

*Natural gas policy change in Mexico. The political economy of
state ownership and regulation (1995-2018)*

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Abstract

A reform of the constitutional bases of the oil and gas industry in Mexico took place in 2013 (with sweeping changes to secondary legislation through 2014). Private and foreign production of hydrocarbons became legal after almost six decades of national monopoly -and 75 years after the revolutionary regime nationalized the assets of foreign producers. A wholesale market for electricity was also put in place. These legal reforms started to crystallize in 2018, as private producers started to have access to the networks carrying electricity and gas across the nation.

This research presents a retrospective examination of 23 years of policy implementation in the natural gas industry of Mexico (1995-2018). The dissertation pays central attention to the patterns of state intervention that have characterized the national economy and that have contributed to shape the outcome of two policy packages pursuing liberalisation (one starting in 1995 and the other in 2013 and 2014).

The research is based on a classical political economy approach, drawing on the literature on Varieties of Capitalism and Varieties of State Capitalism. The study centers on the relations between the players in the sector: their constraints and resources, against a backdrop of other economic policies affecting energy. Importantly, this study considers regulation as a mechanism of economic coordination. As a process-tracing case study, this thesis sets out to elucidate the distinctive factors that contributed to produce the current organization of the natural gas sector in Mexico --one where, ironically, liberalisation has been possible thanks to the deployment of a new state-owned enterprise.

Three factors stand out as characteristic in the Mexican trajectory towards liberalisation: the strength of the national oil company as an obstacle of upstream liberalisation for almost two decades after 1995; the absence or weakness of constituencies supporting the restructuring of the sector (large industrial consumers, local distributors), and the sudden restructuring of supply and demand patterns, with the state-owned electricity enterprise emerging as a dominant trader. The new centrality of the electricity SOE and an Independent System Operator (also an SOE) underscores the limits of the new, more competitive, structure of the Mexican natural gas industry.

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In my defense, I have to say that when I started this research, I did not know a word about energy, and I knew very little about Canada. I am glad that now I can say a few words about both --and also about energy matters in Canada.

I do not think that I can take stock of all of what I have learned working with Monica, as student, and as part of the great Positive Energy team. Jumping from zero into writing about energy and climate change, polarization, Canada-U.S. relations, and regulation, has been an enormous privilege and a transformative experience. I have a long way to go, but I do not regret having changed my career. Thanks to all my colleagues at the University and the Institute for Science Society and Policy.

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One day, Jérôme will ask again why it took so long to finish. Now it does not matter.

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BCF.- Billion cubic feet

BLT.- Build-Lease-Transfer

BOO.- Build-Own-Operate

CCE.- Consejo Coordinador Empresarial

CCGT.- Combined cycle gas technology (for production of electric power)

CENACE.- Centro Nacional de Control Eléctrico

CENAGAS.- Centro Nacional de Gas

CFE.- Comisión Federal de Electricidad

CONCAMIN.- Confederación de Cámaras Industriales de los Estados Unidos Mexicanos

CRE.- Comisión Reguladora de Energía

EIA.- Energy Information Agency (U.S. government)

GATT.- General Agreement on Tariffs and Trade.

IPP.- Independent Power Producer

IPSO.- Independent Pipeline System Operator

LCOE.-Levelized cost of electricity

LDC.- Local distribution company

LNG.-Liquefied natural gas

LPG.- Liquefied petroleum gas

MEM.- Mercado Eléctrico Mayorista (wholesale electricity market)

MMBD.- Million barrels per day

MMBTU.- Million British Thermal Units

MCF.-Thousand cubic feet (10^3)

MCMD.—Thousand cubic meters per day

MMCFD.-Million cubic feet (10^6)

MORENA.- Movimiento de Regeneración Nacional

MTOE.- Metric tonnes of oil equivalent

NAFTA.- North American Free Trade Agreement

NOC.- National oil company

OECD.- Organization for Economic Cooperation and Development

PAN.- Partido Acción Nacional

Pemex.- Petróleos Mexicanos
PPA.- Power purchase agreement
PRD.- Partido de la Revolución Democrática
PRI.- Partido Revolucionario Institucional
SOE.- State-owned enterprise
Sener.- Secretaría de Energía/ Ministry of Energy
SHCP.- Secretaría de Hacienda y Crédito Público (Ministry of Finance)
SIE.- Sistema de Información Energética (Energy Information System)
TCF.- Trillion cubic feet
TPA.- Third party access (synonym of open-access)
TSO.- Transport System Operator
USMCA.- United States Mexico Canada Agreement
VoC.- Varieties of Capitalism
VoSC.- Varieties of State Capitalism

Introduction

We are not neoliberals. We do not have a neoliberal vision. We have a social nationalist vision and we are going to work on that scheme

Manuel Bartlett, CEO of the electricity SOE (2019)¹

¹ CE. Noticias Financieras, February 22nd 2019, “This is the new CFE: more generation, more control — and less private companies”, accessed via Factiva on October 30th 2019.

