SEI Stockholm Environment Institute

Transition or lock-in?

Tracking institutional support for gas in two Latin American case studies

SEI working paper
November 2023

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Cover photo: Gas pipes on the side of a building © Luis M / Getty

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Patricio Calles Almeida wrote the initial draft and led research when employed at SEI in 2022-2023; Claudia Strambo and Elisa Arond updated the research, addressed the editor's comments and finalized the text for publication.

This study was funded by the Swedish International Development Cooperation Agency (Sida) through core support to the Stockholm Environment Institute.

DOI: https://doi.org/10.51414/sei2023.058

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Key messages

- **Institutional carbon lock-in occurs when public and private actors create dynamics that perpetuate the production and use of fossil fuels, even against technological and market trends.**
- **Many Latin American countries are expanding gas capacity without adequate justifications and beyond demand projections under current policies and decarbonization scenarios, increasing lock-in risks around gas.**
- **Energy regulators often approve infrastructure projects based on preconceived notions that gas is a "clean" fuel and that access to gas is linked to development, without proper evaluation of its social, environmental, and climate effects.**
- **As they often benefit financially from developing and operating gas infrastructure, state-owned companies play a significant role in creating institutional carbon lock-in.**

ABSTRACT

Within a growing global demand for gas over the last decade, particularly for power generation, Latin America has seen inconsistent political and market signals regarding interest in accessing and using fossil methane (natural) gas (hereafter referred as gas). Despite widespread government goals of fueling economic and social development through gas infrastructure, projects face many hurdles to get gas flowing. Sometimes, governments absorb cost overruns and remain trapped in bureaucratic rigidity; at other times, legacy gas infrastructure provides enough justification for continued building. This context signals a growing risk of institutional carbon lock-in, where powerful public and private actors create dynamics that perpetuate the production and use of fossil fuels, even against technological and market trends.

In an effort to identify causes and effects of this divide, this document explores financial, regulatory and political drivers and obstacles involved in developing gas supply infrastructure projects in Colombia and Mexico. It finds that supply momentum, the political and financial muscle of state-owned enterprises and a lack of robust energy demand planning are the critical factors increasing gas lock-in risks and associated outcomes, including overbuilding infrastructure.

1. Carbon lock-in and the energy transition

Costs of renewable energy technologies grow increasingly competitive with fossil fuels (IRENA, 2021). At the same time, rhetoric on accelerating decarbonization emphasizes the role of government institutions and political capital. But discussions about public policies to support the energy transition tend to ignore ongoing or increasing commitments to fossil fuel-based greenhouse gas (GHG)-emitting technologies and systems, even as their phase-out is ever more urgent. Ensuring just energy transitions for affected populations, which is vital for securing long-lasting transformations, means also paying attention to how potential winners and losers of this evolution will respond (Atteridge & Strambo, 2020).

Fossil fuel producers and their support networks are often identified as transition losers, given that the energy transition implies a move away from fossil fuels; in other words, a disruption to the status quo of carbon-intensive energy systems. As such, producers' efforts to maintain relevance amid the ongoing transition would be expected.

Continued political support and institutional inertia in favor of fossil fuels could halt ongoing transition processes independently of technological breakthroughs or even economically favorable alternatives (Kemp, 2020), perpetuating what is known as "carbon lock-in". The strategies through which producers and their networks respond to the disruptions posed by transition processes depend on market conditions, but also on politics. Political support for fossil fuels alongside a commitment to expand renewable technologies underscores the power of carbon lock-in: "the inertia of technologies, institutions and behaviors individually and interactively limit the rate of systemic transformation [and] inhibit innovation and competitiveness of low-carbon alternatives," continuing and expanding use of carbon-intensive technologies and practice" (Seto et al., 2016, p. 3). In addition to technological and cultural factors, institutional dimensions of lock-in highlight how "powerful economic, social, and political actors [...] seek to reinforce a status quo trajectory that favors their interests" (Seto et al., 2016, p. 22). In other words, both explicit and implicit government strategies can create dynamics that perpetuate the production and use of fossil fuels instead of adopting alternatives.

1.1 Objective

This working paper takes a first step towards exploring the dynamics of institutional gas lock-in in Latin America, which vary across different geographies and scales. As lock-in may occur in different forms, this paper focuses on specific policy mechanisms that uphold institutional lock-in: financial and regulatory support, as well as some of the political dynamics around these. It provides a basis for further discussions on gas lock-in by characterizing financial, political and regulatory trends surrounding two cases of gas infrastructure development in the region. As such, it represents the beginning of the policy analysis process, identifying the rationale behind institutional decision-making in both the public and private spheres.

Despite the rise of gas as a strategy many governments are relying on to meet objectives of low-carbon development, energy access and other priorities, there are yet substantial gaps in the evidence base for informed public debate and policy decisions, especially in the Latin American region. Consequently, this paper aims to highlight the links between energy governance and lock-in dynamics based on specific gas project developments and to stimulate richer discussions on gas projects among non-governmental organizations, think tanks and academia, as well as interested policymakers in the region.

As such, its goal is limited to characterizing energy project planning under the context of institutional path dependence and carbon lock-in specifically. While recognizing that gas is a fossil fuel linked to increased GHG emissions and other negative health and biodiversity effects (Achakulwisut et al., 2022), this working paper does not aim to determine whether specific projects are inherently negative to the countries developing them, nor does it calculate precise impacts for national or regional Latin American climate ambitions. Rather, it seeks to point out energy governance risks which, in turn, could lead to more emissions and negative externalities associated with fossil fuels. In a broader sense, then, this working paper does not assess the role of gas as in energy transition strategies, social development, greenwashing narrative and any other mystifying or demystifying characterization.

