# MEXICO
# POLICY ENVIRONMENT PAPER
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UN HABITAT
FOR A BETTER URBAN FUTURE

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# ABSTRACT

Mexico is the 11th most populated country in the world with an estimated population of 124,574,795 inhabitants and an annual population growth rate of 1.12% (CIA, 2018). The country is the 10th largest global GHG emitter accounting for 1.68% of global emissions. Nevertheless, it is the first developing country to pass a general Climate Change law and has voluntary pledged $10 million to the Green Climate Fund. In 2010, its national emissions in units of carbon dioxide equivalent ($CO_2$-eq) amounted to 748,252.2 Gg, with an annual average growth rate of 1.5% (CICC, 2012). According to the Climate Change Performance Index (CCPI, 2018), the country is performing relatively well (fig.3) in the policy category due to the actions taken by the government, such as the reduction of subsidies to fossil fuels, which leads to a high rating. However, its low-rated 2030 target for clean energy and its lack of compliance with the road below 2°C, makes Mexico one of the worst performing countries in the renewable energy section.

# COUNTRY OVERVIEW

Mexico, officially the United Mexican States is located in North America, bordered to the North by the United States of America and to the southeast by Belize and Guatemala. It is the 15th largest country in the world in terms of area with 1,964,375 km2 and the 11th most populated with 124.57 million inhabitants. Its urbanization rate is 1.59% per year (2015-20 est.) and an estimated 80.2% of its population in 2018 live in urban areas (CIA, 2018).

Its main metropolitan areas are Mexico City, the capital of the country and a megacity with approximately 22 million people; Guadalajara with 5 million; Monterrey with 4.7 million; followed by Puebla, Toluca de Lerdo and Tijuana (CIA, 2018).

According to the World Bank (2018), Mexico is the second largest economy in Latin America, and the 11th largest economy in the world with a GDP of 1.15 trillion USD. Although its GDP per capita estimated in 2017 is 8,902.83 USD (World Bank, 2018), about 46% of its population live below the poverty line (CIA. 2018). Mexico's unemployment rate estimated in 2017 was 3.6%; nevertheless, its underemployment could reach 25% (CIA. 2018).

Mexican economy has become increasingly oriented toward manufacturing since the North American Free Trade Agreement (NAFTA) entered into force in 1994. Its main industries are food and beverages, tobacco, chemicals, iron and steel, petroleum, mining, textiles, clothing, motor vehicles, consumer durables and tourism. Mexico has more than 90% of its trade under free trade agreements with 46 countries. In addition, it is member of the Asia-Pacific Economic Cooperation (APEC), the Pacific Alliance (PA) and the World Trade Organization (WTO) (CIA, 2018).
The country is the 10th largest global GHG emitter (EDF, 2018), since it generates 748,252.2 Gg $CO_2$-eq, with an annual average growth rate of 1.5% (CICC, 2012), which accounts for 1.68% of global GHG emissions. In terms of per capita emissions, it remains below the G20 average of 8.7 t$CO_2$-eq with 5.7 t$CO_2$-eq (CAT, 2016).

# SUMMARY OF NDC

Due to its geographical location between two oceans, Mexico is exposed to extreme hydro-meteorological disasters, which have resulted in economic losses of more than 48 million USD each year. In the last 50 years, it has experienced several events due to climate change, such as tropical cyclones, landslides, floods and droughts, as well as an increase in its temperature of more than 0.85°C, all of which has resulted not only in high social and economic expenses, but also in the loss of human lives (INDC, 2015).
Since 2000, Mexico has approved three national strategies and a special program, showing its commitment to address Climate Change. In 2012, Mexico launched its General Law on Climate Change becoming the first developing country to pass a law on the topic. Additionally, it has created organizations and instruments to diminish its greenhouse emissions (GHG) and aims to enhance its capacity for adaptation (INDC, 2015).

Mexico's GHG emissions reached 713 $MtCO_2$-eq in 2012, while emissions from land use, land-use change and forestry (LULUCF) were 44 $MtCO_2$-eq. Its Energy-related $CO_2$ emissions per capita increased up to almost 4 $tCO_2$; however, they remain below the G20 average (CICC, 2012). By sector, transport accounts for 26% of national GHG emissions, electricity generation for 19% and waste management for 5%. In addition, the transport sector accounts for 38% of the total black carbon emissions (INDC, 2015).