The 2010s was a momentous decade for the energy scene in Mexico.² In 2013, an ad hoc political coalition finally succeeded in upending the constitutional protections that kept private investment almost completely out of the upstream electricity and oil and gas sectors for more than a century. Besides the groundwork for oil and gas production, electricity and natural gas transportation and trading saw the most substantial transformations. Then, in 2018, a self-proclaimed leftist political party took the national election. Without promoting legislative changes, the new national executive started to reverse the policies that had been consolidating for more than 5 years.

On the electricity flank, through administrative decisions, the new government has been hindering the entrance of renewables and has stopped the auctioning processes to replace old public generation capacity with more efficient technologies. The electricity SOE is issuing debt to keep up the expansion of generation and transmission infrastructure –no matter that the legal framework allows private firms to risk into that. For producers and suppliers of petroleum products, expectations have also fallen into disarray: *farm-outs* for new exploration fields have been cancelled, permits for new gas stations have been withheld, and the Ministry of energy has been promoting a turn towards coal and fuel oil over natural gas and renewables. Without an explicit program yet, the new government is signaling that boosting the oil and electricity state enterprises is a major priority of policy.

Even without contemplating the environmental consequences of these decisions (and that is an enormous omission), it is difficult to elucidate whether and how the fruits of the reform will crystallize. For the natural gas industry -the subject matter of this research- attention centers on regulation: the possibilities of survival of a regulatory framework that intends to form a competitive industry –in the presence of a large and power-seeking electricity SOE, and with the legacies of a still regionally dominant NOC (National Oil Company).

This dissertation seeks to make a contribution to the current appraisals of energy reform in Mexico by looking at the –actually slow and troubled—transformation of natural gas policy and regulation within the last two and a half decades, from 1995 to 2018. The dissertation argues that the current organization of the natural gas sector in Mexico is as much a product of recent decisions to liberalise and regulate production, imports and transportation as it is the outcome of a medium-

² To make the reading more agile, the introduction omits references of facts that are referenced in the text.

term process framed by inevitable --or at least very strong-- patterns of state intervention in the economy. Mexico has neither been a socialist economy nor a centrally directed one. But the natural gas sector as it exists today still reveals the extent to which it was contained in a set of relations where hierarchy weighted more than markets and the institutions that make them work, with regulation at the centre of a complex set of relationships.

A process of policy change and its national particularities

This research forms part of a more general appreciation of energy in Mexico, and, for that reason, providing a minimum historical context is necessary. In ways that were like other economies lagging in their industrial development, petroleum and electricity grew at the start of the 20th century as private industries with considerable foreign ownership and technology. As the nation found a more solid political foundation in the aftermath of revolutionary violence, and as the national market integrated, energy became a priority for national development. The state-owned enterprises of oil and electricity were founded just before WWII and carried out processes of concentration that culminated until 1958 and 1968, respectively. Mexico was one of the first nations to create a NOC (National Oil Company), also spearheading the trend of nationalizations of electricity enterprises around the world, including in developed nations (Victor et al. 2012).

Economic stability and state ownership of a wide range of industries went together well for a couple of decades. First, with energy enterprises as a fulcrum of industrial development, then, in the case of oil after 1979, as a support of public finances. By the end of the 1980s, Mexico found itself trying to balance its budget and find a niche in the world economy while it stayed locked in the economic constraints of an oil *rentist* nation. For decades now, political leaders have tried without determinant success to rein in the NOC. Modernization and profitability of Pemex (Petróleos Mexicanos) has been historically hindered by the public sector's own dependency on the rent of the oil company and the exorbitant perks of its politically powerful workers union.

More fundamentally, Mexico's entrance into hydrocarbon abundance occurred in a very bad timing. The Mexican variant of the dilemma of abundance manifested by precluding an indispensable debate and reform of the oil and gas industry. Abundance also made public finances dependent on oil exports, although, fortunately, Mexico has a diverse economy that has grown

with international trade. Abundant oil and cheap labor have shaped the fate of Mexico's economic development for almost half a century.

Against this backdrop, a complex of social and political relations with the SOEs as loci --and not nationalist sentiment alone-- might explain more concretely the difficulties that policymakers have encountered to regulate and open the energy sector of Mexico. Oil, gas and electricity require their own history of efforts of reconfiguration. For the three, the SOEs are always at the center. For natural gas, specifically, there are some particularities worthy of remark: it was, until little more than a decade ago, an unimportant piece of the whole energy system. A small number of industrial consumers and few and poorly rooted LDCs constituted most of the demand before IPPs started to grow in the 2000s. Also, land imports had not been an important source of supply. Mexico considered imports of natural gas from the U.S. as only a question of small day-to-day balancing almost until the start of the current century.

