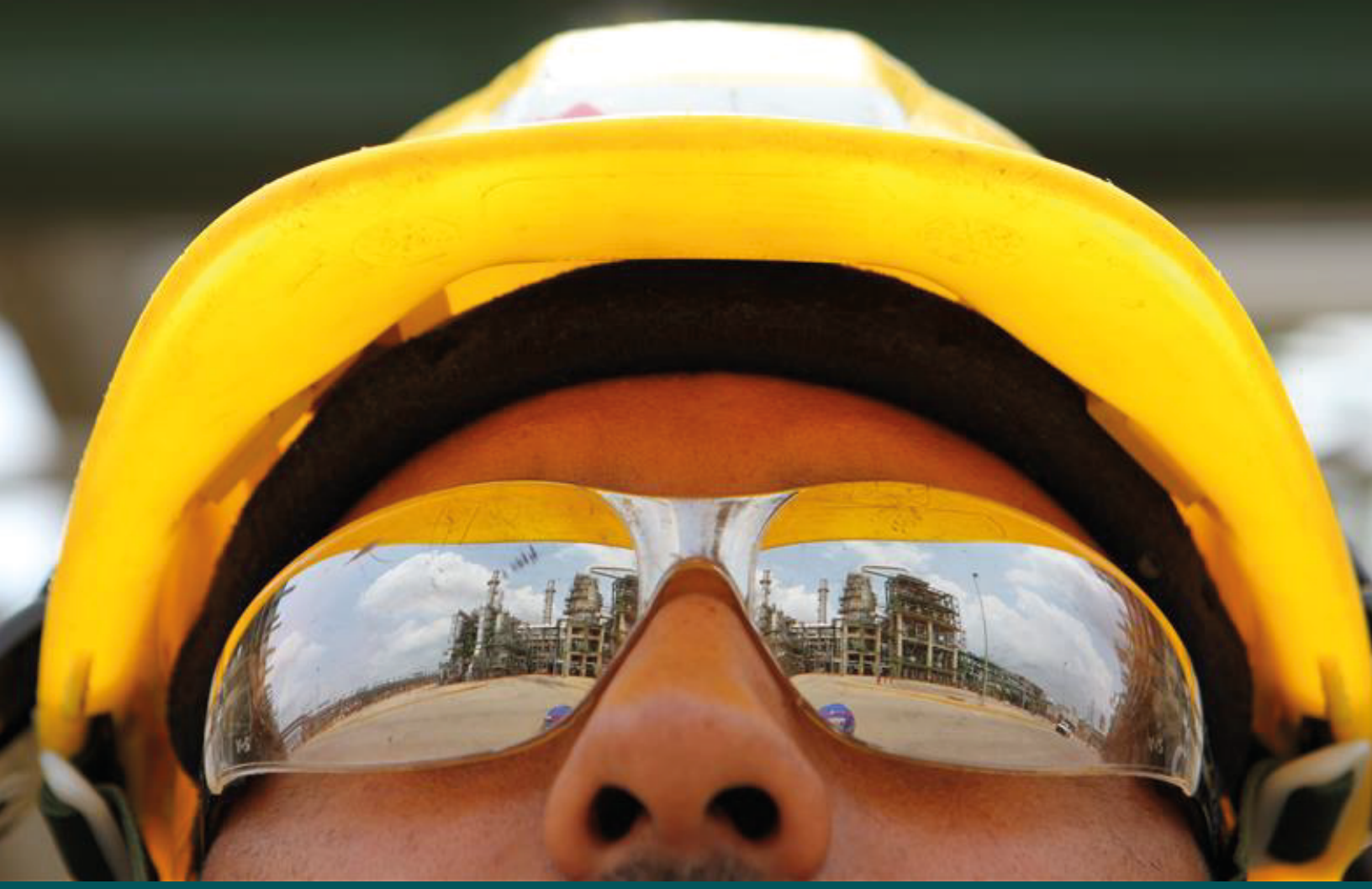


Gas in Mexico: Risks and Alternatives for a Sustainable Energy Model

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Executive summary

Gas[1] is a core fuel in the Mexican energy system: it supplies nearly 60 percent of national electricity generation and is a key input for industry and Pemex's operations. Its expansion in recent decades was made possible by access to gas from the United States, which has led to growing dependence on imports. Today, more than 70 percent of the gas consumed in Mexico is imported, mainly through pipelines from Texas, creating vulnerabilities that require strategic management.

This discussion paper examines three assumptions that have underpinned Mexican energy policy in recent years:

- Mexico will have sustained access to an abundant and reliable supply of natural gas
- The price of natural gas in the United States will remain low and stable
- Natural gas does not compromise Mexico's climate and energy transition goals.

Public debate of these assumptions has been limited, making it difficult to identify vulnerabilities and mitigate risks. This paper seeks to enrich the debate by analyzing the benefits and risks of gas in an increasingly dynamic and uncertain national and global context. Factors such as geopolitical realignments, shifting trade patterns, the climate emergency, and the global energy transition have increased the risks associated with Mexico's growing dependence on gas.

More specifically, we analyze three aspects of dependence:

- **Dependence on external sources of supply:** Mexico meets a significant share of its natural gas demand through imports, almost all of which come from the United States.
- **Technological dependence:** The dominance of combined-cycle power plants has resulted in a highly specialized power system designed around the use of gas as its main fuel.
- **Logistical dependence**: Natural gas imports flow through a limited number of pipelines and entry points and the country has limited storage capacity (equivalent to just 2.4 days of consumption).

The growing reliance on natural gas has worsened the country's energy vulnerabilities, making it more susceptible to shocks. Without proper management, this dependence can be risky and have serious socioeconomic consequences. It is therefore important to analyze the emerging risks and assess how compatible the current gas strategy is with Mexico's broader energy policy objectives.

1 Unless otherwise indicated, in this document NRGI uses the term "gas" to refer to natural gas, defined in the *Hydrocarbons Sector Law* (Ley del Sector Hidrocarburos, LSH) as a "mixture of gases obtained from extraction or industrial processing and consisting mainly of methane and other, heavier hydrocarbon gases. It may also contain nitrogen, carbon dioxide and hydrogen sulphide, among other compounds. It may be associated natural gas, non-associated natural gas, gas associated with coal, or gas from industrial processing." *Ley del Sector Hidrocarburos, Nueva Ley publicada en el* Diario Oficial de la Federación, 18 March 2025, available at: www.diputados.gob.mx/LeyesBiblio/pdf/LSH.pdf

Supply Risks

These risks refer to threats of physical interruption to natural gas flows, or operational, political and natural events that make gas unavailable. Fortuitous or man-made events may prevent expected volumes of gas from reaching their intended locations on time. The disruptions can be short-term, such as failures of critical infrastructure, extreme weather events, accidents, attacks, or political decisions that temporarily restrict gas trade; or longer-term, such as a structural decline in regional production or the rerouting of gas flows toward more profitable markets. Since the impact of each disruption will depend on its scope and duration, each requires a unique response.

In Mexico, the assumption that natural gas is an abundant, easily accessible resource has proven true in recent decades, thanks to oversupply in the United States and physical integration between the two markets. This has allowed Mexico to maintain a high share of gas in the energy mix without significantly increasing domestic production or implementing an ambitious technological diversification strategy. However, risk arises when this assumption is treated as a permanent condition rather than as a dynamic circumstance, subject to geopolitical, technical, and market shifts.

Mexico urgently needs to update the analytical framework used to assess energy dependence, so that it can closely examine three important supply risks:

- The new geopolitical environment with its renewed focus on security of supply, driven by national security concerns, strategic competition and efforts to strengthen domestic production capacity.
- Bilateral tensions between Mexico and the United States, which could lead to natural gas being used as a geopolitical tool.
- Extreme weather events, such as Winter Storm Uri in 2021, which exposed the vulnerability of natural gas supply and the lack of resilience in the energy system.

Economic Risks

These risks reflect gas dependence's impact on energy costs and the broader performance of the national economy. This type of risk considers Mexico's exposure to a range of external factors that can affect the price, availability or conditions of its access to natural gas, and influence the planning and sustainability of the national energy model.

Mexico's recent energy policy has assumed that U.S. gas prices will remain low and stable, which would justify structuring much of the national energy infrastructure around this resource. As a result, Mexico has chosen to take advantage of low prices, integrating its logistical infrastructure and developing domestic capacities to expand natural gas use, both in industrial processes and power generation.

The expansion of gas in Mexico and trade with the United States have generated positive economic effects over recent decades. Yet a side effect of low-cost imported gas has been a loss of incentives to produce it in Mexico, which has contributed to a sustained increase in imports. Over time, this scenario can expose economic vulnerabilities, especially when the planning and development of the energy system are structured around an external input over which Mexico has no direct control. The country needs to analyze three main risks:

- The volatility of imported natural gas prices, since prices in Mexico are subject to fluctuations in the U.S. market and to increasing exposure to global prices.

- Upward price pressures stemming from the expansion of liquefied natural gas (LNG) in the United States, which could raise the price of gas piped to Mexico by increasing international competition for the resource.

- Potential overinvestment in gas infrastructure that, under certain energy transition scenarios, could translate into stranded assets.

Environmental and Climate Risks

These risks stem from natural gas's environmental impacts. Although gas is less carbon-intensive than other fossil fuels, its use still generates greenhouse gas (GHG) emissions and poses sustainability challenges. This type of risk considers the environmental factors across the different stages of the gas value chain, from extraction to final consumption.

In recent decades, Mexico has built natural gas power plants and related infrastructure on the assumption that their environmental impacts are compatible with the country's climate and energy transition commitments. However, in the absence of rigorous management and sustained oversight, gas emissions can pose risks to the environment, public health and the country's climate goals.

The tension between Mexico's climate ambitions—for instance, achieving net-zero emissions by 2050 and generating 45 percent of electricity from clean sources by 2030—and its current energy policy, which focuses on increasing domestic gas production and expanding power generation through combined-cycle plants, requires deeper long-term consideration about the viability of gas. In particular, stakeholders should analyze three key risks:

- Natural gas's full life cycle emissions limit its environmental benefits compared to what is commonly assumed, especially when methane leaks are taken into account.

- The extraction of unconventional gas resources through fracking can impact water, land, local communities and the financial viability of large-scale development.

- The possibility of carbon lock-in, whereby structural dependence on gas in energy planning displaces or delays the development of renewable sources and other clean technologies.

Through discussion of the different types of risk, this paper offers sets of guiding questions to frame the debate. The aim is not to offer specific answers, but to highlight information gaps and areas that require further discussion. At NRGI, we intend to use these questions to frame discussions with experts and focus our work in Mexico on the most strategic and urgent issues related to natural gas.

1. Introduction

In Mexico, natural gas has become the main fuel used to generate electricity, displacing other more expensive or more polluting fuels such as fuel oil, diesel and coal. Today, around 60 percent of the electricity generated in Mexico comes from natural gas, both in state-owned Federal Electricity Commission (CFE) plants and in combined-cycle plants operated by private entities[2]. Natural gas also meets critical energy needs in industry and in Petróleos Mexicanos (Pemex) operations, so its availability and price have a direct impact on the country's economic competitiveness.

In a fast-evolving global environment, marked by geopolitical realignments, shifts in trade patterns, the climate emergency and the energy transition, Mexico's growing dependence on gas—particularly imported gas from the United States—poses significant challenges. Economic development in recent decades has benefited from access to such an affordable fuel. However, this pronounced dependence creates vulnerabilities that require strategic management. At the same time, the intensifying climate crisis, reflected in increasingly frequent extreme weather events and growing pressures to reduce GHG emissions, underscores the need to diversify the energy mix and make the energy system more resilient.

This discussion paper examines three key assumptions that have underpinned energy policy in recent years. The viability of Mexico's bet that gas will be a convenient, low-risk option for the country depends on whether these assumptions hold. These assumptions are:

- Mexico will have sustained access to an abundant and reliable supply of natural gas.
- The price of natural gas in the United States will remain low and stable.
- Natural gas will not compromise Mexico's climate and energy transition goals.

Regular public debate of these assumptions by decision-makers has been limited, which has hindered the timely identification of vulnerabilities and the mitigation of risks. This paper seeks to enrich that debate by analyzing the benefits and risks associated with gas, both in the national context and in an increasingly dynamic and uncertain global environment. Only a clear, well-founded assessment will make it possible to develop evidence-based strategies and public policies that bring together the objectives of energy security, economic development, environmental sustainability and social justice. This, in turn, will be key to strengthening the governance of the gas sector in Mexico.

2 Secretaría de Energía (Ministry of Energy, SENER), "Programas indicativos para la instalación y retiro de centrales eléctricas (PIIRCE)" (Indicative Programs for the Installation and Retirement of Power Plants, PIIRCE), *Programa de Desarrollo del Sistema Eléctrico Nacional 2024-2038 (National Electricity System Development Program 2024–2038)*, chapter 4, p. 97, available at: base.energia.gob.mx/PRODESEN2024/prodesen24-38cap4.PDF

2. Current context

Rapid growth in natural gas consumption, combined with declining domestic production, has increased dependence on external sources of supply. In particular, Mexico relies on gas imports from a single country, the United States, to meet most of its domestic demand, an atypical situation even among economies that are heavily dependent on natural gas imports[3]. Thus, Mexico has an energy model in which gas is dominant, domestic production does not cover consumption needs, and there are no strategic inventories or backup infrastructure in place to guarantee the country's energy security in the event of disruptions. This section explores the path that has led Mexico to this situation, defines the concept of energy dependence, and identifies the associated risks in terms of supply, economic, environmental and climate impacts.

The evolution of gas in the economy and in the power sector

Since the early 2000s, natural gas consumption in Mexico has grown rapidly, driven by its use in power generation. The expansion of combined-cycle gas plants, which are more efficient and have lower GHG emissions than other fossil options (as discussed later), together with lower fuel costs driven by the U.S. shale gas boom, have made gas a strategic option. In this way, it went from being a minor source at the beginning of the century to becoming the dominant fuel in the power sector, currently accounting for around 40 percent of installed capacity and 60 percent of actual generation, displacing traditional sources such as fuel oil and coal[4].

