Achieving a High Ambition Pathway with Enhanced Subnational Climate Action in Mexico

SEPTEMBER 2025

Authors:
Maria A. Borrero[a], Ryna Cui*[a], Jenna Behrendt[a], Christoph Bertram[a], Alexandra Kreis[a], Dmitry Churlyaev[a], Jiehong Lou[a], Kowan O'Keefe[a], Xinyue Li[a], Mohammed Syed[a], Luli Pesqueira[b], Jordi Tovilla[c], Daniel Buira[c], Thalia Hernández[c], Nate Hultman[a]
*corresponding author: ycui10@umd.edu

Suggested citation: M. Borrero, R. Cui, J. Behrendt, C. Bertram, A. Kreis, D. Churlyaev, J. Lou, K. O'Keefe, X. Li, M. Syed, L. Pesqueira, J. Tovilla, D. Buira, T. Hernandez, N. Hultman (September, 2025). "Achieving a High Ambition Pathway through Enhanced Subnational Climate Action in Mexico." Center for Global Sustainability, College Park.

[a] Center for Global Sustainability, School of Public Policy, University of Maryland College Park; College Park, MD, USA.
[b] WWF Mexico.
[c] Tempus Analítica A.C., Mexico

Table of contents

Introduction

Mexico is the second-highest greenhouse gas (GHG) emitter in Latin America and the 16th-largest emitter globally.[1] The country's total GHG emissions increased by 14% from 2010 to 2023.[2] From 2010 to 2020, emissions including Land Use, Land Use Change and Forestry (LULUCF) remained relatively stable, but started to show an upward trend from 2021, driven by increasing transportation and power sector emissions.[3,4] As of 2023, methane, power generation, and transportation are the largest emissions sources, each accounting for about 22% of total GHG emissions including LULUCF, followed by industry at 16%.[5] Land-use change emissions in Mexico are likely low and potentially negative, based on data from the country's latest national inventory reported to the UNFCCC, the Biennial Update Report (BUR) and Global Carbon Budget models.[6,7,8]

Mexico's 2030 Nationally Determined Contribution (NDC) has committed to reducing total GHG emissions by 35% unconditionally and 40% conditionally relative to a Business-as-Usual scenario (BAU).[9] These targets cover all GHG emissions from all sectors, but it remains unclear whether land sinks are included in meeting them. The unconditional target implies a 6% increase of total emissions (including LULUCF) between 2023 and 2030, which corresponds to an average annual growth rate of 1%. The conditional target indicates a 2% reduction in total emissions from 2023 to 2030, with an average annual reduction rate of 0.2%. Overall, when considering emissions including LULUCF, these targets do not reflect high ambition.

Mexico was one of the last major economies to make a net-zero commitment. At COP 29, Mexico pledged to reach net-zero emissions by 2050.[10] Mexico's new administration plans to shift the country's climate agenda by fostering the expansion of renewable power, decarbonizing state-owned energy companies, and adopting a sustainable development approach.[11] Recent policy efforts have concentrated on enhancing the country's energy security by increasing oil production and reducing gas imports.[12] Additionally, the government has introduced a new electricity plan aimed at expanding both generation capacity and grid infrastructure.[13] Mexico has also set targets for methane reduction in the oil and gas sector and is exploring policies to incentivize the adoption of electric vehicles.[14,15]

Globally, non-state actors (states/provinces, cities, businesses, etc.) show increasing leadership in policy development and implementation that can drive large emissions reductions. As Mexico develops its new NDC target for 2035, a critical element of the strategy is to mobilize and integrate diverse subnational action into national climate ambition through an all-of-society approach, leveraging powers and strengths from different actors to maximize and reinforce the combined outcomes. Despite increasing levels of federal centralization, states and municipalities in Mexico have strong ability to support and strengthen national emissions reduction efforts. This includes strengthening energy efficiency and promoting and incentivizing rooftop solar in the industrial and residential sectors; reducing methane emissions, particularly from food loss and waste; advancing the circular economy and industrial efficiency; and modernizing public and private transit.

This report presents **a plausible, *High Ambition* pathway for Mexico that achieves a 47%-51% reduction in economy-wide GHG emissions by 2035 and net-zero emissions by 2050**, using the Global Change Analysis Model (GCAM-CGS), an open-source global integrated assessment model, and incorporating bottom-up sectoral analyses focused on technologies with proven track-records of enabling rapid decarbonization in various countries. The report also identifies key sectoral policy priorities and provides a detailed analysis of Mexico's multilevel climate governance, exploring the role of subnational actors in delivering targets under the *High Ambition* pathway. By combining country-specific insights, this approach offers a practical and ambitious view of mitigation potential, complementing top-down assessments of national ambition.

Emissions Trajectories

At COP 29, Mexico, along with other countries, released a joint statement expressing its intention to submit a 2035 NDC that is aligned with the 1.5°C goal, covers all greenhouse gases and economy-wide emissions, and follows a linear or steeper trajectory toward their net-zero target.[16] Our *High Ambition* pathway reflects these characteristics (see Appendix for more details) and achieves a 47%-51% reduction in GHG emissions including LULUCF by 2035, relative to 2023 levels.

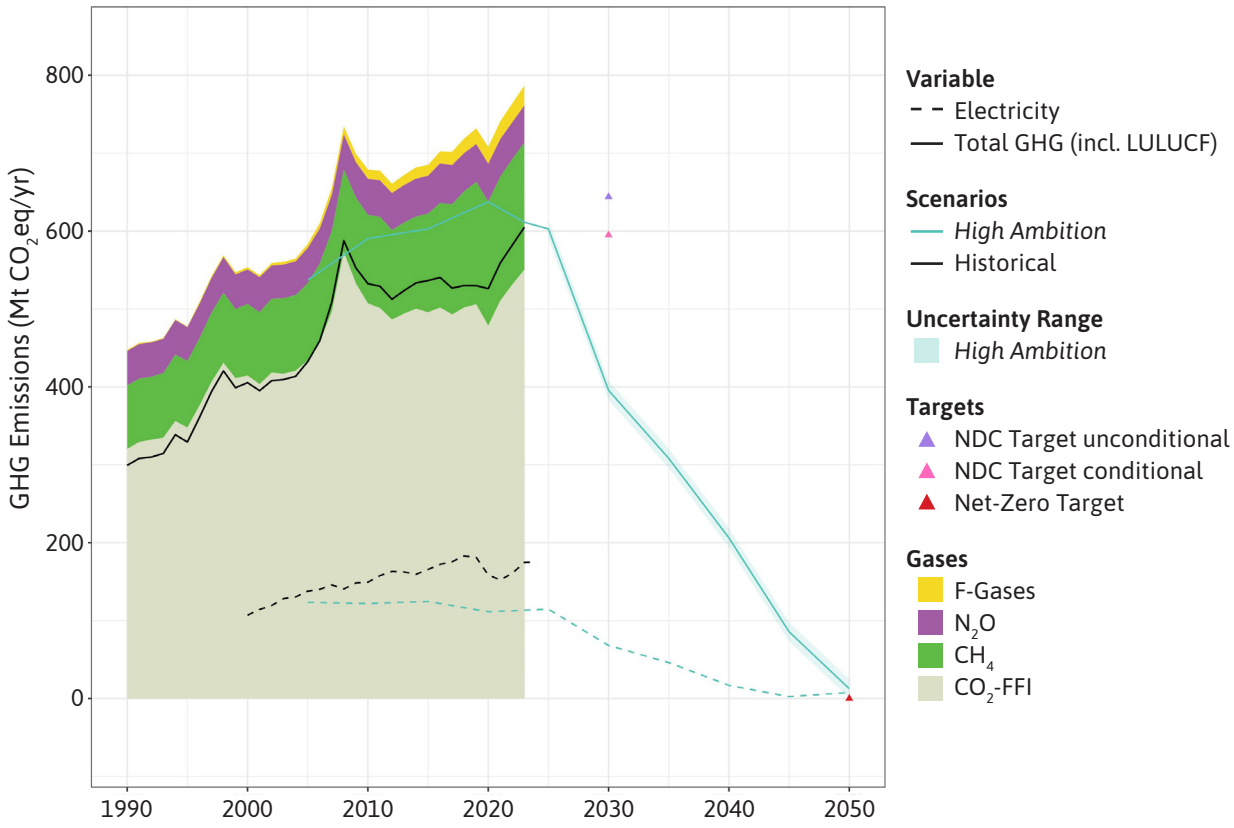

Figure 1. Mexico's GHG including LULUCF emission pathway. Historical data is from PRIMAP-hist[17] (solid black line for total GHG, including LULUCF), Ember[18] (dashed black line for electricity supply GHG emissions), and CEDS[19] (colored breakdown of historic GHG emissions, without F-Gases). Colored triangles mark the official 2030 NDC and net-zero targets. Pathways data includes LULUCF emissions and is based on the scenarios developed using the GCAM-CGS model from the NGFS Phase V with adjustments (see Appendix).[20] The shaded area represents +/- 2% of NDC base year emissions.

Mexico's *High Ambition* pathway implies a reduction in GHG emissions, including LULUCF, from estimated peak-year levels in 2023 by 2035 (Table 1). This trajectory broadly aligns with NDC targets in countries such as the United States and Brazil, when considering reductions including LULUCF from 2023 levels.

Table 1. Total GHG emissions reductions by 2035 under a *High Ambition* pathway for Mexico and other relevant comparable countries with declining emissions or released or proposed 2035 NDCs, relative to their respective NDC base years and 2023 levels. For countries other than Mexico without an official 2035 NDC target, the *High Ambition* pathway from CGS' prior global analysis was used.[21]

Country	Type of target	NDC Base Year or Estimated Peak Year	2035 emissions (incl LULUCF)	
			% change from base year	% change from 2023
Mexico	CGS assessment	2023**	-47% to -51%	-47% to -51%
Argentina	CGS assessment	2007*	-39% to -43%	-30% to -34%
Brazil	Official NDC target[22]	2005	-59% to -67%	-46% to -56%***
United States	Official NDC target[23]	2005	-61% to -66%	-51% to -57%***

*Estimated peak year based on PRIMAP historical data, total GHG emissions excluding LULUCF.
**Estimated peak year based on the *High Ambition* scenario, total GHG emissions excluding LULUCF.
*** Not included in NDC, estimated for this analysis using PRIMAP historical data.

