



NDC ASPECTS

Country Report

Transition pathways for Mexico

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Andreas Meurer
German Aerospace Center (DLR)
Institute of Networked Energy Systems

Jordi Tovilla
Tempus Analítica A.C.

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Key messages

- A change of perspective in climate governance, involving the whole of Mexican government and society, is essential for effective climate action. Viewing the reduction of greenhouse gas emissions as an opportunity rather than an obligation would help in this process and enable appropriate actions.
- A full energy transition is needed in all activities and sectors, mostly towards green electricity. This also includes the controlled phase-out of the oil and gas industry on the long term and a diversification of the economy.
- The commitment to a full transition, not only in the energy and industry sectors, but especially in urban transport, will bring about an improvement in the quality of life for all citizens.

Introduction and overview

With a population of over 126 million and a GDP of approximately \$25 thousand per capita (around \$3.2 trillion in total), Mexico is the second largest economy in Latin America. Key economic indicators include an inflation rate of around 4% and a labor force participation rate of around 60%. However, socio-economic disparities remain significant, with a poverty rate of more than 40% and a high income inequality [1].

In terms of climate commitments, Mexico has introduced the initial Nationally Determined Contributions (NDCs) as part of the Paris Agreement in 2016 and a revision of the NDC in 2022. Based on the current NDC, the country aims to reduce greenhouse gas (GHG) emissions by 35% by 2030, compared to a business-as-usual (BAU) scenario with rising absolute emissions. The goal aims for a 30% reduction through domestic resources and an additional 5% reduction through international cooperation that has been already agreed. The conditional target, requiring additional international support, aims at a reduction of 40%. However, even the revised targets of Mexico's NDC are not in line with the goals stated in the Paris Agreement aiming at a 1.5°C world scenario [2].

Scenario analysis confirm that the current NDC targets will probably not lead to an absolute reduction in national GHG emissions by 2030 [2–5] either compared to the 2016 level or the 2020 level. While a first update of the NDC in 2020 was suspended by a national court as it considered the mitigation commitments regressive, the strategy of comparing the mitigation against a business-as-usual baseline scenario was also maintained in the update of 2022, where the baseline emissions were even increased compared to the NDC of 2016.

Recent development

Since the adoption of the Paris Agreement in 2015, the population of Mexico has grown by approximately 7% [6]. The GDP per capita increased around 40% in the same period, leading to an absolute increase of the GDP of more than 50% [6]. The demand for primary energy records a slight increase of around 3% in the same period, dampened by the effects of the COVID-19 pandemic which resulted in a drop in primary energy demand of around 10% in 2020 compared to 2019. Overall energy-related GHG today are similar to the level of 2015, but follow the trend of increasing primary energy demand with a slight absolute increase of around 2% [7].

Mexico's energy landscape is characterized by a significant reliance on fossil fuels for its primary energy supply. The



share of fossil fuels only decreased slightly after 2015 and is today at around 90%, mainly dominated by oil and gas with a total share of around 87% which remains rather constant in the last decades [7]. The national oil industry is a significant pillar of Mexico's economy. A decline in oil production and a loss in competitiveness led the Mexican government to the introduction of an energy reform in 2013 which aimed at the revitalization of the oil sector. This was enabled by opening the sector to private investments, as it was formerly dominated by the state-owned company PEMEX. Private investments in combination with significant fossil fuel subsidies undermine the ambition of transitioning towards a sustainable energy sector.

The power sector has undergone a substantial development in the past years, switching from oil-based to gas-based generation [7]. However, there is no significant improvement regarding the introduction of sustainable electricity generation. The share of fossil-based electricity in the power sector remains relatively stable at around 80%. From 2018 onwards, there has been an increase in the expansion of PV capacity which in 2023 reached 7.5 GW, representing an 8% share of the total installed electrical capacity of nearly 100 GW. Additional renewable capacity is provided by hydroelectric power plants with a capacity of around 12 GW, which has remained stable over the last decades, and wind power plants with a capacity of around 7 GW. The disregard of the 2015 "Ley de Transición Energética" (LTE) [8] by the present administration (2018-2024) is noteworthy. After a highly controversial decision to redefine the "clean energy" threshold in 2023 in order to artificially meet the law's targets, the latest official documents (PRODESEN 2024-2038 [9]) set the share of clean energy (in annual generation) at 23.19% in 2023. This is far below the 35% target set for 2024.