According to the Natural Gas Outlook 2023–2037 published by the Ministry of Energy (SENER), 59 percent of the natural gas used in Mexico is for power generation[5]. However, it is not the only sector that has increased its use of this fuel. At present, the industrial sector makes up around 17 percent of gas consumption, driven by the expansion of industrial parks and value chains for steel, glass, petrochemicals, manufacturing and food, among others[6]. On the other hand, 23 percent of natural gas is consumed by the oil sector, mainly by Pemex in its refining, steam generation and reservoir reinjection processes, among other operations[7]. Consumption in the residential and transport sectors remains incipient, accounting for only one percent of total national demand, due to limited gas distribution infrastructure in cities and the low uptake of gas-powered vehicles[8].

3 Comisión Nacional de Hidrocarburos (National Hydrocarbons Commission, CNH), "Prospectiva de la producción nacional de gas natural" (Outlook for National Natural Gas Production), p. 5, available at: www.gob.mx/cms/uploads/attachment/file/488400/Prospectiva_Produccion_Nacional_Gas_Natural__2_.pdf

4 Secretaría de Energía (Secretariat of Energy, SENER), "Balance Nacional de Energía 2000" (National Energy Balance 2000), 2001, p. 71, available at: www.cie.unam.mx/xml/se/pe/fmp/BALANCE_E_2000.pdf ; SENER, "Anexo 1. Infraestructura del Sistema Eléctrico Nacional" ("Annex 1. National Electricity System Infrastructure"), *Programa de Desarrollo del Sistema Eléctrico Nacional 2024-2038* (National Electricity System Development Program 2024–2038), p. 160, available at: base.energia.gob.mx/PRODESEN2024/prodesen24-38A1.PDF ; Government of Mexico, "Mexico's Plan. Strategy for Equitable and Sustainable Economic Development for Shared Prosperity" (First draft), 2025, slide 17, available at: embamex.sre.gob.mx/trinidadytobago/images/Cargar/turismocomercialesyculturales/English_Version_Plan_Mexico_2030-compressed.pdf

5 SENER, "Prospectiva de Gas Natural 2023-2037" (Natural Gas Outlook 2023–2037), p. 33, available at: base.energia.gob.mx/Prospectivas23/PGN_23-37_F.pdf

6 Ibid.

7 Ibid.

8 Ibid.

During the 1970s and 1980s, the development of large oil fields in the Gulf of Mexico, such as Cantarell, made it possible to meet domestic demand with associated gas, which in turn allowed for a relatively stable balance between natural gas production and consumption[9]. However, from the 2000s onwards, natural gas consumption in Mexico grew faster than production, leading to a steady increase in imports. Between 2014 and 2024, domestic natural gas production fell by 33 percent, from 5,758 million cubic feet per day (MMcfd) to 3,854 MMcfd[10], due to the depletion of mature fields and the lack of significant investment in exploration, among other factors. It also reflected Pemex's focus on crude oil production, given its higher profitability.

Mexico's gas deficit has increased over time. Pipeline imports rose from 913 MMcfd in 2010 to 6,421 MMcfd in 2024—a sevenfold uptick in a little over a decade[11]. By 2023, 73 percent of the country's natural gas consumption came from imports, mainly from the United States[12]. Thus, Mexico became the world's third-largest importer of natural gas by pipeline, behind only China and the United States, the latter a country that, in addition to being an exporter, also imports Canadian gas[13]. Various projections show this dependence on U.S. gas increasing in the coming years, driven by rising demand, the limitations of domestic production and the expansion of the gas pipeline network[14].

Pipeline expansion in Mexico has been a key factor in the country's growing gas imports. During the 2010s, following several episodes of scarcity that triggered critical alerts in the system, the gas pipeline network was significantly expanded to connect gas basins in southern Texas with Mexico's main demand centers[15]. Notable projects include the Los Ramones pipeline and the South Texas–Tuxpan offshore pipeline. These projects deepened Mexico's integration with the U.S. gas market, enabling large volumes of shale gas from the Permian Basin and the Eagle Ford formation to flow into the country. As a result, Mexico's gas pipeline network expanded from 11,300 km to 19,000 km between 2012 and 2024[16]. Likewise, the number of entry points rose from 9 in 2000 to 24 in 2024[17]. Over the same period, however, the development of gas storage infrastructure was minimal: current storage capacity amounts to roughly 2.4 days of national consumption. This deviates from most importing countries, which typically maintain reserves covering weeks or even months[18].

9 Javier Estrada, Víctor Rodríguez and Víctor Hugo Ventura, *El gas natural en México. Impacto de la política de autosuficiencia, seguridad y soberanía en la transición y la integración energética regional* (Natural Gas in Mexico. Impact of Self-Sufficiency, Security and Sovereignty Policy on the Energy Transition and Regional Integration), Economic Commission for Latin America and the Caribbean (ECLAC), 2022, available at: repositorio.cepal.org/server/api/core/bitstreams/49810616-0d2c-44c6-80f8-aa5a250f9be1/content

10 Ibid.; SENER, "Prospectiva de Gas Natural 2023-2037" (Natural Gas Outlook 2023–2037), p. 49, available at: base.energia.gob.mx/Prospectivas23/PGN_23-37_F.pdf; SENER, "Estrategia Nacional del Sector de Hidrocarburos y Gas Natural" (National Strategy for the Hydrocarbons and Natural Gas Sector), 13 November 2024, p. 22, available at: factorenergetico.mx/wp-content/uploads/2024/11/13NOV2024-Estrategia-Nacional-del-Sector-Hidrocarburos-y-Gas-Natural-Pemex.pdf

11 U.S. Energy Information Administration (EIA), Natural Gas, available at: www.eia.gov/dnav/ng/hist/n9132mx2a.htm

12 Octavio Amador, "Importación de gas natural desde EU marcó récord con AMLO" ("Natural Gas Imports from the US Reached a Record under AMLO"), *El Economista*, 12 December 2024, available at: www.eleconomista.com.mx/empresas/importacion-gas-natural-eu-marco-record-amlo-20241212-738051.html

13 Energy Institute, *Statistical Review of World Energy*, 2024, p. 45, available at: www.energyinst.org/statistical-review/home

14 Fitch Ratings, "Mexico Reliance on US Natural Gas to Grow Amid Rising Trade Tensions", 20 February 2025, available at: www.fitchratings.com/research/corporate-finance/mexicos-reliance-on-us-natural-gas-to-grow-amid-rising-trade-tensions-20-02-2025 ; Javier Estrada, Víctor Rodríguez and Víctor Hugo Ventura, *El gas natural en México. Impacto de la política de autosuficiencia, seguridad y soberanía en la transición y la integración energética regional* (Natural Gas in Mexico. Impact of Self-Sufficiency, Security and Sovereignty Policy on the Energy Transition and Regional Integration), Economic Commission for Latin America and the Caribbean (ECLAC), 2022, p. 91, available at: repositorio.cepal.org/server/api/core/bitstreams/49810616-0d2c-44c6-80f8-aa5a250f9be1/content

15 Lilia González, "Industria perdió US16,16350 millones por alertas de gas" ("Industry Lost US$.35 Billion Due to Gas Alerts"), *El Economista*, 24 January 2013, available at: www.eleconomista.com.mx/empresas/Industria-perdio-US16350-millones-por-alertas-de-gas-20130123-0117.html

16 SENER, Directorate-General for Natural Gas and Petrochemicals, "Estatus de gasoductos" ("Status of Gas Pipelines"), April 2018, p. 2, available at: www.gob.mx/cms/uploads/attachment/file/314344/Estatus_de_gasoductos_abril_2018.pdf ; SENER, "Prontuario Estadístico" ("Statistical Handbook"), March 2024, p. 10, available at: base.energia.gob.mx/dgaic/DA/P/SubsecretariaHidrocarburos/ProntuarioDeGasNaturalPetroquimicos/SENER_02_ProntuarioGNP_MAR24.pdf

17 Ibid., p. 11

18 Javier Estrada, Víctor Rodríguez and Víctor Hugo Ventura, *El gas natural en México. Impacto de la política de autosuficiencia, seguridad y soberanía en la transición y la integración energética regional* (Natural Gas in Mexico. Impact of Self-Sufficiency, Security and Sovereignty Policy on the Energy Transition and Regional Integration), ECLAC, 2022, p. 59, available at: repositorio.cepal.org/server/api/core/bitstreams/49810616-0d2c-44c6-80f8-aa5a250f9be1/content; Mexican Institute for Competitiveness (Instituto Mexicano para la Competitividad, IMCO), *Infraestructura de almacenamiento de gas natural para la seguridad energética* (Natural Gas Storage Infrastructure for Energy Security), 2022, p. 2, available at: imco.org.mx/wp-content/uploads/2022/11/Infraestructura-de-almacenamiento-de-gas-natural_Documento-2022.pdf

How is energy dependence defined?

SENER has acknowledged that "the downward trend in national natural gas production over the last decade has generated dependence on imports of this hydrocarbon"[19]. In simple terms, energy dependence refers to a country's inability to meet its energy needs with its own resources, forcing it to rely on external sources[20]. It is important to note that energy trade and integration of energy infrastructure are not inherently negative, as they provide economic benefits, strengthen energy security and can even align political interests between countries. However, when energy dependence intensifies and the relationship becomes asymmetric, vulnerabilities and risks can emerge for the importing country. In this context, energy dependence can be analyzed along the following three dimensions, which, in the case of gas in Mexico, are deeply interconnected:

- **Dependence on external sources of supply: this refers to the extent to which a country meets its demand through energy imports, and to the degree of concentration or diversification of its supply sources.** Mexico's case is notable: more than 70 percent of its natural gas consumption comes from abroad, mainly from a single country, as noted above. Whereas other importers such as France, Japan, Germany and Spain buy natural gas from multiple countries, thereby reducing geopolitical and market risks, Mexico has depended almost exclusively on its land border with the United States to meet demand.

- **Technological dependence: this refers to intensive reliance on a particular technology, together with the specific know-how and equipment, often of foreign origin, needed to use a given fuel.** Mexico shows a high degree of technological dependence in the power sector, driven by the dominance of combined-cycle plants that use natural gas as their main fuel. These plants currently account for 40 percent of installed capacity and 60 percent of total electricity generation in the country[21]. This concentration in a single technology means that equipment, operational know-how and control systems are optimized to maximize the efficiency of these plants. Most of them are designed and built by international companies. In recent decades, CFE has largely outsourced the development of these plants, initially through the Independent Power Producer (IPP) model—in which producers sold their electricity exclusively to CFE—and through the award of engineering, procurement and construction (EPC) contracts for the installation and commissioning of combined-cycle plants.

- **Dependence on infrastructure and logistics: this refers to the degree to which energy supply is constrained by the capacity, redundancy and resilience of transport and storage systems.** In the case of natural gas, factors include the number and types of routes used, entry points, volume distribution and potential bottlenecks or critical points of failure. For Mexico, this dependence is reflected in the high concentration of gas flows through a few pipelines and entry points,

19 Authors' translation. SENER, "Prospectiva de Gas Natural 2023-2037" (Natural Gas Outlook 2023–2037), p. 50, available at: base.energia.gob.mx/Prospectivas23/PGN_23-37_F.pdf

20 SENER, "Balance Nacional de Energía" ("National Energy Balance"), 2023, p. 40, available at: www.gob.mx/cms/uploads/attachment/file/977268/Balance_Nacional_de_Energ_a_2023.FINAL06.02.2025.1.pdf; Eurostat, "Statistics Explained: Energy dependency rate", available at: ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Energy_dependency_rate

21 SENER, "Anexo 1. Infraestructura del Sistema Eléctrico Nacional" ("Annex . National Electricity System Infrastructure"), Programa de Desarrollo del Sistema Eléctrico Nacional -2020 (National Electricity System Development Program 202438124–2038160), p. 160, available at: base.energia.gob.mx/PRODESEN2024/prodesen24-38A1.PDF, Government of Mexico, "Mexico's Plan. Strategy for Equitable and Sustainable Economic Development for Shared Prosperity" (First draft), 2025, slide 17, available at: embamex.sre.gob.mx/trinidadytobago/images/Cargar/turismocomercialesyculturales/English_Version_Plan_Mexico_2030-compressed.pdf

especially along the border with Texas[22]. In addition, limited storage capacity—equivalent to only 2.4 days of national consumption—means that the system operates under a *just-in-time* model, with no room for maneuver in the event of disruptions, which limits the ability to respond to contingencies.

These three dimensions—external sources of supply, technology and infrastructure/logistics—shape the phenomenon of energy dependence on gas. Understanding each of them individually helps to make visible the different challenges Mexico faces. For example, what are the implications of having a limited technology portfolio? How prepared is the country's power infrastructure to integrate clean energy sources? And how can the physical resilience of gas supply systems be strengthened in the face of disruptions or emergencies?

Current energy policy and the current government's plans

Since 2018, the principle of sovereignty has been one of the central pillars of Mexico's energy policy. This concept is associated with state ownership of resources, the strengthening of state-owned enterprises in the sector and self-sufficiency, understood as the aspiration not to depend on foreign countries to meet domestic demand. However, it has been applied in different ways depending on the resource in question. In liquid hydrocarbons, the sovereignty policy has sought to reduce gasoline imports by strengthening Pemex's production, through projects such as the Olmeca refinery in Dos Bocas and the acquisition of the Deer Park refinery, located in Texas. In the power sector, by contrast, sovereignty has meant limiting private companies' share of power generation to a maximum of 46 percent, guaranteeing CFE at least 54 percent, as well as promoting the rehabilitation of existing hydropower plants.

In the gas sector, the application of the concept of *energy sovereignty* has been ambiguous, as the government's promotion of this fuel for electricity generation contrasts with the goal of self-sufficiency and the aspiration to reduce dependence on external sources of supply. According to the National Electricity System Strengthening and Expansion Plan 2025–2030, 15 new combined-cycle power plants are expected to come online over this period, adding approximately 10,100 MW of generation capacity, which would come to represent 35 percent of total installed capacity, including both CFE and the private sector[23]. The government forecasts that the electricity generated by this type of power plant will increase from 213 TWh in 2024 to 243 TWh in 2030, a 14 percent increase. Under this scenario, the share of these plants in total generation would remain practically unchanged, moving only slightly from 60 percent to 59 percent[24]. CFE thus seeks to expand its asset base in order to meet growing national power demand and secure the minimum market share envisaged under the energy sovereignty approach.