Mexico aims to unconditionally reduce 25% of its GHG and Short Lived Climate Pollutants (SLCPs) emissions below the Business As Usual baseline (BAU) by 2030. This measure involves reducing 22% of its GHG and 51% of Black Carbon emissions. By sector, Mexico will reduce by 2030 its Black Carbon emissions in transportation by 83% and in electricity generation by 33% as shown in fig. 1. Furthermore, it will reduce GHG emissions by 18% in the transport sector, 31% in electricity generation and 29% in Waste Management (fig.2).

Moreover, Mexico is committed to reducing its GHG emissions up to 36% and its Black Carbon emissions up to 70%, conditioned on receiving external support, such as technology transfer and access to low-cost financial resources (INDC, 2015).

In the same way, Mexico has implemented adaptation measures that focus not only on responding to disasters, but also on the anticipation and prevention of fragilities related to climate change. These adaptation measures include increasing the climate resilience of communities, main ecosystems, infrastructure and economic sectors. For instance, it has the objectives of reducing vulnerability in at least 50% of the municipalities, increasing funding for disaster prevention, as well as focusing on anticipating events rather than responding to disasters (NRDC, 2017).

Figure 1: National GHG emissions under the baseline. Own chart based on: INDC. (2015). Intended National Determined Contributions. Gobierno de la República.

| -22% GHG emissions | Base Line (MtCO2e) | | | | Non Conditional GOALS | | |
|---|---|---|---|---|---|---|---|
| | 2013 | 2020 | 2025 | 2030 | 2030 | Δ | |
| Transport | 174 | 214 | 237 | 266 | 218 | -18% | |
| Electricity generation | 127 | 143 | 181 | 202 | 139 | -31% | Conditional GOALS Δ |
| Resources | 31 | 40 | 45 | 49 | 35 | -29% | |
| Others: Residential & commercial, Oil & Gas, Industry, Agriculture, | | | | | | | |
| **Total** | 665 | 792 | 888 | 973 | 762 | -22% | -36% |

Figure 2: National Black Carbon emissions under the baseline scenario (BAU) and NDC mitigation non-conditional goals, 20313-2030. Own chart based on: INDC. (2015). Intended Nacional Determined Contributions. Gobierno de la República.

| -51% Black Carbon emissions | Base Line (MtCO2e) | | | | Non Conditional GOALS | | |
|---|---|---|---|---|---|---|---|
| | 2013 | 2020 | 2025 | 2030 | 2030 | Δ | |
| Transport | 47 | 47 | 52 | 58 | 10 | -83% | |
| Electricity generation | 8 | 4 | 4 | 3 | 2 | -33% | Conditional GOALS Δ |
| Resources | <1 | <1 | <1 | <1 | <1 | 0% | |
| Others: Residential & commercial, Oil & Gas, Industry, Agriculture, | | | | | | | |
| **Total** | 125 | 127 | 138 | 152 | 75 | -51% | -70% |

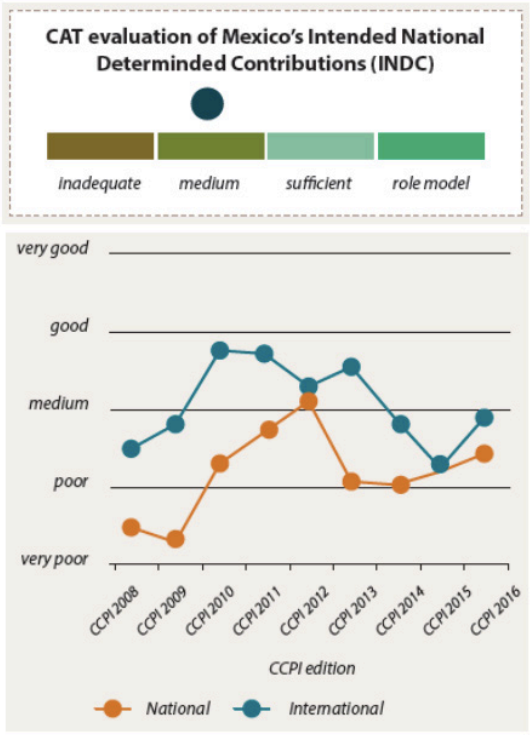


Figure 3: CAT. (2016). Brown to Green: G20 transition to a low carbon economy Mexico. Climate Action Tracker.