Sectoral Priority Policy Actions

The following section presents key sectoral priority policy actions aligned with the national *High Ambition* pathway. Achieving significant emissions reductions by 2035 requires efforts in the sectors with the largest share of total emissions, while also considering the availability of cost-competitive mitigation technologies, such as solar and wind power and electric vehicles. To deliver meaningful emissions reductions through 2035, Mexico can focus on the following areas:

- **Power sector:** Accelerating annual solar and wind deployment, doubling the 2019 levels, aiming for 58% and 77% of non-fossil generation by 2030 and 2035, respectively. Phasing out coal power generation by 2030 and canceling the development and pre-construction of gas power plants.
- **Methane and other non-CO_2s**: Advancing solid waste management, adopting sustainable agricultural practices, and retrofitting oil and gas infrastructure to reduce methane emissions. Evaluating current subsidies for fertilizer use and production, and implementing catalytic processes in the fertilizer industry to reduce N_2O emissions.
- **Industry:** Accelerating electrification and promoting energy efficiency by providing technical and financial resources to manufacturing facilities. Implementing the Emission Trading System with more ambitious decarbonization goals and extending the carbon tax to include gas.
- **Transportation:** Incentivizing EV adoption through subsidies for vehicles and charging device installations, expanding EV charging infrastructure throughout the country, and promoting a modal shift toward mass transportation for passengers and electric rail for freight.

Power sector

As one of the largest sources of emissions in Mexico, with a significant share of fossil fuels, the electricity sector presents a substantial opportunity for low-cost decarbonization in the coming decade. As of 2024, coal and gas contributed 6% and 61%, respectively, to total electricity generation, while other fossil fuels accounted for 8% and nuclear for 3%. Renewables made up 22% of the total, with solar and wind contributing 13%.[24]

Power sector emissions increased by 5% from 2010 to 2023,[25] driven by a rise in gas-fired generation. Over the last decade, Mexico has added 15 GW of gas capacity, with another 7 GW currently under construction and 1 GW in pre-construction stages.[26] Nearly half of Mexico's gas fleet has been in operation for over 20 years, while 35% has been operating for less than 10 years.[27] As of 2023, 60% of the gas supplied in Mexico is imported—primarily through pipelines from the U.S.—and 40% is produced domestically.[28] Gas imports have steadily increased over the past decade due to abundant U.S. supply, low prices, growing demand from the power sector, and limited domestic gas production.[29,30] In 2024, 54% of gas power generation relied on imported gas.[31] Transitioning from imported fossil fuels to renewable energy in the power sector could strengthen the country's energy security while reducing emissions.

Annual solar and wind deployment in Mexico has slowed significantly in recent years, declining from over 4.8 GW in 2019 to just 1.6–1.1 GW in 2023 and 2024.[32] This slowdown is largely attributed to government efforts to prioritize the dispatch of thermal power plants operated by the state-owned utility, Comisión Federal de Electricidad (CFE), over privately owned renewable power plants through specific legislation.[33] Although the Supreme Court later ruled against this law, lingering uncertainty and distrust in government policy continue to hamper the energy transition in the power sector.[34] The shifts in the energy policy paradigm over the last decade have placed the power sector under significant pressure, limiting innovation, entrepreneurship, investment and social participation.

Under the *High Ambition* scenario, emissions from electricity generation decrease by 67% between 2023 and 2035, with accelerated solar and wind deployment, cancellation of new gas projects, and a coal phaseout by 2030. Specifically, power sector transitions under the *High Ambition* pathway include:

- Solar and wind energy generation share increases from 13% in 2024 to 42% by 2030 and 61% by 2035.
- Solar and wind installation increases from 1.1 GW in 2024 to 9 GW/year from 2025 to 2030 and 12 GW/year from 2030 to 2035.
- Coal generation phase out by 2030.
- Gas generation declines by 33% by 2030 and 55% by 2035 from 2024 levels, with no new gas expansion, by canceling 1 GW of pre-construction projects.

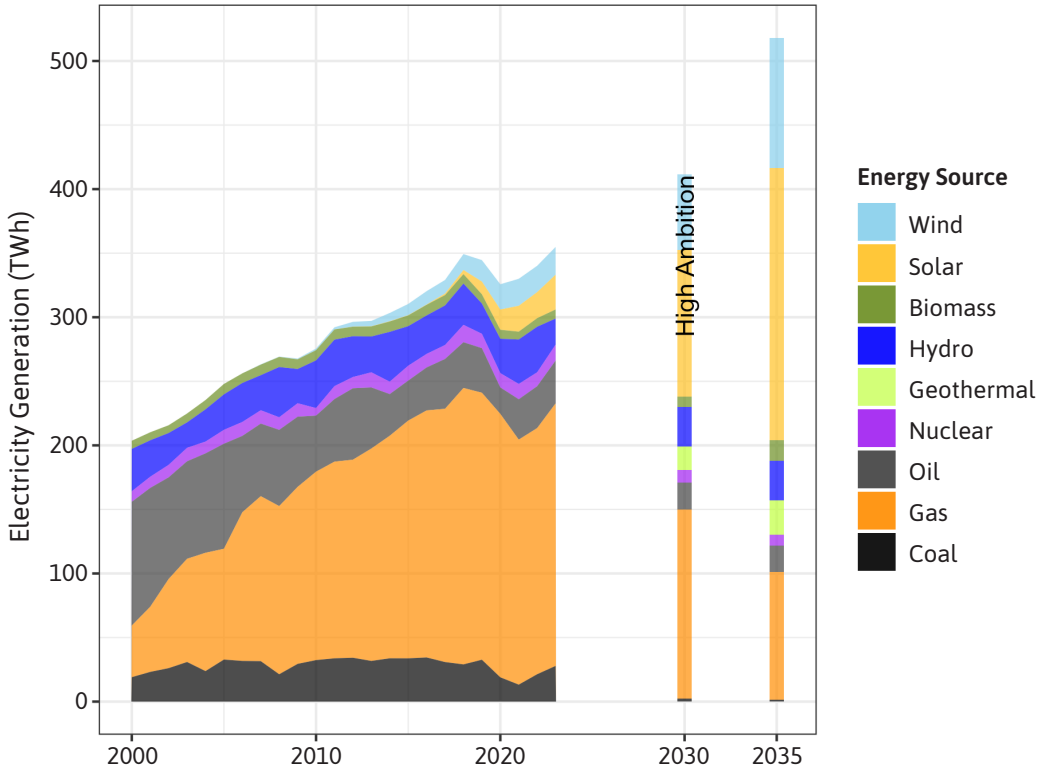

Figure 2. Electricity generation in Mexico by technology in historical years and modeled projections for 2030 and 2035 under the *high-ambition* scenario. Historical data is from Ember[35] and 2030 and 2035 data is based on the scenarios developed using the GCAM-CGS model for the NGFS Phase V with adjustments.[36]

Recent national strategies have focused on strengthening the country's energy sovereignty by planning the installation of more than 22 GW of new power capacity through 51 projects (13 GW gas, 8 GW renewable, and 2 GW storage) by 2030.[37,38] The government expects the private sector to deploy over 6 GW of renewable power capacity by 2030 (out of the 8 GW in the plan), while the most ambitious scenario in the national energy plan envisions reaching 45% renewable electricity by that year.[39,40] However, Mexico's energy plan falls short when compared to the *High Ambition* scenario, in which renewables account for 56% of total generation by 2030, with no new gas expansion, while still assuming a 2% annual growth in generation from 2024 to 2030.

Methane

Methane was one of the largest contributors to Mexico's emissions in 2023.[41] Enteric fermentation accounted for 46% of the country's methane emissions, followed by solid waste at 39%, the oil and gas industry at 8%, and wastewater at 4%.[42] Recent research suggests that Mexico's methane inventory may be underestimated, likely due to emissions from the oil and gas sector.[43] Mexico is a signatory to the Global Methane Pledge (GMP), aiming to reduce methane emissions by 30% by 2030 compared to 2020 levels. The country also participates in the Lowering Organic Waste Methane Initiative, which seeks to reduce methane emissions from waste at the subnational level,[44] and aims at achieving a 98% methane gas utilization rate and eliminating routine glass flaring by 2030.[45]

Given the significant share of non-CO_2 emissions, particularly from hard-to-abate sources like enteric fermentation, achieving net-zero GHG emissions in Mexico will likely require deeper CO_2 reductions. In the near term, there is potential to reduce methane emissions from solid waste and the likely underestimated

emissions from the oil and gas sector, as well as to promote technological and policy innovation to address agricultural methane and nitrous oxide (N_2O) emissions. Key strategies to further reduce emissions include strengthening monitoring and data management for methane emissions, advocating for equipment upgrades, implementing leak detection and repair programs, and capturing flared gas in the oil and gas sector. Additionally, efforts to enhance local initiatives that improve solid waste management and reduce food loss and waste through technical and financial assistance, developing waste management guidelines and protocols, and supporting agricultural practices that prevent methane emissions—such as substituting fertilizers and capturing and managing biogas—would be beneficial.

Industry

In 2022, cement production was responsible for nearly 20% of CO_2 emissions in the industrial sector.[46] To address this, the cement industry set a target to reduce emissions to 520 kg of CO_2 per ton of cement produced by 2030—a 17% decrease from 2016 levels.[47] Recent efforts have focused on lowering the clinker content in the cement mix, optimizing water usage, and enhancing recycling practices.[48] In 2024, Cemex, which holds 50% of the cement market in Mexico, announced that it had already exceeded the targets set by the sector,[49] indicating that there is room for higher ambition.

Oil and gas account for 44% of total final energy consumption in the industrial sector in Mexico.[50] To transition industrial production to cleaner technologies, Mexico established an Emissions Trading System (ETS) in 2018. It was set to begin operations in 2024 but is still in the pilot phase.[51] Under this system, companies in the industrial and energy sectors (including hydrocarbons and electricity) that emit more than 100,000 tons of CO_2 per year are required to participate.[52] The government is expected to prioritize the development of the necessary regulations for the market to operate effectively. Additionally, states are working to align their policies with the national framework.[53] However, further coordination and attention from the federal government are needed to make the ETS a reality.