On the other hand, the government has also promoted increased domestic gas production as part of its 2030 goals. Although Pemex has achieved modest increases in its production in recent years, thanks to the Quesqui and Ixachi fields in Tabasco and Veracruz, respectively, these

22 SENER, "Prontuario Estadístico" ("Statistical Handbook"), March 2024, p. 20, available at: base.energia.gob.mx/dgaic/DA/P/SubsecretariaHidrocarburos/ProntuarioDeGasNaturalPetroquimicos/SENER_02_ProntuarioGNP_MAR24.pdf

23 Federal Electricity Commission (Comisión Federal de Electricidad, CFE), "Plan de Fortalecimiento y Expansión del Sistema Eléctrico Nacional 2025-2030" (National Electricity System Strengthening and Expansion Plan 2025–2030), 5 February 2025, pp. 4–7, available at: factorenergetico.mx/wp-content/uploads/2025/02/05febrero26-Plan-Fortalecimiento-y-Expansion-Sistema-Electrico-Nacional.pdf

24 Government of Mexico, "Mexico's Plan. Strategy for Equitable and Sustainable Economic Development for Shared Prosperity" (First draft), 2025, slide 17, available at: embamex.sre.gob.mx/trinidadytobago/images/Cargar/turismocomercialesyculturales/English_Version_Plan_Mexico_2030-compressed.pdf

gains only partially offset the decline of mature fields[25]. As a result, Pemex's gas production remains below national demand, maintaining the need to continue importing gas from the United States, at least in the short and medium term. From an energy security perspective, this raises the question of whether this situation could open the door to greater participation by private producers in developing infrastructure and in exploiting gas fields.

Current policy assumes that the main way to reduce dependence on imported gas is to boost domestic production. For this reason, the government aims to increase natural gas production from 3,854 MMcfd in 2024 to 5,000 MMcfd by 2030, a 30 percent rise. However, this goal appears difficult to achieve given historical trends, and even if it did happen, it would not be enough to close the current gap since imports exceed 6,000 MMcfd[26]. To meet these new goals, the government plans to use the new legal framework published in March 2025, which introduces a system of mixed development assignments, under which Pemex will be able to complement its technical, operational, financial and execution capacity with support from the private sector[27]. Recent reports also indicate that the government has begun talks with private companies to explore the feasibility of fracking in certain shale formations, even though this runs counter to its electoral platform and its net-zero emissions goals for 2050, an issue discussed later in this paper[28]. Current plans also contemplate the possibility of doubling national gas storage capacity in the coming years[29].

25 Andrew Baker, "Mexico Natural Gas Production Slides Again Despite Record Ixachi Output", *Natural Gas Intelligence*, 26 November 2024, available at: www.naturalgasintel.com/news/mexico-natural-gas-production-slides-again-despite-record-ixachi-output/

26 SENER, "Estrategia Nacional del Sector de Hidrocarburos y Gas Natural" (National Strategy for the Hydrocarbons and Natural Gas Sector), 13 November 2024, p. 22, available at: factorenergetico.mx/wp-content/uploads/2024/11/13NOV2024-Estrategia-Nacional-del-Sector-Hidrocarburos-y-Gas-Natural-Pemex.pdf; Octavio Amador and Karol García, "Producción de gas natural de Pemex toca nivel mínimo de 232025 años" ("Pemex Natural Gas Production Falls to 30-Year Low"), El Economista, February , available at: www.eleconomista.com.mx/empresas/produccion-gas-natural-pemex-toca-nivel-minimo-30-anos-20250223-747628.html

27 *Ley del Sector Hidrocarburos* (Hydrocarbons Sector Law), *Nueva Ley publicada en el* Diario Oficial de la Federación, 18 March 2025, available at: www.diputados.gob.mx/LeyesBiblio/pdf/LSH.pdf

28 Reuters, "Mexico weighs increasing fracking to reduce reliance on US gas, FT reports", 7 April 2025, available at: www.reuters.com/business/energy/mexico-weighs-increasing-fracking-reduce-reliance-us-gas-ft-reports-2025-04-08/; National Electoral Institute (Instituto Nacional Electoral, INE), "Plataforma política de Morena, Proceso Electoral 2024" ("Morena Political Platform, 2024 Electoral Process"), p. 11, available at: portal.ine.mx/wp-content/uploads/2024/02/MORENA-PlataformaElectoral-VInculos.pdf; Secretariat of Environment and Natural Resources (Secretaría de Medio Ambiente y Recursos Naturales, Semarnat), press release "México reafirmó su compromiso con la acción climática ambiciosa en la COP29" ("Mexico reaffirmed its commitment to ambitious climate action at COP29"), 27 November 2024, available at: www.gob.mx/semarnat/prensa/mexico-reafirmo-su-compromiso-con-la-accion-climatica-ambiciosa-en-la-cop29?idiom=es

29 Diego Oré, "Mexico to speed up plans to double gas storage capacity amid Trump supply fears", *Reuters*, 29 January 2025, available at: www.reuters.com/business/energy/mexico-speed-up-plans-double-gas-storage-capacity-amid-trump-supply-fears-2025-01-29/

3. Vulnerability and growing risks

As mentioned previously, not all energy dependence is negative; if well managed, it can strengthen a country's energy security. In other words, dependence does not always equate to vulnerability, nor does all vulnerability stem from dependence[30]. In Mexico's case, gas from Texas has been supplied over recent decades in an affordable and reliable way, contributing to the competitiveness of the national economy and creating a perception of security of supply. Both countries have benefited: Mexico has received abundant, low-cost gas, while the United States has obtained revenue and stability for its producers, who have found a market for their gas, helping to sustain hydrocarbon production.

However, this picture has begun to change in recent years. If we start from the financial principle that "past performance does not guarantee future returns or results," the deepening of dependence has exacerbated the country's energy vulnerabilities, making it more susceptible to adverse conditions. In certain circumstances, and in the absence of proper management of vulnerabilities, dependence can be risky and have serious socioeconomic consequences. To determine the degree of vulnerability, it is important to carry out a thorough analysis of the types of risks that have emerged, as well as to assess how compatible the current gas strategy is with energy policy goals.

Dependence on gas from the United States, which accounts for the bulk of national consumption and electricity generation, combined with dependence on critical infrastructure to deliver this gas in a system with limited redundancy, exposes Mexico to events and decisions by external actors beyond its control. This reality challenges the notion of energy sovereignty that has guided the government to date and raises questions as to whether this is the most appropriate framework for addressing gas-related challenges and designing solutions. In this context, energy sovereignty should not be limited to increasing domestic gas production to achieve self-sufficiency, but should be broadened to include other domestic energy sources that strengthen Mexico's energy security. Although it is interpreted in various ways, most definitions agree that energy security refers to the availability of a reliable, affordable and sustainable energy supply that reduces vulnerabilities[31]. From this perspective, it is possible to explore alternative and complementary measures, with lower environmental and social impacts, in order to reduce energy dependence.

Applied to gas in Mexico, an energy security lens offers a more flexible perspective, focused on maximizing alternatives that meet the country's energy needs without making gas imports indispensable for the continued operation of the national electricity system and Mexican industry. This broader vision opens the door to a portfolio approach that, in addition to valuing increases in domestic production, promotes solutions aligned with the principle of sovereignty, such as energy diversification, technological substitution, energy

30 Víctor Rodríguez, Seguridad energética. *Análisis y evaluación del caso de México (Energy Security. Analysis and Assessment of the Case of Mexico*), "Estudios y Perspectivas" ("Studies and Perspectives") series, ECLAC Subregional Headquarters in Mexico, 2018, p. 21, available at: repositorio.cepal.org/server/api/core/bitstreams/7b0b428a-070e-49cb-815d-baf161c92a0f/content

31 Ibid., pp. 19–20; Aaron Sayne and Thomas Scurfield, "Goal 2: Achieving Energy Security, *Framework for Countries Evaluating Gas-to-Power Pathways",* Natural Resource Governance Institute, February 2024, p. 4, available at: resourcegovernance.org/sites/default/files/2024-02/gas_to_power_goal_2_achieving_energy_security.pdf

demand management and electrification of end uses, among others.

Building on the above, the first step in addressing Mexico's dependence on gas is to characterize the risks the country faces, understood as the likelihood that a specific harm will occur because of a vulnerability[32]. The following section presents three categories of risks that should be considered:

- **Supply risks: these refer to threats of physical interruption or constraints on the availability of gas.** They include events such as technical failures, natural disasters or political and commercial decisions at the source of supply that can restrict flows to Mexico. This category assesses the energy system's vulnerability to external shocks and how disruptions to supply could affect the operation of the country's energy system.

- **Economic risks: these refer to the impact of dependence on energy costs and on the competitiveness of the national economy more broadly.** These relate to a country's exposure to external factors that can affect the price, availability or conditions of access to energy resources, as well as to their influence on the planning and sustainability of the national energy model.

- **Environmental and climate risks: these refer to the environmental impacts associated with using gas as a central element of the energy mix.** Although this fossil fuel is less carbon-intensive than others, its use still generates GHG emissions and poses sustainability challenges. This also considers environmental impacts across the different stages of the gas value chain—from extraction through to final consumption—as well as alignment with climate commitments, sustainable development principles and the country's energy transition goals.

The following sections analyze each of these risk categories in turn and end with a set of guiding questions designed to highlight information gaps and areas for further discussion. The paper concludes with an overall reflection on the role of gas in Mexico and the priorities identified.

1. Supply Risks

Supply risks refer to threats of physical interruption of natural gas flows, or to operational, political or natural constraints that affect the continuous availability of gas[33]. In other words, they involve situations—whether natural or human-made—that can prevent gas from reaching the quantities required, at the times and locations where it is needed. These risks range from short-term disruptions—such as failures of critical infrastructure, extreme weather events, accidents, attacks or political decisions that temporarily restrict gas trade—to long-term scenarios, such as a structural decline in regional gas production or the rerouting of gas flows toward more profitable markets. Not all disruptions have the same consequences: the impact of each event varies according to its scope and duration. Each type of disruption therefore requires a tailored response protocol. Understanding this spectrum of risks is the starting point for realistically assessing the security of supply and the assumptions on which it rests.

In Mexico, growing technological, infrastructure and logistical dependence—combined with the

32 Víctor Rodríguez, *Seguridad energética. Análisis y evaluación del caso de México (Energy Security. Analysis and Assessment of the Case of Mexico*), Serie "Estudios y Perspectivas", ECLAC Subregional Headquarters in Mexico, 2018, p. 21, available at: repositorio.cepal.org/server/api/core/bitstreams/7b0b428a-070e-49cb-815d-baf161c92a0f/content

33 This description of risks is based on what is established by the International Energy Agency (IEA), which defines energy security as the uninterrupted availability of energy sources at an affordable price. For more information, see the Agency's glossary: www.iea.org/glossaryhttps://www.iea.org/glossary

concentration of gas supply in a single external source—poses a significant challenge for the resilience of the energy system. Although this trend has been recognized by specialists, sector stakeholders and even some government entities over the past decade, responses have been partial, and a comprehensive strategy to address disruptive events more effectively has yet to be put in place.

Tolerance for supply risks rests on a central assumption: that gas is an abundant, reliably accessible resource, readily available thanks to surplus production in the United States. This assumption is built on two key facts. First, the shale gas boom, which triggered an unprecedented increase in production and redefined that country's energy position: from concerns about scarcity to becoming the world's largest producer[34]. Second, infrastructure development, which has enabled Mexico to capitalize on that abundance of gas. The construction of cross-border interconnections and the expansion of the domestic gas pipeline network have tightly linked the Mexican and U.S. markets, increasing both the routes available and the capacity to receive gas from Texas. Taken together, these two elements—structural oversupply in the United States and physical integration between the two markets—have reinforced the idea that natural gas supply would be not only sufficient but also reliable in the long term. A reflection of this can be seen in the current government's plans, which implicitly assume high levels of imports by keeping gas's share of the electricity mix constant, without significantly increasing domestic production or implementing an ambitious strategy of technological diversification.

The assumption of an abundant and reliable supply is not, in itself, mistaken. Under an energy security paradigm, trade and the regional integration of energy supply chains are not inherently problematic or undesirable. On the contrary, they can generate efficiencies, add resilience and redundancy to energy systems and even foster cooperation and trust between countries. This has largely been the case for Mexico and the United States over recent decades, during which supply has, on average, been continuous and stable, with positive effects for the regional economy.

The risk arises when this assumption is treated as a permanent condition rather than as a dynamic circumstance, subject to geopolitical, technical and market changes. In such cases, dependence can intensify and create asymmetric relationships between countries, thereby increasing the vulnerability of the importing country. To mitigate supply risks, it is necessary to adopt a forward-looking perspective and analyze alternatives under different scenarios. In Mexico's case, the assumption of an abundant and reliable supply has not been subjected to the rigorous technical analysis it warrants. This is reflected in current energy policy goals, which aim to expand generation from combined-cycle power plants and to maintain natural gas as the backbone of the national electricity system, on the assumption that supply from the United States will remain constant and secure. Without deeper risk analysis, this assumption could limit the country's ability to anticipate potential disruptions or changes in the international context.

The gas industry, which is strategic for the country, is still operating under assumptions similar to those that prevailed when imports first began to rise steadily. For this reason, it is urgent to update the analytical framework used to assess energy dependence. The following sections examine the factors and context that should be taken into account to clearly analyze the supply risks that Mexico faces.