Currently around 30% of the country's energy-related GHG emissions stem from the transport sector [10], with roughly two thirds attributed to passenger transport and one third to freight transport. In 2023, the share of sustainable transport vehicles is still negligible, although an increase in sales of electric vehicles is noted in the last years. Currently, around 30% of the population live in densely populated urban areas and are particularly affected by transport-related emissions other than GHG that are harmful to health. The growing average income and the related increase in living standards might make this issue more prominent even in non-metropolitan regions in near future. In addition to a standard to improve the fuel efficiency of light-duty vehicles, a draft national strategy has been developed, which includes the goal of 100% fully electric passenger cars by 2050, with intermediate steps to achieve 50% zero-emission vehicles in the light-duty sector by 2030. It also addresses the promotion of regulations and the development of relevant infrastructure for the expansion of sustainable transport modes, including public transport [11].

Comparable with the transport sector, the industry sector accounts for around 25% of the energy-related GHG emissions. Together with additional process-related emissions and emissions due to gas venting and flaring, the industrial sector is one of the three key sectors regarding GHG emissions, together with the power and transport sector. Emission-intensive branches are particularly the cement, steel industry as well as oil and gas industry. Despite joining the Global Methane Pledge, aiming at a reduction of methane emissions by 30% by 2030 compared to 2020 and promoting energy efficiency via the LTE, there has been no significant reduction in the sector's GHG emissions to date.

With around 100 Mt per year, non-energy-related emissions of agriculture account for more than 15% of the GHG emissions. Most of the sectoral emissions derive from livestock enteric fermentation and manure. Despite some measures outlined to reduce GHG emissions from the agriculture sector [12], no relevant absolute reduction in GHG emissions can be reported.

In contrast to many other countries, the Land Use, Land Use-Change and Forestry (LULUCF) sector in Mexico has been a constant GHG sink for many years. However, deforestation still leads to a net forest loss on an annual level. Via the national REDD+ strategy, Mexico aims at reaching net zero deforestation by 2030 [13].

Key decarbonization pathways & related transformations

Based on various analysis in current literature, the NDC's of Mexico are by far not consistent with the target of staying well below 2°C according the Paris Agreement. One major reason is the absence of long-term targets and a long-term strategy beyond 2030.

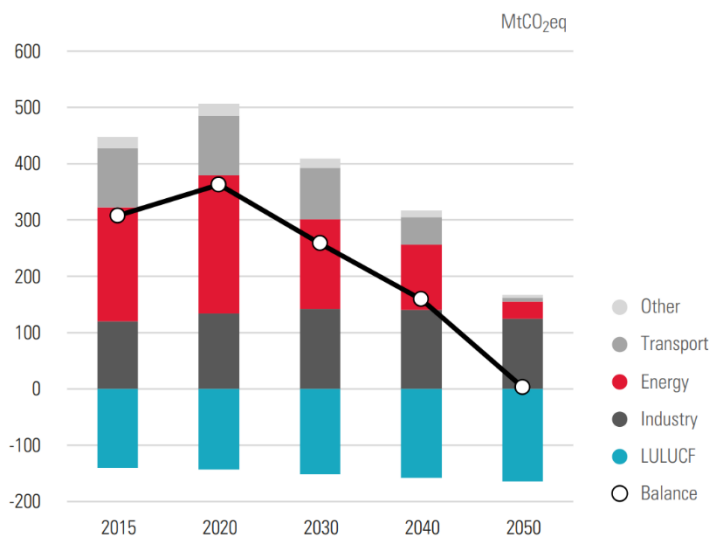


Figure 1: CO₂ flows of a possible ambitious decarbonization pathway from the DDPLAC project [14]

a reduction of applications using liquid or gas as primary energy carriers which are replaced with electric alternatives where possible. This goes along with the need of a significant increase in renewable electricity generation capacity, depending on the scenario, in the range between 200% to 600%, and the resulting increase of the share of renewable energy generation, which is already considered in the LTE (35% renewable energy share in 2024).

Especially for the transport sector, electrification is a significant transformation for decarbonization and requires a comprehensive adaption of the entire transport infrastructure. The role of transport sector is considered particularly crucial, as most of the current scenarios expect a significant increase in future travel demand. Delaying ambitious emission-reducing measures could therefore lead to a sharp increase in future absolute emissions, particularly in this sector. National measures and strategies, like the draft currently under revision, should therefore be formalized in legislation and implemented as quickly as possible.

Improving energy efficiency across industrial, commercial, and residential sectors is another crucial decarbonization strategy. Reduced energy demand helps in particular to minimize the requirements for the additional expansion of sustainable energy sources.