Under the *High Ambition* scenario, key mitigation strategies include strengthening the emissions trading system and aligning it with higher ambition goals, as well as applying the carbon tax to gas.[54] Additional actions involve improving energy efficiency by providing technical and financial assistance to manufacturing facilities across the country,[55] enhancing collaboration with major industry actors to pursue more ambitious commitments, and substituting fossil fuels with electricity in industrial activities wherever possible.[56] In the cement industry, emissions reductions can be accelerated by lowering the clinker content in cement, switching to low emission fuels, using alternative materials, and promoting concrete recycling.[57] For steel and iron production, Mexico already relies on natural gas direct reduced iron (NG-DRI), producing 10.9 million tons of recycled steel, with 94% of production using Electric Arc Furnaces.[58] Strategies for this sector include improving the recovery and management of waste to increase scrap availability and planning for hydrogen-based DRI, depending on the country's progress in developing a green hydrogen industry.

Transportation

In 2024, electric vehicles (EVs) made up less than 2% of the new car sales, but demand is rising rapidly.[59] In particular, EV and PHEV sales grew by 84%, driven by PHEV adoption in 2023-2024.[60] The National Mobility Strategy (under discussion) aims to achieve a 50% share of hybrid or electric vehicles in the total vehicle sales by 2030 and a 100% share by 2040.[61] To meet these targets, the government plans for 50% of the cars produced in Mexico to be zero-emissions by 2050. This will be facilitated through the nationalization of lithium reserves and the establishment of new electric vehicle factories by companies such as BYD, Tesla, and Jetour, among others.[62, 63]

To further reduce emissions from transportation, the shift to greener technologies such as EVs is crucial, as long as the country's electricity supply also comes from cleaner sources. Key policy actions include expanding EV charging infrastructure from 1,100 public charging stations in 2023 to at least 38,000 by 2040.[64] Mexico can also incentivize EV adoption through subsidies for vehicle purchases and home charging device installations, while planning to phase out gasoline-powered vehicles and gradually eliminate gasoline subsidies, given their regressive nature.[65,66] A modal shift toward mass transportation for passengers and electric rail for freight could further enhance emissions reductions.[67] To support this shift, enhancing urban planning and promoting alternative transportation methods are also essential. Key measures include electrifying public transportation, improving efficiencies in urban areas, expanding and retrofitting railways, switching to fuels synthetized from green hydrogen and CO_2 in aviation and freight transport,[68,69] and encouraging transport modes such as cycling and walking.

Contribution of Enhanced Subnational Actions

While climate and energy policy is increasingly centralized at the federal level (see Box), states and municipalities in Mexico still have the capacity to support and strengthen national emissions reduction efforts. The following section outlines the opportunities for subnational actors to mitigate emissions in sectors such as power, industry, and transportation, as well as for methane mitigation. The analysis considers the degree of centralization and extent of subnational influence in each sector, existing policies and initiatives, equity considerations, key challenges for subnational actors, and their potential to enhance climate action.

Table 2. Summary of the roles of federal and subnational actions in key sectors

Policy Field	Level of Centralization	Targeted Policies	Equity	Challenges	Current Subnational Action	Subnational Potential
Power Sector	Highly centralized. Subnational actors can support the transition by streamlining permits and promoting distributed generation and behind-the-meter projects.	Federal and some state and local targets for renewable deployment.	Most energy poverty and electricity access policies are federal.	Outdated grid infrastructure, regulatory uncertainties, lengthy permitting processes, lack of RE training and technical knowledge.	Some ambitious renewable energy policies. (Ciudad Solar initiative in Mexico City and state/local energy plans (e.g., Jalisco)) which still can be expanded.	State and local distributed generation systems and self-consumption projects, in coordination with federal authorities.
Oil & Gas Methane	Highly centralized. States and municipalities do not have direct impact levers but have authority in permitting and zoning.	Only federal targeted policies for oil and gas methane.	Local monitoring, civil dialogue and innovation education efforts and accountability mechanisms are weak.	Lack of accountability, transparency, and information sharing at all levels.	State and local policies are rare but can be scaled up.	State monitoring, accountability, and compliance, local zoning and permitting.

Policy Field	Level of Centralization	Targeted Policies	Equity	Challenges	Current Subnational Action	Subnational Potential
Livestock & Rice Methane	Shared governance. Landowner groups have control over ejido land use.	Lack of federal and subnational policies for agricultural methane.	Rural farmers struggle to make adequate income.	No financial, historical, or infrastructure base for agricultural methane mitigation.	Some states participate in voluntary livestock methane projects (Baja California, Sonora, etc.).	Scaling up of experimental methane mitigation projects in agriculture.
Waste Methane	Subnational governance. Waste management is primarily operated by municipalities.	Lack of targeted waste methane city policies, despite some existing programs in large municipalities.	Limited public education on waste management. Path dependency of the waste management providers. Informal sector waste collectors lack formal recognition and financing.	Lack of sufficient funding for the waste management facility modernization or maintenance projects.	Municipalities are the primary actor in the waste management chain. Waste management represents a significant share of municipal budgets.	Installing more capture and use systems on waste management facilities and creating stable budgets for the new infrastructure.
Industry	Highly centralized. The federal government oversees and enforces environmental industrial regulations.	Developing ETS, NOMs for industry regulation, NAMA-PyME for supporting emissions reductions in SMEs.	SMEs may need more federal support to access technologies to reduce emissions.	Coordination gaps between federal and regional levels, and some policy tools (ETS and SMEs) are still small-scale.	Not sufficient subnational action. Lack of regional engagements with industry stakeholders.	Develop circular economy relations in industries within states.
Transport	Shared governance. Subnational actors have significant power in transit, public transport, and road policies permitting, taxation, and other incentives.	Federal targets for emissions reduction and LEV sales. Some subnational entities have EV promotion incentives and transit electrification targets.	Heavy air pollution in urban areas from older private and commercial vehicles which contribute to the pollution disproportionately.	Few rural charging facilities and modest national EV production incentives. Lack of unified subnational standards.	Some ambitious policies. Strong local EV switch incentives and public transit electrification ambition.	High potential to lead fleet electrification through state and local incentives, ensure standards unification, and public systems modernization.

Administrative Organization and Structure

The United States of Mexico (Mexico) is a federal republic with 32 states. In total, Mexico has 2,478 municipalities.[70] All states, including Mexico City, operate under a presidential system in which the governors serve as the head of state (Chief of Government in Mexico City's case).

Mexico's fiscal intergovernmental relations can be characterized as complex, featuring a relatively high degree of expenditure centralization and limited fiscal revenue collection powers of the state and municipal governments.[71] Since the 1980s, Mexico's states and municipalities relinquished their authority to collect certain taxes in exchange for larger federal transfers which reached 74% of total state revenues in 2024.[72] The federal government is responsible for levying income and social security taxes, VAT, excises, tariffs, etc., while the state governments can levy payroll, vehicle ownership, hospitality, entertainment, and lottery taxes and civil services fees, with the municipalities being able to levy property taxes, user fees for utilities and parking, and other minor fees for permitting, licensing, and inspecting.[73]

This centralized fiscal structure allows the federal government to steer or withhold support for subnational climate initiatives depending on political preferences. Although the federal government can, and currently does, support climate projects through conditional transfers, this support is still discretionary and contingent on federal willingness to prioritize climate spending. Greater decentralization and diversification in the distribution of fiscal revenue could enable more independent subnational climate action. This would give states and local governments greater budgetary independence and a more stable revenue stream in the event of a federal policy reversal.

Mexico's General Law on Climate Change (LGCC, promulgated in 2012 and last amended in 2024) enables states and municipalities to adapt national climate policies to their needs, capacities, and priorities, supporting both horizontal and vertical climate governance and fostering subnational climate action.[74] The federal government is responsible for designing and maintaining strategic climate policy and tools, such as the National Strategy, Special Climate Change Program, Nationally Determined Contribution (NDC), and National Emissions Inventory, among others, as well as for overarching environmental budgeting (Art. 7).[75] Federal ministries are also expected to mainstream climate concerns across all public policies and to collaborate with subnational entities.[76] This structure allows for intergovernmental climate dialogue in Mexico, in a form of two-level policy coordination, where lower levels of authority align with higher-level policies. However, this coordination needs to be strengthened and better articulated to avoid policy overlaps and contradictions, providing subnational actors with clearer guidance and greater opportunities to enhance climate action.

The state authorities in Mexico, in coordination with municipalities, have broad powers to define specific environmental requirements and regulations for transportation, residential and commercial facilities, water and waste management, and agricultural and livestock activities (Art. 8).[77] States are required by law to establish so-called State Programmes on Climate Change. These programmes are expected to be aligned with the national strategy, but are not required to be updated at the onset of a new strategy,[78] which may slow down climate action in less ambitious states even amid a more ambitious federal environmental policy. The same state policy requirement goes for mandatory state-level GHG inventories and State Risk Atlases. States are also legally authorized to enter agreements with other states, municipalities, or the federation for both mitigation and adaptation.[79]

Municipalities are likewise empowered to develop coordinated policies and programs on municipal water and waste management, public transportation, civil defense, and urban planning, with a right to form associations with neighboring municipalities to improve their climate policy implementation capacity (Art. 9),[80] which provides an established legal framework for horizontal municipal climate governance cooperation. However, municipalities face several obstacles to engaging in climate action and implementing sustainable programs, including short municipal terms that affect project continuity, high staff turnover, and limited technical and financial capacity in some areas.[81]

To create additional funds for financing their climate projects, some subnational entities in Mexico launched state carbon pricing schemes.[82] These mechanisms empower states to make independent budgetary decisions on climate mitigation and adaptation. As a result, subnational entities with regional carbon pricing have greater potential to independently pursue climate projects and engage in public-private partnerships, even without federal support. However, greater homogeneity and transparency are needed. Although these schemes have proven to be an effective financing mechanism, differences between schemes across states create gaps in capacities and resources. Additionally, some states use these funds at their discretion, which can reduce trust among society and businesses.