In the mid-1990s it seemed workable and realistic to attempt a modernizing transformation. The prospects of success of a reform were attractive precisely because natural gas was not an important fuel in the energy mix. The initial move of reform sought to expand consumption of natural gas by creating formal restrictions of operation to the transportation monopoly (following open-access rules) and by phasing out restrictions to imports of natural gas. A new regulatory commission defined wholesale domestic pricing of natural gas sold by Pemex and determined the tariffs in the system of transportation also controlled by that incumbent. Instruments were put in place to attract private investment to create new privately owned connections. These policy moves were inspired by a trend of policies in developed nations, seeking to build markets through vertical separation of public utilities and some degree of deregulation of upstream pricing. For Mexico, policy also has had an international component. Although the country took small import quantities at that time, decision-makers trusted that Pemex could increase its production, eventually making Mexico *an exporter* of natural gas to the United States.

Problems at each stage revealed some weak assumptions of this original plan and redesigned or insinuated new possibilities of change. Planning in the abstract gave way to concrete implementation. Disarray and crisis emerged, however, as the clearest result of policy incoherence --and bad luck. Amidst shortages produced by declining production and strains in the system of

transportation, the sectoral regulator and some policymakers started to elucidate incremental responses. These steps prefigured (but did not cause) a deep transformation that got a boost from the liberalisation of the sector in 2013 and 2014, and as importantly, from the availability of very low priced American natural gas.

Open-access and price deregulation are in place now. And there is some upstream competition. However, as this research intends to demonstrate, the most notable aspect of the transformation affects the players in the sector. If crisis brought a shared lesson, it is that regulation is necessary, and that the heightened complexity of the system must be navigated more effectively with respect to the new rules that grant open-access and some degree of upstream competition. t.

Since 1995, Pemex trumped a first move towards opening the sector to upstream competition. The NOC exerted its position as controller of the central system of transportation and as the sole supplier of all large consumers. The subsidiaries and bureaus of Pemex blatantly infringed the *Chinese-Wall* provisions aimed to enforce the vertical separation of the NOC. Without unselfish commitment from Pemex these provisions turned out to be more fictitious than strong--based on good faith, after all. It can be argued, however, that Pemex had its reasons. As it had been the case throughout its history, through subsidization and price caps, plus a daunting taxation structure, the fiscal policy of the national government dwindled Pemex's budget and hindered its investment plans. Price controls often hurt the financial standing of Pemex, while favouring large users or consumers. Added to the chronic problems of governance and management afflicting Pemex, there is little reason left to hope that it has the capabilities to mimic an enterprise in a competitive environment.

Yet, throughout 20 years, the whole sector moved. Even if at very slow pace, investments in natural gas-powered generation started to mount since the first moves of partial liberalisation. The electricity SOE went through a learning curve, stretching and circumventing the strictures of its procurement policies and budgets. At first, the electricity SOE responded to the exclusive imperative of securing coverage and reliability, replacing old capacity and connecting new users to the network. In time, however, CFE (Comisión Federal de Electricidad) started to reckon the need to secure supply of natural gas for its new plants and for its private power suppliers. Land imports had to be complemented with LNG at some point, early in this century. LNG also gained

importance as the infrastructure of transportation was insufficient to cope with more demand in a wider geographic distribution network.

Electricity is the key to appreciate how natural gas became, very recently, critical to national energy security, and how rapidly the trade profile of Mexico has been changing and adapting. In 2009, the electricity SOE was planning to rely more on hydro and nuclear, and it slowed down the substitution of natural gas for coal, fuel oil and diesel. Plans to develop production still aimed to complement international supply *towards* the United States. Nevertheless, by the start of this decade, abundant production of shale gas changed in the U.S. all the energy game in the continent (if not the world). Starting in 2014, the creation of a wholesale market of electricity in Mexico also created a more complex and solid support for natural gas demand in Mexico.

In addition to growing demand for power generation, the geographic source of supply shifted, from domestic production in the Gulf of Mexico to a mix that added imports of LNG in the Pacific and Atlantic coasts, and then an enormous reliance on American natural gas. Production of associated gas in the Gulf started to decrease. Also, for economic reasons, shale contributed to a plateau of the onshore production of non-associated gas that had grown in previous years in the Mexican fields bordering Texas and the Gulf. New opportunities to expand demand for industrial and residential use appeared alongside new projects for power generation. With new demand volumes and geographical regions, the natural gas sector has started to take on a very different shape.

The contours and fundamental institutions of a market of natural gas do exist now in Mexico. These institutions redistributed authority between the central and regulatory agencies in ways that, ironically, fostered the key elements of liberalisation (open-access, integration of a system favouring upstream competition) through clearer and stronger legal attributes for another IPSO (Independent Pipeline System Operator), which is also an SOE. The implementation of the reform between 2014 and 2018 bet on applying asymmetric regulation (taking away a sizable share of the market share of the NOC) and bringing the new and existing players to a new level of complex interaction, where a strong regulator would be critical.