Future work could expand on the preliminary findings of this paper and assess the specifics of existing and planned infrastructure projects linked to gas production, transport and storage. These potential follow-ups may quantify the evidence needed by decision-makers to approve, or cancel, further fossil fuel expansions. For example, techno-economic analyses of gas infrastructure projects can quantify the associated emissions of each project and the expected profitability under different future market scenarios, including stranding risk under scenarios aligned with limiting global warming to 1.5°C; a geospatial mapping exercise can help in identifying potential impacted communities and ecosystems close to project sites and related infrastructure.[1] These types of precise analyses can provide further ideas for untangling the drivers and barriers of energy project development and contribute to more effective and grounded energy governance processes.

1.2 The dimensions of institutional carbon lock-in

In the academic literature, lock-in dynamics are considered normatively neutral (MacKinnon et al., 2019; Seto et al., 2016) and therefore not inherently negatively affecting energy transition processes, but rather creating circumstances in which fossil fuels continue developing. It is not until these dynamics are compared to actual transition pathways that the adverse effects of lock-in are clear. Two measures that exemplify that comparison are emissions and profits from fossil projects. Emissions associated with new projects that exceed agreed targets to limit global warming are an example of the consequences of a project with increased carbon lock-in risk. Recent evidence shows that committed carbon emissions from existing fossil fuel-combustion and -extraction infrastructure already exceed the remaining carbon budget for a 50% chance of limiting warming to 1.5°C (Trout et al., 2022), meaning that any new fossil fuel projects are now essentially incompatible with the 1.5°C limit. And when considering negative emissions technology limitations, global gas production and use need to start declining now and be cut by 84% between 2020 and 2050 (Achakulwisut et al., 2023).

Similarly, lock-in increases the risk of stranded assets into the future if, for example, a fossil project becomes unprofitable before investments are recovered due to rising costs or decreasing profits along the value chain. Regardless of the difference in the measuring standard, both signal the development of more carbon-intensive projects than policy or market forces call for. Under this definition, project development resulting in excess fossil fuel availability or use can arguably have followed carbon lock-in dynamics. This highlights governance obstacles for the energy transition: to know why and how fossil fuel projects continue to receive the benefits of institutional support that include securing financing, overcoming political opposition and expediting necessary permits.

Limiting lock-in dynamics that lead to overdevelopment of fossil fuel projects involves different challenges, depending on the fuel in question. Coal transitions, for example, have found success in reducing dependency among both supply and demand actors, thanks in part to fierce phase-out commitments that have translated into political priorities, and the fact that coal is easier to replace[2] than other fossil fuels like oil and gas (Diluiso et al., 2021; Garg et al., 2017; Luderer et al., 2018). On the other hand, gas has taken on the role of "transition fuel" for some, as it is considered a mature technology generating fewer carbon emissions than other fossil fuels, and that can help stabilize

1 See examples of technoeconomic analysis (Erickson, 2018), as well as geospatial analysis highlighting competition between extractive industry infrastructure and livelihoods (Cuba et al., 2014) and deforestation and community rights (Bebbington et al., 2018; Kartha, 2022).

2 Nonetheless, coal is often substituted by other fossil fuels, especially gas, that, despite producing fewer emissions, contributes to "health and environmental hazards and reduced social welfare at every stage of its life cycle" (Landrigan et al., 2020, p. 104).

or ease the shocks of short- and medium-term transition processes[3] (Gürsan & de Gooyert, 2021). Yet gas itself can also contribute to, and be subject to, dynamics of lock-in. For instance, less than three months after COP26 negotiations, where 23 countries committed to phase down coal (UN Climate Change Conference, 2021), gas was added to the European Union taxonomy for sustainable activities (European Commission, 2022). While this development exemplifies global trends for fossil transitions, identifying and understanding the process through which lock-in develops and is sustained (hereafter referred to as lock-in dynamics) requires singling out differences in political economies at regional and even national levels (MacKinnon et al., 2019).

Generally, the likelihood of institutional lock-in often increases as political and market forces diverge. Specifically referring to dependencies[4] around infrastructure development, this divergence can sometimes be explained by differing time tables, the range of possible outcomes that can be achieved from a given starting point, benefits to energy systems and a strong status-quo bias linked to existing fossil fuel networks (Pierson, 2000). Decision-making processes are, as a result, likely to follow the inertia of previous decisions against potential alternatives that markets provide. This inertia does not necessarily protect the fossil fuel sector from the existential threat of the low-carbon energy transition, but possibly generates tensions between different fossil fuel-intensive trajectories. This occurs as energy policies in the region are often packaged into wider attempts to stimulate economic and social development. Signaling progress towards such broader goals often requires investing economic and political capital into large projects and subsidies that can directly and indirectly increase lock-in risk (Fouquet, 2016).

Public initiatives for transitions are often implemented with limited time and support, and require negotiations and iterative agreements with other stakeholders (Könnölä et al., 2006). Financing tensions help determine project selection and development, while financing sources and their flexibility may determine the desirability and necessity of any project (Cantarelli et al., 2010). Government-supported projects are constrained by the institutional pressures of wider policy packages and, as a result, are prone to regulatory capture (Könnölä et al., 2006) – in other words, a situation where a regulatory agency is heavily influenced by the industries or entities it is supposed to regulate, and their interest prevails over that of the general public (Levine, 2002). Additionally, regulatory support is often accepted by the business sector, as it signals an environment of desired stability for their investments and operations, but also the potential, as operators, to reduce their obligations of compliance, through the aforementioned mechanism of regulatory capture or negotiation (del Río & Labandeira, 2009). In the case of gas, identifying the sources of funding and political capital requires an assessment of infrastructure development processes at the project level. This consideration calls for a case study selection in order to avoid "black-boxing" the complexity of regional policy dynamics (Uyarra & Flanagan, 2012); at the same time, analysing the interplay of market and policy dynamics at multiple levels is necessary to identify and explain how institutional lock-in for specific projects materializes (García Kerdan et al., 2019).

