helped to identify key criteria that

Figure 6 – Guadalajara, Mexico. Unsplash©

1 Mobility as a Service (MaaS) is a type of service that through a joint digital channel enables users to plan, book, and pay for multiple types of mobility services [6].

local governments use for prioritization of their climate action, other than technical estimates on GHG emission reductions [10]. The validation of emission reductions from localized measures in the Distrito Tec, coupled with local data inputs, is envisioned to be replicated at a larger scale in MMA municipalities, as this model produces robust estimates on mitigation potential from renewable energy generation, sustainable mobility and energy efficiency measures tested in a sample area. Stakeholder engagement should enable the dialogue towards the creation of the necessary arrangements for defining and achieving a science-based climate target, including the availability of funds and expertise, and the involvement of the general public.

Each stakeholder benefits from the knowledge generated through the project while contributing to the achievement of the targets. Local governments gain data-driven information on mitigation potential of specific climate actions and its implementation in a sample area. This leads towards better informed public policies to reduce GHG emissions and to support planning for low emissions development. The private sector benefits from insights on GHG emission reduction potentials from different technologies, which in turn enables them to make decisions on where to direct their efforts for further exploration and investment. Academia gains knowledge to promote research and the study of demonstrative projects and innovations in technologies for deploying electric buses, smart mobility applications, and renewable energy systems. The public benefits from economic, social, and environmental co-benefits associated with climate mitigation. In turn, active public participation promotes transparency and accountability of the climate actions promoted and implemented by local and regional governments.

2. Public Infrastructure Prototypes for a City of the Future in Guadalajara Metropolitan Area

The project *Public Infrastructure Prototype (PIP) for a City of the Future* aims to develop a thorough and reproducible model for collecting, evaluating and monitoring climate data, so that AMG's stakeholders can make data-driven decisions and plan coherent actions to mitigate climate change. *dérive LAB* in cooperation with the Secretariat of Infrastructure and Public Works of Jalisco, received support for the implementation of the project through the Action Fund and ICLEI. Guadalajara Metropolitan Area (AMG) is situated in the west of Mexico and refers to the surrounding area of the city of Guadalajara and eight other municipalities of the state of Jalisco. According to the 2020 census, the AMG has a population of 5,268,642 inhabitants, making it the third largest metropolitan area in the country [3]. AMG's urban layout presents

Figure 7 – Discussion on data measurements [14]

Figure 8 – The City of Guadalajara, Mexico, Google EIE©

many planning and administration challenges, including local climate action implementation, thus the Government of Jalisco is using data to inform policy making on climate and on environmental issues.

2.1 From data, to knowledge, to action

PIP for a City of the Future seeks to develop a strategy that considers public buildings as spaces that can provide opportunities for mitigating climate change. *dérive LAB* is a multidisciplinary laboratory that aims to explore and inspire different approaches to fostering a more sustainable urban life. Through research, design and action, the lab develops projects whose purpose is to impact in three dimensions: the community, the built environment, and everyday activities. To create a robust environmental baseline, dérive LAB collected data from local, national and international databases. Four prototypes of basic sensing and monitoring systems were installed in 4 of the 46 stations of the Bus Rapid Transit system called *"Mi Macro Periférico"* (Figure 7), to collect data on air pollutants, solar radiation, energy efficiency, noise levels and GHG emissions from transportation [7].

Additionally, Google's EIE platform provided tools to set an environmental data baseline that would help understand AMG's current environmental status in terms of air quality, solar potential, and GHG emissions from buildings and transportation. Based on the baseline, the project aims to identify opportunities for the reduction of pollutants and to boost action towards climate change mitigation. It proposes an interdisciplinary approach, where local stakeholders and AMG's municipalities can turn data into valuable information and knowledge and apply it to public policies and urban design lineaments, that contribute to climate planning efforts.

2.2 Public engagement to promote the use of data

A strategic alliance was formed between Jalisco's Ministry of Infrastructure and Public Works (SIOP) and the Ministry of Environment and Territorial Development (SEMADET), to co-create and disseminate the outcomes of the project. The project enables the access to data for a network of data specialists, urban planners, educators, independent organizations, private companies and government officials. This entails an element of continuous and effective communication among stakeholders to keep the use of data and generation of knowledge up-to-date and relevant to the current local needs. The outcomes are available in a public repository of the project's website. The project included engagement activities and capacity building on data visualization methods and geographic information systems (GIS). This was done in an effort to promote and support the use of the data in a collaborative and inclusive way. Stakeholders were convened at all phases, including the set-up of arrangements to collect data. Local stakeholders, including academia, NGO's, private offices and active actors of the civil society were engaged in collaborative workshops where they worked with low-budget