34 International Energy Agency (IEA), "Natural gas", available at: www.iea.org/world/natural-gashttps://www.iea.org/world/natural-gas

The new geopolitical environment and the renewed focus on the security of supply

The way the reliability of imported gas supply is assessed is changing as a result of profound shifts in the global economic and geopolitical environment. After several decades of progressive globalization, the world has shifted toward an environment marked by greater protectionism, economic nationalism, proactive industrial policies, self-sufficiency strategies and *reshoring* of value chains, as well as renewed emphasis on the security of supply and diversification[35]. A series of recent developments has catalyzed this change of course: trade tensions between major powers, which have led to tariffs and restrictions on strategic exports; the disruption of value chains during the COVID-19 pandemic; and deepening geopolitical rivalries. All of this has ushered in an era in which countries' economic policymaking is guided not only by efficiency and cost-reduction criteria, but also by considerations of national security, strategic competition and the strengthening of domestic productive capacity.

In this new environment, security of supply has once again become a priority in energy decision-making. An increasing number of countries are reassessing their reliance on external inputs and stepping up efforts both to strengthen domestic production and diversify their sources of supply. Policies that once prioritized the lowest cost in global markets now take into account risk scenarios in which certain imports may become inaccessible or be used as instruments of geopolitical pressure.

This renewed focus on security of supply is driven by three trends that have gained strength in recent years. First, the politicization of energy supply, which has emerged as an instrument of power in international disputes. Some governments have used their position as suppliers—or even as major consumers—to exert pressure or gain geopolitical influence. Second, the growing association between energy supply and national security. In the wake of COVID-19, securing essential inputs—such as medicines, semiconductors and energy, among others—became imperative for countries with vulnerabilities. In this context, more and more governments have justified state intervention on the grounds of protecting strategic sectors. Third, the disruption of global energy markets. Various recent events have called into question the resilience of international energy trade; for example, the 2020–2023 pandemic, which caused sharp drops and subsequent rebounds in demand, leading to market instability. A paradigmatic case that brings these three trends together is Russia's invasion of Ukraine, which catalyzed renewed focus on security of supply.

The European Union's (EU) response to Russia's 2022 invasion of Ukraine offers a clear example of how a region can be forced to rethink its energy security. After the conflict began, Russia weaponized its gas exports to exert geopolitical pressure, sharply cutting supplies to Europe in retaliation for Western sanctions. In response, the European Commission implemented the REPowerEU plan, with the aim of diversifying sources of supply and accelerating clean energy generation, mobilizing nearly 300 billion euros[36]. Within a matter of months, emergency measures were adopted: agreements were negotiated to import liquefied natural gas (LNG) from multiple origins, import terminals were reactivated and floating storage and regasification units (FSRUs) were installed in record time[37]. At the same time,

35 World Bank Group, "Protectionism Is Failing to Achieve Its Goals and Threatens the Future of Critical Industries", 29 August 2023, available at: www.worldbank.org/en/news/feature/2023/08/29/protectionism-is-failing-to-achieve-its-goals-and-threatens-the-future-of-critical-industries

36 European Commission, "REPowerEU at a glance", available at: commission.europa.eu/topics/energy/repowereu_en

37 EIA, "Europe's LNG import capacity set to expand by one-third by end of 2024", 28 November 2022, available at: www.eia.gov/todayinenergy/detail.php?id=54780

energy-saving campaigns were launched and investment in renewable energy was stepped up. As a result, the share of Russian gas in EU imports fell from 45 percent in 2022 to 19 percent in 2024[38].

As part of this renewed focus on security of supply, a trend has emerged in global markets known as Peak Oil Trade. The term refers to the idea that international trade in hydrocarbons has already reached its peak and will decline in the future, not because of resource scarcity but as a result of strategic decisions taken by countries[39]. According to a recent report by Carlyle Group, the share of imported fossil fuels in global energy consumption peaked in 2017 and has fallen by 5 percent by 2025[40]. This decline reflects efforts by many countries to shield themselves from geopolitical and economic risks by reducing external dependence and strengthening security of supply.

Although fossil fuels are still expected to grow in the short term, cross-border trade in these fuels is projected to slow down. As the report itself notes, "If trade is under threat, then so are fossil fuels"[41]. As a result, large net importers such as China, India and the EU are proactively investing in domestic energy capacity—particularly in renewables, nuclear power and electrification of end uses—in order to reduce their exposure to international market volatility. In this context, energy produced locally tends to acquire additional value. Many countries are willing to pay a premium for that security, comparable to the cost of a tariff or environmental tax, recognizing that resilience is itself a strategic asset.[42]

Mexico's case stands in marked contrast to current economic and geopolitical trends. While the global environment has become increasingly hostile to deep trade integration regimes, Mexico has moved in the opposite direction, deepening its dependence on gas from the United States. This combination of factors has increased the country's vulnerability, since the assumption of an abundant and reliable supply from a single external supplier is increasingly at odds with today's landscape. As an analysis by the Center for Strategic and International Studies (CSIS) warns, "recent system shocks to world energy markets have made it clear that it is unsafe to rely on a single energy supplier, even if the provider is an allied country"[43]. In this context, it has become urgent to update the analytical framework used to assess the supply risks facing the country. The following sections therefore examine two specific types of risk: the possible use of energy as a geopolitical tool by the United States and exposure to interruptions caused by natural phenomena.

Mexico–United States bilateral tensions: gas as a potential geopolitical tool

Although Mexico and the United States have maintained a mutually beneficial energy relationship in recent decades—with Mexico accessing gas at competitive prices and the United States finding a stable market for its surplus—it is worth asking whether, in a context of political or trade tensions, energy could be used as an instrument of pressure. In recent years, Mexico's nationalist energy policy has come under strong criticism from the United States, which has argued that various legal, regulatory and administrative

38 European Commission, "Roadmap to fully end EU dependency on Russian energy", 6 May 2025, available at: commission.europa.eu/news/roadmap-fully-end-eu-dependency-russian-energy-2025-05-06_en

39 Jeff Currie, *The New Joule Order*, Carlyle Group, 2025, available at: www.carlyle.com/global-insights/research/the-new-joule-order

40 Ibid.

41 Ibid., p. 10

42 Ibid.

43 Ryan C. Berg, Emiliano Polo and Henry Ziemer, "For North American Energy Security, Go Local: Examining the Role of Natural Gas and Mexico's Energy Sector", Center for Strategic and International Studies, 24 August 2023, available at: www.csis.org/analysis/north-american-energy-security-go-local-examining-role-natural-gas-and-mexicos-energy

initiatives contravene the provisions of the United States–Mexico–Canada Agreement (USMCA)[44] . For its part, the U.S. government has used the threat of tariffs as a means of pressuring Mexico to make commitments, especially on issues such as migration control and security policy[45].

Although the threat of an interruption in gas supply from the United States has not yet materialized, this scenario is now being taken more seriously than at any other time in recent history[46]. The possibility of a political shift in Washington toward even more nationalist or unpredictable positions has led some analysts to suggest that continued gas supply could be tied to other U.S. strategic interests[47]. Potential conditions could include pressure to secure further concessions on migration policy, influence the next renegotiation of the USMCA, promote the relocation of industries to U.S. territory or even shape the management of other key natural resources.

Other observers in the energy industry do not see a risk of gas supply interruption, arguing that such a move would be in neither Mexico's nor the United States' interests[48]. They note that access to the Mexican market has benefited the U.S. oil and gas industry by providing a natural outlet for gas produced in the Permian Basin. From this perspective, geographical proximity, growing Mexican demand and rising local production have ensured steady revenues and operational viability for the Texas oil and gas industry, making it economically irrational to restrict gas flows to Mexico[49]. In addition, experts argue that a unilateral cut would face resistance from the local industry, as well as legal challenges, political opposition and public disapproval.

In an uncertain regional environment, it is useful to consider different risk scenarios. This makes it possible to assess more comprehensively the assumption of an abundant and reliable gas supply, which in turn helps to design more effective measures to mitigate vulnerabilities in the energy system. It is important to note that the potential effects of a supply cut on Mexico would vary, since a total or permanent interruption would not be necessary to generate a significant impact on the country. A partial or temporary suspension at critical moments would be enough, without significantly impairing the operation of the oil and gas industry in the United States. In fact, even if a supply interruption never materializes, the mere use of this possibility as a threat or instrument of pressure is sufficient to highlight Mexico's vulnerability[50]. Its high dependence limits its room to maneuver and puts it at a disadvantage in negotiations.

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44 Office of the United States Trade Representative, press release "United States Requests Consultations Under the USMCA Over Mexico's Energy Policies", 20 July 2022, available at: ustr.gov/about-us/policy-offices/press-office/press-releases/2022/july/united-states-requests-consultations-under-usmca-over-mexicos-energy-policies

45 The White House, "Fact Sheet: President Donald J. Trump Imposes Tariffs on Imports from Canada, Mexico and China", 1 February 2025, available at: www.whitehouse.gov/fact-sheets/2025/02/fact-sheet-president-donald-j-trump-imposes-tariffs-on-imports-from-canada-mexico-and-china/

46 Tzuara De Luna, "La peligrosa dependencia de México del gas natural estadounidense", *Expansión*, 5 de febrero de 2025, disponible en: expansion.mx/empresas/2025/02/05/peligros–de–que–mexico–dependa–gas–estadounidense; Esther Herrera, "Riesgo por cierre en suministro de gas en gobierno de Trump es latente, advierte Clúster", *Milenio*, 21 de enero de 2025, disponible en: www.milenio.com/negocios/riesgo–cierre–suministro–gas–gobierno–trump–latente–cluster–energetico; Fitch Ratings, "Mexico's Reliance on U.S. Natural Gas to Grow Amid Rising Trade Tensions", 20 February 2025, available at: www.fitchratings.com/research/corporate-finance/mexicos-reliance-on-us-natural-gas-to-grow-amid-rising-trade-tensions-20-02-2025

47 Simon Romero, "Mexico's Achilles' Heel as It Faces Trump? Reliance on One U.S. Fuel", *The New York Times*, 16 April 2025, available at: www.nytimes.com/2025/04/16/world/americas/mexico-us-natural-gas-trump.html?smid=tw-share

48 Abril Moreno, "ESENTIA Energy Systems Sees No Immediate Risk in US Gas Imports, but Growth Opportunities", *Energía a Debate*, 23 April 2025, available at: energiaadebate.com/esentia-energy-systems-no-percibe-un-riesgo-inmediato-en-la-importacion-de-gas-de-eua-sino-oportunidades-de-crecimiento/

49 Killian Staines and Sheky Espejo, "Mexican energy experts expect strong US natural gas flows to continue despite tariff talk", S&P Global, 26 November 2024, available at: www.spglobal.com/energy/en/news-research/latest-news/natural-gas/112624-mexican-energy-experts-expect-strong-us-natural-gas-flows-to-continue-despite-tariff-talk; Christopher Lenton, "Trump's Tariffs Risk Trade War with Mexico, but Natural Gas Flows Safe", Energiesnet.com, 22 December 2024, available at: energiesnet.com/trumps-tariffs-risk-trade-war-with-mexico-but-natural-gas-flows-safe-christopher-lenton-ngi/; Scott Disavino, "US natgas output and demand to peak in 2032, EIA says", Reuters, 15 April 2025, available at: www.reuters.com/business/energy/us-natgas-output-demand-peak-2032-eia-says-2025-04-15/

50 Víctor Rodríguez, Seguridad energética. *Análisis y evaluación del caso de México (Energy Security. Analysis and Assessment of the Case of Mexico*), "Estudios y Perspectivas" ("Studies and Perspectives") series, ECLAC Subregional Headquarters in Mexico, 2018, available at: repositorio.cepal.org/server/api/core/bitstreams/7b0b428a-070e-49cb-815d-baf161c92a0f/content

Natural phenomena and supply interruptions: the case of Winter Storm Uri

Interruptions of political or commercial origin are not the only risks to gas supply in Mexico. As dependence on imports has increased, so too has exposure to interruptions caused by natural phenomena, particularly extreme weather events, which are becoming more frequent and severe. These events have highlighted the vulnerability of energy infrastructure on both sides of the border.

A striking example was Winter Storm Uri in the state of Texas in February 2021. The storm affected oil wells, gathering systems and gas pipelines, with a particularly severe impact in the Permian Basin, where production fell by almost 5,000 MMcfd[51]. In response to the storm's impacts, Greg Abbott, the governor of Texas, took the extraordinary step of instructing the Railroad Commission of Texas (RRC) to restrict gas exports for four days[52]. Shortages in Mexico had immediate and visible effects. First, a state of alert was declared and fuel availability for industrial use was restricted. Second, rolling, random power cuts were implemented to stabilize the National Electricity System. At the peak of the crisis, on 15 February 2021, the interruptions affected 5.9 million users in 23 states[53]. To cope with the emergency, CFE made all its generation capacity available to the National Energy Control Centre (CENACE), including plants running on fuel oil, diesel, coal and clean sources[54]. In parallel, CFE purchased four cargoes of LNG, which made it possible to inject 450 MMcfd of gas through the ports of Manzanillo and Altamira. These actions enabled full restoration of electricity supply within two days.[55]

Winter Storm Uri left several valuable lessons for Mexico's energy system. First, it exposed the vulnerability of gas supply and the lack of resilience of the energy system, which was unable to respond immediately to an unexpected disruptive event with sufficiently robust alternatives to keep supply flowing. Evidence of this is that power cuts lasted several days. Second, it revealed the system's lack of redundancy: although, under state coordination, it was possible to mobilize resources—activating a diverse portfolio of power plants and purchasing LNG cargoes—limited domestic production and the absence of strategic gas storage left the country exposed, with no immediate response capacity to cushion the interruption. In this regard, although the government has identified economically unviable hydrocarbon fields that could be repurposed as gas storage infrastructure, it has not yet managed to award or successfully develop these projects, despite several attempts in recent years.[56]

51 EIA, "Winter storms have disrupted U.S. natural gas production", 13 March 2024, available at: www.eia.gov/todayinenergy/detail.php?id=61563

52 Morgan Lewis, "Texas Restricts Gas Exports Amid Cold Weather Crisis", JD Supra, 19 February 2021, available at: www.jdsupra.com/legalnews/texas-restricts-gas-exports-amid-cold-9554350/

53 CFE, press release "Interrupción del suministro de energía eléctrica por déficit de generación" ("Interruption of Electricity Supply Due to Generation Deficit"), 17 February 2021, available at: app.cfe.mx/Aplicaciones/OTROS/Boletines/boletin?i=2110