In this context, Section 2 first shows that the growing relevance of gas in the region cannot be explained by market dynamics alone, suggesting the importance of examining political and regulatory factors. Section 3 explains the methodology, including case study selection, methods and data sources used. Section 4 describes the two case studies, also identifying the momentum in Latin American gas infrastructure development. Selected project case studies highlight political, regulatory and financial factors influencing their development. Section 5 presents arguments on why and how institutional support for natural fossil gas in general is linked to widespread institutional support for gas infrastructure development. The concluding section 6 draws on the case study analysis to propose avenues for future research and specific questions that may guide those discussions.

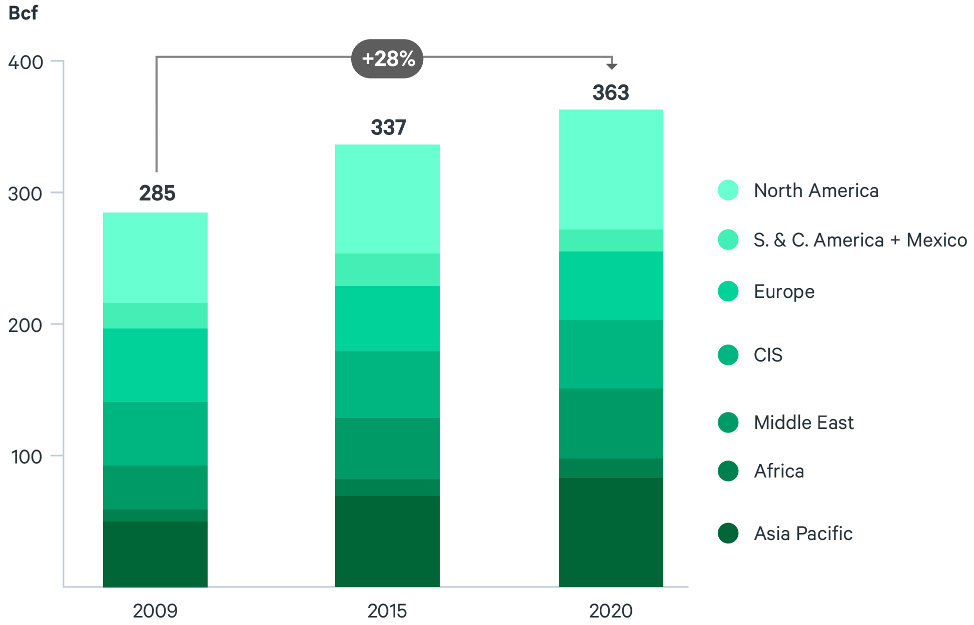
3 Stability in energy transitions may refer to technological, economic, and political factors and is difficult to define for an entire region.

4 Path dependency is conceptualized as "a social process grounded in a dynamic of 'increasing returns'" (Pierson, 2000, p. 251). In other words, once one starts down a particular technological or development pathway, there are often costs to backtracking and some marginal benefits to continuing, which explain some of the dynamics of lock-in.

2. Gas expansion in Latin America

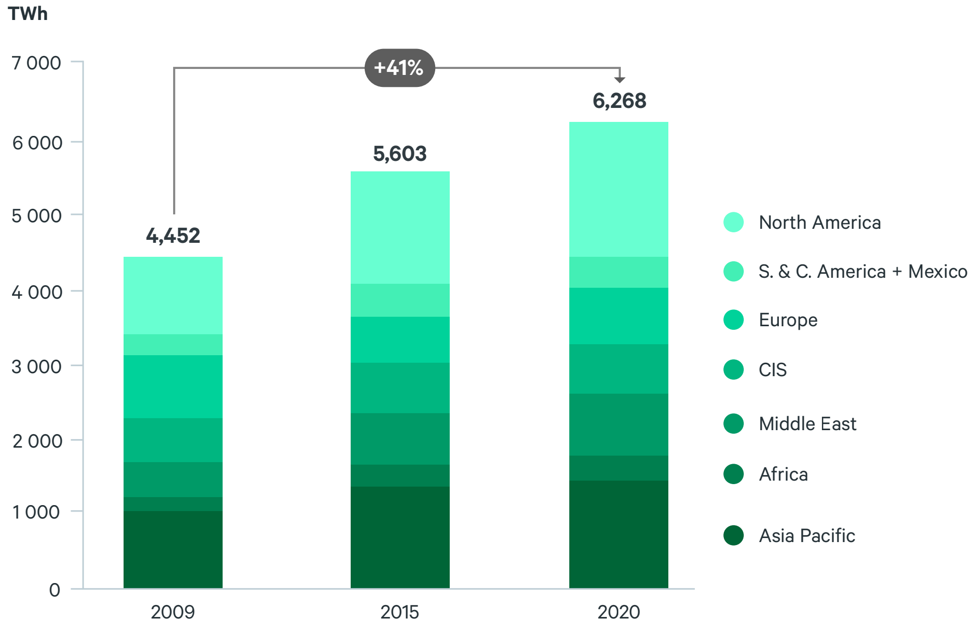
Gas use has expanded globally over the last decade, gaining relevance in new geographies and sectors. **Figure 1** shows that global gas consumption has increased 28% between 2009 and 2020, and represented about 35% of fossil CO_2 emissions in the same time period (Peters et al., 2020). Since the Paris Agreement of 2015, widely considered a turning point in the effort to limit climate change, global gas use has increased 10%, driven by growth in Asia and North America for power generation, as shown in **Figure 2**.

Figure 1: Change in global gas consumption (billion cubic feet)[5]



Source: BP, 2021

Figure 2: Change in global electricity generation from gas (terawatt hour).