States, markets and the study of energy policy and regulation

The strategy of this research gives a central role to contingency. Crises, as a general premise, have the potential to turn power resources and ideas upside down (Jervis 2001). Few policy sectors beyond energy seem to have the systemic requisites that make the aforementioned premise relevant: transmission and delivery networks connect multiple producers and consumers. Plus, the network itself consists of costly and highly specific assets that, once deployed, affect the cost-benefit equation of all energy consumption. Functionally, networks need permanent balancing to carry and distribute their load efficiently in consideration of physical and economic constraints. Finally, all these interactions exist within a frame of economic exchange, determined by institutions, decisions of public authorities and private players.

Students looking at economic policy through the lens of Varieties of State Capitalism give a central place to contingency in ways that are useful for this research.

“The positive effect of having state ownership to fill institutional voids and implement government capabilities is stronger the larger those voids are and tends to disappear as financial markets grow and the rule of law improves. In other words, institutions will likely act as a contingency, changing the benefits (and risks) of having the state as a relevant stakeholder in capitalist societies.” (Musacchio et al. 2015: 120).

Therefore, as many studies on energy policy and regulation show, explaining responses to pricing and supply contingencies (or crises) takes research to multifaceted levels of analyses, related to financing of infrastructure, consumption patterns, pricing of fuels and subsidization policies. All of these exist within an institutional frame in which players can define a strategy to advance their interests, regulators and governments included. It is precisely there-- how regulators, governments and some organized and big players interact -- that the national-level mechanics of coordination have (or might have) relevance for the study of energy policy and regulation.

That is the approach that guides this research. The dissertation centers on the relations between the players in the sector, examining their resources, constraints and, when possible, their short and long-term rationales. Coordination and trust are key notions that link the independent and dependent variables in the literature on varieties of capitalism. For this research, it is essential to

clarify that, as a process of institutionalization progresses, the notions of mistrust and trust take on a different meaning. This is so because the coordination of more and more complex relations takes place in a different setting of authority and through different instruments and intentions determined by policy.

This research takes place at different levels. In a purely narrative way, the dissertation reconstructs contexts and consequences of policy and regulatory decisions. From this perspective, legal reform becomes the ultimate source of policy change: a regulator gains some legal strength, and, moreover, the decisions of a regulatory agency become central at some point amidst a chronic crisis of supply. A policy of liberalisation crystallizes, therefore, when a constitutional and legal reform opens new paths for institutions and for the structure of the industry. However, this research concentrates on explaining the dysfunctions and contingencies that occur along the path of policy implementation.

[The plan of the dissertation](#)

The first two chapters of the dissertation review the academic literature about natural gas in Mexico and lay out the research question and theoretical framework. The third chapter reviews the basic notions and mechanisms of monopoly regulation that have framed the economic activity in the natural gas sectors of the world. This section includes a review of how some jurisdictions have restructured their natural gas sectors to allow or enhance upstream and midstream competition. The purpose of the chapter is to describe the trends of restructuring in which the Mexican case can be situated and, importantly, to lay out the specific hypotheses that integrate the practice of regulation and policy with the theoretical framework.

Chapters 4 to 7 present the empirical case, organized into three periods, with attention to the economics of energy and natural gas -prices, demand, production, institutions, and policy and regulatory changes. The periods coincide with election terms of national governments. The case study relies on subcases and subordinate stories that illustrate or reflect the working of the mechanisms that are relevant for the dissertation's thesis.

A final chapter revisits the case analytically, from a comparative perspective, across the periods of the preceding chapters, and across jurisdictions. This chapter also reflects on the reach, pertinence, and clarity of the concepts that guide research in this area of analysis of policy change. Despite this last incursion into comparison, however, this dissertation remains a case study. It seeks to offer a thorough description of policy change, in part aided by analytical tools, but also using a broad definition of the unit of analysis, which is examined intensively (see chapter 2).

The array of sources of information in this study comprises:

- Scholarly literature
- Official data on energy prices, exports, imports, and consumption;
- Yearly and quarterly reports of the SOEs;
- Regulatory decisions and instruments emitted by the sectoral agencies or by the federal government;
- Planning documents of the central government and regulatory agencies;
- Financial information of SOEs (audit reports);
- Trade journals and newspapers.

In 2016, 2019 and 2020, I also conducted interviews with former and acting officials in the Mexican government (twelve, between 30 and 45 minutes each). Their input was used almost exclusively to test the argumentative lines of the research and to guide the interpretation of publicly available sources of information. I could have supported my research with the views obtained during interviews, but, as the writing of the dissertation progressed, all of the relevant aspects that I ended up using became public in (mainly) non-scholarly sources. The information provided by the interviewees, therefore, is not used directly, in the form of quotes, to support the research, although it was invaluable as an orientation, especially for a student who was an absolute novice on things energy.