54 Javier Estrada, Víctor Rodríguez and Víctor Hugo Ventura, El gas natural en México. *Impacto de la política de autosuficiencia, seguridad y soberanía en la transición y la integración energética regional* (Natural Gas in Mexico. Impact of Self-Sufficiency, Security and Sovereignty Policy on the Energy Transition and Regional Integration), Economic Commission for Latin America and the Caribbean (ECLAC), 2022, available at: repositorio.cepal.org/server/api/core/bitstreams/49810616-0d2c-44c6-80f8-aa5a250f9be1/content

55 El Economista, "CFE reporta que se restableció al 100% el suministro de electricidad" ("CFE Reports Electricity Supply Restored 100%"), 17 February 2021, available at: www.eleconomista.com.mx/empresas/CFE-reporta-que-se-restablecio-100-el-suministro-de-electricidad--20210217-0073.htm l

56 National Natural Gas Control Centre (Centro Nacional de Control de Gas Natural, CENAGAS), "Bases de licitación para la adjudicación del contrato para el servicio de recepción, almacenamiento en campo económicamente inviable para la extracción de hidrocarburos, y entrega de gas natural al Sistrangas" ("Bidding Terms and Conditions for Awarding the Contract for the Service of Reception, Storage in a Field that is Economically Unviable for Hydrocarbon Extraction, and Delivery of Natural Gas to Sistrangas"), available at: boletin-gestor.cenagas.gob.mx/Docs/jaf/Bases%20de%20Licitaci%C3%B3n%20Almacenamiento%20Gas%20Natural%202024.pdf

Key questions on supply risks

- For Mexico, what range or level of imports can be considered manageable from a security of supply perspective?
- Realistically, are the conditions in place to boost domestic gas production and invest in sufficient storage to mitigate the country's supply risks?
- In addition to focusing on supply conditions, should Mexico adopt concrete measures to reduce gas demand and close the import gap? This would include promoting energy efficiency and renewable energy, among other options. What has prevented this from happening to date?
- Is Mexico willing to pay a higher price to ensure greater security of gas supply? Diversifying sources (LNG), prioritizing domestic production over imports, or investing in greater storage capacity would all bring additional costs.

2. Economic risks

One of the main reasons Mexico has increased its dependence on gas is its geographical proximity to the United States and the low prices in that market, which in recent years has offered the cheapest gas in the world[57]. While this has been a competitive advantage for the Mexican economy, the country's energy policy has assumed that these prices will remain low and stable, justifying the decision to build much of the national energy infrastructure around this resource. As a result, Mexico has chosen to take advantage of this access by integrating its logistics infrastructure and developing domestic capacities aimed at expanding gas use, both in industrial processes and in electricity generation.[58]

The expansion of gas in Mexico and trade with the United States have generated positive economic effects over recent decades. Since the 1990s, the industry has invested more than $35 billion along the value chain[59]. In addition to contributing to economic growth and to the creation of direct and indirect jobs in regions where infrastructure is developed, gas use has helped lower costs in strategic sectors such as electricity generation and manufacturing, with economy-wide impacts on Mexico's competitiveness[60]. Thus, the country's most industrialized regions, such as the north and

57 IEA, data and statistics, "Industry end-user prices for natural gas in selected countries, 2019-March 2023", available at: www.iea.org/data-and-statistics/charts/industry-end-user-prices-for-natural-gas-in-selected-countries-2019-march-2023; Global LNG Hub, "The cheapest natural gas price on earth", available at: globallnghub.com/the-cheapest-natural-gas-price-on-earth.html

58 Diana Nava, "La CFE mantiene su apuesta por el gas natural en su plan de negocios 2021-2025", "CFE Maintains its Bet on Natural Gas in its 2021–2025 Business Plan", *Expansión*, 25 January 2021, available at: expansion.mx/empresas/2021/01/25/cfe-continuara-apostando-gas-dejara-despues-renovables

59 Global Energy, "Gas natural: la clave para el futuro energético de México" ("Natural Gas: The Key to Mexico's Energy Future"), 9 August 2024, available at: globalenergy.mx/noticias-especiales/gas-natural-la-clave-para-el-futuro-energetico-de-mexico/

60 Ana Laura Ludlow, "What Role Has Natural Gas Played in Mexican Economic Development", *Mexico Business News,* 23 January 2023*,* available at: mexicobusiness.news/energy/news/what-role-has-natural-gas-played-mexican-economic-development

the Bajío, coincide with those that have greater access to this fuel[61].

However, a side effect of low-cost imported gas has been the loss of incentives to produce it in Mexico. On the one hand, the availability of U.S. gas—priced at a fraction of oil—has encouraged higher domestic consumption but has discouraged exploration and production of new gas fields, especially as Pemex has prioritized its capital spending on more profitable oil projects[62]. As a result, Mexico has stopped investing proactively in domestic gas production, while its reserves of this resource have remained stable, without significant increases, between 2016 and 2024[63]. Moreover, around 63 percent of prospective gas resources nationwide are unconventional, a type of development in which Mexico has yet to engage at scale[64]. On the other hand, for more than two decades, domestic price regulation also failed to favor national production. Between 1996 and 2017, wholesale natural gas prices were set under the Maximum First-Hand Sale Price (PMVPM), indexed to the price of gas in South Texas plus transport costs[65]. This formula aimed to reproduce competitive market conditions, but did not reflect the real costs of gas production in Mexico, reducing the profitability of producing dry gas locally. Even after price liberalization in 2017, domestic prices remained tied to Texan hubs, given the large share of imported gas[66]. Since the shale gas boom, it has generally been cheaper to import gas than to produce it domestically.

Over time, a situation of low domestic production and high import dependence can expose economic vulnerabilities, especially when planning and development of the energy system are structured around an external input over which Mexico has no direct control. In other words, risks emerge when the country adapts its infrastructure and energy model to facilitate the consumption of imported gas, rather than developing a robust industry that can make use of that resource without depending on it. The economic risks associated with this dependence relate to external factors that can affect the price, availability or conditions of access to gas, as well as to their influence on planning and sustainability of the national energy model. These risks can be short-term—for example, price spikes caused by weather-related disruptions, external political decisions or exchange-rate volatility—or long-term, such as the rerouting of supply toward more profitable markets or the loss of competitiveness of gas-fired power plants relative to cleaner technologies. In addition, higher gas prices could translate into higher costs for strategic products such as electricity, cement, iron and steel, as well as for the chemical industry, all of which are highly dependent on gas as a fuel or feedstock. In

61 Mexican Institute for Competitiveness (Instituto Mexicano para la Competitividad, IMCO), *Gas natural: aliado de la transición energética y promotor de desarrollo y prosperidad* (Natural Gas: Ally of the Energy Transition and Driver of Development and Prosperity), available at: imco.org.mx/wp-content/uploads/2024/12/AMGN_Investigacion_20241211.pdf

62 Javier Estrada, Víctor Rodríguez and Víctor Hugo Ventura, El gas natural en México. *Impacto de la política de autosuficiencia, seguridad y soberanía en la transición y la integración energética regional* (Natural Gas in Mexico. Impact of Self-Sufficiency, Security and Sovereignty Policy on the Energy Transition and Regional Integration), ECLAC, 2022, p. 10, available at: repositorio.cepal.org/server/api/core/bitstreams/49810616-0d2c-44c6-80f8-aa5a250f9be1/content

63 CNH, "Reporte de la Consolidación de Reservas de la Nación al 1 de enero de 2024" ("Report on the Consolidation of National Reserves as of January 1, 2024"), June, p. 10, available at: www.gob.mx/cms/uploads/attachment/file/921219/ConsolidaciondeReservas2024.pdf

64 CNH, *Retos y Oportunidades de la Producción de Petróleo y Gas Natural de Yacimientos No Convencionales en México (Challenges and Opportunities for Oil and Natural Gas Production from Unconventional Reservoirs in Mexico*), 2022, p. 120, available at: www.gob.mx/cms/uploads/attachment/file/766408/Retos-Oportunidades-YNC-2022.pdf

65 Ministry of the Interior (Secretaría de Gobernación, SEGOB), DIRECTIVA sobre la Determinación de Precios y Tarifas para las Actividades Reguladas en Materia de Gas Natural (Directive on the Determination of Prices and Tariffs for Regulated Activities in Natural Gas), 20 March 1996, Diario Oficial de la Federación. Available at: www.dof.gob.mx/nota_detalle.php?codigo=4876551&fecha=20/03/1996#gsc.tab=0

66 Energy Regulatory Commission (Comisión Reguladora de Energía, CRE), "Se elimina el precio máximo de venta de primera mano de gas natural" ("Maximum First-Hand Sale Price of Natural Gas is Eliminated"), 16 June 2017, available at: www.gob.mx/cre/prensa/se-elimina-el-precio-maximo-de-venta-de-primera-mano-de-gas-natural

this context, this section identifies three main risks: volatility in imported gas prices, upward pressures stemming from the expansion of LNG in the United States and possible overinvestment in gas infrastructure that, under certain energy transition scenarios, could result in stranded assets.

Volatility in imported gas prices

One of the most evident economic risks of relying on imported gas is exposure to price volatility. This is closely linked to the previous section on supply risks: potential interruptions in gas flows—due to technical, political or climate-related causes—can constrain supply, create scarcity and trigger market jitters, which in turn lead to price spikes and higher costs for gas and electricity consumers. In addition to this is the exchange-rate risk, since import transactions are denominated in dollars, exposing Mexico to currency fluctuations that can make the fuel even more expensive. Beyond physical disruptions to supply, periods of geopolitical tension or global macroeconomic instability can add further uncertainty and influence natural gas prices.

Because gas prices in Mexico are indexed to South Texas markets, they mirror fluctuations in the U.S. market. This linkage has been an advantage for much of the past decade, as shale gas has kept prices remarkably low. However, unforeseen events have shown that these prices can suddenly surge, with immediate impacts on Mexico. This was the case of the already mentioned Winter Storm Uri in February 2021: spot gas prices rose sharply, reaching levels close to 400 dollars per million BTU at some hubs in Texas, when just a week earlier they had been around 4 dollars[67].

The impact on Mexico was considerable. According to CFE reports, the gas available for import at that time was scarce and extremely expensive, with prices in some cases exceeding 100 dollars per million BTU[68]. To cope with the higher fuel bill, the company secured three lines of credit. In total, CFE allocated 65 billion pesos to purchase LNG cargoes, mitigate shortages and restore electricity service[69]. After just two days of power cuts, industries in Chihuahua, Coahuila, Nuevo León and Tamaulipas reported losses of around 2.7 billion dollars[70]. Nationally, the wholesale electricity price averaged 1,384 pesos per MWh in February, up 126 percent on the previous month and 178 percent on the same month a year earlier[71]. This episode showed that when a country's energy planning is built around an imported input, without backup measures that create redundancy and resilience, that input can become unaffordable from one moment to the next, and turn from a competitive advantage into an economic risk.

The gradual integration of global gas markets has added new sources of volatility, with ever-broader impacts. A clear example is Europe's experience after Russia's invasion of Ukraine. Since 2022, gas prices for industrial consumers in Europe have been, on average, 30 percent higher than in China and up to five times higher than in the

67 W. Neal Mann, Katie Biegel, Nicolas E. Stauff and Brent Dixon, "Feb. 2021 Electricity Blackouts and Natural Gas Shortages in Texas", *Argonne National Laboratory,* 2021, p. 14, available at: publications.anl.gov/anlpubs/2021/07/169454.pdf

68 CFE, "Informe Anual 2021" ("2021 Annual Report"), pp. 91 and 180, available at: www.cfe.gob.mx/finanzas/reportes-financieros/Informe%20Anual%20Documentos/Informe%20Anual%202021.pdf

69 Patricia Tapia, "CFE sacó hasta 'debajo del colchón' para pagar cargamentos de gas" ("CFE Even 'Looked Under the Mattress' to Pay for Gas Shipments"), *Forbes México,* 29 July 2021, available at: forbes.com.mx/negocios-cfe-saco-debajo-colchon-pagar-gas/

70 Sharay Angulo and Adriana Barrera, "Texas freeze hits northern Mexico with $2.7 billion blackout", *Reuters*, 16 February 2021, available at: www.reuters.com/business/energy/northern-mexico-suffers-second-day-power-outages-after-texas-frost-2021-02-16/

71 Angie Soto, "Informe del Mercado Eléctrico Mayorista - Febrero 2021" ("Wholesale Electricity Market Report – February 2021"), LinkedIn, 17 March 2021, posted at: www.linkedin.com/pulse/informe-del-mercado-el%C3%A9ctrico-mayorista-febrero-2021-angie-soto/

United States[72]. Several gas- and energy-intensive sectors have been forced to cut output or even close plants on the continent. However, the effects of this conflict were not limited to countries that depended directly on Russian gas; they also cascaded into more distant markets. In the United States, for example, the Henry Hub price averaged 6.45 dollars per million BTU in 2022, its highest annual level since 2008, just before the shale gas boom began[73]. These kinds of geopolitical events show how external factors can translate into internal costs that are hard for importing countries such as Mexico to anticipate.

Upward pressures from LNG expansion in the United States

Another economic risk factor linked to global gas market integration is the potential medium- and long-term impact of LNG industry expansion in North America. As the United States has consolidated its position as the world's largest gas producer, it has begun to develop increasingly robust infrastructure to export LNG to new markets. Over the past decade, the main unconventional gas basins in Texas have thus begun to supply not only the U.S. and Mexico but also consumers on other continents[74]. By 2021, LNG exports surpassed pipeline exports[75]. This means that the cheap gas Mexico has imported in recent years now competes with demand from other countries, particularly in Asia and Europe.

Various analyses have warned that a boom in LNG exports from North America could raise the opportunity cost of selling gas locally, putting upward pressure on prices in the United States and, by extension, in Mexico. As early as 2012, the U.S. Energy Information Administration (EIA) noted that higher natural gas exports would push up gas prices, and that Mexico would also be affected.[76] More recently, a study commissioned by the U.S. Department of Energy estimated that, by 2050, wholesale natural gas prices could rise by up to 30 percent in scenarios where unrestricted LNG export growth is allowed[77].