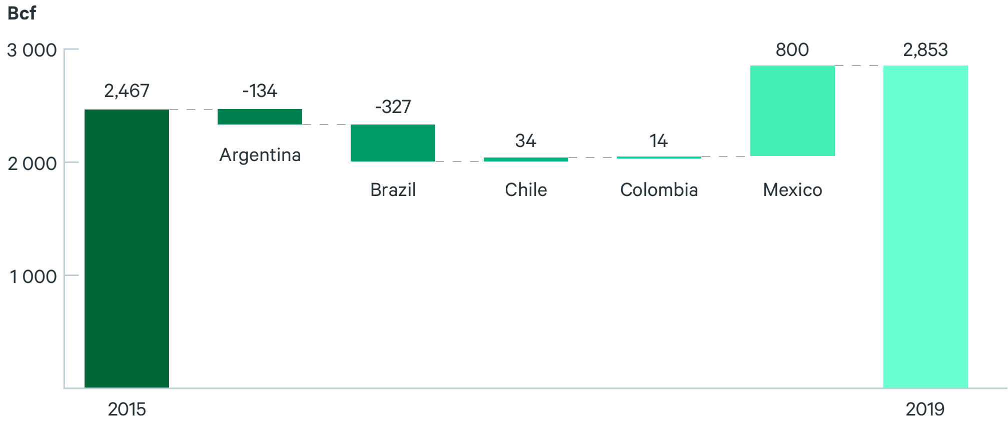
Source: BP, 2021

5 Commonwealth of Independent States (CIS) includes Armenia, Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Moldova, Russian Federation, Tajikistan, Turkmenistan and Uzbekistan.

Although Latin America's electricity generation mix has been historically dominated by hydropower, it has seen an increase of approximately 70% in installed gas-powered generation capacity between 2010 and 2022 (Ember, 2022). However, gas consumption has not risen as quickly, as Figure 2 shows. Moreover, the IEA projects that even without additional policies, global gas demand – like demand for oil and coal – will peak within this decade (IEA, 2023b). There is no evidence of a structural trend forecasting significant increased gas demand in Latin America, in contrast to data for North America and Asia (IEA, 2023a). The intensity and duration of droughts has been identified as the main driver behind the uptake of alternative generation fuels to hydropower, such as solar and wind, but also gas and biofuels (Gonzalez-Salazar & Poganietz, 2021). Additionally, the combination of deregulating utilities and the rise of combined-cycle gas turbine (CCGT) technology to produce gas-powered energy has favored cost-effective thermal plants over large-scale hydropower projects (Arango & Larsen, 2010). Further, deregulation has pushed electricity companies to operate under strict financial constraints due to increased market and financial risks (Geiger et al., 2001). As a result, utilities prioritize projects with shorter payback periods and higher profit margins. Compared to large hydropower plants, CCGT typically requires less capital investment and fewer environmental permits and can be completed faster.

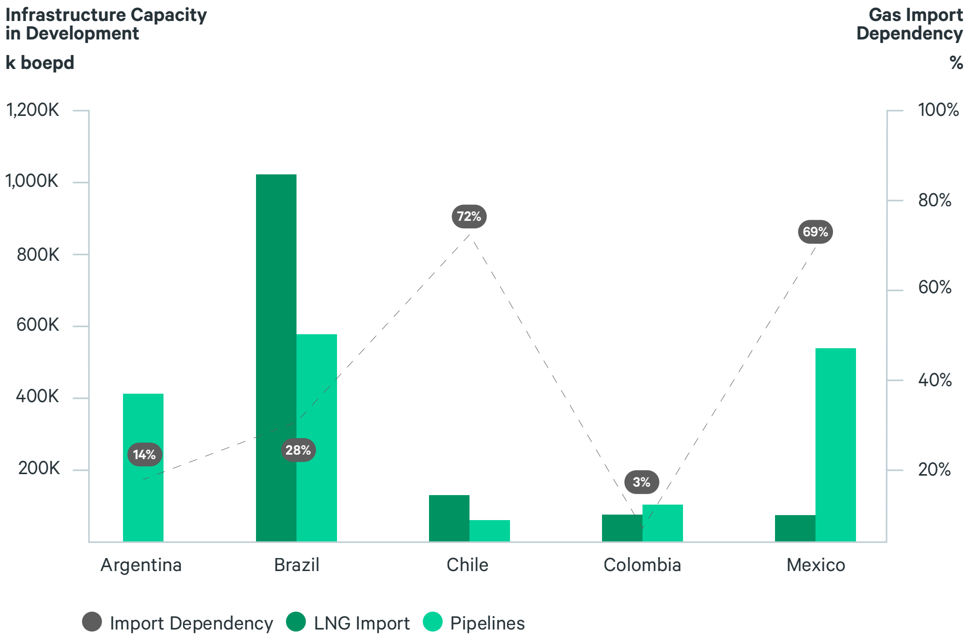
Figure 3 shows that between 2015 and 2019, if not for Mexico, Latin American gas imports would have decreased 33% (BP, 2021; EIA, 2021). Colombia's government has identified this trend and attributes a lack of infrastructure as the main reason behind the decline (UPME, 2020). **Figure 4** shows that other countries in the region are committing to developing capacity for both piped and liquefied natural gas (LNG) imports. This hints that they share the view of Colombia that lack of capacity is a driving factor behind the limited role of gas supply in the region. Even countries that have not shown significant appetite for foreign gas over the last five years, like Chile and Colombia, are planning on expanding gas availability, suggesting that multiple governments consider gas, a fossil fuel, as part of future transition processes (United Nations Environment Programme, 2022).

Figure 3: Change in gas imports growth 2015–2019 (billion cubic feet) .



Source: EIA, 2021

Figure 4: LNG import and pipeline capacity in development (thousand barrels of oil equivalent per day, k boepd) and gas import dependency.



Source: Global Energy Monitor, 2022

The cases of Brazil and Mexico represent a different trend in gas decision-making compared to the regional dynamics exemplified by **Figures 3** and **4**. Despite experiencing a 47% drop in gas import volumes since 2015, Brazil's LNG demand then increased rapidly in 2021 due to severe droughts that affected hydropower production (Reuters, 2022). Consequently, the country became the top destination for US LNG cargoes in September 2021 (S&P Global Platts, 2021). The same year saw a liberalization of the gas market, and as a result, plans for increasing LNG capacity intensified, with new proposals adding to those already included in the government's 10-year energy plan (Chen & Carey-Webb, 2021). Similarly, Mexico has increased its imports from the US by 226% since 2015, with its share of foreign gas increasing from 23% to 70% (CENAGAS, 2021).