Mexico has established a system that allows for cross-institutional and multi-level policy dialogue in the environmental sector. As illustrated in Figure 3, climate governance involves various governmental actors and potential interactions between federal, state, and municipal authorities to advance climate action. The National System for Climate Change (SINACC) coordinates government agencies and consults with the public, private, and civil society stakeholders in climate policy discussions.[83] SINACC is composed of the Congress, the Inter-ministerial Commission on Climate Change (CICC), which includes 14 ministries, 31 federal states and Mexico City and their municipal officials, the Climate Change Council (C3), and the National Institute for Ecology and Climate Change (INECC). The creation of SINACC has opened the possibility for vertical coordination in the design of strategic climate policies, potentially enabling all-of-society participation in major climate decisions.[84] However, SINACC's complex and strictly layered structure can hinder horizontal coordination and may be less effective for urgent, fast-paced climate response.[85]

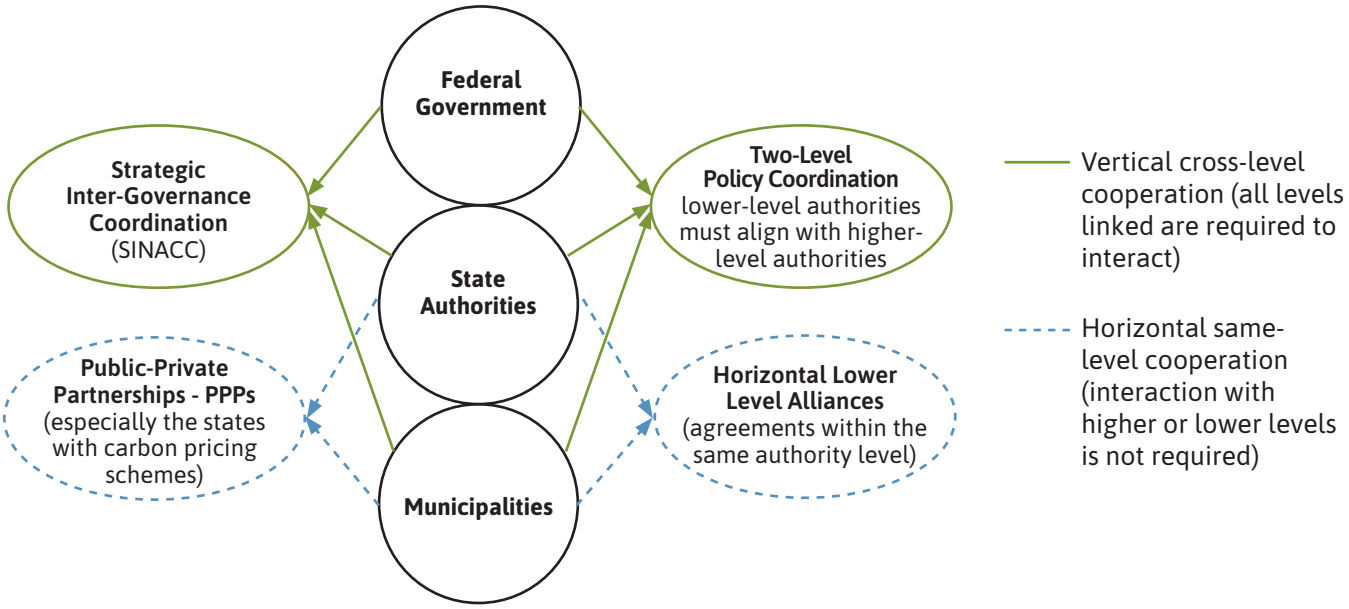

Figure 3. All-of-Society Climate Action Potential for Mexico. Potential all-of-society interactions between different authority levels in Mexico for stronger climate action. Green lines represent cross-level governmental cooperation and blue lines represent same level entities cooperation.

Mexico's climate governance enables subnational and federal actors to play distinct roles within sector-specific policies. States and municipalities can influence climate action in power, industry and transportation sectors, as well as in methane mitigation. Below, we present a brief overview of how subnational action in these sectors can be pursued or enhanced.

Power sector

At the federal level, the Ministry of Energy (SENER) plans, administers, controls, and regulates all energy resources in the country and defines the national energy policy.[86] State policies are formed in accordance with national priorities.[87] The latest Energy Planning and Transition Law (LPTE) centralizes mid- and long-term energy sector planning in Mexico. This law strengthens the role of the Federal Electricity Commission (CFE) and Pemex, promotes an efficient and sustainable use of energy, encourages the development of clean energy sources, and incorporates concepts such as energy justice into the planning process.[88] While the planning instruments have yet to be defined, the law establishes a binding framework, where all actors must align with these instruments.[89] It also designates SENER as the entity responsible for planning all projects in the country that support the energy transition, as well as proposing fiscal and financial incentives to promote energy efficiency, renewable deployment and emissions reductions.[90]

States can create their own energy agencies, commissions, or departments. These entities carry out actions related to energy efficiency, energy savings and the use of renewable energy. Several states such as Baja California, Campeche, Hidalgo, Jalisco, Morelos, Puebla, Veracruz, Zacatecas, among others, already have them in place.[91] Some of these agencies promote the design and adoption of public policies that support the development of a sustainable energy sector by incentivizing investment in renewable energy generation and energy efficiency, while others focus on the growth of the oil industry, and on regional competitiveness based on fossil fuel development.[92,93,94]

States and municipalities in Mexico cannot build or buy electricity directly from power projects, as the CFE is the main producer and sole electricity supplier, controlling 54% of the nation's power generation under the latest constitutional reforms.[95,96,97,98,99] However, they still have significant power to shape the investment conditions in their jurisdictions through streamlined permitting, local regulations, fiscal incentives, and the integration of renewable energy into development plans.[100,101,102] In addition, they can drive the energy transition in their regions by promoting small-scale and behind-the-meter projects such as distributed generation (under 0.7 MW) and self-consumption (0.7-20 MW), which do not require federal authorization.[103] They can further accelerate the deployment by simplifying licensing procedures, fostering local development, and acting as intermediaries between private investors, CFE, and communities to support grid integration and build social acceptance. Mexico City's "Ciudad Solar" initiative is an example of this approach, promoting the use of solar energy for electricity and water heating in private and public buildings, small and medium-sized enterprises, and new housing developments.[104]

Some of the challenges states and municipal governments face in implementing renewable energy projects include outdated and saturated grid infrastructure (owned and operated by the federal government) that requires expansion to connect new projects, low capacity factors, regulatory uncertainty at the federal level that affects investment incentives, the social and environmental impacts of these projects, and a lack of training and technical knowledge.[105]

Methane

Oil and gas. At the federal level, authorities set and enforce national methane rules and plan large-scale modernization projects, while state and municipal governments oversee zoning, permitting and local oversight, as well as foster local partnerships.[106] By exercising and strengthening this authority, subnational actors could help enhance local monitoring and accountability, for example by establishing independent emissions monitoring units in affected areas. Additional policy action could come from local or other grass-roots NGOs, which can advocate for residents' rights to transparent emissions information and equitable access to compensation.

Livestock and rice. The federal agencies with authority to address livestock and rice methane emissions include the Ministry of Environment (SEMARNAT),[107] the Ministry of Agriculture and Rural Development (SADER),[108] and the National Water Commission (CONAGUA) which can regulate methane emissions from rice paddies through water management policies.[109] Although state environmental agencies mostly implement federal guidelines, they still have authority to issue permits and conduct impact assessments, which could allow for a more informed local and federal policymaking. Municipal governments have significant authority in land use planning and permitting, and can also enforce local standards[110] such as crop residue management regulations. In addition, they could promote entrepreneurship and create investment-conducive conditions in their jurisdictions, while motivating local farmers and agribusinesses to pursue new solutions and collaborations by adopting local agricultural methane regulations for both livestock and rice production.

Mexico has begun implementing targeted policies to address methane emissions from livestock and rice production. One of such policies is the non-binding "Mexico Livestock Project Protocol", which provides standardized methodologies for measuring and verifying methane reductions from livestock waste treatment, such as biodigesters and composting, offering access to voluntary carbon markets.[111] Another U.S.-Mexico private initiative aimed at reducing livestock methane emissions is the operation of a Hawaii-based start-up "Symbrosia" in Mexico's Ejido Erendira (Baja California), where large-scale trials of its seaweed feed additive are being conducted, showing potential to reduce livestock methane emissions by over 80%.[112]

Waste. Waste management in Mexico primarily exists at the municipal level,[113] but the majority of municipalities lack funding for infrastructure.[114] Collaboration between levels of government for waste management does exist. Municipalities authorize operations, while SEMARNAT advises and coordinates with states and municipalities, particularly on monitoring compliance with solid waste minimization criteria, soil and radioactive pollution prevention, reuse and recycling standards, and pollutant release and transfer registry maintenance.[115] Federal actions such as the proposed General Law on Circular Economy and Integrated Waste Management for Greenhouse Gas Emissions Mitigation serve as a promising step towards effective food waste management coordination across different levels of government.[116] The integrated waste management strategies proposed aim to not only reduce methane emissions from landfills directly, but to reduce virgin material production, saving unnecessary material from overflow in municipal facilities.

While most states and municipalities have their own waste laws and regulations, only few entities have climate policies on waste, e.g. the Circular Economy Law in Mexico City, or the waste diversion and biogas use plans in Quintana Roo, Guadalajara, and Monterrey.[117,118] The major challenges impeding improved waste management are the lack of funding for new facilities and the lack of technical regulations for waste separation and recycling.[119] These obstacles could be improved through enhancing waste collection and separation practices at the street level, providing public education and

worker training on best practices, coordinating with states and SEMARNAT to secure stable funding for biogas capture and use facilities buildout, and including non-major metropolitan areas.

Industry

SEMARNAT and the Secretariat of Economy (SE) are the key agencies responsible for sustainable industrial development in Mexico.[120] SEMARNAT develops and enforces the Official Mexican Standards (NOMs), which among others, focus on environmental quality.[121] Beyond the NOMs, Mexico's industrial climate policy also includes programs such as the Emissions Trading System (ETS) and the National Circular Economy Strategy, as well as the Nationally Appropriate Mitigation Action for Small- and medium-scale enterprises.[122]

As environmental regulations and high-level systems are primarily managed at the federal level, especially under heightened centralization, state and municipal actors are well-positioned to serve in a supportive and advisory role for agencies like SEMARNAT. For example, states and municipalities can collaborate in partnership with federal agencies, similar to how NAMA-PyME works alongside foreign implementation organizations. With greater financial support, subnational governments can aid in advising on regional industrial priorities, checking whether local industrial actors are compliant, and serving as an implementation arm for federal-level policies.