Mexico, for its part, has also begun to authorize the development of LNG export infrastructure. In October 2024, the country "re-exported" its first LNG cargo to Europe from a floating terminal off the coast of Tamaulipas, developed by New Fortress Energy[78]. Other companies—such as Sempra, Mexico Pacific and even CFE itself—have expressed interest in, or begun, projects to re-export U.S. gas, particularly from the Pacific coast,

72 Gergely Molnar and Peter Zeniewski, "European gas market volatility puts continued pressure on competitiveness and cost of living", International Energy Agency, 23 February 2025, available at: www.iea.org/commentaries/european-gas-market-volatility-puts-continued-pressure-on-competitiveness-and-cost-of-living

73 Christopher Lenton, "Average Henry Hub Natural Gas Spot Price Shoots to 14-Year High in 2022", *Natural Gas Intelligence*, 9 January 2023, available at: naturalgasintel.com/news/average-henry-hub-natural-gas-spot-price-shoots-to-14-year-high-in-2022/

74 EIA, Liquefied U.S. Natural Gas Exports, available at: www.eia.gov/dnav/ng/hist/n9133us2m.htm

75 EIA, Liquefied U.S. Natural Gas Exports and Re-Exports by Country, available at: www.eia.gov/dnav/ng/ng_move_expc_s1_a.htm

76 EIA, "Effect of Increased Natural Gas Exports on Domestic Energy Markets", 2012, pp. 6 and 13, available at: www.energy.gov/sites/prod/files/2013/04/f0/fe_eia_lng.pdf

77 U.S. Department of Energy, "Energy, Economic, and Environmental Assessment of U.S. LNG Exports", December 2024, p. 4, available at www.energy.gov/sites/default/files/2024-12/LNGUpdate_SummaryReport_Dec2024_230pm.pdf; Jacob Dick, "DOE Cautions Against 'Unfettered' U.S. LNG Exports", December 2024, p. 4, available at: naturalgasintel.com/news/doe-cautions-against-unfettered-us-lng-says-prices-emissions-would-skyrocket-if-left-unchecked/; Jacob Dick, "DOE Cautions Against 'Unfettered' U.S. LNG, Says Prices, Emissions Would Skyrocket if Left Unchecked", Natural Gas Intelligence, 17 December 2024, available at: naturalgasintel.com/news/doe-cautions-against-unfettered-us-lng-says-prices-emissions-would-skyrocket-if-left-unchecked/

78 Clio Ho, "Mexico exports first LNG to Europe, from New Fortress' Altamira project to Gate", *S&P Global*, 15 October 2024, available at: www.spglobal.com/commodity-insights/en/news-research/latest-news/lng/101524-mexico-exports-first-lng-to-europe-from-new-fortress-altamira-project-to-gate

which offers a shorter and less costly route to Asian markets than transit through the Panama Canal[79]. These projects offer potential benefits, such as attracting capital that spurs job creation and boosts local economies in the regions where they are located. Mexico could also collect fiscal revenues for services provided on its territory, while the new infrastructure can add flexibility and redundancy to the national energy system[80]. However, a recent report by the Institute for Energy Economics and Financial Analysis (IEEFA) concludes that if Mexico deepens this path and tightens regional supply further, "building new LNG export terminals in Mexico could raise the price of both natural gas and electricity for Mexican consumers and businesses, [leading to] increase price volatility in North American energy markets"[81]. Overall, the country needs to carefully assess different production, demand and price scenarios to gauge the potential benefits.

Overinvestment in gas infrastructure and stranded asset risk

Dependence on imported gas is reflected not only in the bills paid by users each month; it also shapes how the sector's most important investment decisions are made. As described earlier, geographical proximity to cheap gas from the southern United States provided a strong incentive for Mexico to invest in associated infrastructure: gas pipelines, cross-border interconnections, LNG terminals and combined-cycle power plants. All of this has assumed that the availability of cheap gas north of the border makes it economically optimal to structure national energy infrastructure around that resource. However, one vulnerability of this assumption is that, in the absence of strong energy security criteria and ongoing monitoring, imported gas can cease to be a tactical advantage—a means—and become the core of the energy model itself—a goal in its own right. This raises the risk of overinvestment in gas infrastructure, understood as the possibility that overly optimistic financial projections will drive a rapid shift toward this fuel and lead to excessive construction of infrastructure such as pipelines or combined-cycle plants.[82]

Overinvestment risk involves the possibility that the industry will accumulate a significant number of stranded assets, that is, investments and projects that depreciate prematurely and cease to be economically viable due to technological or regulatory changes in the market[83]. Once this happens, governments are often faced with the dilemma of subsidizing them or allowing them to close, both of which carry potential political, economic and social costs. In the context of the global energy transition, there are decarbonization scenarios in which parts of the infrastructure along the hydrocarbon value chain could become obsolete. It is estimated that the total value of assets currently at risk of becoming stranded amounts to 1.4 trillion dollars worldwide.[84] According to the International Energy Agency (IEA), stranded asset risk is particularly high in the

79 Karol García, "México comenzará exportación de gas natural licuado en el 2025" ("Mexico Will Begin Exporting Liquefied Natural Gas in 2025"), *El Economista*, 25 July 2023, available at: www.eleconomista.com.mx/empresas/Mexico-comenzara-exportacion-de-gas-natural-licuado-en-el-2025-20230725-0117.html; Christopher Lenton, "Mexican Firms Tout Coatzacoalcos LNG Project Targeting European Market", *Natural Gas Intelligence,* 6 January 2025, available at: naturalgasintel.com/news/mexican-firms-tout-coatzacoalcos-lng-project-targeting-european-market/

80 IMCO, Gas natural: aliado de la transición energética y promotor de desarrollo y prosperidad (Natural Gas: Ally of the Energy Transition and Driver of Development and Prosperity), pp. 40–41, available at: imco.org.mx/wp-content/uploads/2024/12/AMGN_Investigacion_20241211.pdf

81 Clark Williams-Derry and Suzanne Mattei, LNG Build-Out in Mexico Based on U.S. Gas: Rising Risks for Consumers*, Institute for Energy Economics and Financial Analysis, p. 3, available at:* ieefa.org/sites/default/files/2025-04/LNG%20Build-Out%20in%20Mexico%20Based%20on%20U.S.%20Gas_March%202025%20%281%29_0.pdf

82 David Littell, "Natural Gas: Bridge or Wall in Transition to Low-Carbon Economy?", Natural Gas & Electricity, January 2017, available at: www.raponline.org/wp-content/uploads/2023/09/littell-natural-gas-electricity-journal-bridge-wall-transition-low-carbon-economy-2017-jan.pdf

83 Sini Matikainen and Eléonore Soubeyran, "What are stranded assets?", The London School of Economics and Political Science – Grantham Research Institute on Climate Change and the Environment, 27 July 2022, available at: www.lse.ac.uk/granthaminstitute/explainers/what-are-stranded-assets/

84 Gregor Semieniuk, et al., "Stranded fossil-fuel assets translate to major losses for investors in advanced economies", Nature Climate Change, volume 12, pp. 532–538, 26 May 2022, available at: www.nature.com/articles/s41558-022-01356-y#citeas

midstream segment, which includes refineries and LNG facilities[85]. At the national level, one factor that could trigger this phenomenon is the introduction of stricter environmental regulations, in line with the commitments already assumed by the Mexican government, such as the national goal of reaching net-zero emissions by 2050 or of generating at least 45 percent of the electricity from clean sources by 2030[86]. A recent report by Global Energy Monitor warns that new LNG re-export projects in Latin America, including those in Mexico, are highly likely to become stranded assets if countries meet their own climate goals[87].

On the other hand, the economic context of the power sector also poses challenges for gas-fired plants, which could become stranded under certain scenarios: for example, in the event of gas shortages and high prices, if supply is redirected to more profitable markets, or when operating costs exceed revenues and public subsidies are required. Over the past decade, the cost of renewable energy, particularly wind and solar photovoltaic, has fallen significantly worldwide, increasing its market share[88]. Today, both technologies are often more competitive than generation from combined-cycle power plants[89]. In Mexico, this competitiveness was reflected in the power auctions held between 2015 and 2017, which yielded some of the lowest prices in the world for renewable projects[90]. Given the strong potential they have shown in the national market, the role of renewable energy needs to be clearly and strategically redefined within the energy transition process.

In this regard, a study by Ember estimates that if Mexico meets its goal of generating 45 percent of its electricity from clean sources by 2030, in line with the Mexican government's goal, it would avoid demand for approximately 384,000 MMcfd of natural gas per year for power generation. This would reduce gas import costs by around 1.6 billion dollars per year and would cut gas-based generation by about 20 percent, from 204 TWh in 2024 to 163 TWh in 2030. This estimate underscores the importance of taking a holistic view of decisions on future infrastructure, considering not only the immediate benefits of certain technologies but also their long-term economic and environmental implications.[91]

In sum, the most effective way to mitigate overinvestment risk is for the government to use its binding planning powers to define a coherent energy transition pathway that realistically considers the role of gas and renewable energy over the coming decades. This would make it possible to clearly set the depth and pace of the transition, weighing costs and benefits and balancing reliability, affordability and sustainability criteria throughout the process. In this way, it would be possible to drive an orderly and coherent transition in which all sector actors know their roles and the risk of creating stranded assets is minimized.

85 IEA, The Oil and Gas Industry in Net Zero Transitions, available at: www.iea.org/reports/the-oil-and-gas-industry-in-net-zero-transitions/executive-summary

86 Semarnat, "México reafirmó su compromiso con la acción climática ambiciosa en la COP29" ("Mexico Reaffirmed its Commitment to Ambitious Climate Action at COP29"), 27 November 2024, available at: www.gob.mx/semarnat/prensa/mexico-reafirmo-su-compromiso-con-la-accion-climatica-ambiciosa-en-la-cop29?idiom=es; Office of the President (Presidencia de la República), "Versión estenográfica. Conferencia de prensa de la presidenta Claudia Sheinbaum Pardo del 6 de noviembre de 2024" ("Stenographic Version. Press Conference by President Claudia Sheinbaum Pardo, 6 November 2024"), 6 November 2024, available at: www.gob.mx/presidencia/articulos/version-estenografica-conferencia-de-prensa-de-la-presidenta-claudia-sheinbaum-pardo-del-6-de-noviembre-de-2024

87 Global Energy Monitor, LNG 2024: Latin America and the Caribbean edition, October 2024, pp. 8 and 16, available at: globalenergymonitor.org/wp-content/uploads/2024/10/GEM-Latam-LNG-brief-Oct-2024.pdf

88 Lazard, Levelized Cost of Energy, June 2024, p. 17, available at: www.lazard.com/media/xemfey0k/lazards-lcoeplus-june-2024-_vf.pdf

89 Ibid., p. 9

90 SENER, "En la tercera Subasta Eléctrica mexicana se obtuvo uno de los precios más bajos internacionalmente: PJC" ("Mexico's Third Electricity Auction Achieved One of the Lowest Prices Internationally: PJC"), 22 November 2017, available at: www.gob.mx/sener/prensa/en-la-tercera-subasta-electrica-mexicana-se-obtuvo-uno-de-los-precios-mas-bajos-internacionalmente-pjc

91 Ember, Las renovables, el camino hacia la seguridad energética en México (Renewables: The Path to Energy Security in Mexico), May 2025, p. 16, available at: ember-energy.org/app/uploads/2025/05/ES-Reporte-Las-renovables-el-camino-hacia-la-seguridad-energetica-en-Mexico.pdf

Key questions on economic risks

- Are there financial, regulatory or institutional tools that the Mexican government has not yet used to mitigate episodes of high volatility in natural gas prices and exchange-rate fluctuations? What measures could industry adopt to hedge against this economic risk?
- From a strategic perspective, is the development of unconventional resources in the subsoil justified to increase domestic gas production? Is it profitable? And from an economic standpoint, is this an optimal allocation of resources to mitigate the risks associated with dependence on imported gas?
- How would the expansion of LNG re-exports from Mexico affect the domestic gas and electricity market, particularly in terms of price stability and security of supply?
- Given the current dynamism of the LNG market in North America and its potential medium- and long-term economic effects, should Mexico support the development of re-export terminals on its territory? If the answer is yes, to what extent? Do the benefits outweigh the costs?
- How close or far is Mexico from an overinvestment scenario in gas infrastructure in which stranded assets accumulate? How much room is there to continue expanding this infrastructure, given the country's climate commitments?
- How should the expansion—or, where appropriate, the contraction—of gas infrastructure such as pipelines, combined-cycle plants and LNG terminals be planned to minimize the risk of creating stranded assets?
- In the context of the global energy transition, what should the role of gas be within the energy mix relative to renewable energy and other lower-emission sources? What steps could Mexico take to move in that direction?

3. Environmental and Climate Risks

Dependence on gas has implications that go beyond energy policy and the country's economic objectives. Like any fossil fuel, its life cycle—from extraction to consumption—creates environmental impacts along the entire value chain. In recent decades, one of the assumptions underpinning the growth of the National Electricity System around gas-fired plants and infrastructure has been that its environmental effects are compatible with Mexico's climate and energy transition commitments. This section, however, explores how, in the absence of rigorous management and sustained oversight, these impacts can translate into risks for the environment, public health and the country's climate goals.

Identifying vulnerabilities along the gas value chain requires understanding the tension between the country's climate ambitions and its current energy policy. On the one hand, Mexico has made specific commitments, such as reaching net-zero emissions by 2050 and cutting 30 percent of its methane emissions by 2030. It also aims to generate at least 45 percent of its electricity from clean sources by 2030[92]. On the other hand, as noted above, the government has expressed its intention to increase domestic gas production and expand gas-fired combined-cycle generation, projecting that its share in the power mix will remain at 59 percent by 2030[93]. So far, it remains unclear how these different objectives will be implemented, but there are windows of opportunity to set out a unified vision. These include, in particular, the update of the Nationally Determined Contribution (NDC) under the Paris Agreement and the binding energy planning processes arising from recent legal reforms. In this context, aligning objectives and ensuring institutional coordination will be crucial to identify vulnerabilities and mitigate environmental and climate risks.