Different economy-wide ambitious decarbonization pathways were analyzed as part of the IPCC 6th Assessment report, in projects such as the “Deep Decarbonization Pathways in Latin America and the Caribbean” (DDPLAC) [3] (see Figure 1 [14]) or by the “Iniciativa Climática de México”. Although they consider a multitude of different and varying sectoral mitigation measures, they are united by some central narratives that are required to reach ambitious GHG emission targets in line with 1.5°C world scenarios.

One of the primary overarching transformation targets required for ambitious pathways is the replacement of fossil energy carriers with sustainable alternatives. In many cases, this means

As especially for some specific industrial branches, there is currently no available possibility to get rid of process-related emissions, CO₂ sinks provided by the LULUCF sector or via carbon capture and storage technologies are crucial to achieve net-zero emissions.

Sectoral system transformations

This section summarizes key challenges, targets and measures which may serve as enabler in the context of 1.5°C-compatible pathways towards a GHG-neutral economy for the key sectors in Mexico.

Energy sector

The transition from the current economy which is heavily relying on the extraction of fossil fuels is crucial to enable a significant reduction of GHG emission on both national and global level.

- A reduction of the energy demand through electrification, improved energy efficiency and behavioral changes reduces the demand on primary energy and thus on the currently fossil-based energy to be replaced by sustainable sources.
- Despite the high quantities of crude oil extraction, Mexico is depending on fuel imports, as most of the crude oil is exported. As the refineries in operation were initially designed for a lighter crude oil mixture than what is extracted today, valorization in the own refineries is considered less profitable than export. A reduction of the dependency on fossil-based energy carriers protects the society and industry from impacts of price fluctuation of the global oil market.
- Alternatives for the crude-oil related industry can be found in the expansion of industry related to renewable energy technology, the production of high-value sustainable industrial products like green steel or the further expansion of the automotive sector towards electric vehicles. This can provide both job opportunities and export revenue.

Regarding the power sector, the transition from a heavily fossil-based power sector towards mainly fluctuating energy sources goes along with challenges not only regarding additional generation capacity expansion, but also concerning required infrastructure and technology to ensure a resilient and secure energy supply.

- The diversification of the electricity matrix is key to a robust and resilient power sector in the long term, considering all available sustainable technologies, such as PV, Wind, geothermal plants and thermal powerplants using biomass.
- An extensive expansion of PV and Wind generation capacity is a no-regret option and key to a sustainable electricity supply. The expansion of decentralized PV should be accelerated by enabling private sector participation, supporting it with targeted subsidies and implementing new prosumer business models and the necessary infrastructure such as metering.
- In line with the expansion of renewable generation capacities and on the basis of a long-term strategic planning, electricity storage options and the transmission grid have to be expanded.
- In 2024, Mexico, via the national infrastructure FONADIN, bought over 8.5 GW of mainly gas-fired power generation assets from Spanish electric utility company Iberdrola which is aiming at advancing its development of renewable energy capacities in Mexico. Despite the current increase in energy sovereignty that this brings, the strategy should aim for long-term energy security, which is better served

by a high share of domestically owned renewable capacity, rather than fossil-based capacity that is dependent on fuel imports and may lead to technological lock-in effects.

- New installation of fossil-based electricity capacities has to stop. Existing oil- and coal-fired power generation should be phased out. The existing gas-fired power plants can provide flexibility for a power sector with high share of renewables.

Transportation

The transport sector is the demand sector with the highest emissions, which are expected to double under a business-as-usual scenario. Actions towards sustainable transportation are crucial and should address both passenger and freight transport. Specifically, for the passenger transport, possible measures should aim at improving the framework conditions under the narrative of the Avoid-Shift-Improve framework.

- Consideration of sustainable transport modes should be obligatory via legislation for relevant urban planning and construction projects. Holistic urban planning should guarantee a safe road space to promote substitution of car rides with manual transport modes like walking, biking etc.
- A more homogeneous city development with a reduction of the typical centralization of economic activities can reduce a large amount of passenger travels which result from commuting to and from work. Policies in this regard could include mixed land uses, land taxes with a gradient and periphery development [15].
- A sustainable and electrified public transport system with frequent service encourages a shift from individual to public transport. Expansion of the public transport especially in low-income areas can reduce social inequalities.
- Electrification of the transport sector brings co-benefits, especially improvements in air quality or road safety.
- Subsidies for battery-electric vehicles (BEV) and the introduction of electricity-based public transport aims at the electrification of transport, which has to be accompanied by the expansion of lading infrastructure on the basis of integrated urban planning concepts.
- The introduction and promotion of light electric vehicles in urban areas can replace transport modes with internal combustion engines for short trips. Compared to battery-electric vehicles, the specific energy demand per person kilometer can be reduced to below 5%.
- An improvement of general infrastructure (access to fast internet etc.) promotes remote activities like work from home or online shopping, leading to a relevant reduction of travel activities.