A final additional note on documentation is warranted: the investigation extended for a time long enough to allow events to come to important conclusion. Almost all the central aspects of new regulation became effective in 2017, and a new national government took office in December of 2018. As the current historical chapter unfolds, the new experimentation in policy and regulation also enables a clearer observation of policy change in the period covered by the research (1995-2018). There are also some policy relevant ideas that can be pointed out (chapter 8).

The following section of the dissertation positions the research within the academic literature on energy and natural gas policy. It also presents the theoretical framework and the plan of the research.

Chapter 1. Literature Review

Natural gas has always been an essential part of energy policies and, consequently, of research on energy policy, but not always for the same reasons. This chapter reviews the areas of interest, approaches and methodologies of the scholarly literature on natural gas policies, where regulation has been a central part, especially for the period of time that this research examines (1995-2018).

This revision of articles on natural gas in Mexico reveals that the academic literature, including some grey literature written by renowned scholars, only builds a very slim and disparate body of articles.³ Pricing regulation dominates as a central issue, but the politics that affect regulation occupy a marginal place in scholarly attention. To the best understanding of this researcher, there are no integrative explanations of natural gas policy for Mexico. Regulation has become central to understanding energy policy, but attention to the politics that affect regulation of natural gas has been marginal, specifically as regards the SOEs. The gaps that characterize the literature on Mexican policy, however, can hardly be considered extraordinary when bearing in mind that the academic literature on natural gas also exhibits a notoriously patchy landscape.

These appreciations can also apply to the review of approaches and cases for other jurisdictions. A large part of the scholarly literature has incorporated a conceptual perspective that centers on the instruments of restructuring (a mixture of regulation, privatisation and separation of vertically integrated firms) while giving oblique attention to the persistence and influence of state actors like SOEs and of policies like subsidization and centralized management.

Accounting for the state-directed instruments that influence, or hurdle liberalisation and privatisation insinuates itself as a potentially rich perspective to understand energy policy and regulation. The task is important on its own count, and it bears directly on State-Owned enterprises. As a research choice, bringing state enterprises and state instruments back into the analysis can also serve to reappraise the roles of security of supply and public service obligations in the overall picture of energy policy analysis.

The first part of this literature review contextualizes the interests and approaches of the scholarly literature on natural gas, not only related to restructuring policies but also in consideration of security of supply. The lines of relevance in the first part give basis to the scrutiny of the second

³ To the best understanding of this researcher, there are no books on the single issue of natural gas in Mexico.

part, which deals with Mexico. The conclusions anticipate the research question and the theoretical framework to be presented in chapter 2.

Shifts and continuity in the study of natural gas

More than a topic on its own, natural gas has been considered in the context of comprehensive revisions of energy policies that put petroleum at the centre (Samuels 1987; McDougall 1982; Goodwin 1981). That is understandable: the policies and economic processes to produce and transform natural gas share several features with oil and its derivatives. Also, due to the economies of scale and scope proper of the oil sector, the firms that produce and trade natural gas often participate in the various markets of petroleum, considering their end as fuels or as other petrochemical products. Globally, natural gas comes third (3,272 MTOE) to oil and coal (4,501 and 3,821 respectively. IEA 2019: 38). These three sources make more than 80% of primary energy demand (IEA 2019: 38). Because of the economies of scope and scale that characterize all hydrocarbons, natural gas is one fuel and one industrial input among several produced and commercialized by the same firms, whether they are owned by states or private shareholders.⁴

Part of the renewed relevance of natural gas also has to do with its aggrandized role as a fuel to produce electricity, and not only heat, due to its lower (although not substantially lower) emissions of greenhouse gases, in comparison to other fossil alternatives, such as diesel, fuel oil and coal (IEA 2016 and Chapter 3). For some years, natural gas had the reputation of a *bridge* in the grand scheme of transition to renewable sources of energy. Now it has become a potential option to stay for long in the energy mix of most economies, due to the reliability and affordability that it favours in the power sector (IEA 2016; Pierce 2012), and in spite of its still considerable carbon footprint (chapter 3). Finally, natural gas and crude oil and its derivatives are at this moment at the centre of a very complex set of societal and governance tensions involving the acceptance of new infrastructure projects by local communities, indigenous peoples, and society at large (Cleland & Gattinger, 2018). This area of policy will continue to evolve, not only in Canada but in other democratic societies with the potential to produce or transport hydrocarbons.

⁴ Chapter 3 explains in detail the economic peculiarities of natural gas in comparison to oil.

