CLIMATE CHANGE, ENERGY TRANSITION POLICY IN MEXICO AND THE PROMOTION OF THE USE OF NATURAL GAS

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I. INTRODUCTION

Climate change is one of the most serious problems humanity faces collectively and "represents a growing threat to ecosystems as well as infrastructure, human settlements, productive processes, public health and other factors affecting development",[1] so much so that if nothing is done to stop or control it, there will be catastrophic consequences for human life.

In its Fifth Assessment Report (AR5),[2] the Intergovernmental Panel on Climate Change (IPCC)[3] noted: "New evidence confirms that climate system warming is unequivocal… land and ocean surface air temperatures, as a global average, rose 0.85°C in the period 1889-2012".[4]

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1 Tudela, Fernando, "Cambio climático, un problema de todos", *Foreign Affairs Latinoamérica*, vol. 15, No. 4, 2015, p. 8.

2 IPCC Fifth Assessment Report 2014.

3 A panel of experts from the United Nations Environment Programme and the World Meteorological Organization.

4 Pichs, Ramón, "Prólogo", in Cruz, Xóchitl y Delgado, Gian Carlo (coords.), *México ante la urgencia climática: Ciencia, política y sociedad*, México, UNAM, Centro de Investigaciones Interdisciplinarias en Ciencias y Humanidades y Programa de Investigación en Cambio Climático 2015, p. 17.

According to the IPCC AR5, human influence on the climate system is becoming increasingly evident and is due to rising concentrations of greenhouse gases (GHG) in the atmosphere[5] because of the increased production and use of fossil fuels to generate energy. Despite the growing number of climate change mitigation policies, anthropogenic GHG emissions have continued to surge, reaching 49 ± 4.5 Gt of CO_2e per year (49,000 million tons) in 2010. Carbon dioxide (CO_2) emissions from fossil fuel combustion and industrial processes contributed around 78% of the total increase in emissions[6] and:

> In the absence of any additional efforts to reduce GHG emissions beyond current levels, these emissions are expected to grow driven by global population growth and economic activities and subsequently lead to a rise in the global average surface temperatures of between 3.7˚C and 4.8˚C by 2100 compared to pre-industrial levels.[7]

According to the IPCC Sixt Assessment Resport, since 2011 (measurements reported in AR5), concentrations have continued to increase in the atmosphere, reaching annual averages of 410 parts per million (ppm) for carbon dioxide (CO_2).

At the 21st Conference of the Parties to the United Nations Framework Convention on Climate Change, which culminated in the Paris Agreement, it was agreed to hold the global average temperature increase well below 2°C from pre-industrial levels to avert a possible catastrophe, and to continue efforts to limit this temperature increase to 1.5°C so as to minimize adverse effects on the climate system.[8]

Reaching this 2°C target will, however, require substantial reductions in GHG emissions in the coming decades and practically zero emissions of CO_2 and other long-lived gases by the end of the 21st century. The Paris Agreement was limited to voluntary commitments by all the parties, embodied in the so-called Nationally Determined Contributions (NDCs) to be

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5 IPCC, Climate Change 2014, Synthesis Report, Summary for Policymakers, 2014, p. 5, available at: *https://archive.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM_es.pdf.*

6 Pichs, Ramón, "Prólogo", *op. cit.*, p. 17.

7 Convención Marco de las Naciones Unidas para el Cambio Climático, Acuerdo de Paris, 2015, available at: *https://unfccc.int/files/meetings/paris_nov_2015/application/pdf/paris_agreement_spanish_.pdf.*

8 Convención Marco de las Naciones Unidas para el Cambio Climático, Acuerdo de Paris, 2015, available at: *https://unfccc.int/files/meetings/paris_nov_2015/application/pdf/paris_agreement_spanish_.pdf.*

implemented in 2020-2024 and which were defined by each signatory country according to their national circumstances. Each party also established NDC implementation timeframes or periods, scope, and methodologies.

Although these NDCs proposed relevant actions such as the expansion of renewable energies and an increase in energy efficiency, there is a notorious weakness or even an absence of measures that directly impact the logic and dynamics of the oil-gas business. Nor is it by chance that the negotiators of the Paris Agreement refused to establish a carbon budget that could limit emissions, especially those produced by burning fossil fuels, and to abandon the attempt to transition from coal and oil to (natural) gas as a way to decarbonize the energy matrix through the so-called expansion of *low-carbon energy sources*. This reveals a resistance to genuine change in the energy paradigm since *low-carbon energy sources* include not only renewable, but also gas and nuclear energy.[9]

It is therefore evident that "…for large oil companies to change their production patterns… implies a devaluation of their capital…".[10] Thus, there are economic and social forces interested in maintaining sustained growth in their production levels and the growing use of fossil fuels to the detriment of the climate system.