Arguably, specific project conditions are enabling gas infrastructure development contrary to what regional commodity market dynamics, let alone emission reduction targets, would forecast. The number of ongoing gas infrastructure projects suggests that public and private developers anticipate an increased gas demand in the region. If this assumption was based on a robust energy demand analysis, building ahead would be justified, and common practice, even. In Latin America, however, these expectations are sustained with inadequate technical evidence. In other words, it could be said that the aim is to build gas infrastructure in the region, hoping that increased gas demand will eventually materialize.

Identifying why public decision-making is fuelling this trend is vital for Latin America and beyond, in order to assess whether the assumptions underlying these decisions are really in line with climate mitigation targets and sustainable economic development. One possible explanation for this direction of gas development includes the spread of discourses linked to the "bridge fuel" concept arising predominantly in Europe and North America, where gas is in the process of effectively displacing coal in the power generation matrix (IEA, 2021).[6] It is possible that similar ideas, generalizing the presumed benefits of fossil-fuelled economies and minimizing its adverse effects, are finding legitimacy in Latin America without considering their geographic,

6 There have been some shifts back to coal power in some countries in response to the Russia-Ukraine conflict, but this is expected to be a short- to medium-term trend, not long-term (Yanguas-Parra et al 2023).

technological, and regulatory contexts. This is occurring in spite of arguments that an energy transition led by renewable energies is not only technically and economically feasible, but would also lead to more jobs and economic savings overall, in addition to less environmental damage, than one led by gas (Brauers, 2022; Howarth, 2014; Janzwood & Millar, 2022; United Nations Environment Programme, 2022).

However, considering the disconnect between the policy momentum behind gas infrastructure and the financial and bureaucratic hurdles to actually develop projects, identifying how government strategies are being defined and implemented becomes just as important as determining why projects are launched. Therefore, this analysis places significant emphasis on characterizing domestic institutional support to supply-side gas infrastructure development to better understand institutional carbon lock-in. More specifically, the study focuses on gas pipelines and import terminals, for three main reasons. Firstly, since they connect gas demand and supply, studying them allows for identifying whether government strategies are driven by both supply and demand institutions (Brauers et al., 2021; Seto et al., 2016). Secondly, as an enabler of international trade, this type of infrastructure reveals evidence of mutual support between major international and domestic players in the gas market to further expand the use of gas. And lastly, tracking supply-side gas infrastructure development can provide a sense of the speed and scale of both gas production and consumption in the region.

3. Methodology

3.1 Case study selection

This working paper presents two cases of gas infrastructure projects that signal gas lock-in risks due to contradictory policy and market drivers. Despite widespread interest across the region in building new gas infrastructure, such commitments vary in planned added capacity and legitimacy of government involvement. This section introduces the case studies, explaining the regional focus on Latin America and project selections in Mexico and Colombia. **Table 1** summarizes the criteria used in the country and project selection. At the country level, this includes the evidence of institutional lock-in influencing gas infrastructure development, such as the existence of long-term energy scenarios, infrastructure development plans and assigned funding. At the project level, criteria include data accessibility, the public sector's role in proposing projects, level of public visibility, and project timelines. These also illustrate different factors present throughout the entire decision-making process.

Table 1: Case study selection criteria.[7]

Country selection criteria	Project selection criteria
• Country has developed long-term gas supply and demand scenarios. • Country has approved regulation for gas infrastructure development plans. • Plans have assigned funding and have not been shelved nor delayed.	• Technical and financial data is openly accessible from official sources. • Projects have been designed or suggested by public actors, not just sanctioned. • Projects have received considerable media and political attention. • Projects plan for operation before 2025.

In Latin America, only Colombia and Mexico have active gas infrastructure development plans approved by energy regulators. Argentina and Peru have developed gas scenarios in national energy demand outlooks, but publicly funded infrastructure development has been shelved due to political instability and lack of funding. In Brazil, major reforms to its regulatory framework aimed towards liberalizing its gas sector have halted most government-sanctioned projects in favor of private efforts that do not necessarily signal institutional support. Therefore, plans from these latter countries (Argentina, Peru or Brazil) cannot be analysed to the same extent as material developments from Colombia and Mexico. As countries with robust and active gas infrastructure plans, case studies from the Colombian *Estudio Técnico para el Plan de Abastecimiento de Gas Natural* (Technical Study for Natural Gas Supply Plan) and the Mexican *Plan Quinquenal de Expansión de Sistema de Transporte y Almacenamiento Nacional Integrado de Gas Natural 2020–2024* (5-Year Natural Gas Transport and Storage System Expansion Plan) were selected for analysis (CENAGAS, 2020; UPME, 2020). Specifically, the cases include one staple project from each country that received wide political and media attention, representing a significant portion of the total planned gas infrastructure investment.

3.2 Methods and data sources

This paper develops a case study analysis based on a desk-based grey literature review of publicly available government documents. Reviewed literature included technical analyses from regulatory bodies, business plans of state-owned utilities, calls for tenders, national infrastructure plans and gas supply contract models. Such documents provided sources for gas market descriptions, project justifications, site selection and financing objectives, to characterize, in both case studies, indications of institutional support. Additionally, to identify political follow-ups to the most recent version of each project, press releases and news coverage were also part of the analysis.

7 The countries considered include Argentina, Brazil, Chile, Colombia, Mexico and Peru.

4. Case studies overview

This section briefly introduces the selected projects. **Table 2** outlines their regulatory and financial drivers to then identify how lock-in dynamics and energy governance strategies interact in section 5.