Transportation

At the federal level, the Ministry of Infrastructure, Communications and Transport (SICT) regulates national transport infrastructure and licensing.[123] States have their own ministries of mobility or transport that manage licensing and public transit, while municipal governments are empowered to regulate public transit systems and roads.[124] Although national EV policy is under discussion, subnational governments can combine tax incentives with municipal parking and driving benefits, to encourage EVs adoption. For example, Mexico City leads with comprehensive incentives, including tax exemptions, driving privileges, and free parking for EVs in metered zones.[125]

Mexican states and municipalities could accelerate the transition to EVs in leased fleets by setting fleet electrification targets, offering licensing incentives, and providing public-private support such as subsidized electricity rates or subsidized charging infrastructure for the leasing companies, through regional cooperation mechanisms.[126] They also play a key role in rezoning for mixed land use and redesigning roads to prioritize non-motorized and public transit over private light-duty vehicles.[127] Additionally, subnational actors have the capacity to electrify public transportation systems. For example, the state of Jalisco aims to fully renovate its public transportation fleet with low-emission vehicles by 2030, and has launched a fully-electric 1,515 mi bus line, which is expected to reduce annual GHG emissions by 4 kt of CO_2e.[128] Jalisco is also planning to electrify another public route in Puerto Vallarta, with 38 new electric buses.[129]

Discussion and Conclusions

Mexico can strengthen both its climate ambition and energy security by implementing broad policies across the power, industry, and transportation sectors, as well as methane mitigation. Under the *High Ambition* scenario, this approach could lead to a 47%-51% reduction in GHG emissions, including LULUCF, from 2023 levels by 2035. To achieve this, economy-wide policies must align with Mexico's climate commitments, specifically, the 2050 net-zero target and the intention to follow a linear pathway to reach it. This requires stronger efforts to accelerate renewable energy deployment, phase out fossil fuels, reduce gas imports dependency in the power sector, and prioritize electric vehicle adoption over expanding oil production. In addition, structural political economy measures are needed to lessen the country's economic reliance on fossil fuels. Methane emissions remain one of the country's key challenges, but they also present an opportunity for Mexico to become an international leader in advancing technological and policy solutions to reduce non-CO_2 emissions from the agriculture and waste sectors.

Subnational leaders are vital for bolstering the ambition of NDCs, as they demonstrate power to tailor ambitions to local circumstances, advocate for stronger policies and increased financial support, and ensure that broader national and global climate goals are realized and benefitted from within their local communities. In Mexico, subnational actors have demonstrated promising frameworks to support and strengthen national emissions reduction targets, despite increasing levels of federal centralization. As limited financial resources at the state and municipal level can decelerate independent ambitious target-setting and implementation, subnational actors may benefit from multi-level coordination, resource sharing, and pushing for national policies and incentive programs.[130] Through such collaborative action, specific measures may include promoting distributed generation projects and streamlining permitting processes to accelerate clean technology deployment,[131] building codes to drive solar heating, thermal insulation, electrification, enhancing methane monitoring and accountability in oil and gas sector and scaling up agricultural start-ups to reduce methane from livestock, and advancing EV adoption by enforcing standards, modernizing public transit systems,[132] and developing procedures to streamline infrastructure installation in collaboration with the national power utility.[133]

Raising Mexico's 2035 NDC ambition will require strong engagement from both national and subnational stakeholders, stable policy frameworks aligned with international commitments, and technological innovation and adoption to support sectoral transitions and enhance energy security. Additional emissions reductions beyond those presented in this report are possible by enhancing energy efficiency in buildings, and further reducing land-use emissions. By setting clear and ambitious climate policies, Mexico may reduce the risk of climate-induced setbacks while driving significant economic growth.[134] Across Mexico, the integration of these strong climate policies can also serve to bolster equitable access to nutritious and affordable food, facilitate energy security, reduce rural poverty, and strengthen the transparency and rule of law for all.[135] In pursuing these efforts, Mexico has the potential to position itself as a climate leader in the region.

Technical Appendix

Modeling method

Global Change Analysis Model (GCAM)

The Global Change Analysis Model (GCAM) is a global market equilibrium model that combines economic, energy, land use, and climate systems to analyze the interactions between human activities and global environmental changes. It is designed to assess the impacts of various policy scenarios and technology options on energy use, land use change, greenhouse gas emissions and climate change. GCAM is a dynamic recursive model, meaning that decision-makers do not know the future when planning today. After it solves each period, the model then uses the resulting state of the world, including the consequences of decisions made in that period – such as resource depletion, capital stock retirements and installations, and changes to the landscape – and then moves to the next time step and performs the same exercise. GCAM operates in 5-year time-increments, with each new period starting from the conditions that emerged in the last. GCAM has previously been used to examine impacts of mitigation policies and technology deployment on greenhouse gas emissions.

GCAM tracks emissions of 16 different species of GHGs and air pollutants from energy, agriculture, land use, and other industrial systems. In GCAM, the world is disaggregated into 32 economic regions, the resolution at which socioeconomics, energy, and market processes (including global trade) are modeled. Water flows and land use are modeled in more than 200 and 300 regions, respectively. The Earth system model (i.e., carbon-cycle climate module) Hector is the climate model within GCAM. GCAM is a hierarchical market equilibrium model. The equilibrium in each period is solved by finding a set of market prices such that supplies and demands are equal in all simulated markets.

Scenarios used in this analysis

Overall scenarios

We used the 1.5°C and delayed transition scenario from NGFS 2024 for high-ambition and low-ambitions scenarios, with additional adjustments in land use emissions (see below). The NGFS scenarios are not forecasts, but aim at exploring the bookends of plausible futures. The scenario narratives are regularly updated and expanded to reflect the most recent developments and technological ones (e.g. the availability of CDR), as well as delays in policy implementation within regions and globally. Most scenarios employ a top-down emissions constraint based on transition pathways at the regional level.

- The net zero 2050 or 1.5°C scenario has a 50% chance of limiting average global warming to below 1.5 deg C by 2100, with an overshoot likely around mid-century. Global CO_2 emissions reach or approach zero in 2050 and countries with a political commitment to a net zero target defined before February 2023 meet this target before or after 2050. Some jurisdictions such as the US, EU, UK, Canada, Australia, and Japan reach net zero for all GHGs.

- For the High Ambition scenario (including LULUCF), we used the net zero 2050 or 1.5°C scenario for emissions excluding LULUCF, and adjusted LULUCF emissions based on historical data. Specifically, we assumed LULUCF emissions remain at -180 $MtCO_2eq$, following the historical values reported by the country in its latest national inventory, where LULUCF emissions have stayed at this level since 2010.

Additional figures and tables

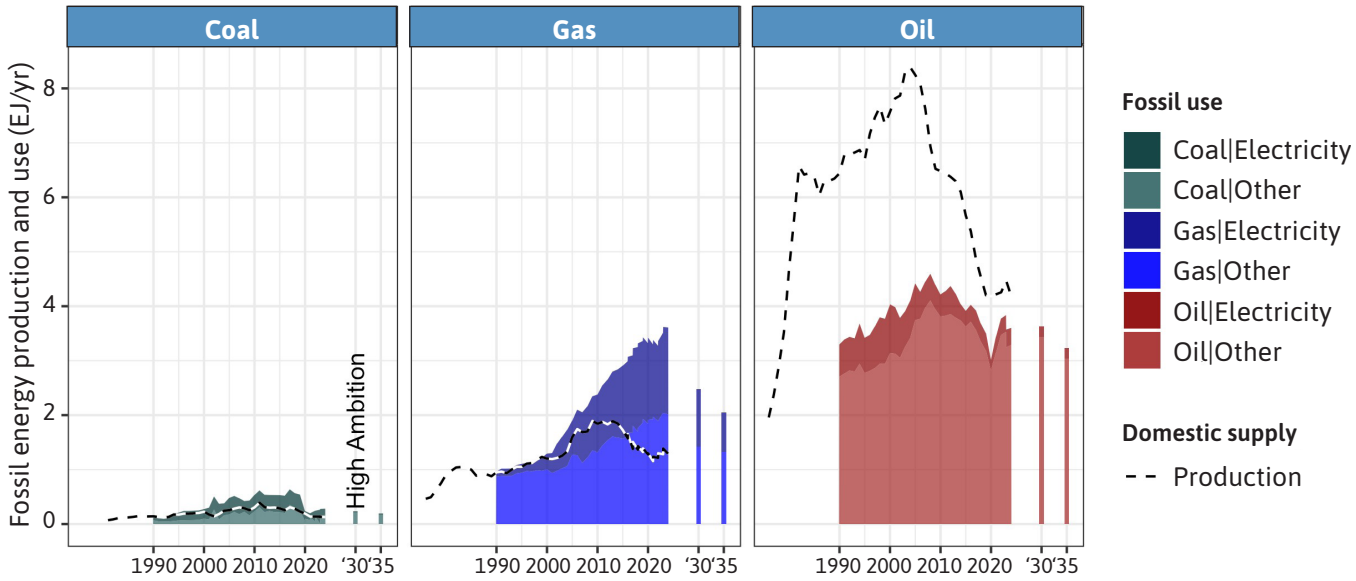

Figure S1. Mexico's fossil energy production and use. Historical data is from the Statistical Review of World Energy Data[8] and Ember[4] and 2030 and 2035 data is based on the scenarios developed using the GCAM model for the NGFS Phase V with adjustments.[5]

Table S1. Electricity capacity and generation mix[8]

	Installed capacity (% of total)						Electricity generation (% of total)					
	2019	2020	2021	2022	2023	2024	2019	2020	2021	2022	2023	2024
Coal	5%	5%	5%	4%	4%	4%	9%	6%	4%	6%	8%	6%
Gas	39%	40%	40%	36%	36%	36%	60%	63%	58%	56%	58%	61%
Other fossil	26%	25%	25%	33%	32%	32%	10%	6%	10%	10%	9%	8%
Nuclear	2%	2%	1%	1%	1%	1%	3%	3%	4%	3%	3%	3%
Total RE	27%	28%	29%	25%	26%	26%	17%	21%	25%	24%	21%	22%
Hydro	13%	13%	12%	11%	10%	10%	7%	8%	11%	10%	6%	7%
Solar	6%	7%	8%	8%	9%	10%	3%	5%	6%	6%	8%	8%
Wind	7%	7%	7%	6%	6%	6%	5%	6%	6%	6%	6%	6%
Biomass	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%