Security comes first

Security of supply has been a fundamental dimension of natural gas policy (and energy policies). A good share of the studies on natural gas follow the industry events, the market variations and the policy and regulatory decisions that underlie or explain the question: *what explains the sufficiency (or the scarcity) of natural gas in a given period for this country or this region?*

Geology is not destiny. Countries with sizable reserves also need capital, technology, and expertise to develop and transport them. Countries without enough geological resources need to secure land or maritime transportation, and most of the times, to navigate the political dilemmas entailed on the build-up of very costly infrastructure and on hedging all the risks of volatility and dependency on bilateral relations. Brazil has come to depend mainly on the natural gas of Bolivia, whose nationalist politics always add a premium to the risk of supply, even if Petrobras --the State Owned Enterprise of Brazil-- and other private players, are in charge of developing and transporting most of those resources (P. de Mello, 2009). Argentina, despite its vast geological reserves, cannot plan to rely on indigenous production exclusively. Its policies for the present and future consist of a balance of imports and stimulus to production through price controls and subsidization (R. Ponzo, 2011).

Security of supply also entangles with international relations at a regional scale. Natural gas is strategic for domestic security in some regions of the world, like Europe and East Asia. Its production, consumption, and transportation can override other aspects of energy policy, even if it cannot wholly subordinate its economic and physical constraints (O'Sullivan, 2012) (Victor, Hults, & Thurber, 2012). Asymmetries between sellers and buyers underlie power relations. Some nations are *value-makers* and some *value-takers*. Through its control of natural gas, Russia has maneuvered to influence policy and politics in Eastern Europe (Kropatcheva, 2011). Large consuming nations wield influence over sellers if geography and capability to substitute play in their favour. Turkey can mix sea LNG imports with land imports from Russia, Ukraine, Central Asia and Iran (Cetin & Oguz, 2007).

North America has been somewhat alien to those geopolitical considerations, because of the affinities and integration between the energy sectors of Canada and the U.S. and because of the consensus underlying energy policies since the start of the free trade era between these two nations

(Doern & Gattinger, 2003). The expectations (in the 1990s) of turning Mexico into an exporter of natural gas for the American market did not materialize, but the legal provisions of NAFTA (North American Free Trade Agreement) did consolidate, since the first decade of this century, an institutional basis for subsequent liberalisation, and integration (Jimenez, 2000). Ironically, integration is occurring with gas flowing southwards from the U.S into Mexico. The *shale revolution*, a term which captures the rapid increase of production of unconventional gas and oil in the United States, has brought about new asymmetries in the distribution of resources and the power relations that entangle with them. These new cleavages in the landscape of hydrocarbons have affected the whole energy system in the U.S. including electricity, and opening fault lines that are starting to express in the relationship between Canada and the U.S. and their respective orientations towards the global markets of energy (Gattinger and Aguirre 2016; Plourde 2015).

Put differently, security of supply of natural gas in North America is now *taken for granted* on the two bordering regions of North America (see Chapter 8). The scholarly literature is catching up with the new relevance of energy security for North America. Business media has been covering some insights that might get an academic treatment shortly in the future.⁵ The Mexican power sector has much more exposure now to imports from the United States, and natural gas producers have been trusting that exports to Mexico will hold steady.

Analysis of restructuring policies: policy and regulatory options

Although security is a continuous dimension for the analysis of energy, there are other aspects to examine on natural gas policy and regulation.

Twenty years of implementation across the developed world have brought about a wave of institutional isomorphism --including other non-developed economies. This imitation of policies took place mostly through the enactment of reforms that took regulation off the purview of central agencies, and by fostering competition through vertical separation and privatisation. Deregulation actually came to mean promotion of upstream competition while other segments transformed or re-regulated in the pursuit of new economic and environmental goals. Existing regulatory agencies in North America and new ones in Europe and Latin America set out to separate vertically

⁵ *Milenio*, May 2 2018, “La campana del miedo de los petroleros texanos”, author B. Anderson. Accessed from www.milenio.com on May 3rd 2018.

integrated public utilities and SOEs. There was a different mixture of ends and means in each jurisdiction, but privatisation intended to promote competition and efficiency, besides from relieving public finances (see chapter 3). In North America, characteristically, liberalisation also referred to the new regulatory framework to further integrate national natural gas markets and electricity regions (Joskow 2008). In time, hybridization and innovation have flourished, and expectations have moderated about the possibilities of attaining full-fledged competition and integration, even in the United States (Pollit 2012; Colomer and Hallack 2012; Haase and Bressers 2010; MacAvoy 2007). At the end of the day, even the parameters and the data to appraise the success of restructuring policies are the object of controversy and reflect the incomplete state of policy implementation (Haase & Bressers, 2010).

Aspects of regulation and restructuring can be organized in groups. These speak for the options that tackle specific problems in a selection of jurisdictions.

A first refers to the *incompleteness* at the level of design of restructuring, where the mandate and organization of the public agencies in charge of the restructured sectors are critical for enforcement as a precondition of economic functionality. For instance, Colomer and Hallack (2012) examine how the absence of a framework to give certainty to property rights in Brazil hindered for decades the expansion of infrastructure for transportation, despite the implementation of upstream liberalisation. The incomplete deployment of monopoly or competition regulation also draws attention as a factor impeding integration of regional markets in Europe, although there is a multiplicity of reasons to account for the persistent fragmentation of markets of natural gas in the European Union (Correljé, Groenleer, & Veldman, 2014). The common thread with regards to design and implementation refers, however, to how the adoption of restructuring policies in the direction of liberalisation tend to, sooner or later, reveal the weight of initial conditions that differ from the blueprints or cases of imitation: North America and, for some others, the U.K (Stern, 1997).