# POLICIES AND STAKEHOLDER MAPPING

## 3.1 Political background

Mexico passed in 2012, The General Climate Change Law (LGCC by its Spanish acronym) to formalize a legislation at national level, aimed at establishing a legal framework that regulates public policies of adaptation and mitigation to climate change, as well as promoting the transition towards a competitive low-carbon economy (SEMARNAT, 2015). This law also describes the economic-wide goal of reducing GHG emissions by 50% below the 2000 level by 2050 if international support is received. In addition, it aims to create a national emissions inventory and registry to allow the development of a voluntary emissions trading system, and to create a Climate Change Fund to bring in and canalize resources towards climate action (NRDC, 2017).

In order to implement this law, in 2013, Mexico published the National Climate Change Strategy, which describes scenarios, projections, targets and the vision to address climate change over the next 40 years. Mexico also describes its short-term climate actions in its Special Program for Climate Change (PECC by its Spanish acronym), designed to help meet national mitigation and adaptation goals without affecting economic growth. The PECC is a transversal policy instrument that is implemented within each presidential term (every 6 years). The current PECC covers the period from 2014 to 2018 (NRDC, 2017).

At the national level, the Inter-ministerial Commission on Climate Change (CICC) and the National Institute for Ecology and Climate Change (INECC) design and implement climate policies. The CICC is composed of 13 Federal Ministries and its mandate includes the formulation and implementation of national policies for mitigation and adaptation to climate change, the approval of the National Climate Change Strategy and participates in the elaboration of the PECC (SEMARNAT-INECC, 2016).

In 2014, Mexico established the National Emissions Registry (RENE for the Spanish acronym), a mandatory reporting system on direct and indirect GHG emissions for facilities with annual emissions above 25,000 $tCO_2$-eq. This instrument also comprises a voluntary registration for mitigation or reduction certificates obtained from projects and activities implemented in the country (ICAP, 2018).
Moreover, in 2017 the Ministry of Environment and Natural Resources (SEMARNAT) and the Mexican Stock Exchange (Grupo BMV) announced a national carbon market simulation. More than a hundred companies that account for more than 60% of GHG emissions participated in this simulation during ten months in order to become acquainted with the system and to implement a national Emission Trading Scheme (ETS) by 2018 (ICAP, 2018).
At the state level, each state establishes a local office of Inter-ministerial Climate Change Commission that coordinates public policies, designs or modifies its laws so that they are in congruence with the federal government provisions. Each state also elaborates, leads and coordinates its own State Action Program on Climate Change. At the municipal level, each municipality appoints the leaders and coordinators who, together with universities and other stakeholders, work for its Climate Change Municipal Action Plan (ICAP, 2018).
Mexico is using different national and international, public and private resources to reach its climate goals. For example, Nacional Financiera (NAFIN), a Mexican Development Bank, issued a 500 million USD green bond to finance initiatives for renewable energy in 2015 and a second bond of 2 billion MXN (approximately 100 million USD) in 2016. Additionally, the country introduced a carbon tax in 2014 applied to fossil fuels, excluding natural gas (NRDC, 2017). The Ministry of Finance and manages resources at the federal level and then allocates them to specific programs. However, international resources can be transferred directly to subnational entities, development banks, private institutions, or directly to the implementation of projects through international cooperation agencies (AFCC, n.d.).

# SECTOR OVERVIEW
# ENERGY

In 2015, the country ranked 15th with 1.4% of the total energy produced in the world. In 2016, its energy dependency index was equivalent to 0.84, meaning that Mexico produced 15.6% less energy than it made available. It had an annual energy consumption per capita 6.1% higher than in 2015, and its electricity consumption per capita was 2,126.81 kWh. During this year the production of primary energy decreased 6.6% with respect to 2015 accounting for 7,714.23 PJ. The main factor that defines the behaviour of energy production at the national level is the reduction of oil (SENER, 2016).