Table S2. Recent solar and wind deployment[9]

Annual Solar & Wind Capacity Additions in Mexico (GW)									
	2016	2017	2018	2019	2020	2021	2022	2023	2024
Solar	0.32	0.46	1.7	3.48	0.91	1.77	0.43	1.55	1.08
Wind	0.78	0.13	0	2.36	0.46	0.47	0.16	0	0
Total Solar + Wind	1.10	0.59	1.70	5.84	1.37	2.24	0.59	1.55	1.08

Table S3. Recent gas builds and current pipeline[10]

Annual Gas Capacity Additions in Mexico (GW)										Current Pipeline as Jan 2025 (GW)	
	2016	2017	2018	2019	2020	2021	2022	2023	2024	Under construction	Pre-Construction
Gas	1.7	1.7	1.2	3	2.9	1.6	1.1	0.7	0.8	7	1

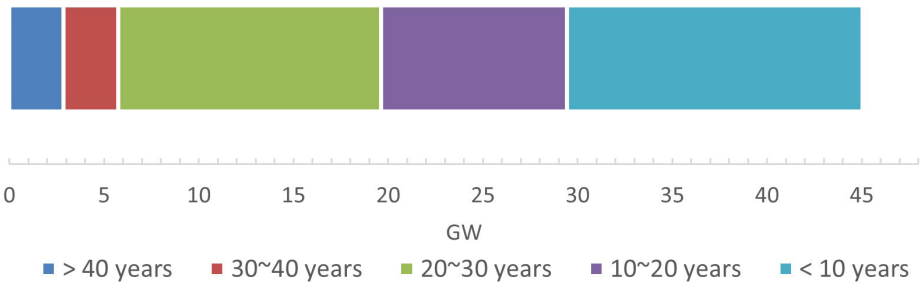

Figure S2. Gas power capacity by vintage group[11]

Endnotes

1. Johannes Gütschow et al., "The PRIMAP-Hist National Historical Emissions Time Series (1750-2023) v2.6.1," version 2.6.1, Zenodo, March 13, 2025, https://doi.org/10.5281/zenodo.15016289.

2. Gütschow et al., "The PRIMAP-Hist National Historical Emissions Time Series (1750-2023) v2.6.1."

3. Gütschow et al., "The PRIMAP-Hist National Historical Emissions Time Series (1750-2023) v2.6.1."

4. Rachel Hoesly et al., "Community Emissions Data System (CEDS) V_2025_03_18 Aggregate Data," version v_2025_03_18, Zenodo, March 18, 2025, https://doi.org/10.5281/zenodo.15059442.

5. Hoesly et al., "Community Emissions Data System (CEDS) V_2025_03_18 Aggregate Data."

6. Secretaría de Medio Ambiente y Recursos Naturales, *México: Informe Del Inventario Nacional de Emisiones de Gases y Compuestos de Efecto Invernadero, 1990-2022* (Gobierno de México, 2025), https://unfccc.int/sites/default/files/resource/INEGYCEI_170625_CGMCC.pdf.

7. Estados Unidos Mexicanos, "Mexico. Biennial Update Report (BUR) BUR 3. | UNFCCC," 2022, https://unfccc.int/documents/512231.

8. Pierre Friedlingstein et al., "Global Carbon Budget 2024", Earth System Science Data, 17-3, 2024.

9. Government of Mexico, "Contribucion Determinada a Nivel Nacional. Actualizacion 2022," 2022, https://unfccc.int/sites/default/files/NDC/2022-11/Mexico_NDC_UNFCCC_update2022_FINAL.pdf.

10. Secretaría de Medio Ambiente y Recursos Naturales, "México reafirmó su compromiso con la acción climática ambiciosa en la COP29," Gobierno de México, November 27, 2024, http://www.gob.mx/semarnat/prensa/mexico-reafirmo-su-compromiso-con-la-accion-climatica-ambiciosa-en-la-cop29?idiom=es.

11. Secretaría de Medio Ambiente y Recursos Naturales, "México traza un nuevo camino en materia de cambio climático, afirma la secretaria de Medio Ambiente," gob.mx, October 21, 2024, http://www.gob.mx/semarnat/documentos/mexico-traza-un-nuevo-camino-en-materia-de-cambio-climatico-afirma-la-secretaria-de-medio-ambiente.

12. "Plan México: Estrategia de Desarrollo Económico Equitativo y Sustentable para la Prosperidad Compartida," January 2025, https://www.planmexico.gob.mx/.

13. Gobierno de México and Comisión Federal de Electricidad, "Plan de Fortalecimiento y Expansión Del Sistema Eléctrico Nacional," February 5, 2025, https://www.energiaestrategica.com/wp-content/uploads/2025/02/05febrero26-Plan-Fortalecimiento-y-Expansion-Sistema-Electrico-Nacional.pdf?x29040.

14. Gobierno de México, "Contribución Determinada a Nivel Nacional. Actualizacion 2022," 2022, https://unfccc.int/sites/default/files/NDC/2022-11/Mexico_NDC_UNFCCC_update2022_FINAL.pdf.

15. Secretaria de Medio Ambiente y Recursos Naturales, "Estrategia Nacional de Movilidad Eléctrica," May 2, 2023, https://www.gob.mx/cms/uploads/attachment/file/832517/2.3.ENME.pdf.

16. Directorate-General for Climate Action, "COP29: Joint Press Release on 1.5°C-Aligned Ambition in NDCs Toward Net Zero - European Commission," European Commission, November 21, 2024, https://climate.ec.europa.eu/news-your-voice/news/cop29-joint-press-release-15degc-aligned-ambition-ndcs-toward-net-zero-2024-11-21_en.

17. Gütschow et al., "The PRIMAP-Hist National Historical Emissions Time Series (1750-2023) v2.6.1."

18. Ember, "Electricity Data Explorer - Open Source Global Electricity Data," Ember, 2025, https://ember-climate.org/data/data-tools/data-explorer/.

19. Hoesly et al., "Community Emissions Data System (CEDS) V_2025_03_18 Aggregate Data."

20. Ravi Menon and Livio Stracca, NGFS Scenarios for Central Banks and Supervisors - Phase IV (Network for Greening the Financial System (NGFS), 2023), https://www.ngfs.net/system/files/import/ngfs/medias/documents/ngfs_climate_scenarios_for_central_banks_and_supervisors_phase_iv.pdf.

21. Cui et al., *Enhancing Global Ambition for 2035: Assessment of High-Ambition Country Pathways*.

22. Brazilian Government, "Brazil's NDC. National Determination to Contribute and Transform," (UNFCCC, 2024), https://unfccc.int/sites/default/files/2024-11/Brazil_Second%20Nationally%20Determined%20Contribution%20%28NDC%29_November2024.pdf.

23. Government of the United States of America, "The United States of America Nationally Determined Contribution. Reducing Greenhouse Gases in the United States: A 2035 Emissions Target," (UNFCCC, 2024), https://unfccc.int/sites/default/files/2024-12/United%20States%202035%20NDC.pdf.

24. Ember, "Electricity Data Explorer - Open Source Global Electricity Data."

25. Hoesly et al., "Community Emissions Data System (CEDS) V_2025_03_18 Aggregate Data."

26. "Global Coal Plant Tracker," Global Energy Monitor, 2024, https://globalenergymonitor.org/projects/global-coal-plant-tracker/.

27. GEM, "Global Oil and Gas Plant Tracker," Global Energy Monitor (GEM), January 2025, https://globalenergymonitor.org/projects/global-oil-gas-plant-tracker/.

28. IEA, "Mexico - Natural Gas Supply," International Energy Agency (IEA), 2023, https://www.iea.org/countries/mexico/natural-gas.

29. Columbia | CGEP, "Lucrative Reward or Mounting Risk? Mexico's Growing Reliance on US Gas," Center on Global Energy Policy at Columbia University SIPA | CGEP, October 24, 2023. https://www.energypolicy.columbia.edu/publications/lucrative-reward-or-mounting-risk-mexicos-growing-reliance-on-us-gas/.

30. Consejo Nacional de Humanidades Ciencias y Tecnologías, Gobierno de México, "Flujos y Uso de Gas - Plataforma Nacional de Energía, Ambiente y Sociedad," 2023, http://energia.conahcyt.mx/planeas.

31. Wilmar Suárez, "Las Renovables, El Camino Hacia La Seguridad Energética En México," Ember, May 19, 2025, https://ember-energy.org/app/uploads/2025/05/ES-Reporte-Las-renovables-el-camino-hacia-la-seguridad-energetica-en-Mexico.pdf.

32. Ember, "Electricity Data Explorer - Open Source Global Electricity Data."

33. Dana Nuccitelli, "What Is Mexico Doing About Climate Change?," Yale Climate Connections, 2023, http://yaleclimateconnections.org/2024/04/what-is-mexico-doing-about-climate-change/.

34. "Mexico's Supreme Court Rules Against Electricity Law Favoring State-Owned Utility Over Firms," Associated Press News, 2024, https://apnews.com/article/mexico-power-sales-unconstitutional-060ab7b4918d6af511a610088f167655.

35. Ember, "Electricity Data Explorer - Open Source Global Electricity Data."

36. Menon and Stracca, *NGFS Scenarios for Central Banks and Supervisors - Phase IV*.

37. "Plan México: Estrategia de Desarrollo Económico Equitativo y Sustentable para la Prosperidad Compartida."

38. Gobierno de México and Comisión Federal de Electricidad, "Plan de Fortalecimiento y Expansión Del Sistema Eléctrico Nacional."

39. Presidencia de la República, "Versión estenográfica. Conferencia de prensa matutina del 9 de abril de 2025," Gobierno de México, April 9, 2025, https://www.gob.mx/presidencia/articulos/version-estenografica-conferencia-de-prensa-de-la-presidenta-claudia-sheinbaum-pardo-del-9-de-abril-de-2025.