Mexico – Tehuantepec Isthmus Cluster

This cluster includes two individual projects: a trans-isthmic pipeline connecting the Gulf of Mexico with the Pacific Ocean and an unspecified underground storage site near domestic production hubs for a total estimated capital expenditure of US$900 million (CENAGAS, 2020). Regulatory approval and cost estimations were completed in 2019. A second stage, dependent on how the market reacts to the first two projects, involves developing an LNG export terminal without committed completion dates, but is expected to be under construction by 2024, when the five-year plan will be renewed.

This energy project is part of the *Pacto Oaxaca* regional policy package, and is also linked to the interregional Multimodal Interoceanic Corridor megaproject. The Pacto Oaxaca's goal looks beyond energy access to lift the Isthmus region out of poverty. The region ranks poorly in industrial activity and human development among regions in Mexico (Duhalt, 2021; Gobierno del Estado de Oaxaca, 2020). The government identified gas supply development as a cost-effective tool to improve regional development prospects, as regions with historical access to gas lead the country in industrial and human development (CENAGAS, 2020). The project is designed to be paid off through increased gas transport tariffs, usually passed through to end-users. The project has become a flagship project of the federal government despite growing costs and development challenges. As ministries, regulators and government officials tour the Tehuantepec region looking for ways to increase gas demand, including through the development of industrial clusters, the necessity for the project has been called into question by civil society, Indigenous Peoples and grassroot organizations (Agencia Reforma, 2023; EJOLT, 2021).

Colombia – Pacific LNG Import System

Based on energy demand and water availability projections by its Energy Planning Unit (UPME), Colombia expects an increase in electricity demand while a strong *El Niño* may reduce water availability for hydropower generation (UPME, 2020). To add reliability to its electricity mix in that scenario, UPME explicitly defines gas as a "low-carbon buffer". Its 2020 Gas Supply Plan deems an LNG import terminal and pipeline in the national strategic interest, questioning the national hydroelectric power capacity to manage a potential abnormally dry 2024 season as a result of *El Niño*. The port of Buenaventura on the Pacific coast was selected as the most cost-effective site location, including the development of the interconnection pipeline for the national gas transport system.

The idea of an additional import terminal for Colombia, however, has been discussed since 2016 by industry players (Portafolio, 2016). It gained political traction after a 2019 memorandum of understanding between the governments of Colombia and the US for the potential terminal to receive gas from the Louisiana-based Sabine Pass LNG terminal (Guía del Gas, 2019). The original 2021 bidding round was declared void after none of seven parties that registered placed a bid for its development (UPME, 2021). A new tender was opened in 2022, but in May 2023, the Colombian government postponed the bid submission due to concerns about limited interest from potential investors (Palmigiani, 2023). In August 2023, the project bidding call was opened again following some modifications, and subsequently declared void (UPME, 2023). Though several firms formally expressed interest, only one actually presented a proposal, which, upon detailed examination by the UPME, did not comply with the requirements for a proposal as established by law. The project could still happen, however, and remains part of the strategic five-year gas plan. The current project status exemplifies the disconnect between political initiative and market mechanisms, given it remains a political priority while yet failing to attract market interest.

Table 2: Support and hindering factors for selected gas infrastructure projects.[8]

Project	Support	
	Financial	**Regulatory / Political**
Mexico Tehuantepec Isthmus Cluster	First non-LNG storage option for the country could decrease commodity price by lowering the cost for developing storage and operation (Carrillo et al., 2022) Comisión Federal de Energía (CFE), with access to low-cost capital, as main off-taker (CFEnergía, 2021)	Existing surplus contracted capacity in US import pipeline (Energía a Debate, 2021; Solís, 2021) Subsidies for industrial investments that will increase gas demand (Berg et al., 2023; Redacción TyT, 2023)
Colombia Pacific LNG Import System	Expectation that the project will encourage industrial investment in Cauca Valley region (Ortiz Cortés, 2023; Toro Torres, 2023)	Limited environmental government oversight (Contraloría General de la República, 2021) Regulatory decision to allow payment to investors to start before the project is fully operational (Vita Mesa, 2021)

8 Table 2 describes the selected gas infrastructure projects. Project support was identified through project design and approval documents which, in both cases, argued for the projects to become strategic and of national importance.

5. Case studies discussion

5.1 Why is institutional support for gas infrastructure growing?

National planning committees and gas suppliers in Mexico and Colombia have argued that regional economic development correlates with the availability of gas as an energy source (CENAGAS, 2020; CFE, 2021). However, this argument lacks robust empirical backing, as well as clear links to expected gas demand projections. For example, these arguments are often made without incorporating existing regional and local development roadmaps that could provide an overview of actual gas demand. As a result, decision-making processes aim to expand reliable supply options without first properly acknowledging if this is justified by demand growth.

In both the Colombian and Mexican cases, gas regulators have assessed gas infrastructure options with a predefined conception that some projects need to be approved due to strategic national interest. This preconception is explicitly based on two generic narratives around gas: that gas is a "clean" fuel, and that gas availability is linked to development. Without an analysis to sustain those claims, detailing what demand these projects will fulfil, gas planning processes are simplified into project approval mechanisms. Ultimately, infrastructure development policies that follow gas supply momentum can result in increased gas lock-in risk and overbuilding.

For example, the Tehuantepec Isthmus project highlights how existing assets, including brownfield infrastructure projects and legacy gas supply contracts, enable or even justify new project approvals. In 2021, almost two years after the approval of the Isthmus Cluster projects, the Mexican government toured the region to promote gas demand creation with the private sector (Solís, 2021). Official gas infrastructure plans in both Colombia and Mexico lack a sectoral demand analysis when approving new supply options, even if power generation is expected to be the most important demand-setter in the long term. Similarly, climate effects of methane flaring and leaks along the supply chain are not considered in project approval processes. This also suggests that gas infrastructure development, especially projects of a national scale, are significantly influenced by wider domestic and global socioeconomic and political circumstances (Feijoo et al., 2018). In the Colombian case, no political voices against the project in Congressional discussions were actually opposed to increased gas supply in the country; rather, they disagreed about how gas is paid for and where it comes from. In sum, supply and demand scenarios are part of, but not the only key factors used in regulatory project planning and approval (García Kerdan et al., 2019).