The Mexican government, meanwhile, boasts of maintaining a leading position at the international level in addressing climate change and has committed to building consensus and defining actions to deal with it. Thus, Mexico is the first and only developing country to submit five National Communications to the United Nations Framework Convention on Climate Change (UNFCCC), and its First Biennial Update Report. It "…was one of the few countries to submit its INDCs in the originally stipulated time. In fact, it was the first developing country to do so".[11] It was also the first developing country and the second country in the world to have a legal framework on climate change by enacting the General Law on Climate Change (LGCC) in June 2012. But while the central issue of energy and environmental policy in most countries around the world has focused on how to reduce production, consumption and dependence on fossil fuels be-

[9] Delgado, Gian Carlo, "COP 21 y la transición hacia escenarios de bajo carbono, eficiencia, innovación tecnológica y cambio de paradigma" in Rueda, Clemente and Gay, Carlos (coords.), *21 Visiones de la COP 21, El Acuerdo de París: Retos, y áreas de oportunidad para su implementación en México*, México, UNAM, 2016, pp. 83-85.

[10] Schoijet, Mauricio, *Límites del crecimiento y cambio climático*, México, Siglo XXI, 2008, p. 49.

[11] Muñoz, Gabriela, "Contribuciones previstas y determinadas a nivel nacional" in Rueda, Clemente and Gay, Carlos (coords.), *21 Visiones de la COP 21, El Acuerdo de París: Retos y áreas de oportunidad para su implementación en México*, Mexico, UNAM, 2016, p. 64.

cause of their effects on the global climate, Mexico, with its energy reform and implementation of the Energy Transition Law (LTE) and its policy instruments, has opted for greater extraction, importing and use of one fossil fuel –natural gas– in the electricity industry.

The aim of this paper is to analyze the LTE within the framework of the 2013 energy reform and the promotion of the use of natural gas to achieve the objectives of this law and of the LGCC, as well as to detail its consequences on the climate system.

II. Energy Transition Law

In December 2013, Mexico approved the Constitutional Reform on energy-related matters, by amending Articles 25, 27 and 28 of the Constitution. Published in the Federal Official Gazette on December 20 of the same year, its decree also included twenty-one transitory articles, among which we highlight the Seventeenth:

> …the Congress of the Union will adapt the legal framework to establish the bases on which the State will ensure the protection and care for the environment, in all processes related to this decree by incorporating criteria and best practices in the areas of efficiency in the use of energy, the reduction in generating greenhouse gases and compounds…, as well as a smaller carbon footprint in all its processes.

And the Eighteenth Transitory Article, which says: "The Federal Executive… shall include a transition strategy in the National Program for the Sustainable Use of Energy (PRONASE) to promote the use of cleaner technologies and fuels".

In compliance with the above, the Ministry of Energy (SENER) and the National Commission for the Efficient Use of Energy (CONUEE) developed the first Transition Strategy to Promote the Use of Cleaner Technologies and Fuels, which became part of the PRONASE in force at that time and was published in the Federal Official Gazette on December 19, 2014.

Subsequently and under pressure from non-governmental organizations when the 21st Conference of the Parties (COP 21) to the UNFCCC was taking place, the Mexican Congress passed the Energy Transition Law.

Article 3 of this law defines the Transition Strategy to Promote the Use of Cleaner Technologies and Fuels as the guidelines for designing the Spe-

cial Energy Transition Program (PETE) and the PRONASE, which are the mandatory benchmarks for clean energy and energy efficiency policies.

The update to the first Transition Strategy to Promote the Use of Cleaner Technologies and Fuels was published in the Federal Official Gazette on December 2, 2016,[12] in compliance with the Fifteenth Transitory Article of the LTE. The Agreement by which the SENER issued the PETE 2017-2018 was published on May 31, 2017, and the Energy Transition Law Regulation was published on May 4, 2017.

III. Energy transition policy and the use of natural gas

As part of the secondary laws prescribed by the transitory articles of the 2013 constitutional energy reform, the LTE was belatedly enacted in December 2015, with the aim of: "…regulating the sustainable use of energy, as well as obligations regarding clean energy and the reduction of polluting emissions from the *electricity industry*, while maintaining the competitive edge of the productive sector".

This is the only law in the energy law related to environmental protection. One of its objectives is to help meet the LGCC goals of reducing GHG emissions from electricity generation, by promoting the use of clean energies like those from renewable sources. This is reflected in the Third Transitory Article of the LTE, which states: "The Ministry of Energy shall set a minimum participation of clean energy in the generation of electricity of 25% by 2018, 30% by 2021 and 35% by 2024". For this reason, it should be the principal legal instrument to mitigate the negative effects of the energy reform on the climate system.