40. Gobierno de México, "Estrategia Nacional Del Sector Eléctrico," November 6, 2024, http://www.gob.mx/presidencia/prensa/la-estrategia-nacional-del-sector-electrico-garantizara-energia-a-todas-y-todos-los-mexicanos-presidenta-claudia-sheinbaum.

41. Hoesly et al., "Community Emissions Data System (CEDS) V_2025_03_18 Aggregate Data."

42. Hoesly et al., "Community Emissions Data System (CEDS) V_2025_03_18 Aggregate Data."

43. Xiao Lu et al., "Methane Emissions in the United States, Canada, and Mexico: Evaluation of National Methane Emission Inventories and 2010–2017 Sectoral Trends by Inverse Analysis of In Situ (GLOBALVIEWplus CH4 ObsPack) and Satellite (GOSAT) Atmospheric Observations," *Atmospheric Chemistry and Physics* 22, no. 1 (2022): 395–418, https://doi.org/10.5194/acp-22-395-2022.

44. Bureau of Oceans and International Environmental and Scientific Affairs, United States Department of States, *Lowering Organic Waste Methane Initiative (LOW-Methane) Release*, 2023, https://2021-2025.state.gov/lowering-organic-waste-methane-initiative-low-methane/.

45. Government of Mexico, "Contribucion Determinada a Nivel Nacional. Actualizacion 2022," 2022, https://unfccc.int/sites/default/files/NDC/2022-11/Mexico_NDC_UNFCCC_update2022_FINAL.pdf.

46. Patrick R O'Rourke et al., "CEDS V_2021_02_05 Release Emission Data," version v_2021_02_05, Zenodo, February 5, 2021, https://doi.org/10.5281/zenodo.4509372.

47. Hoja de Ruta Mexico. Industria Del Cemento. and Camara Nacional del Cemento (CANACEM), "Hacia Una Economía Baja En Carbono 2023," n.d., https://canacem.org.mx/site/wp-content/uploads/2023/03/Folleto-Hoja-de-Ruta-CANACEM.pdf.

48. Centre for Climate Engagement, "Cemex: Abriendo Camino Hacia Cero Emisiones Netas En La Industria Cementera," Climate Governance Initiative, 2024, https://hub.climate-governance.org/article/Cemex_case_study_es.

49. "Cemex alcanza meta en reducción de emisiones siete años antes que el sector," CEMEX Mexico, 2024, https://www.cemexmexico.com/-/cemex-alcanza-meta-en-reduccion-de-emisiones-siete-anos-antes-que-el-sector.

50. IEA, "Mexico - Efficiency & Demand," International Energy Agency (IEA), 2022, https://www.iea.org/countries/mexico/efficiency-demand.

51. Vianey Amellali García Moreno and Carlos David Franco Vergara, "El Sistema de Comercio de Emisiones en México: Avances y Retos actuales," Redacción Factor Energético, January 27, 2025, https://factorenergetico.mx/el-sistema-de-comercio-de-emisiones-en-mexico-avances-y-retos-actuales/.

52. CSR Staff, "Sistema de Comercio de Emisiones en México: Como Funciona y Explicación," CSR Consulting, 2023, https://www.csrconsulting.com.mx.

53. Daniela Villanueva et al., "Mexico ETS Delay Likely to Persist on Regulatory Uncertainty, Lack of Political Will: Sources," S&P Global, 2024, https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/energy-transition/040324-mexico-ets-delay-likely-to-persist-on-regulatory-uncertainty-lack-of-political-will-sources.

54. Simon Black et al., "A Comprehensive Climate Mitigation Strategy for Mexico," *IMF Working Papers*, IMF Working Papers 2021, no. 246 (2021), https://doi.org/10.5089/9781513599847.001.

55. UNIDO, "Mexico - Industrial Decarbonization Accelerator," United Nations Industrial Development Organization, 2023, https://www.industrialenergyaccelerator.org/where-we-work/mexico/.

56. IEA, "Mexico - Efficiency & Demand."

57. Sarah Heincke et al., "Decarbonizing Cement and Concrete Value Chains: Takeaways from Davos," McKinsey & Company, 2023, https://www.mckinsey.com/industries/engineering-construction-and-building-materials/our-insights/decarbonizing-cement-and-concrete-value-chains-takeaways-from-davos.

58. Claudia Cardenas, "INTERVIEW: Mexican Steel Industry Must Seek Regional Strengthening in 2025: Canacero," S&P Global Commodity Insights, December 12, 2024, https://www.spglobal.com/commodity-insights/en/news-research/latest-news/metals/121224-interview-mexican-steel-industry-must-seek-regional-strengthening-in-2025-canacero.

59. Oskaras Alšauskas et al., "Global EV Outlook 2024. Moving Towards Increased Affordability," International Energy Agency (IEA), 2024, https://www.iea.org/reports/global-ev-outlook-2024.

60. MBN Staff, "Mexico's EV and PHEV Sales Surge 83.8% in 2024," Mexico Business News, January 15, 2025, https://mexicobusiness.news/automotive/news/mexicos-ev-and-phev-sales-surge-838-2024.

61. Secretaria de Medio Ambiente y Recursos Naturales, "Estrategia Nacional de Movilidad Eléctrica."

62. Nuccitelli, "What Is Mexico Doing About Climate Change?"

63. "Electric Vehicle Adoption In Mexico: What Does the Future Hold?," Frotcom Intelligent Fleets, 2024, https://www.frotcom.com/blog/2024/04/electric-vehicle-adoption-mexico-what-does-future-hold.

64. Frotcom Intelligent Fleets, "Electric Vehicle Adoption In Mexico: What Does the Future Hold?"

65. Jorge Alberto Rosas Flores et al., "Effects of Removing Energy Subsidies and Implementing Carbon Taxes on Urban, Rural and Gender Welfare: Evidence from Mexico," *Energies* 17, no. 9 (2024): 2237, https://doi.org/10.3390/en17092237.

66. Aida Pelaez-Fernandez, "Mexico Makes Lots of Electric Cars, But Few Mexicans Drive Them," Reuters, 2023, https://www.reuters.com/business/autos-transportation/mexico-makes-lots-electric-cars-few-mexicans-drive-them-2023-03-21/.

67. Jordi Tovilla et al., *Pathways to Deep Decarbonization in Mexico* (Sustainable Development Solutions Network (SDSN) and Institute for Sustainable Development and International Relations (IDDRI), 2015), https://ddpinitiative.org/wp-content/pdf/DDPP_MEX.pdf.

68. Daniel Buira et al., "A Whole-Economy Deep Decarbonization Pathway for Mexico," *Energy Strategy Reviews* 33 (January 2021): 100578, https://doi.org/10.1016/j.esr.2020.100578.

69. Tovilla et al., *Pathways to Deep Decarbonization in Mexico*.

70. Marco Heredia and Beatriz Corral, "Climate Governance and Federalism in Mexico," in *Climate Governance and Federalism. A Forum of Federations Comparative Policy Analysis*, ed. Alan Fenna et al. (Cambridge University Press, 2023), https://doi.org/10.1017/9781009249676.012.

71. Teresa Ter-Minassian, *Fiscal Federalism in Theory and Practice* (International Monetary Fund, 1997), https://doi.org/10.5089/9781557756633.071.

72. Mariela Dal Borgo, "Effect of a Transfer Shock on Subnational Debt: Micro Evidence from Mexico," *Journal of Public Economics 239* (November 2024): 105251.

73. Luis Felipe Munoz et al., "Mexico - Overview," PwC, *Worldwide Tax Summaries*, April 2025, https://taxsummaries.pwc.com/mexico.

74. Ley General de Cambio Climático (2012), https://www.diputados.gob.mx/LeyesBiblio/pdf/LGCC.pdf.

75. Ley General de Cambio Climático.

76. Ley General de Cambio Climático.

77. Ley General de Cambio Climático.

78. Heredia and Corral, "Climate Governance and Federalism in Mexico."

79. Ley General de Cambio Climático.

80. Ley General de Cambio Climático.

81. Kalyan Keo et al., *Reforzar La Acción Climática Para Alcanzar Los Objetivos de Desarrollo Sostenible* (UNDP, 2016), https://www.undp.org/sites/g/files/zskgke326/files/publications/1-44%20Climate%20Change-SP-final-web.pdf.

82. World Bank, "State and Trends of Carbon Pricing Dashboard," World Bank Group, November 1, 2023, https://carbonpricingdashboard.worldbank.org/compliance/factsheets.

83. Instituto Nacional de Ecología y Cambio Climático, "Sistema Nacional de Cambio Climático (SINACC)," Gobierno de México, May 18, 2018, http://www.gob.mx/inecc/acciones-y-programas/sistema-nacional-de-cambio-climatico-sinacc.

84. Alina Averchenkova and Sandra L Guzman Luna, Mexico's General *Law on Climate Change: Key Achievements and Challenges Ahead* (London School of Economics and Political Science (LSE), 2018), https://www.lse.ac.uk/granthaminstitute/wp-content/uploads/2018/11/Policy_report_Mexico%E2%80%99s-General-Law-on-Climate-Change-Key-achievements-and-challenges-ahead-29pp_AverchenkovaGuzman-1.pdf.

85. Heiner von Lupke and Mareike Well, "Analyzing Climate and Energy Policy Integration: The Case of the Mexican Energy Transition," *Climate Policy*, National Development and Mitigation Pathways, vol. 20, no. 7 (2020): 832–45., https://doi.org/10.1080/14693062.2019.1648236.

86. Mexico Projects Hub, "Electricity - Investment Cycle," Gobierno de Mexico, 2025, https://www.proyectosmexico.gob.mx/en/how-mexican-infrastructure/investment-cycle/electricity/.

87. Ley General de Cambio Climático.

88. Georgina Gutierrez et al., "México apuesta por un nuevo modelo de planeación energética con un enfoque social y climático," Garrigues, May 19, 2025, https://www.garrigues.com/es_ES/noticia/mexico-apuesta-nuevo-modelo-planeacion-energetica-enfoque-social-climatico.