This section analyses three main related risks: pollutant emissions associated with gas use, the implications of using fracking to exploit unconventional resources, and the possibility of a lock-in effect in energy planning centered around gas.

Pollutant emissions along the gas life cycle

When burned, gas produces lower carbon dioxide (CO_2) emissions per unit of energy than other fossil fuels. As a result, when it replaces higher-carbon sources such as coal, fuel oil or diesel in power generation, combined-cycle plants emit fewer GHGs[94]. However, the environmental benefits associated with gas are more limited than is often assumed, especially when emissions generated over the gas infrastructure life cycle are taken into account and when its share in the energy mix is high[95]. Methane (CH_4), the main component of gas, is the second most abundant GHG after CO_2. Although it remains in the atmosphere for a shorter period—around a decade—its heat-trapping capacity can be between 27.9 and 81.2 times greater, depending on the time horizon considered[96]. It is estimated that methane has contributed between 20 percent and 30 percent to the increase in global temperature since the pre-industrial era[97], and curbing it is considered one of the most effective short-term measures to reduce climate risk.

Some studies warn that leakage rates on the order of 2.7 percent along the gas supply chain can wipe out the net climate benefits of switching from other fossil fuels such as coal[98]. These fugitive emissions occur at various stages —extraction, processing, transport and distribution— and

92 Semarnat, "México reafirmó su compromiso con la acción climática ambiciosa en la COP29" ("Mexico Reaffirmed its Commitment to Ambitious Climate Action at COP29"), 27 November 2024, available at: www.gob.mx/semarnat/prensa/mexico-reafirmo-su-compromiso-con-la-accion-climatica-ambiciosa-en-la-cop29; Ministry of Foreign Affairs (Secretaría de Relaciones Exteriores, SRE), "Mexico joins the Global Methane Pledge at COP26", available at: www.gob.mx/semarnat/prensa/mexico-reafirmo-su-compromiso-con-la-accion-climatica-ambiciosa-en-la-cop29www.gob.mx/sre/prensa/mexico-joins-the-global-methane-pledge-at-cop26?idiom=en; Conferencia de prensa de la presidenta Claudia Sheinbaum Pardo", 6 de noviembre de 2024" ("Stenographic Version. Press Conference by President Claudia Sheinbaum Pardo, 6 November 2024"), available at: /www.gob.mx/presidencia/articulos/version-estenografica-conferencia-de-prensa-de-la-presidenta-claudia-sheinbaum-pardo-del-6-de-noviembre-de-2024

93 Government of Mexico, "Mexico's Plan. Strategy for Equitable and Sustainable Economic Development for Shared Prosperity" (First draft), 2025, slide 17, available at: embamex.sre.gob.mx/trinidadytobago/images/Cargar/turismocomercialesyculturales/English_Version_Plan_Mexico_2030-compressed.pdf

94 Advances in technologies such as carbon capture, utilisation and storage (CCUS) at gas-fired power plants could reduce direct CO_2 emissions even further, making their technical and economic development an important factor to consider. More information in this IEA report: www.iea.org/reports/the-role-of-ccus-in-low-carbon-power-systems/how-carbon-capture-technologies-support-the-power-transition

95 Aaron Sayne, Framework for Countries Evaluating Gas-to-Power Pathways, Natural Resource Governance Institute, September 2022, available at: resourcegovernance.org/sites/default/files/documents/gas_to_power_goal_1_navigating_the_energy_transition_and_climate_crisis_0.pdf

96 Chris Smith, et al., "The Earth's Energy Budget, Climate Feedbacks, and Climate Sensitivity Supplementary Material", Climate Change 2021: The Physical Science Basis, The Intergovernmental Panel on Climate Change (IPCC), 2021, p. 16, available at: www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Chapter07_SM.pdf

97 National Aeronautics and Space Administration, Vital signs, Methane, available at: climate.nasa.gov/vital-signs/methane/

98 Igor A. Bashmakov, et al., "Industry", Climate Change 2022: Mitigation of Climate Change, IPCC, 2022, p. 1182, available at: www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_Chapter11.pdf

their detection, quantification and effective mitigation remain a technical challenge, especially in countries with limited regulatory capacity[99]. Estimates suggest that when emissions are considered across the entire chain, not just those from combustion, the climate footprint of the gas industry can be comparable to, or even greater than, that of coal and diesel[100].

In Mexico's case, this problem is particularly acute. According to the Global Methane Tracker[101], the country has one of the highest levels of unaccounted-for methane emissions in the energy sector. This situation is compounded by structural shortcomings: monitoring systems that are still incipient, limited transparency in public information—especially from Pemex—and reduced institutional capacity to oversee emissions effectively.

Independent estimates based on satellite observations have calculated that methane emissions from Mexico's oil sector are twice the levels officially reported[102]. A consortium of international researchers also published a study reporting exceptionally high methane levels escaping from hydrocarbon facilities in Chiapas, Tabasco, Veracruz and the Campeche offshore area. Drawing on measurements taken from aircraft and corroborated with satellite observations, the researchers found "critical discrepancies in greenhouse gas inventories that affect the country's ability to ensure greater energy efficiency"[103]. Similarly, a group of scientists at the Polytechnic University of Valencia has used satellite data to detect and quantify massive methane leaks—also known as ultra-emission events—at the Ku-Maloob-Zaap production complex in the Gulf of Mexico[104]. Pemex has rejected the study's conclusions, claiming that the real figures are lower than those reported.[105]

In this context, the expansion of LNG terminals—particularly those that facilitate the export of U.S. gas through Mexican ports—has additional implications. The full LNG cycle—extraction, liquefaction, transport and regasification—has a substantial footprint. A recent study found that final combustion of LNG exported from the United States to Asia accounted for between 35 and 37 percent of total emissions, while upstream and midstream emissions—mainly methane leaks—contributed between 46 and 48 percent of the total, and liquefaction/transport another 12 to 17 percent[106]. In addition, these megaprojects have been criticized for their potential impact on environmentally sensitive areas such as the Upper Gulf of California, as well as for the risk of exacerbating social conflicts in territories inhabited by Indigenous communities or with high

99 IEA, "Regulatory Roadmap", Driving Down Methane Leaks from the Oil and Gas Industry, 2021, available at: www.iea.org/reports/driving-down-methane-leaks-from-the-oil-and-gas-industry/regulatory-roadmap

100 Robert W. Howarth, "The greenhouse gas footprint of liquefied natural gas (LNG) exported from the United States", Energy Science & Engineering, 2024, available at: doi.org/10.1002/ese3.1934; Álvarez, et al., "Greater focus needed on methane leakage from natural gas infrastructure", Proceedings of the National Academy of Sciences, 2012, available at: doi.org/10.1073/pnas.1202407109

101 IEA, Global Methane Tracker 2023, available at: www.iea.org/reports/global-methane-tracker-2023#overview

102 Lu Shen, et al., "Unravelling a large methane emission discrepancy in Mexico using satellite observations", Remote Sensing of Environment, July 2021, volume 260, available at: www.sciencedirect.com/science/article/pii/S0034425721001796

103 Authors' translation. Daniel Zavala-Araiza, et al., "A tale of two regions: Methane emissions from oil and gas production in offshore/onshore Mexico", Environmental Research Letters, January 2021, volume 16, available at: iopscience.iop.org/article/10.1088/1748-9326/abceeb/pdf ; Environmental Defense Fund, "Científicos documentan emisiones de metano elevadas en los estados del Golfo de México" ("Scientists Document High Methane Emissions in the Gulf of Mexico States"), 25 January 2021, available at: www.edf.org/media/cientificos-documentan-emisiones-de-metano-elevadas-en-los-estados-del-golfo-de-mexico

104 Itziar Irakulis-Loitxate, et al., "Satellites Detect a Methane Ultra-emission Event from an Offshore Platform in the Gulf of Mexico", Environmental Science and Technology Letters, 2022, volume 9, pp. 520–525, available at: pubs.acs.org/doi/pdf/10.1021/acs.estlett.2c00225; Stefanie Eschenbacher, "Scientists detect second 'vast' methane leak at Pemex oil field in Mexico", Reuters, 2 September 2022, available at: www.reuters.com/business/environment/exclusive-scientists-detect-second-vast-methane-leak-pemex-oil-field-mexico-2022-09-02/

105 Expansión, "Pemex niega 'grandes emisiones de metano' en plataformas de Golfo de México" ("Pemex Denies 'Large Methane Emissions' on Gulf of Mexico Platforms"), 8 September 2022, available at: expansion.mx/empresas/2022/09/08/pemex-niega-grandes-emisiones-de-metano-en-golfo-de-mexico

106 Robert W. Howarth, "The greenhouse gas footprint of liquefied natural gas (LNG) exported from the United States", Energy Science & Engineering, 2024, p. 10, available at: doi.org/10.1002/ese3.1934

vulnerability[107]. Deepening Mexico's dependence on gas without putting in place a robust, transparent and continuous system to measure fugitive methane emissions makes it difficult to accurately assess the real impact of gas on national and international climate commitments, including the NDC and the goal of net-zero emissions by 2050.

Beyond the climate effects linked mainly to methane, the operation of gas infrastructure can generate additional environmental impacts that must be considered when assessing gas within energy policy. A recent analysis estimated that, in 2023, the three main gas-processing complexes— Ciudad Pemex, Nuevo Pemex and Cactus— emitted roughly 800 metric tons per day of sulfur dioxide (SO2)[108], a compound that is harmful to human health, damaging to the environment and a precursor of acid rain. The same analysis notes that none of the complexes reviewed complies with the Official Mexican Standard NOM-137-SEMARNAT-2013 (issued by the Ministry of Environment and Natural Resources), which sets permissible limits and requirements for controlling sulfur compounds in these facilities. Among the causes identified for non-compliance are backlogs in maintaining emissions-control systems due to budget constraints that have prioritized the operation of producing units over comprehensive maintenance of environmental control systems to recover sulfur.[109]

Considerations regarding the extraction of unconventional gas resources through *fracking*

Given the growing dependence on gas imports from the United States, various actors in the sector have argued that national production needs to rise, which has rekindled interest in exploiting unconventional gas reservoirs, as recent sources report[110]. The federal budget for this year has likewise allocated resources to continue projects that use fracking[111].

According to official estimates, Mexico has around 64.2 billion barrels of oil equivalent in prospective unconventional resources, 44 percent of which correspond to gas[112]. These resources are located mainly in the Burgos, Sabinas-Burro-Picachos, Tampico-Misantla, and Veracruz basins. The National Hydrocarbons Commission (CNH) has argued that developing these resources could "contribute to the country's growth and strengthen its sovereignty by reducing dependence on imported products"[113]. Opportunities identified include attracting significant investment, generating employment, boosting economic development in the regions where projects are located, and promoting technology transfer and strengthening local technical capacities by deploying advanced fracking techniques[114].

107 Brian Palmer, "Liquefied Natural Gas 101", Natural Resources Defense Council, 9 February 2024, available at: www.nrdc.org/stories/liquefied-natural-gas-101; Joshua Collins and Daniela Díaz, "Sheinbaum's energy agenda under fire as Mexican activists slam LNG megaproject", Mongabay, 15 April 2025, available at: news.mongabay.com/2025/04/sheinbaums-energy-agenda-under-fire-as-mexican-activists-slam-lng-megaproject/

108 Francisco Barnés and Alejandro Villalobos, "Emisiones a la atmósfera de SO2 de los Complejos Procesadores de Gas" ("SO2 Atmospheric Emissions from Gas Processing Complexes"), Energía a Debate, 24 March 2024, available at: energiaadebate.com/emisiones-a-la-atmosfera-de-so2-de-los-complejos-procesadores-de-gas/

109 Ibid.

110 El Economista, "Pemex y Carlos Slim renegocian proyecto de gas en aguas profundas" ("Pemex and Carlos Slim Renegotiate Deepwater Gas Project"), 31 January 2025, available at: www.eleconomista.com.mx/empresas/pemex-carlos-slim-renegocian-proyecto-gas-aguas-profundas-20250131-744478.html#:~; Global Energy, "AMEXHI urge a Sheinbaum a retomar el fracking para energía" ("AMEXHI Urges Sheinbaum to Resume Fracking for Energy"), 20 August 2024, available at: globalenergy.mx/noticias/amexhi-urge-a-sheinbaum-a-retomar-el-fracking-para-energia/

111 *Global Energy*, "Asignan 12,364 millones de pesos a 4 proyectos de fracking en el PPEF 2025" ("12.364 Billion Pesos Allocated to Four Fracking Projects in the 2025 Draft Federal Budget"), 12 December 2024, available at: globalenergy.mx/noticias/asignan-12364-millones-de-pesos-a-4-proyectos-de-fracking-en-el-ppef-2025

112 CNH, Retos y Oportunidades de la Producción de Petróleo y Gas Natural de Yacimientos No Convencionales en México, 2022, available at: www.gob.mx/cms/uploads/attachment/file/766408/Retos-Oportunidades-YNC-2022.pdf

113 Authors' translation. Ibid., p. 101

114 Ibid.

However, specialists warn that although this option could help increase national gas production in the short term, it also carries significant environmental and economic implications that must be assessed for their medium- and long-term viability and sustainability[115]. The environmental impacts of fracking have been extensively documented in the United States[116] and in Mexico, for example, regarding intensive water use[117], induced seismicity[118] and pollutant emissions[119]. It has also been documented that these impacts tend to be concentrated in communities near extraction sites, which do not always receive compensation for the damage suffered.[120]

From a technical and economic standpoint, developing shale gas in Mexico raises several questions. To begin with, it is important to note that there are no certified unconventional gas reserves, only prospective resources. A recent analysis suggests that, due to the low recovery factor associated with these types of reservoirs, only around 10 percent could become technically recoverable reserves in Mexico[121]. There is also a high degree of uncertainty in the available estimates. CNH itself recognizes that further efforts are needed to characterize and accurately quantify the potential of these resources[122]. Some studies indicate that the country's geological conditions, combined with the lack of infrastructure, push extraction costs above levels that are competitive with imports from the United States.[123] On top of this, fracking shows steep decline rates[124]—that is, production falls rapidly after the first year—requiring continuous drilling to maintain output levels and driving up investment needs[125]. In the United States, some studies suggest that up to 80 percent of wells fail to recover their initial capital