It is important to clarify what is meant by *clean energies*. To this end, the LTE refers to the Electricity Industry Law (LIE), published in the Federal Official Gazette on August 11, 2014, which explains that they are: "Those energy sources and electricity generation processes whose emissions or waste… do not exceed the thresholds established in the regulatory provisions…". Renewable energies are considered clean energies, including wind, solar radiation in all its forms, ocean in its diverse forms, heat from geothermal deposits, hydroelectric, bioenergy, methane produced from waste, and

[12] On February 7, 2020, the most recent update of the Transition Strategy to Promote the Use of Cleaner Technologies and Fuels was published in the Official Gazette of the Federation.

hydrogen, *inter alia*. However, attention must be drawn to the fact that this legislation includes nuclear energy in the *clean energies* category, as well as:

> The energy generated by efficient cogeneration plants under the efficiency criteria issued by the Energy Regulatory Commission (CRE) and the emissions criteria established by the Ministry of the Environment and Natural Resources (Semarnat); energy generated by thermal power plants with geologic carbon dioxide capture and storage or bio-sequestration processes with an efficiency equal to or greater in terms of kWh-generated per ton of equivalent carbon dioxide released into the atmosphere at the minimum efficiency established by the CRE and the emissions criteria established by Semarnat; technologies considered *low-carbon emission* technologies according to international standards, and other technologies determined by SENER and Semarnat, based on energy and water efficiency parameters and standards, atmospheric emissions and waste generation whether direct, indirect or during its life cycle.[13]

With the entry into force of this legislation, the Law for the Use of Renewable Energies and Energy Transition Financing, which as its name indicates, regulated the use of renewable energies, and did not take fossil sources into account, was repealed.

Thus, from the revised definition of clean energies in the LTE, it can be inferred that: The goal of 35% of electricity generation from *clean energies*[14] *by 2024, contained in the LGCC (and established by the LTE) was therefore intended to be met not only with renewable energies, but also through the use of a fossil fuel: natural gas.*[15]

In this regard, the National Electric System Development Program (PRODESEN) 2018–2032 recognizes:

> …that the broader the definition and the list of technologies considered clean, the lower the cost of incorporating these technologies into the system, making it possible for the country to boost its competitiveness, diversify its

[13] The Sixteenth Transitory Article of the Energy Transition Law, as well as the administrative provisions published in the Federal Official Gazette on December 22, 2016, establish the conditions and thresholds for cogeneration, thermal generation with carbon capture and other low-carbon emission technologies (natural gas) that are considered clean energy. In the Reform to the Electricity Industry Law published in the Official Gazette of the Federation on May 11, 2022, the same definition of Clean Energy is maintained.

[14] The General Law on Climate Change does not define what is meant by clean energies.

[15] Mendívil, Ana and Niño, Gabriela, "La política climática de México tras el Acuerdo de París", México, Friedrich Ebert Stiftung, 2016, p. 16.

electricity generation matrix and maintain an efficient and trustworthy balance of the system.[16]

To meet its goals and objectives, the LTE institutes the creation of planning instruments for the national energy policy on *clean energies*, such as the Transition Strategy to Promote the Use of Cleaner Technologies and Fuels and the Special Energy Transition Program.

The Strategy is the guiding instrument for national policy in the medium and long term, 15 and 30 years respectively. About *clean energies*, it seeks, in the medium term, to reduce under economic viability criteria the country's dependence on fossil fuels as a *primary source* of energy and to establish policies and measures to advance the use of renewable resources and replacement of fossil fuels in final consumption. Meanwhile, the Program establishes the activities and projects that must be developed in accordance with the strategy.

Closer examination of the Strategy[17] shows that it does not contain a definition of *clean energies*, by which it can be understood that the definition does not differ from that of the law, that is, it includes not only renewable energies, but also low-carbon emission energies such as natural gas. The goals and scenarios of the energy transition are set out in terms of clean energies; however, the policies and lines of action to reach those objectives are focused on seven areas: bioenergy, wind energy, solar energy, geothermal energy, hydropower and energies from the ocean, carbon capture and storage, development and social impact, but does not include natural gas or low-carbon emission fuels.

Notwithstanding the above approach to renewable energies, the Strategy acknowledges that in forecasting participation by technology type in electrical energy consumption, the contribution of conventional (fossil) fuels will go from 77% of total electricity consumption in 2016 to 59% in 2030, increasing with an average annual growth rate of 1.05%, while renewable energies will go from contributing 23% to 27.6% in the same period, growing at an average annual rate of 5.9%. It is worth noting that nuclear power is expected to have an average annual growth rate of 9%.[18] So, it is possible to assert that: "In this regard, a study by the Economic Commission for Lat-

16 Secretaría de Energía, Programa de Desarrollo del Sistema Eléctrico Nacional, México, 2018, p. 28, available at: *https://www.gob.mx/cms/uploads/attachment/file/331770/PRODESEN-2018-2032-definitiva.pdf*.

17 Refers to the version published in 2016.

18 Secretaría de Energía, Estrategia de Transición para Promover el Uso de Tecnologías y Combustibles más Limpios, México, *Diario Oficial de la Federación*, December 2, 2016, avail-

in America and the Caribbean (ECLAC) indicated that Mexico is projected to continue to depend on fossil fuels to a large extent until 2030".[19]

The Special Energy Transition Program has the express objective to expand installed capacity and the generation of clean energy; diversify the energy matrix; decarbonize the electricity sector and meet the demand for competitively priced electricity and respect for the environment. Hence, the program does take into account the LIE definition of *clean energy* and has a clear focus on these aspects.[20]

It bears mentioning that neither the Strategy nor the Program has established quantitative goals for the participation of renewable energies within the global goals of clean energy in electricity generation.