89. Gutierrez et al., "México apuesta por un nuevo modelo de planeación energética con un enfoque social y climático."

90. Erick Gallego et al., *Reformas al Sector Energético - Parte III: Ley de Planeación y Transición Energética* (Greenberg Traurig, 2025), https://www.gtlaw.com/en/insights/2025/2/reformas-al-sector-energetico--parte-iii--ley-de-planeacion-y-transicion-energetica.

91. Comisión Nacional para el Uso Eficiente de la Energía, "Comisiones Estatales de Energía, Estados y Municipios," Gobierno de Mexico, http://www.gob.mx/conuee/acciones-y-programas/comisiones-estatales-de-energia-estados-y-municipios?state=published.

92. Comisión Estatal de Energía - Baja California, "Energía Sustentable, Para Una Mejor Calidad de Vida," Gobierno Del Estado - Baja California, 2024, https://energiabc.gob.mx/Nosotros.

93. Agencia de Energía del Estado de Campeche (AEEC), "Modelo de Participación," AEEC, 2024, https://agenciaenergiacampeche.gob.mx/75-2.

94. Comisión Nacional para el Uso Eficiente de la Energía, "Comisiones Estatales de Energía, Estados y Municipios."

95. David L. Goldwyn and Cesar Emiliano Hernandez Ochoa, "Mexico's New Electricity Law Could Boost the Country's Energy Sector. But Big Questions Remain.," *Atlantic Council*, March 11, 2025, https://www.atlanticcouncil.org/blogs/new-atlanticist/mexicos-new-electricity-law-could-boost-the-countrys-energy-sector/.

96. Hernan Gonzales Estrada et al., "Mexico Restructures the Electricity Sector," Norton Rose Fulbright, 2024, https://www.projectfinance.law/publications/2024/november/mexico-restructures-the-electricity-sector/.

97. Riccardo Bracho et al., *Evaluación energética de la península de Yucatán: Vías para un sistema energético limpio y sustentable*, 2021, https://www.nrel.gov/docs/fy21osti/81142.pdf.

98. Raquel Bierzwinsky et al., "Mexico Enacts New Laws for the Power Sector," Norton Rose Fulbright, 2025, https://www.projectfinance.law/publications/2025/march/mexico-enacts-new-laws-for-the-power-sector/.

99. Estrada et al., “Mexico Restructures the Electricity Sector.”

100. Ley General de Cambio Climático.

101. Gobierno de la Ciudad de México, “Ciudad Solar,” Secretaria del Medio Ambiente, http://www.data.sedema.cdmx.gob.mx/cambioclimaticocdmx/ciudad_solar.html.

102. Constitución Política de Los Estados Unidos Mexicanos (1917), https://www.diputados.gob.mx/LeyesBiblio/pdf/CPEUM.pdf.

103. Estados Unidos Mexicanos, “Ley del Sector Eléctrico,” March 18, 2025, https://www.diputados.gob.mx/LeyesBiblio/pdf/LSE.pdf.

104. Gobierno de la Ciudad de México, “Ciudad Solar.”

105. Fernanda González, “Estos son los 10 obstáculos que frenan la transición a energías limpias en México,” WIRED, January 25, 2024, 10, https://es.wired.com/articulos/10-obstaculos-que-frenan-energias-limpias-en-mexico.

106. Rainer Grote, tran., “Mexico 1917 (Rev. 2007),” Constitute Project, https://www.constituteproject.org/constitution/Mexico_2007.

107. Gobierno de México, “Secretaría de Medio Ambiente y Recursos Naturales,” Gobierno de México, https://www.gob.mx/semarnat.

108. Instituto Nacional de Ecología y Cambio Climático, “Implementación de una estrategia nacional para mitigar las emisiones de metano del sector ganadero,” Gobierno de México, July 21, 2025, http://www.gob.mx/inecc/articulos/implementacion-de-una-estrategia-nacional-para-mitigar-las-emisiones-de-metano-del-sector-ganadero.

109. Gobierno de México, “Comisión Nacional Del Agua,” Gobierno de México, https://www.gob.mx/conagua.

110. Grote, “Mexico 1917 (Rev. 2007).”

111. “Mexico Livestock Project Protocol Development,” Climate Action Reserve, https://climateactionreserve.org/how/protocols/waste/mexico-livestock/dev/.

112. Miles O’Brien and Will Toubman, “Farmers Turn to Seaweed in Attempt to Reduce Methane Emissions from Livestock,” PBS News, April 14, 2025, https://www.pbs.org/newshour/show/farmers-turn-to-seaweed-in-attempt-to-reduce-methane-emissions-from-livestock.

113. Ley General para la Prevención y Gestión Integral de los Residuos (2023), https://www.diputados.gob.mx/LeyesBiblio/pdf/LGPGIR.pdf.

114. The Global Green Growth Institute, *Mexico Subnational Strategy 2022-2025* (The Global Green Growth Institute, 2023), https://gggi.org/wp-content/uploads/2023/05/SUBNATIONAL-STRATEGY-V4.pdf.

115. Ley General para la Prevención y Gestión Integral de los Residuos.

116. Eliza Galeana, “Senate Proposes New Circular Economy Law Focused on Biogas,” Mexico Business News, June 20, 2025, https://mexicobusiness.news/policyandeconomy/news/senate-proposes-new-circular-economy-law-focused-biogas.

117. Ley de Economía Circular de la Ciudad de México, Congreso de la Ciudad de México II Legislatura (2023), https://www.sedema.cdmx.gob.mx/storage/app/uploads/public/640/775/796/640775796545e564034573.pdf.

118. Paula Garcia Holley et al., “Mexican Waste Sector Methane Analysis,” *Clean Air Task Force*, October 28, 2024, https://www.catf.us/resource/mexican-waste-sector-methane-analysis/.

119. Holley et al., “Mexican Waste Sector Methane Analysis.”

120. Secretaría de Medio Ambiente y Recursos Naturales, “¿Qué Hacemos?,” Gobierno de México, https://www.gob.mx/semarnat/que-hacemos.

121. "Mexican Official Standards (NOM)," airCO2, https://www.airco2.earth/en/resources/glossary/normas-oficiales-mexicanas-nom.

122. Cooperacion Clima GIZ México, "NAMA PyME: Las PyMES Como Contribución a Una Economía Baja En Carbono," https://cooperacionclima.com.mx/proyecto/detalle?id=9.

123. Secretaría de Comunicaciones y Transportes, "Subsecretaría de Transporte," Gobierno de México, March 26, 2024, http://www.gob.mx/sct/acciones-y-programas/subsecretaria-de-transporte.

124. Ciudades y Transporte Sustentable, "The Digitalization of Public Transport in Mexican Cities," Ciudades y Transporte Sustentable, December 2024, https://ciudadesytransporte.mx/wp-content/uploads/2024/12/executive_summary_the_digitalization_of_public_transport_in_mexican_cities.pdf.

125. Carlos Rosado van der Gracht, "Electric Vehicle Market Shows Strong Growth in Mexico," Yucatán Magazine, March 25, 2025, https://yucatanmagazine.com/electric-vehicle-mexico/.

126. Michelle Meyer et al., *Assessment of Real-World Passenger Vehicle and Taxi Emissions in Mexico City* (The Real Urban Emissions Initiative, 2024), https://trueinitiative.org/wp-content/uploads/2024/11/id-79-mexico-city-rs_report_final.pdf.

127. Buira et al., "A Whole-Economy Deep Decarbonization Pathway for Mexico."

128. Comunicación Social Del Gobierno Del Estado De Jalisco, "Este domingo inicia operaciones Mi Transporte Eléctrico, la primera ruta eléctrica en México," July 3, 2021, https://www.jalisco.gob.mx/es/prensa/noticias/128670.

129. MBN Staff, "Puerto Vallarta Unveils Electric Public Transport System," Mexico Business News, January 6, 2025, https://mexicobusiness.news/mobility/news/puerto-vallarta-unveils-electric-public-transport-system.

130. Heredia and Corral, "Climate Governance and Federalism in Mexico."

131. Estados Unidos Mexicanos, "Ley del Sector Eléctrico."

132. Comunicación Social Del Gobierno Del Estado De Jalisco, "Este domingo inicia operaciones Mi Transporte Eléctrico, la primera ruta eléctrica en México."

133. Bracho et al., *Evaluación energética de la península de Yucatán: Vías para un sistema energético limpio y sustentable*.

134. OECD/UNDP, Investing in Climate for Growth and Development: The Case for Enhanced NDCs (OECD Publishing, 2025), https://doi.org/10.1787/16b7cbc7-en.

135. OECD/UNDP, *Investing in Climate for Growth and Development: The Case for Enhanced NDCs*.

Appendix Endnotes

1. Katherine Calvin et al., "GCAM v7.1 Documentation: Common Assumptions," GitHub, 2024, https://jgcri.github.io/gcam-doc/toc.html.

2. L Clarke et al., "CO2 Emissions Mitigation and Technological Advance: An Updated Analysis of Advanced Technology Scenarios," US Department of Energy & Pacific Northwest Laboratory, 2008, https://www.pnnl.gov/science/pdf/PNNL18075.pdf.

3. Jae Edmonds et al., "An Integrated Assessment of Climate Change and The Accelerated Introduction of Advanced Energy Technologies," Mitigation and Adaptation Strategies for Global Change 1, no. 4 (1997): 311–39, https://doi.org/10.1007/BF00464886.

4. C. A. Hartin et al., "A Simple Object-Oriented and Open-Source Model for Scientific and Policy Analyses of The Global Climate System – Hector v1.0," Geoscientific Model Development 8, no. 4 (2015): 939–55, https://doi.org/10.5194/gmd-8-939-2015.

5. Menon and Stracca, NGFS Scenarios for Central Banks and Supervisors - Phase IV.

6. Menon and Stracca, NGFS Scenarios for Central Banks and Supervisors - Phase IV.

7. Secretaría de Medio Ambiente y Recursos Naturales, México: Informe Del Inventario Nacional de Emisiones de Gases y Compuestos de Efecto Invernadero, 1990-2022.

8. Ember, “Electricity Data Explorer - Open Source Global Electricity Data.”

9. Ember, “Electricity Data Explorer - Open Source Global Electricity Data.”

10. GEM, “Global Oil and Gas Plant Tracker.”

11. GEM, “Global Oil and Gas Plant Tracker.”