Industry

Most relevant branches for GHG emissions in industry are the cement, iron & steel and mining industry. Binding legislation instead of voluntary actions should be used to aim at a reduction of GHG emissions in those and other industrial sectors.

- Electrification in combination with obligatory energy efficiency improvements where possible should be the first action for GHG mitigation, defined by clear legislation and guidelines which are accompanied by regular audits to track and enforce the realization. Lock-in effects by replacing inefficient systems with efficient fossil fuel equipment have to be avoided.



- The potential of secondary steel production using scrap metal should be fully exploited.
- The transformation of the steel industry towards large-scale production of sustainable high-quality green steel can be an important pillar for reduction of GHG emissions of the industry sector and represents an alternative to the current oil and gas industry providing additional job opportunities and export potential.
- The current existence of large quantities of electric arc furnaces compared to other countries which are required for the production of green steel provides a good basis and competitive advantage over other countries.
- Promoting and supporting the usage of clinker substitutes by e.g. recycling scrap concrete or using alternative supplementary cementitious materials is a major lever to reduce emissions of the cement industry.
- The development of long-term strategies for green hydrogen and industrial policies supporting emerging technologies (such as direct reduction for Iron and Steel and Carbon Capture Usage & Storage in Cement) can give guidance and planning security for market actors.
- Promoting sustainable heat generation technologies such as heat pumps, solar heaters or electric heaters can reduce GHG emissions for low-temperature applications in industrial sectors like pulp and paper, food processing, textiles or manufacturing in general.
- Enforcing a homogeneous progressively increasing carbon tax could help align decision-making across different levels in the whole industry sector, as ex ante evaluations of projects would internalize such costs.

Buildings

- Increasing the share of distributed energy generation using e.g. rooftop PV can reduce GHG emissions and the necessary investments in electricity grid expansion.
- Energetic improvements of buildings and a switch to decentralized solar heating applications can reduce the demand for fossil-based fuels for heating [3].

LULUCF

- Achieving net zero deforestation until 2030 in accordance with the National Strategy for Reducing Emissions from Deforestation and Forest Degradation (ENAREDD+) will be important to improve the capability of the LULUCF sector to serve as a net carbon sink.

Global conditions

Aside the financial support via global funds for sustainable projects of different sectors, global conditions can particularly be beneficial for Mexico for the transition away from fossil oil and gas extraction.

The developments towards a possible formation of an international supply-side coalition limiting the fossil fuel supply could help to reduce the economic risk of this transformation, and to ramp down the extraction of fossil fuels in a controlled manner, not only on a national but on a global scale. Industry decarbonization would be in line not only with global aspirations but it would also help maintain Mexican competitiveness in light of US-Canada-Mexico trade agreement which dominates the Mexican economy. (Although Mexico has many trade agreements with many countries and regions including EU.) Extra pressure to provide clean energy for industrial/economic activities is being exerted from the current nearshoring process.



The sustainable transition of the steel sector should be promoted on a global level. This includes the creation and promotion of a global demand for green steel, which can lead to a reliable export potential and source for revenues from Mexico's perspective.

Key messages for next NDCs

The current NDC revised in 2022 is not in line with ambitious long-term pathways in accordance with the Paris Agreement. This can be mainly explained with the lack of an overarching long-term strategy and the focus on relative GHG emissions reduction instead of aiming at an absolute reduction. Some core aspects to be considered in the next NCD are:

- The NDC should set GHG emission reduction targets based on economy-wide long-term strategic planning and should also promote a cross-institutional long-term strategic thinking and acting for the institutions that will be involved in the implementation.
- The NDC should aim at an absolute reduction of GHG emissions with a sectoral resolution, targeting net-zero in the long term in line with the PA.
- The expansion of renewable electricity capacities, defossilization of the power sector and transition away from the oil and gas industry in the long term should be the overarching narratives and find themselves explicitly in the NDC revision.

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Corresponding Author

Dipl.-Ing. Andreas Meurer
andreas.meurer@dlr.de

PARTICIPANTS



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