The programs and prospects of the electricity sector merely refer to the development of clean energies in general. According to PRODESEN, in 2017 the installed capacity of the System was 75,685 MW, 70.5% of which were conventional electricity plants and 29.5% plants with clean technologies, classified as such based on the LIE definition, with emphasis on the substitution of solid or liquid fuels for natural gas.[21]

Within the clean energy package, in addition to efficient cogeneration, PRODESEN includes the conversion of thermoelectric plants to dual combustion ones. It also scheduled, as of 2014, the conversion of seven thermoelectric generation units to dual combustion for the purpose of reducing the use of fuel oil and replacing it with natural gas.[22]

Between 2018 and 2021, combined cycle electricity and turbo gas power plants were expected to be installed, representing 47% of the total additional capacity.[23] As a result, natural gas consumption would grow at an average rate of 2.4% a year so that by the end of the planning period, i.e., 2032, its share would reach 63% of the total fossil fuel consumption used to produce electricity. This would be possible with 10 gas pipelines starting

able at: *https://www.gob.mx/cms/uploads/attachment/file/182202/20161110_1300h_Estrategia_CCTE-1.pdf.*

[19] Mendívil, Ana and Niño, Gabriela, "La política climática…", *op. cit.*, p. 5.

[20] Secretaría de Energía, Programa Especial de la Transición Energética 2017-2018, México, *Diario Oficial de la Federación*, May 31, 2017, available at: *https://www.gob.mx/cms/uploads/attachment/file/213322/PETE.pdf.*

[21] Secretaría de Energía, Programa de Desarrollo del Sistema Eléctrico…, *op. cit.*, p. 18.

[22] *Ibidem*, p. 37.

[23] According to PRODESEN 2021-2035, it is estimated that in the evolution of the estimated electricity production of the period, the consumption of natural gas will continue to be predominant, with a gradual incorporation of the participation of renewable energies with the aim of meeting the established goals, guaranteeing reliability in conditions of economic viability.

operations in 2018, thereby boosting transportation capacity by 12,193 million cubic feet per day.[24]

The following table shows the composition of electricity generation during the PRODESEN planning period. With the exception of wind energy, the growth of the rest of the renewable energies remains stagnant, while nuclear energy stands out for its remarkable expansion.

TABLE 1. TOTAL GENERATION BY TYPE OF TECHNOLOGY IN 2022 AND 2032 IN %

Technology	*2022*	*2032*
Combined cycle	52	51
Coal-fired and fluidized bed combustion	11	7
Conventional thermoelectric, internal combustion and Turbogas power plants	4	2
Wind	10	13
Hydroelectric	9	8
High efficiency cogeneration	3	2
Nuclear	3	8
Solar	4	4
Geothermal	2	3
Bioenergy	2	2

SOURCE: prepared by the author based on information provided by PRODESEN.[25]

The Electricity Sector Outlook 2017-2031 estimates that:

> …between 2017 and 2031, 55,840 MW of electricity generation will be added, 37.4% of which will correspond to conventional technologies… 62.6% to clean technologies. It should be noted that of the total additional capacity, the two main technologies contributing the most to the system are combined cycle power plants with 33.9% and wind power stations with 24.2%.[26]

[24] *Ibidem*, p. 81.

[25] *Ibidem*, p. 80.

[26] Secretaría de Energía, Prospectiva del Sector Eléctrico 2017-2031, México, p. 77, available at: *https://www.gob.mx/cms/uploads/attachment/file/284345/Prospectiva_del_Sector_Electrico_2017.pdf*. To the latest Electricity Sector Outlook 2018-2032, in the period the addition of 66,912 MW of new capacity is foreseen, of which 54.9% will be from clean technologies and the remaining 45.1% from conventional technologies. Combined cycle technology will concentrate 42.0% of the total additions.

The Natural Gas Outlook for 2017-2031 reports on the growth of the sector's demand for natural gas:

> The use of natural gas for electricity generation has progressively risen in the country. It accounted for 70% of the demand for fossil fuels used in the electricity sector in 2016 because of the strategy of substituting expensive and contaminating fuels such as oil fuel and diesel for cheaper and more environmentally friendly sources such as natural gas.[27]

Likewise, "[i]n 2031, it is estimated that the demand for natural gas will have increased 26.8% [*sic*] compared to 2016, going from 3,395 MMSCFD[28] in 2016 to 5,947.2 MMSCFD in 2031",[29] an increase of 2,552.2 MMSCFD of natural gas, corresponding to an actual increment of 75%, resulting from building transportation infrastructure and the Federal Electricity Commission (CFE) fuel substitution strategy combined with the conversion of power plants to dual combustion plants. In addition, "[t]his strategy is part of the clean energy goals set out in the Energy Transition Law published in December 2015 to regulate the sustainable use of energy, as well as the obligations regarding clean energy and the *reduction of pollutants in the electricity industry*".[30]