Hydrocarbons contributed 86.8% to primary energy production, while productions from non-fossil sources were 9.9% in 2016. By sources, oil represents 62.6% of total primary energy production in Mexico, natural gas 23.1%, carbon 3.3%, nuclear 1.4%, condensed 1.1%, solar and wind 2.3%, hydropower 1.4% and biogas and biomass 4.7% (SENER, 2016).

In its NDCs, Mexico is committed to increase its clean energy generation by 25% by 2018, 30% by 2021, by 35% by 2024 and 43% by 2030, switching from fossil fuels to natural gas and biomass. The country understands clean energy technologies as: geothermal, hydrogen, nuclear, biomass, hydropower, bioenergy, wind, solar and efficient cogeneration. In addition, Mexico aims to reduce leaks and vents, increase controls on methane burning by 25% and control black soot particles in industrial facilities and equipment (INDC, 2015).

To achieve its goals on clean energy generation, the national Energy Reform set a clean energy certificates market, which forces all large consumers to meet a minimum of clean energy consumption, starting from 5% in 2018 and reach 5.8% by 2019. Additionally, in the residential sector, the new policies foster the implementation of solar heaters and panels (NRDC, 2017).

# TRANSPORT

The transport sector represents 20.4% of national GHG emissions, of which 16.2% are emitted by the auto-motor subsector, mainly trips by individual motorized transport (UN-HABITAT, 2014).

From 1992 to 2008, eighty-three cities and metropolitan areas developed comprehensive road and transport studies and / or strategic transport or mobility plans, financed by the World Bank and UN Habitat through the "One Hundred Cities" program. Furthermore, since 2008, the National Infrastructure Fund (FONADIN) and the Federal Mass Transportation Support Program (PROTRAM) have promoted the preparation of planning documents on mobility since BANOBRAS, the national development bank in charge of the public investment fund destined to developing transport infrastructure at state and municipal levels, requires the elaboration of Integral Sustainable Urban Mobility Plans (SUMPs) for cities to access funds for their mobility projects (ITDP, 2012). As a matter of fact, only 40% of the SUMPs developed, presented a true sustainable vision of mobility when considering issues such as urban development (growth, expansion, land uses), public space, environment, public transport, non-motorized transportation, roads and cars, freight transport, cultural aspects among other topics (ITDP, 2013).

In Mexico, the road network has been designed mainly based on the needs of private transport, 67% is concentrated in metropolitan areas larger than 500 thousand inhabitants. However, the constructions of this infrastructure have been adapted to urban sprawl, in such a way that the road density is proportionally higher in the less dense cities (UN-HABITAT, 2014).

According to UN-HABITAT (2014), mobility in Mexico presents: road congestion as a result of the dispersion and prominence given to motorized transport; poor quality of public transport due to its fleet with the lowest growth on technological innovation, administration and operation systems; and increasing cost for people, governments and the environment, which affects competitiveness and decreases the quality of life in cities (UN-HABITAT, 2014).

In Mexico, initiatives to improve the increasingly committed urban mobility started in big cities based on a sustainable urban mobility that integrates massive urban public transport systems, with urban development and road infrastructure policies aimed at: technological and administrative upgrading of integrated transport systems; rationalization of the road infrastructure use and public resources; reduction of social and environmental costs; free spaces for the encounter and citizen coexistence; and generation of cultural and institutional changes in favour of quality public transport (UN-HABITAT, 2014).

In this sense, the country is upgrading and promoting a multimodal public transport (NRDC, 2017). It aims to implement better measures for transit in cities and ways of driving, as well as to design technical and regulatory policies to expand the networks of mass public transport systems (CICC, 2012).

Mexico also plans to invest in projects of urban transport infrastructure and optimization of transport systems, with a potential for abatement of 8 $MTCO_2e$ by 2020. These projects include the construction of railways in land freight transport; and the improvement of the logistics of freight transport by road, through the coordinated operation of vehicles, the creation of cooperatives and associations, the construction of specialized terminals and cargo corridors, and the implementation of a reliable information system (CICC, 2012).

# RESOURCES

In 2015, Mexico generated 53.1 million tons of solid urban waste, 61.2% more than in 2003, equivalent to 1.2 kg/day per capita. Organic waste represented 52.4%, paper and its derivatives 13.8% and plastics 10.9% of the national waste in 2012 (SEMARNAT, 2015).