Even countries with robust and regulated long-term energy plans, such as Colombia and Mexico, may fail to properly link the expansion of gas supply with corresponding evidence of expected demand growth and greenhouse gas emissions reduction targets. In other words, national gas policies often fail to account for realistic mid- to long-term anticipated market developments, let alone climate mitigation considerations. When the misalignments between gas infrastructure policy and market circumstances have become evident, public institutions doubled down on carbon-intensive investments with reduced transparency, instead of reconsidering them.

For example, in 2021, Mexico's state-owned electric utility Comisión Federal de Electricidad (CFE) announced a $4.5 billion investment to supply gas to the Yucatán Peninsula and the Isthmus projects, as a way to utilize the under-used gas transport capacity it had secured from the US during the previous presidential period to supply future power plants under a take-or-pay contract (Energía a Debate, 2021; Solís, 2021).[9] This sudden investment was jointly announced with *Centro Nacional de Control del Gas Natural* (National Center for Natural Gas Control, or CENGAS) and the Secretariat of Energy, despite not being part of the regulated five-year plan. This commitment alone represents the equivalent of 250% of the investment value of the entire plan, but lacks regulatory oversight, being outside the plan. This suggests a lack of appropriate evaluation processes for developing gas infrastructure in relation to both expected demand and climate ambitions. This gap highlights that decision-making within the energy ecosystem

9 A form of contract that "obligates the buyer to take an agreed minimum quantity of gas at a set contract price over a given period of time or to pay an agreed-on amount if the minimum gas quantity is not taken" (Thomson Reuters Practical Law, n.d.).

faces common challenges for infrastructure in general: To secure project approval, costs are underestimated while benefits are overestimated (Flyvbjerg, 2009). In the context of energy transitions, lock-in dynamics perpetuate both sides of the equation. Narratives that exaggerate low-carbon attributes of gas reinforce the idea that economic development is within reach with minimal negative effect on climate.

Narratives prevalent in Europe and the US imply that gas works as a universal transition fuel. Yet the globalization and commoditization of the gas ecosystem highlight fundamental regional differences that challenge these narratives. First, the idea of gas as a "bridge fuel" is a simplified narrative that could be doing harm to places like Latin America that try to incorporate gas into energy plans without strategies to increase accountability of the gas supply chain's GHG emissions and without plans to eventually transition from gas to clean energy sources. For some gas infrastructure, such as gas power plants, lifetimes typically span several decades (Erickson et al., 2015). In reality, the EU taxonomy, for example, just sets a guideline that provides a role for gas within their existing energy transition strategies, allowing gas to be labeled as a climate-friendly investment, but without defining whether gas is inherently beneficial or harmful (European Commission, 2022). In the Colombian and Mexican cases, both governments approved gas infrastructure without identifying the specific role these projects could play in the transition, that is, the niche sectors or locations where gas might be used to reduce emissions in the long term, if any.

5.2 How do state-owned enterprises support gas?

Governments, and public actors in general, influence gas development both domestically and internationally. In Latin America, institutional lock-in extends beyond policymakers and regulators. National oil and gas companies and state-owned utilities actively, by both opportunity and design, benefit from continued lock-in. Either by building infrastructure or promoting extended gas use through financial and political capital, state-owned enterprises have become material enforcers of gas lock-in dynamics that could keep gas dominant for years to come.

In both case studies, state-owned actors benefit financially from the opportunity to develop and operate gas infrastructure. In Colombia, the national oil and gas company Ecopetrol banked on its domestic know-how and image to nominate itself to develop its own project to replace potential foreign project developers (Canchila García, 2021). By doing this, it would avoid recurring opposition from the domestic oil and gas lobby to resolve gas supply expansion with imports. Further, Ecopetrol has sought to position itself as a leader in the energy transition, with an expanded focus on gas production, processing (including regasification), and commercialization as a key part of its strategy (Ecopetrol Group, 2022). In the Mexican case, gas investments labelled as climate-friendly can not only lead to carbon lock-in, but interfere with other energy policy agendas: CFE was granted 72% of the climate change mitigation funds of the 2022 fiscal year budget to pay for gas transport, worth approximately $2.3 billion (Secretaría de Haciendo y Crédito Público, 2021). The Isthmus cluster, together with the Interoceanic corridor megaproject, envision the creation of ten industrial clusters, while Pemex anticipates providing gas to these new industries (Tapia Cervantes, 2023).

5.3 How do international geopolitics shape support for gas?

From an international perspective, US institutions have grown in relevance among gas suppliers through increased export volumes and market share (IEA, 2021). The boom in gas production in the US in the 2010s following the introduction of shale extraction technology caused suppliers to look for new export possibilities. It also led to a shift in US geopolitical standing, whereby the country sought to reposition itself in the global political landscape thanks to the power granted by its new status as an energy powerhouse (Vargas, 2015). For instance, the US government has put direct pressure on German public officials to increase EU's LNG trade with the US (Brauers et al., 2021).

This geopolitical reshuffling also transformed Mexico into an importer of high volumes of gas. As part of its repositioning, the US amended the North American economic integration project that initiated with the 1994 North American Free Trade Agreement (NAFTA), and thus sought to further integrate the energy economy of the US, Canada and Mexico, including through investments in domestic and transboundary fossil fuel infrastructure (Vargas, 2015). This was also enabled by the 2013 energy sector reform in Mexico, which aligned the Mexican model with that of the US (Rodríguez Padilla, 2018). As a result, and due to the low price of gas and declines in domestic production, Mexico's gas dependence increased dramatically to reach over 90% in 2018 (Estrada et al., 2022). Overall, the rapid development of gas production in the US reversed its strategic relationship with Mexico, with the US becoming a strategic gas supplier to Mexico (Morales, 2022). And it is in this context of a supply push that the Mexican government contracted the large gas transport capacity contract that led to plans for developing the Tehuantepec Isthmus Cluster.