The scenario for renewable energies is very different. At the end of 2016, the installed capacity in Mexico had risen 10.17% over the preceding year. Meanwhile, 15.4% of electric energy was generated using renewable energies, and solar and wind power were the technologies that showed the greatest growth.[31]

PRODESEN estimates that between 2017 and 2031, renewable energies will grow by an average annual rate of 7.4%, to end the period at 135,027 GWh.[32]

According to an ECLAC report, in 2012 a comparative analysis of the efficient and renewable energy policies in Mexico and China found that

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27 *Ibidem*, p. 14.

28 Millions of standard cubic feet per day.

29 *Ibidem*, p. 17.

30 *Ibidem*, p. 62. In the Natural Gas Outlook 2018-2032 it is estimated that in 2032 the demand for natural gas will be 9,920.5 mmcfd, which will represent an increase of 30.33% compared to 2017. And it is confirmed that the electricity sector will continue to lead the demand for gas, derived from the continuous use of natural gas associated with the conversion of electricity generation plants, the progress in projects for the installation of combined cycle power plants and the expansion of the infrastructure of the gas pipeline network.

31 Secretaría de Energía, Prospectiva de Energías Renovables..., *op. cit.* p. 13.

32 *Idem.*

Mexico had not allocated significant resources for renewable energy projects.[33] From the data, we observe that this trend continues.

IV. Incentives for using natural gas

Due to its low carbon emissions, natural gas has long been considered an alternative to the use of solid fossil fuels like coal or liquid fuels like diesel or fuel oil. Even major oil companies have spread the idea that it can be a bridge fuel for the transition to renewable energies, claiming that in order to achieve the long-term emission reduction goals, it is necessary to lower the use of coal and other fuels with large carbon footprints per unit of energy produced and replace them with natural gas of both conventional and non-conventional origins. The latter, however, is extracted by using the controversial hydraulic fracturing technology with estimated GHG emissions up to 11% higher than those generated by extracting from conventional deposits.[34]

In its Fifth Assessment Report (2014) of the Intergovernmental Panel on Climate Change (IPCC), Working Group III suggested some possible benefits to increasing natural gas production, even when extracting from shale basins.[35]

According to a paper by the German Institute for Economic Research, Mexico pushed through its energy reform with the intention of expanding the use of natural gas over other fossil fuels, mainly in the energy sector, and thus opening the market to private investors.[36]

This is reflected in the different strategies adopted, especially by Semarnat, supposedly aimed at lowering emissions and complying with international commitments. Moreover, investment programs in gas production, import and transportation infrastructure highlight the following items:

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[33] Heres, David, *El cambio climático y la energía en América Latina*, Chile, United Nations ECLAC, European Union, 2015, p. 33.

[34] Hultman, Nathan *et al.*, "The Greenhouse Impact of Unconventional Gas for Electricity Generation", *Environmental Research Lett*ers, no. 6, 2011, p. 1.

[35] Committee on Climate Change, "Does the IPCC Endorse Shale Gas?", United Kingdom, April 17, 2014, available at: *https://www.theccc.org.uk/2014/04/17/does-the-ipcc-endorse-shale-gas/*.

[36] Feijoo, Felipe *et al.*, "North American Natural Gas Model Impact of Cross-Border Trade with Mexico", *Discussion Paper of DIW Berlin*, no. 1553, 2016, p. 1, available at: *https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2737266*.

1. *Government policy and mitigation actions*

The National Climate Change Strategy 10-, 20- and 40-Year Outlook was published as mandated by the LGCC in the *Federal Official Gazette* on June 3, 2013. It is the planning instrument to guide the nation in combatting the phenomenon of global warming and its aftermaths over the next 40 years. Like the LGCC, this document does not include a definition of clean energies although the Third Transitory Article of the Law establishes that SENER, in coordination with the CFE and the CRE, should advocate for the generation of electricity from clean energy sources reaching a minimum goal of 35% by 2024.

Among the array of mitigation actions of this Strategy, the CFE fuel substitution strategy is considered one of the most viable medium-term actions, given the current conditions, in order to reach the goals, set by the law on this issue.

One of the main tactics in the Strategy is to accelerate the energy transition towards clean energy sources since Mexico has vast potential for generation through renewable sources and to overcome the barriers to their full incorporation into the national energy system. Among the lines of action is to promote the generation of energy through the use of clean sources and more efficient technologies to replace fossil fuels, thus minimizing their environmental and social impact and to encourage the generation of energy through renewable sources such as wind, photovoltaic, geothermal, hydroelectric and solar thermal power, as well as the inclusion of nuclear energy, as part of the clean energy sources for the energy transition.