Choosing between the lesser of evils seems to be the only absolute rule when evaluating the outcome of policies of restructuring and the performance of regulatory instruments. Even the highly integrated and redundant systems of North America have not completed a transition towards price deregulation. Oligopolistic behaviour and underinvestment have also created bottlenecks that

compromise the functionality of the system of transportation and, moreover, that have prevented the attaining of the efficiencies that were central to restructuring in the 1980s and 1990s. Evidence has not been conclusive as to the positive impact of regulation on final prices paid by domestic or commercial and industrial consumers (MacAvoy 2008; MacAvoy 2000).

A second theme of interest also refers to missing parts or links, but now in a more literal way, pointing to the lack of physical infrastructure --mostly transportation pipelines but also storage, compression and regasification facilities--, that aggrieves many jurisdictions that have implemented restructuring policies. The quid of conceptualizing transportation as a network resides in the premise that multiple interconnections enable arbitrage and diminish power asymmetries between economic players (holdups that monopoly regulation can control more easily with redundant connections operated by different firms). However, the existing physical infrastructure and dominant players constrain the growth of new demand and further expansions to the transportation system. Problems of underinvestment can ensue. In Brazil, for instance, adjustments have come in the forms of regulation to favour third party access (TPA) to the system, specifically in order to prevent collusion that discriminates such access in favour of Petrobras, the State-owned petroleum enterprise (Colomer and Hallack 2012; P. de Mello 2009) (Colomer & Hallack, 2012) (P. de Mello, 2009). Spain, another mid-large sized economy with a natural gas sector in expansion --like Brazil and Mexico-- has also been grappling with the increased complications of growing demand and small and poorly interconnected networks of transportation. In Spain, privatisation of the State-owned enterprise came first, and vertical separation kept the network of transportation in the hands of a regulated monopoly (Colomer and Hallack 2012; Comision Nacional de Energía 2005).

Besides the regulatory aspects that affect how supply meets demand, there are the regulatory aspects that affect how to manage the traffic and storage of natural gas. Central management of the system of transportation fosters some certainty to planning and day to day traffic but comes at a cost for allocative efficiency, because enforceable parameters to transport natural gas must substitute for self-regulating supply and demand signals. The academic literature on European gas systems has been catching up with how TSOs (Transportation System Operators) and non-centralized systems of self-regulation can combine and favour the functionality of transportation. Functionality and fair pricing mean, above all, keeping the adequate pressure inside the system

and making charges to adequately reflect the effects that injections and extractions have for the whole traffic. The development of rules of cooperation can (and should) be the outcome of collaboration between stakeholders (suppliers, purchasers, TSOs and other regulators). That cooperation also constitutes a challenge for regulation and policy itself, either when evaluating the dilemmas affecting allocative efficiency or when unpacking the process of deliberation and decision of that side of regulation (Van Dinther & Mulder, 2013).

The analysis of the policy options to form a European market of natural gas could constitute a separate and relevant theme and stream on the academic literature. Comparisons with North America are inherent for examinations of the policies decided in Brussels to pursue a *top-bottom* process of convergence of the several national regulatory frameworks and natural gas industries (Genoud, Arentsen, & Finger, 2004). While the United Kingdom and Norway managed to create liberalised markets, pricing deregulation and integration and the less ambitious objective of harmonization have stayed as an ideal horizon for the European Union. The process of restructuring through directives in Europe has lagged in attaining coordination between national governments on networks of transportation, coordination of domestic regulators –arms-length or not—and the unification of criteria or decisions of competition watchdogs (Correljé, Groenleer, & Veldman, 2014).

These problems of design seem inherent to the complicated history of the still incomplete European natural gas market. Transport systems operators in Europe have become the defining characteristic of the governance of natural gas transportation, and corrections center on the aspects that could improve allocative efficiency within that paradigm (Hunt 2008). Policies and regulatory instruments seek to enable the liquidity of wholesale markets but different national frameworks of regulation for the patchy physical network poses particular challenges. Chief among these problems is the gap between the capacity that can be commercially available and the actual capacity of the system, plus the allocative efficiency losses that derive from that incongruence (Hallack & Vazquez, 2013). One question of relevance for Europe that applies to other jurisdictions considers that efficiency gains in national and regional systems of transportation can compromise security and capacity to readapt to external shocks (Westphal, 2014). In sum, Europe gives valuable points of contrast in the purpose of showing processes of liberalisation that ended up with several hybrid features, like the implementation of centrally managed systems operators

and the implementation of capacity release programs to reduce SOEs' market shares, while keeping them as central actors in the field (Haase and Bressers 2010; Genoud, Arentsen and Finger 2004).