The European energy crisis of 2021–2022, deepened by the Russian invasion of Ukraine, also reveals important geopolitical dynamics associated with institutional carbon lock-in. The crisis provided the basis for a narrative about how US energy exports provide energy security for the world. This idea has been embraced by both private and public institutions, restarting policy discussions on energy production and export and its role in global energy security dilemmas. However, these discussions have failed to acknowledge that the current focus on US gas exports was specifically born out of market forces, not public policies. Existing production, transport and export flows were altered by European buyers who outbid developing countries on spot markets. Alternatively, gas users realized the trading opportunity presented by the European urgency and resold some of their own gas. Any arguments by US politicians that energy exports improve global energy security is questionable unless parallel policies are implemented to make sure energy security in the Global South does not suffer from geopolitical and market realignments.

6. Conclusions and considerations for future work

This working paper presents evidence that characterizes institutional drivers of two different gas development projects, including efforts to promote industrial activity and address multidimensional poverty, and the perceived role of gas as a lower-carbon transition fuel that increases electric system reliability. Our analysis also highlights how existing gas assets, including brownfield infrastructure and legacy contracts, enable new investments and increase gas lock-in risk. The case studies also show how, even when market forces present financial obstacles to developing new gas infrastructure, state entities may double down on their expansion strategies by sidestepping regulator-sanctioned plans with less transparency and scrambling for logistical alternatives to meet goals, sometimes redesigning projects altogether.

Specifically, we propose the following preliminary set of considerations for gas planning and development policy analysis. We suggest that future institutional carbon lock-in work with an emphasis in Latin America should include, at least, these four themes:

- **The role of state-owned enterprises.** The Colombian Pacific LNG Import System project will likely open again for bids. The Colombian government has deemed it a strategic project, and thus decided not to cancel it after the bidding round was declared void twice. Nevertheless, the private sector remains doubtful of whether to face the financial, social and logistical obstacles that limit its feasibility. In this context, Ecopetrol has explored the possibility of replacing the public tender project with a modular project of its own (Bernal Marín, 2022; Canchila García, 2021). Considering that the project has not identified end users beyond the National Transport System, this represents a strategic risk for the company. Public institutions in Colombia should learn from the Mexican case and avoid absorbing the costs, uncertainties and negative externalities associated with projects with no clear off-takers.

- **(Un)democratic governance processes that lead to institutional carbon lock-in.** When projects within government-sanctioned plans are transformed to the point of redefining the financial and social assumptions used to approve them, the validity and usefulness of supposedly robust regulatory oversight is put into question.

- **The scope of energy development plans.** Energy planning institutions should look beyond merely balancing anticipated energy supply and demand when planning for future energy infrastructure development, and rather follow an integrated approach that considers the need for a rapid and managed transition away from fossil fuels in coordination with scaling up renewable energy and storage systems (Grubert & Hastings-Simon, 2022), in order to limit long-term warming to 1.5°C. The market conditions and non-climatic environmental and social implications surrounding energy infrastructure, including the health and biodiversity implications of gas expansion (Harfoot et al., 2018; Romanello et al., 2022), also need to be incorporated into project design and approval processes. Moreover, anticipated economic benefits from gas infrastructure expansion may not necessarily materialize, as illustrated by the case of Mozambique (Gaventa, 2021).

- **The problem of importing energy frameworks.** Any commitments to gas as part of near-term decarbonization strategies should be carefully evaluated and complemented with transition plans, especially given lock-in risks and the need for rapid and substantial overall reductions in gas production and use between now and mid-century. Gas is not a magic bullet for the energy transition. Even if gas infrastructure might play a role in decreasing the carbon intensity of the Latin American power mix under very specific conditions, there are serious risks (Bataille et al., 2020). For example, in Mexico, where the power generation matrix is dominated by fossil fuels, gas might represent an alternative to coal in the short term to achieve fast, yet partial, decarbonization. During the February 2021 cold front that prevented Texas from exporting gas to Mexico, power generation turned to coal and fuel oil to prevent blackouts (CENACE, 2021). But the momentum created by massive investments in gas infrastructure under the premise of reducing emissions may crowd out planning for longer-term alternatives based on renewable energy and risks generating other geopolitical dependencies and trade-offs. Further, the arguments for promoting gas in one specific country might not apply equally in a different carbon-intensity context. The fact that the US or Europe have found gas to be an energy solution to displace coal within specified parameters (IEA, 2019), based on their own circumstances, remains contested by scientists and does not mean the same framework is valid for all Latin American countries (Khan, 2022).

This exploratory analysis also raises questions regarding the assumptions made at high-level decision-making regarding fossil fuels and their added value to net-zero and low-carbon energy systems, and how these assumptions fuel carbon lock-in. Renewable energy sources increasingly form the basis of an economically beneficial, climate-aligned electricity matrix (IEA, 2023b; United Nations Environment Programme, 2022). Yet, a common argument in these case studies was that gas is important for the reliability of power generation systems. The accuracy of this argument across different contexts and scales, however, remains uncertain and should be examined in existing and future lock-in dynamics studies (Sayne, 2022). Further detailed analysis is also needed to evaluate planning around other uses of gas in sectors like transportation, agroindustry and chemical industry. The question of whether these potential end uses justify massive gas infrastructure projects faces different trade-offs than for power generation. But equally, such proposals need to be examined according to each context and scale, without assuming gas is the universal “transition” fuel, as some countries’ policymakers seem to be doing. Determining whether and where gas has any supporting role in energy transition and sustainable development pathways requires more detailed analysis, as it is likely to remain on the policy agenda.

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