Objective 3 of the Special Program on Climate Change 2014-2018 published in the Federal Official Gazette on April 28, 2015, sets out: "To reduce greenhouse gas emissions to transition to a competitive economy and low-emission development", in light of Strategy 3.2 which focuses on "accelerat[ing] the energy transition to less carbon-intensive energy sources". To this end, it proposes actions such as promoting the diversification of the energy matrix with public and private investment in generation using clean energies, thus replacing diesel and fuel oil in the energy matrix with less carbon-intensive sources and developing policies and measures to ensure the adequate supply of natural gas. It should be noted that biofuels and renewable energies are also mentioned.[37]

[37] Gobierno de la República, Plan Nacional de Desarrollo 2013-2018, Programa Especial de Cambio Climático 2014-2018, México, 2013, available at: *http://www.semarnat.gob.mx/sites/default/files/documentos/transparencia/programa_especial_de_cambio_climatico_2014-2018.pdf.*

On March 27, 2015, Mexico submitted its Nationally Determined Contributions (NDC) to the United Nations Framework Convention on Climate Change (UNFCCC) in preparation for the Conference of the Parties held in Paris in December 2015. The NDC proposed to lower GHG emissions by 22% from the baseline by 2030, and 51% of black carbon. It also committed to reaching peak emissions by 2026 by decoupling GHG emissions from economic growth, i.e., emissions intensity per unit of GDP would be reduced by around 40% by 2030.[38]

The mitigation actions to achieve this goal in the electricity industry include generation with 35% clean energy by 2024 and 43% by 2030 (66%) and the substitution of natural gas for fuels (1%).[39]

The First Biennial Update Report for the UNFCCC,[40] which outlines the guidelines for emissions to comply with the INDCs pledged at the 2015 Paris COP21 details the areas of opportunity identified for GHG emissions reduction at the sectoral level, among which are, in the case of oil and gas: a reduction of fugitive methane emissions in the extraction of unconventional gas reservoirs and deep waters; improvement of operating practices promoting cogeneration and energy efficiency projects; and greater supply of natural gas to replace more carbon intensive fuels.

To accelerate the energy transition towards clean energy sources, some of the proposed mitigation measures are disseminating the advantages of cogeneration and converting 7 generation plants from fuel oil to gas, among others that include fostering renewable energy sources. In this context, it should be recognized that the proposed path for the electricity industry envisages the installation of more than 18000 MW of generation capacity from renewable sources in 2018.

2. *Reduction of short-lived climate pollutants*

The aforementioned National Climate Change Strategy 10-, 20- and 40-Year Outlook acknowledges that control of short-lived climate pollutants such as methane, tropospheric ozone and especially black carbon, generates mitigation opportunities that are cost-effective and have a significant

38 Mendívil, Ana & Niño, Gabriela, "Una política energética sustentable: un pendiente para México", México, Friedrich Ebert Stiftung, *Perspectivas*, No. 1, 2016, p. 13.

39 *Idem.*

40 Gobierno de la República, *Primer Informe Bienal de Actualización ante la Convención Marco de las Naciones Unidas sobre el Cambio Climático*, México, Semarnat, Instituto Nacional de Ecología y Cambio Climático, 2015.

impact. Such actions have high global-warming potential and great environmental co-benefits, in addition to contributing to reducing toxic compounds harmful to human health.

Currently, there is no baseline for short-lived climate pollutants emissions; they are calculated as a carbon dioxide equivalent because there is still no international scientific consensus on the proper conversion factors.

The inclusion of black carbon in the absence of scientific certainty on the issue is another example of this policy promoting natural gas. Given the toxicity and carcinogenicity of soot particles or black carbon, Mexico, under the pretext of combining climate change mitigation efforts with the protection of public health, was the only country to commit to a goal of reducing this compound by up to 51% from the baseline by 2030, in its NDCs submitted in March 2015.[41] However, this raises reasonable suspicions about its encouraging the use of this fossil fuel as it is, after all, derived from liquid or solid fossil fuels and the best way to reduce its emission is to replace it with natural gas. This seems to simply give the appearance of complying with the ambitious mitigation goals, without jettisoning the use of fossil fuels or changing the country's energy profile.

3. *Failure to include renewable energy goals in NDCs*

It is necessary to point out that Mexico has not committed to any specific renewable energy goals, unlike other countries like Brazil, India and China. Brazil has pledged to diversify its energy matrix so that by 2030 between 28% and 33% of renewable energies would be used to generate electricity. India will build 100 GW of solar energy capacity and 60 GW generated by wind power capacity by 2022. Finally, China will install between 800 and 1,000 GW of renewable energy by 2030.[42]

4. *Carbon tax does not include natural gas*

"Among the best climate change mitigation policies is the imposition of a price on carbon to hold us accountable for the social costs of our

[41] Gobierno de la República, *Compromisos de Mitigación y Adaptación ante el Cambio Climático para el periodo 2020-2030*, México, 2015, available at: *https://www.gob.mx/cms/uploads/attachment/file/162974/2015_indc_esp.pdf.*