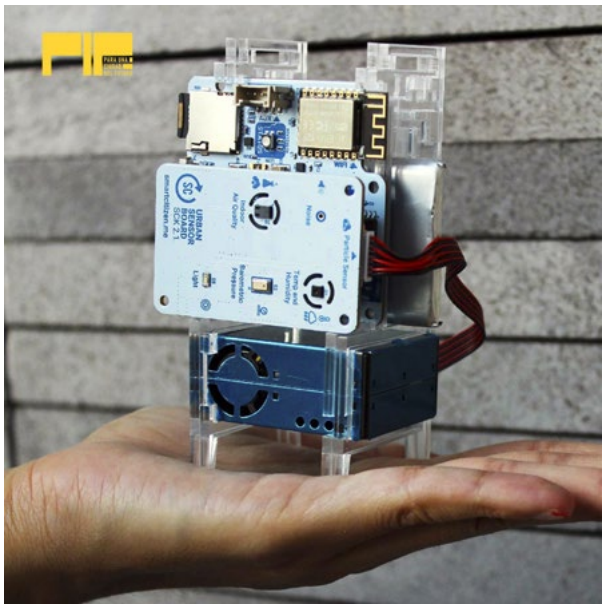

Figure 9 – Sensing and Monitoring Systems [15]

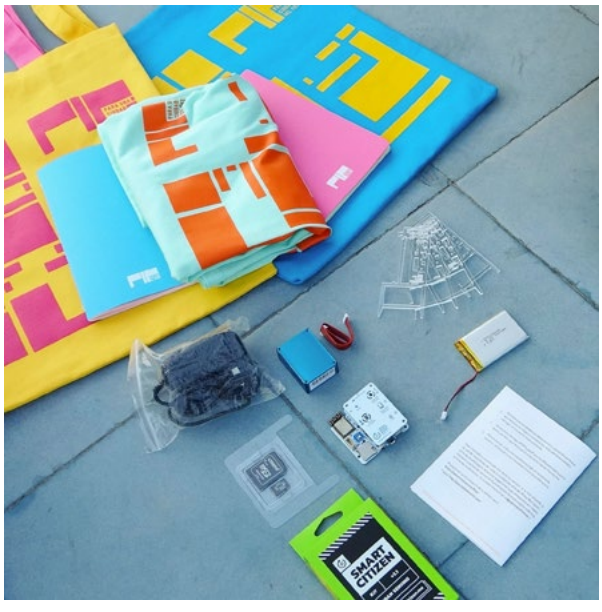

Figure 10 – Smart Citizen Kits [15]

sensors such as the *Smart Citizen Kit* and *Flow, by Plume Labs*, to collect environmental open data and to explore ways of using the information to promote individual and collective climate action [8]. Examples of this were the use of the *Smart Citizen Kit* with girls from a local High School who explored potential uses of data generated by the sensors. Similarly, the *"Social Data Challenge"* was organized by the *Data Lab Community of Guadalajara* to promote the use of open data generated by the *Smart Citizen* sensors installed in the AMG. Additionally, a portable version of the *Plume Labs' Flow* sensors was used by staff that cycles different routes in Guadalajara and Zapopan's *"Vía Recreativa"*. The sensors were used to capture environmental data to support the promotion of cycling routes as intangible public urban infrastructure, based on data-driven interpretation of this environment's behavior. These activities are expected to engage the public in the formulation of climate action programs and strategies through an increased awareness of their surrounding environment.

2.3 Replicating the benefits

One of the goals of the project was to share the knowledge generated through the PIP models, to allow its replication in metropolitan areas with similar challenges, with the aim to support climate planning and action. For this, a series of guidance documents has been developed combining experiences and recommendations for improvement. The documents provide technical guidance on the uses and benefits of *Google's EIE platform* and the monitoring and sensing systems, including open data issues that may arise when implementing similar projects. The guide is not only aimed at cities that have already developed an environmental baseline, but also at those that have not yet engaged in this activity. In terms of public engagement, the guide describes impressions on the process of understanding the relationships between technology, data use and urban challenges, exemplified with experiences from the project. Lastly, it illustrates how the models can be applied to leverage local climate action, offering concrete arguments to accelerate decision making towards a low emission path, through actions that have a greater impact and lower implementation costs.

Lessons Learned

Two projects on the use of integrated data in metropolitan areas have been implemented to support local and regional governments to assess, plan and implement data-driven climate actions. The following outlines some takeaways that are to be considered when replicating such projects:

- In the context of the country, different actors have highlighted the challenges for accessing reliable data that supports climate action. Data platforms can provide an opportunity to validate and compare existing data and to establish baselines for climate planning.
- Due to lack of capacities, local and regional governments often struggle to define and select the most climate- and cost-effective mitigation actions. Data platforms, integrated with data publicly available, present an opportunity to build capacities in local and regional governments by generating robust estimates on mitigation potential of tested actions to support climate plan designing.
- Data use and knowledge generation are iterative processes which require constant feedback from beneficiaries. The involvement of stakeholders in early stages can support in the management and interpretation of data in a more efficient and relevant way, which in turn can help to shape the outcomes of the project, so that these are fit to the local context and can be later amplified.
- Capacities need to be built among stakeholders in order to successfully make use of data collected and modelled through such projects. It is expected that creating technical guides and capacity building programs provide opportunities for successful ways to involve and co-create with different stakeholders.
- Even if robust data-driven assessment on GHG emission reductions are available, there are other legal, governance, and cultural issues that local governments face during the implementation of their climate action. The need to consider these insights makes stakeholder engagement especially relevant towards advancing local climate action efforts.

About the Action Fund

The Action Fund is an initiative led by ICLEI with support from Google.org, to boost environmental projects in selected cities in Europe, Mexico and South America. The grant aims at empowering civil society organisations, academic institutions and non-profit research institutes, leading data-driven climate action efforts to reduce citywide emissions.

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