According to SEMARNAT (2015), Mexico collected 93.4% of the total waste generated in 2012. The states with the greatest waste collection rates were Aguascalientes (98.9% of the total volume generated), Baja California (97.7%), Nuevo Leon (97.7%), Oaxaca (97.1%), Baja California Sur and Mexico City (both 97%). Furthermore, waste collection accounted for 90% of the total generated waste in metropolitan areas, 80% in medium-sized cities, 26% in small urban areas and 13% in semi-urban areas and rural communities.

In Mexico, 95.6% of the municipalities have a waste collection system in place. Oaxaca is the only state that lacks this service in 87 municipalities, which represents 3.5% of national waste. Data from 2010 shows that only 11% of the collected waste nationwide had been previously separated. In 2013, 74.5% of Mexico's final waste disposal was in controlled sites (landfills), 21% in uncontrolled sites and only 5% was recycled (SEMARNAT, 2015). Mexico aims to reduce the GHG emissions resulting from waste by 26 $MtCO_2e$ by 2020. In order to achieve this goal, Mexico plans to (CICC, 2012):

- Promote private sector participation in recycling projects, waste separation, reuse and creation of collection points;
- Correct the tariff systems of the collection and treatment services;
- Reinforce education and information campaigns;
- Use the biogas produced in landfills; and
- Composting.

# CITY EXAMPLE: AGUASCALIENTES

The city of Aguascalientes, the capital of the state with the same name, is located in the southern border of the state, in the central-northern region of Mexico. The Aguascalientes urban agglomeration (AUA) is composed by the city of Aguascalientes, as well as the surrounding municipalities of Jesús María, Pabellón de Arteaga and San Francisco de los Romo. The AUA has 233 km2 of urban area. From 2000 to 2015 it presented an expansive pattern of urbanization with an annual growth rate of 8.4% of housing and a 3.7% of population. It has 974 thousand inhabitants and in 2030 it is estimated to reach 1.240 million (UNHABITAT, 2016).
It is considered a city-state, since it houses almost 7 out of 10 inhabitants of the state total. Five of the nine Territorial Delegations that conform it, are located within the city and the four remaining, are distributed in its rural area (SENER, 2015).
The AUA has as its main economic activity the manufacturing industry; however, the municipality of Aguascalientes specializes in health services and local assistance. (UNHABITAT, 2016). In terms of land use, Aguascalientes stands out for its agricultural use, dedicating 39.3% of the metropolitan area to crops; 26.24% of the land is dedicated to pastures and 10.29% to forests. In contrast, only 4.5% of its land is for residential use; 4.8% of urban area and; 2.7% for industrial use (SENER, 2015).

Among the main economic activities, the cultivation of perennials such as the vine, alfalfa, peaches and seasonal crops such as corn and beans stands out. Another important activity is livestock, based mainly on the exploitation of dairy cattle. The most dynamic industrial sectors are food, textiles, clothing, metal-mechanics, automotive, wine and electronics (SENER, 2015).
Aguascalientes city generates 7.31 million tCO2-eq, annually, of which the transport sector represents 35% (ITDP, 2015).

# ENERGY

As in many other states from Mexico, the Federal Electricity Commission (CFE) provide electricity to the municipality of Aguascalientes which accounts for 69% of the total state consumption. The residential sector consumes 87% of the city's electricity, followed by 12% of the industrial and services sectors (SENER, 2015). In Aguascalientes 99.8% of households are connected to the electricity grid, 15% have a solar water heater, 0.5% have a solar panel for electricity generation and 49% uses energy-saving light bulbs (INEGI, 2015).
In the state of Aguascalientes there are five transmission substations that supply energy to all its municipalities. By sector, the energy consumption of Aguascalientes is distributed as follows: 50% transport, 32.08% industry, 15.4% residential, 3.26% agricultural and 2.76% commercial.
In terms of clean energy, the city has a biogas self-generation permit with an internal combustion plant. The authorized capacity is 2.6 MW and in 2013, it generated 12 GWh. At the state level, there are no energy generating facilities that contribute to the national public energy service (SENER, 2015).
The city of Aguascalientes consumes an average of 2,055 kWh of electricity per capita, a value similar to that reported by Sao Paulo, Cairo, and Bucharest. The electricity consumption per GDP is 0.114 kWh / per $ USD GDP (SENER, 2015).