[42] Mendívil, Ana and Niño, Gabriela, "Una política energética sustentable…", *op. cit.*, p. 6.

actions".[43] At COP21, Mexico declared that its policy of promoting clean energies is based on a carbon tax established in 2013, but this is applied to all fuels, except natural gas.[44]

5. *Natural gas imports and gas pipeline expansion*

To sustain this policy, Mexico needs to import large quantities of natural gas. Among the premises considered by the Five-Year Plan for the Expansion of the Integrated National Natural Gas Transportation and Storage System 2015-2019 for planning the National Gas Pipeline System are: "The resulting balance in global terms shows that the demand for natural gas grows, on average, 500 million cubic feet per day every year, while the supply decreases, on average, 100 MMSCFD. This implies a growing demand for imported natural gas, both by pipeline and liquefied natural gas (LNG), (by sea)".[45]

The cited five-year plan contained projects considered strategic to guaranteeing the efficient development of the gas transportation system and entailed an expansion of 5,159 km of new gas pipelines with an estimated total investment of $9,736 million USD.

In March 2018, the National Natural Gas Control Center (CENAGAS) published a third revision of the 2015-2019 Five-Year Plan, approved by SENER. This new version contained plans for 10 new pipelines that would add a further 3,354 km to the system.[46] In addition, CENAGAS conducted a study of the underground storage potential for natural gas, which was centered on identifying hydrocarbon deposits which could be converted to subterranean natural gas storage units. Meanwhile, there are three storage

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[43] Huesca, Luis and López, Alejandra, "Impuestos ambientales al carbono en México y su progresividad. Una revisión analítica", *Economía Informa*, México, No. 399, May-June, 2016, p. 23.

[44] Mendívil, Ana and Niño, Gabriela, "Una política energética sustentable...", *op. cit.*, p. 6.

[45] Secretaría de Energía, Plan Quinquenal de Expansión del Sistema de Transporte y Almacenamiento Nacional Integrado de Gas Natural 2015-2019, México, 2015, p. 9, available at: *https://www.gob.mx/cms/uploads/attachment/file/43397/Plan_Quinquenal_del_Sistema_de_Transporte_y_Almacenamiento_Nacional_Integrado_de_Gas_Natural_2015-2019.pdf.*

[46] Secretaría de Energía, *Tercera Revisión Anual, Plan Quinquenal de Expansión del Sistema de Transporte y Almacenamiento Nacional Integrado de Gas Natural 2015-2019*, México, 2018, p. 68, available at: *https://www.gob.mx/cms/uploads/attachment/file/311763/531.DGGNP.209.18.INF.1.OT.12_Tercera_Revisi_n_PQ_2015-2019.pdf.* In the Five-Year Plan corresponding to the period 2020-2024 it is reported that from the first to December 31, 2019, the natural gas transmission network grew 7.7%.

and regasification terminals for LNG located in Ensenada, Manzanillo and Altamira.[47]

Natural gas imports went up 53% in 2015.[48] The year before that, 69% of all natural gas imports came from the United States,[49] highlighting how dependent the country was on its northern neighbor and how vulnerable that made it.

An average of 2,000 MMSCFD entered Mexico through pipelines from the United States, and the capacity was projected to increase to more than 5,000 MMSCFD by 2020, which, along with the construction of LNG regasification terminals, could elevate the volume of imports.[50]

According to the National Energy Balance, domestic natural gas production fell from 4,685.0 MMSCFD in 2006 to 3,568.1 MMSCFD in 2016 with an average annual growth rate of -2.7. Meanwhile imports rose from 1,018.4 MMSCFD in 2006 to 4,181.1 MMSCFD in 2016 with an average annual growth rate of 15.1. In total, demand increased from 5,672.9 MMSCFD to 7,618.7 MMSCFD from 2006 to 2016, with an average annual growth rate of 3.0.[51]

At the close of 2016, import volume was 4,168 MMSCFD, up 17.5% over the previous year. Of the imported volume, 87.2% (3,791 MMSCFD) came through import pipelines from the United States and 12% as LNG (527 MMSCFD).[52]

From a review of previous budgets, it can be said that: "…the energy reform amounted to the construction of a great, political, economic and infrastructural scaffolding for projects to extract this hydrocarbon (natural gas), promoted by the Federal Government".[53]

V. Use of natural gas and climate change

As already mentioned, natural gas is frequently touted as a bridge fuel that will allow society to continue to use fossil fuels in the coming decades since its

47 *Ibidem*, p. 30.

48 During 2019, 69% of the demand was met with imported natural gas.

49 Pemex, *Indicadores Petroleros*, México, 2016, available at: *http://www.pemex.com/ri/Publicaciones/Indicadores%20Petroleros/eimporpetro_esp.pdf*, 201.