115 Luca Ferrari, José Rafael Flores and Diana Hernández, "A 20 años del pico del petróleo en México: análisis del sector hidrocarburos e implicaciones para el futuro energético nacional" ("Twenty Years After Peak Oil in Mexico: Analysis of the Hydrocarbons Sector and Implications for the Country's Energy Future"), Revista Mexicana de Ciencias Geológicas, UNAM, 2024, p. 82, available at:www.rmcg.unam.mx/index.php/rmcg/article/download/1770/1597?inline=1

116 Robert B. Jackson, et al., "The Environmental Costs and Benefits of Fracking", Annual Review of Environment and Resources, 11 August 2014, available at: doi.org/10.1146/annurev-environ-031113-144051; Mohammed S. Hashem and Angela Guggemos, "A Literature Survey of the Fracking Economic and Environmental Implications in the United States", Procedia Engineering, 2015, available at: www.sciencedirect.com/science/article/pii/S1877705815020706

117 José Rafael Flores and Manuel Llano, Estimación del consumo requerido de agua para la explotación de recursos petroleros no convencionales mediante fracturación hidráulica en México (Estimation of the Water Consumption Required for the Exploitation of Unconventional Petroleum Resources through Hydraulic Fracturing in Mexico), National Council of Humanities, Sciences and Technologies (Consejo Nacional de Humanidades, Ciencias y Tecnologías, CONAHCYT), 2024, available at: cartocritica.org.mx/2024/nuevo-informe-estimacion-del-consumo-requerido-de-agua-para-la-explotacion-de-recursos-petroleros-no-convencionales-mediante-fracturacion-hidraulica-en-mexico/; Alejandro Villalobos-Hiriart et al., "Implications of Hydraulic Fracturing of Unconventional Oil and Gas Resources in Mexico," Water Availability and Management in Mexico, Springer, 2019, available at: link.springer.com/chapter/10.1007/978-3-030-24962-5_5

118 Manuel Llano and Alessia Kachadourian, "Sismicidad inducida y fracking" ("Induced Seismicity and Fracking"), CartoCrítica, 16 December 2015, available at: cartocritica.org.mx/2015/sismos_inducidos_fracking/

119 Yoatzin Popoca et al., Fracking, cambio climático y derechos humanos: un análisis de las afectaciones en territorio totonaco (Fracking, Climate Change, and Human Rights: An Analysis of Impacts in Totonac Territory), Mexican Center for Environmental Law (Centro Mexicano de Derecho Ambiental), 2022, available at: www.cemda.org.mx/wp-content/uploads/2023/05/Informefrackingpapantla.pdf

120 Letizia Silva, Paul G. Munro and María de Lourdes Melo, "Proyectos de Muerte: Energy justice conflicts on Mexico's unconventional gas frontier", The Extractive Industries and Society, 2018, available at: doi.org/10.1016/j.exis.2018.06.010; Fernando Castro-Álvarez, et al., "Sustainability lessons from shale development in the United States for Mexico and other emerging unconventional oil and gas developers", Renewable and Sustainable Energy Reviews, 2018, available at: doi.org/10.1016/j.rser.2017.08.082; Yoatzin Popoca, et al., Fracking, cambio climático y derechos humanos: un análisis de las afectaciones en territorio totonaco (Fracking, Climate Change, and Human Rights: An Analysis of Impacts in Totonac Territory), Centro Mexicano de Derecho Ambiental, 2022, available at: www.cemda.org.mx/wp-content/uploads/2023/05/Informefrackingpapantla.pdf

121 Luca Ferrari, José Rafael Flores and Diana Hernández, "A 20 años del pico del petróleo en México: análisis del sector hidrocarburos e implicaciones para el futuro energético nacional" ("Twenty Years After Peak Oil in Mexico: Analysis of the Hydrocarbons Sector and Implications for the Country's Energy Future"), Revista Mexicana de Ciencias Geológicas, UNAM, 2024, p. 83, available at: www.rmcg.unam.mx/index.php/rmcg/article/download/1770/1597?inline=1

122 CNH, Retos y Oportunidades de la Producción de Petróleo y Gas Natural de Yacimientos No Convencionales en México, 2022, available at: www.gob.mx/cms/uploads/attachment/file/766408/Retos-Oportunidades-YNC-2022.pdf

123 Luca Ferrari, José Rafael Flores and Diana Hernández, "A 20 años del pico del petróleo en México: análisis del sector hidrocarburos e implicaciones para el futuro energético nacional" ("Twenty Years After Peak Oil in Mexico: Analysis of the Hydrocarbons Sector and Implications for the Country's Energy Future"), Revista Mexicana de Ciencias Geológicas, UNAM, 2024, p. 83, available at: www.rmcg.unam.mx/index.php/rmcg/article/download/1770/1597?inline=1

124 U.S. Energy Information Administration, "Production Decline Curve Analysis in the Annual Energy Outlook 2023", 16 March 2023, available at: www.eia.gov/analysis/drilling/curve_analysis/

125 Financial Times, "US shale oil: can a leaner industry ever lure back investors?", 1 February 2021, available at: www.ft.com/content/a8d72d4d-09b1-47fb-bb6c-3c314770f1c1; Ángel de la Vega and Jaime Ramírez, "El gas de lutitas (shale gas) en México Recursos, explotación, usos, impactos" (Shale Gas in Mexico: Resources, Exploitation, Uses, and Impacts), Economía UNAM volume 12, no. 34, January–April 2015, available at: www.elsevier.es/es-revista-economia-unam-115-articulo-el-gas-lutitas-shale-gas--S1665952X15300062

costs[126]. Socially and politically, opposition to fracking has been significant in various regions of the country, leading even to municipal and state-level moratoria or bans[127]. This creates uncertainty for investors and limits its viability as a long-term energy strategy.

To date, Mexico has drilled only a limited number of exploratory wells in unconventional reservoirs, and both under the previous administration and in President Claudia Sheinbaum's campaign proposals there was an explicit pledge to ban the use of fracking. In the face of growing domestic pressure to reconsider the potential exploitation of these resources, it is necessary to assess this option more carefully considering its economic, environmental and social implications, as well as its consistency with the energy transition and decarbonization goals that Mexico has adopted domestically and internationally.

The risk of *carbon lock-in* and gas planning in Mexico

A critical aspect when evaluating how compatible gas is with Mexico's climate and energy transition commitments is the potential to incur a carbon lock-in. This concept refers to a situation in which present-day decisions—such as investing in carbon-intensive energy infrastructure—create technological, economic and institutional pathways that are difficult to reverse, limiting the future ability to adopt low-carbon alternatives.[128]

In this context, it is worth reflecting on the role gas should play in the future of Mexico's energy mix. Beyond assuming its continued presence as a structural component, the country needs to assess how much gas it will require over the coming decades in light of its economic, energy security and decarbonization goals. It must also examine whether keeping gas at the core of the national electricity system is consistent with its climate commitments or whether, on the contrary, its role will have to be adjusted to reduce risks that could compromise the sustainability of the energy system. To this end, the government should continuously monitor the relationship between gas and renewables, ensuring—through comprehensive strategic planning—that the former does not constrain the growth of the latter. For example, because LNG projects require decades to recover their investment, their financial viability depends on sustained gas demand. This could discourage investment in clean technologies and lock in carbon-intensive energy models beyond the timelines recommended by climate science.[129]

From a realistic standpoint, and given projected growth in electricity demand in Mexico, it is clear that the energy mix will continue to rely on gas for the foreseeable future. However, this resource will increasingly have to compete with renewables, which, as explained in the previous section, have become progressively more cost-competitive. According to the IEA, clean energy accounted for

126 Rystad Energy, "Only 10% Of U.S. Shale Drillers Have A Positive Cash Flow", in OilPrice.com, 29 May 2019, available at: oilprice.com/Energy/Crude-Oil/Only-10-Of-US-Shale-Drillers-Has-A-Positive-Cash-Flow.html

127 Rubén Torres, "Gobierno de SLP se opone al fracking (SLP government opposes fracking)", Energía y Ecología, 5 September 2025, available at: energiayecologia.mx/energia/gobierno-de-slp-se-opone-al-fracking/

128 Ichiro Sato, Beth Elliott and Clea Schumer, "What Is Carbon Lock-in and How Can We Avoid It?", World Resources Institute, 25 May 2021, available at: www.wri.org/insights/carbon-lock-in-definition; Karen C. Seto, et al., "Carbon Lock-In: Types, Causes, and Policy Implications", Annual Review of Environment and Resources, 2016, available at: doi.org/10.1146/annurev-environ-110615-085934

129 Stephen Stapczynski, "Big Spending Cements LNG in Energy Mix for Decades to Come", Bloomberg, 11 January 2024, available at: www.bloomberg.com/news/newsletters/2024-01-11/huge-wave-of-lng-investment-may-delay-global-energy-transition

more than 80 percent of total growth in power generation in 2024, and renewables were the fastest-growing energy source that year[130]. Even so, the dispatchability of combined-cycle plants and their ability to deliver firm power—especially on days with unusual demand peaks—means that gas remains difficult to replace in many regions. As a recent analysis by Carlyle notes, batteries will be able to cover short-term gaps, but gas will remain the "balancing joule", that is, the source that provides the marginal increments of energy needed over longer periods[131]. Energy policy must therefore define the role gas should play within the power system so as to strike a balance between reliability, affordability and sustainability of supply.

In sum, persistent dependence on gas creates at least two structural risks. First, the country could continue to accumulate environmental and financial liabilities associated with methane and other pollutants if more stringent monitoring and mitigation mechanisms are not put in place. Second, meeting energy-transition and climate-mitigation goals within the pledged timelines becomes more difficult, especially if investment in gas infrastructure does not complement but instead displaces alternative sources.

Key questions on environmental and climate risks

- Can the country uphold its climate goals while continuing to expand long-lived fossil infrastructure such as LNG terminals, which require decades of operation to be profitable?
- Is it realistic to assume that methane regulation and monitoring can be strengthened fast enough to ensure that gas use does not undermine emissions-reduction commitments? Moreover, how would this trajectory affect the policy signals needed to mobilize investment in renewables, which require stable regulatory environments and budgetary priority?
- To what extent can the exploitation of unconventional gas through fracking in Mexico be considered a strategy that is compatible with energy transition and decarbonization commitments, given its economic, environmental and social implications?
- How close is Mexico to a carbon lock-in scenario, in which investment in gas infrastructure constrains the deployment of clean energy?
- Is Mexico taking a sufficiently critical view of the deferred costs of a strategy that does not appear to fully incorporate the environmental and climate risks of gas?

130 IEA, *Global Energy Review 2025: Electricity,* available at: www.iea.org/reports/global-energy-review-2025/electricity
131 Jeff Currie, *The New Joule Order*, Carlyle Group, 2025, available at: www.carlyle.com/global-insights/research/the-new-joule-order

4. Conclusions

This discussion paper shows how gas has become the backbone of Mexico's energy system. Mexico's geographic proximity to the United States has enabled a stable, low-cost supply for the country's economy. However, this competitive advantage has resulted in growing dependence on imported gas, creating an increasingly asymmetric relationship that requires effective mechanisms to address disruptions, price spikes or geopolitical realignments.

Currently, more than 70 percent of the gas consumed in the country comes from a single supplier. This dependence on external sources is compounded by technological dependence—given the dominance of combined-cycle power plants in the electricity mix—and logistical dependence, reflected in the high concentration of gas flows in a small number of pipelines and entry points, as well as limited storage capacity at the national level. Taken together, these dimensions of gas dependence highlight the structural vulnerabilities of Mexico's energy system.

In this context, inaction in the face of emerging risks has stemmed from adherence to three assumptions long taken for granted in energy policy: sustained access for Mexico to an abundant and reliable gas supply, low and stable gas prices in the United States, and the belief that gas does not compromise the country's climate and energy-transition goals. However, episodes such as the Winter Storm Uri, price spikes, the rapid development of LNG in North America, unaccounted-for methane emissions, and the debate over fracking are a reminder that gas supply in Mexico must be subject to constant monitoring and periodic assessment, so that the country can respond effectively to supply, economic, environmental and climate risks.

This paper seeks to contribute to a more informed and realistic debate on the role of gas in Mexico. One factor that has hindered a comprehensive assessment of the issue is that it is often addressed from polarized positions. Between these two extremes, the complexity of the risks and the nuances of the decisions needed to balance reliability, affordability and sustainability tend to be overlooked. What is needed is a more pragmatic, evidence-based approach that recognizes the contributions gas has made to date, while also identifying the limits and conditions for its future use.

To move in that direction, this analysis identifies four key priorities:

1. **Adopt a comprehensive framework for assessing gas-related risks: energy policy should explicitly incorporate the assessment of supply, economic, environmental, and climate risks associated with dependence on imported gas.** This assessment should be scenario-based and form part of the government's binding energy planning.

2. **Promote an orderly, coherent energy transition, with a trajectory that aligns the role of gas and renewable energy: the government should clearly define the depth and pace of the transition, considering costs and benefits in an integrated way and balancing criteria of reliability, affordability and sustainability at each stage of the process.**

3. **Develop a policy for managing gas demand: energy security is not strengthened only from the supply side.** A robust energy efficiency policy, together with the electrification of high-impact sectors such as transport, building heating and cooling, and certain industrial processes, as well as technological diversification that includes decarbonizing the power sector, could also help close the gap in gas imports.

4. **Strengthen methane measurement, monitoring, reporting and verification capacities: to credibly meet national and international climate commitments, the oil and gas industry must strengthen its leak-detection and repair programs, incorporating technologies such as optical gas-imaging cameras, aircraft, drones and satellite data.**

Mexico's growing dependence on gas, particularly imports from the United States, now represents one of the most pressing challenges for the country's energy security. Mexico has the legal framework, technical capacities and institutional tools needed to reduce this dependence and mitigate the risks that stem from it. Using these capacities strategically will be essential to ensuring a reliable, affordable and sustainable energy supply in the decades to come.

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