In 2011, the energy sector accounted for 60.7% of the national GHG emissions with 498.51 tCO2-eq, of which the transport sector represented about 40% and electricity generation 30.8% (SENER, 2015). According to the Aguascalientes Municipal Development Plan (PDMA, 2017), the outlook for the growth of the energy sector is encouraging and, therefore, will regulate it to ensure its sustainable use through the State Program of Renewable Energies.

# TRANSPORT

The road infrastructure network of the state is composed of 347 km of federal highways, 1,020 km of state roads and 608 km of rural roads. In terms of physical conditions, 67% of the infrastructure network is in good condition, 22% is in regular state and 11% is in poor conditions (PED, 2016). The municipality does not have mass transit systems such as metro, rapid transit buses or passenger trains (SENER, 2015).

Aguascalientes city does not have a road for freight transport, one of the roads for this purpose is still inconclusive and due to the increase in the service demand and industrial development (regional and national), the city has congested roads, which has a direct environmental impact and on the degradation of road infrastructure (CICC, 2012).

Regarding railway infrastructure, there are 133 km of tracks, of which 92 km are distributed from north to south, leading to important logistics conditions and commercial relations with neighboring states with Mexico City as its main destination on the south and Ciudad Juarez on the north. However, this infrastructure does not transport passengers. (CICC, 2012).

According to the development State Plan (PED, 2016), the modal split in the city of Aguascalientes indicates that 33% of trips are made by private vehicles, 31% by urban bus, 22% walking, 4% by bicycle, 4% by institutional transport, 3% by taxi, 1% by combi and the remaining 2% by other means of transport.

The transport sector accounts for 35% of the 7.31 million tCO2-eq that the municipality of Aguascalientes produces each year. In order to reduce the GHG and SLCPs emissions, the government of the state planned an Integrated Metropolitan Transport System (SIT by its Spanish acronym), to be financed by BANOBRAS. The first phase of the project includes 3 corridors aimed to reduce 25.5% of the GHG emissions generated by the transport sector (ITDP, 2015). Additionally, the Municipal Development Plan (PDMA, 2017) established the commitment to expand the infrastructure for non-motorized transport currently composed of bicycle routes; and strengthen and generate schemes for promotion, education and dissemination of a new culture that fosters non-motorized mobility through educational projects that raise awareness about the use of bicycles.

# WASTE MANAGEMENT

Solid waste management in the city is carried out by the City Council, through the Public Cleaning Department. The service consists of: home collection, manual sweeping of pedestrian paths, mechanical sweeping of pedestrian paths, mechanical sweeping of streets and roads, transportation of waste to the transfer center, and to the San Nicolás landfill (SENER, 2015).

The municipalities of Aguascalientes have excelled at national level for its system of sweeping, collection and final disposal of urban solid waste. However, further programs are required for the reduction, reuse and recycling of waste (PDMA, 2017). Solid waste consists of 34.8% of organic waste, 16.6% of paper and cardboard, 9.2% of glass, 6.7% of plastic, 3.6% of metal, and remaining 29.1% corresponds to “other” (any material not classifiable in the previous categories). Despite the significant amount of waste with recyclable character, in the municipality only 0.4% of the total generated waste is recycled. Recycling is being promoted through the Friendly Action Program through which the waste producers take the materials to collection centers and receive money in exchange, which they can choose to claim or donate to organizations linked to the program (SENER, 2015).

In Aguascalientes municipality, 50% of homes separate their waste. For the temporary waste storage service, the municipality has located 4,328 containers strategically through the city. For its collection 26 garbage trucks are required, however, the city has only 15 available, which has caused discomfort and bad image to the inhabitants. The final disposal of the city’s waste is carried out at the San Nicolás landfill, which generates 2.2 kWh electric power, however, the state has no planning or coordinated work to reuse this natural resource, renewable and clean, that could contribute to improve the quality of life of the population, reduce environmental pollution and reduce HGH emissions (PDMA, 2017).

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# SOLUTIONS

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