50 Feijoo, Felipe *et al.*, "North American Natural Gas Model", *op. cit.*, p. 4.

51 Secretaría de Energía, Sistema de Información Energética, available at: *http://sie.energia.gob.mx.*

52 *Idem.*

53 Mendívil, Ana and Niño, Gabriela, "Una política energética sustentable…", *op. cit.*, p. 6.

combustion emits a smaller amount of GHGs per unit of energy than other fossil fuels like coal and fuel oil. Natural gas is mainly composed of methane, whose greenhouse effect potential is far higher than that of carbon dioxide produced by combustion.

The supposed advantages of using natural gas as an alternative are misleading; owing to methane's high global warming potential, the possible benefits of reducing the carbon footprint by using it as a replacement for solid or liquid fuels are not merely offset, but far exceeded.

For purposes of GHG inventory calculations, it is standard practice to consider methane as having 28 times the global warming potential of carbon dioxide at 100 years.[54] The half-life of methane in the atmosphere is 12 years while carbon dioxide has an effective influence on atmospheric chemistry lasting 100 years or more.[55]

The 2013 IPCC report on the scientific bases of global warming highlights the role of methane in global warming and establishes that there is no scientific argument for selecting 100 years as the value for warming potential and not one corresponding to other time horizons.[56] According to Howarth, it is more appropriate to use a 20-year value, which is 86 times that of CO_2, because of the urgent need to prevent the severe effects of global warming over the next 15 to 35 years[57] and to achieve the goals of the Paris Agreement to hold the increase of average global temperature well below 2°C and to continue efforts to limit that increase to 1.5°C above pre-industrial levels so as to lower the risks of climate change as quickly as possible.

If this is taken into account, the GHG footprint of natural gas in electrical power generation is almost 30% higher than that of coal.[58]

With regard to fugitive emissions, natural gas management systems are the main sources of methane emissions in the United States, accounting for 40% of total methane emissions.[59]

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54 Value used in the Inventarios Nacionales de Gases y Compuestos de Efecto Invernadero, as well as in the Registro Nacional de Emisiones according to the Acuerdo que establece los gases o compuestos de efecto invernadero que se agrupan para efectos de reporte de emisiones, así como sus potenciales de calentamiento, *Diario Oficial de la Federación*, August 14, 2015.

55 Howarth, Robert W. *et al.*, "A Bridge to Nowhere: Methane and the Greenhouse Gas Footprint Of Natural Gas", *Energy Science and Engineering*, 2014, p. 6.

56 *Ibidem*, p. 7.

57 *Ibidem*, p. 1.

58 *Ibidem*, p. 9.

59 Howarth, Robert W. *et al.*, "Methane Emissions from Natural Gas Systems. Background Paper Prepared for the National Climate Assessment", February 25, 2012, Cornell

In studies published up to 2011, estimates of fugitive methane emissions in natural gas extraction and processing systems are 0.4% to 2% of the natural gas produced during the life cycle of a well while in transportation and distribution systems, they range from 0.4% to 2.5%. In more recent investigations, estimates have been as high as 10% of the natural gas extracted.[60]

To get an idea of the above, if we take the values in the Natural Gas Outlook for 2017-2031, which foresees that in "2031 the demand for natural gas will grow 26.8% [*sic*] over 2016, moving from 3,395 MMSCFD in 2016 to 5,947.2 MMSCFD in 2031".[61] In 2016, 152.775 MMSCFD of methane were released into the atmosphere and by 2031, it will have increased to 267.62 MMSCFD due to fugitive emissions in the extraction, production and transportation of natural gas. It is important to clarify that these estimates have a high degree of uncertainty, but it should be considered that the global warming potential of methane over carbon dioxide is 28 times greater at 100 years and 86 times greater at 20 years.

And so, it can be seen that much of the federal government's efforts at energy reform and climate change mitigation, far from leading to a decarbonization of the economy by encouraging the use of renewable energy, is heading towards promoting the use of natural gas. This was evident in the widespread publicity of the reform in the media that promised as one of its benefits: "Cheaper and more abundant gas will contribute to lowering light bills".

VI. Conclusions

As shown in all the planning documents on energy and climate policy, the use of natural gas was promoted by prioritizing measures to replace solid and liquid fuels with this fossil fuel, whose management produces large amounts of fugitive methane emissions which pose a far greater global warming potential than carbon dioxide. These emissions are therefore expected to contribute significantly to the increase in the planet's average global temperature and to the disruption of the climate system.

The proposed expansion of clean fuels with low-carbon content is a clear sign of the resistance to change in an energy paradigm currently based

University, available at: *http://www.eeb.cornell.edu/howarth/Howarth%20et%20al.%20--%20National%20Climate%20assessment.pdf.*

60 *Ibidem*, pp. 2 and 3.

61 Secretaría de Energía, *Prospectiva de Gas Natural 2017-2031*, *op. cit.*, p. 17.

on the extraction and consumption of hydrocarbons. But it is necessary to move towards a real decarbonization of the economy and to adopt a sustainable model committed to the environment by limiting energy consumption and promoting renewable energies.

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