Finally, privatisation has deserved academic attention on its own. Restructuring often requires governments to liberate from directly managing and owning assets, with all or part of their entangled financial obligations on their energy sectors. Divesting rarely comes without strong political implications tied to the financial and social impacts of change in ownership, and to the redistribution of responsibilities to secure the fulfillment of reliability, affordability and public service obligations. A large part of the literature has seen the processes of privatisation associated to restructuring of energy sectors through the lenses of regulation; attention centers, hence, on how regulation and new regulatory agencies, can rearrange the complex of relations formed throughout the old era of State ownership. The critical questions, visible since some years ago, not only refer to *how much* state ownership can complicate liberalisation, but to *how far* can privatisation actually go unhindered by legacies of the SOEs (Hira, 2003) and, more broadly, by the whole set of patterned relations around the SOEs, the central agencies and the existing constituencies that can hamper or facilitate liberalisation. In the case of Mexico, the oil and the electricity SOEs have marked the path of liberalisation, by resisting its implementation and forcing new alternatives (a new SOE to operate the midstream system of transportation) and by enabling upstream competition, although with a dominant role for the trading arm of the electricity SOE (chapters 4 to 8).

The theme of privatisation and the regulation of the SOEs includes the question of how to roll back subsidies or other more direct forms of state intervention through the use of public finance or bureaucratic management of the economy. A legion of jurisdictions still has some form of subsidization or price controls that are afforded by taxpayers and that in most cases, hurdle the essential purposes of liberalisation (IEA, 2016). In principle, subsidies are inimical to price deregulation and the spirit of free competition. Consequently, subsidizations appear as a distortion in large part of the literature that reviews the outcome of liberalisation. Champions of liberalisation policies have vowed to eliminate bloat and inefficiency, but closer examination of privatisations and deregulation often reveal other, more pressing, motivations –like divestiture in times of financial stringency. Once implementation is underway, the goals of efficiency of liberalisation

can complicate functions that were embedded in pre-reform energy sectors, like security, affordability and even political stability. It behoves us to reappraise how all these functional goals have rebalanced once the move towards liberalisation has come of age.

To be sure, the discussion around the motives and potential goals of liberalisation and restructuring carries a normative load, at least in part of the literature. In its origins, arms-length regulation as a model sought to strengthen the autonomy and the capacity of the state against large energy firms and monopolies (Armstrong & Nelles, 1988). However, the diffusion of the North American model of arms-length regulators has also shown that governments decide the mandate and attributes of regulators (Majone, 1997). Contemporary attention to the institutional strength of regulatory agencies has instilled a scientific view as to what is the right model for regulation, and there is a lot to learn from that perspective (for instance, Gilardi, 2005). However, it is also important to consider that the design option to relocate decisions out of the reach of central agencies (i.e., in the line of the politically appointed command) can only solve one part of the wider set of problems that stand in the way of policies, especially when these policies seek to expand markets against monopolies or oligopolies, State-owned or not.

It is also noteworthy that the quest for autonomy and capacity of regulatory agencies runs as a parallel process with liberalisation. Arms-length regulation has transformed its oversight over a multiplicity of sectors, including those that, by their monopoly nature, could not be subject to the measures of price deregulation and vertical separation (Gilardi, 2005 a). To complicate things a little more, these normative approaches have affinities with the *new public management* values and practices that also permeated regulation and public administration in the 1990s, by seeking to streamline and speed-up processes and to replace oversight with incentives (Mansell & Church, 1995). More recently, the pursuit of *regulatory excellence* has recovered these aspirations in a new research program that has integrated the concerns of a wider variety of non-governmental organizations as stakeholders participating in regulatory processes. Some academic voices are optimistic that regulators can catch up and evolve towards much higher complexity (Baldwin 2015; Levi-Faur 2015; Coglianese 2016) while others point to the natural limits that such complexity imposes (Hempling 2011). Requisite variety is as much a law-like principle constraining the possibilities of organization as is the principle of diminishing returns (Hood, 2010).

In sum, the landscape of literature that deals with regulation from that normative perspective has widened considerably to include a set of new interests and precepts about government. Throughout the contemporary history of advanced democracies, there has always been an assumption that regulation constitutes a test for state autonomy and capacity *against* economic and societal interests, including those of the SOEs (Levi-Faur 2004; Majone 1997; Armstrong and Nelles 1988). This research buys that assumption, but specifies that institutional autonomy and capacity of the regulator cannot be taken as equivalent to state autonomy and state capacity. Surely, regulators are central players in the long game of policy change, but precisely because of that, their influence can be compromised by overriding constraints: some are purely economic, but often they also result from the constant accommodation of organizational factors and economic variability (see chapter 3). Regulation is one part of the composite that harmonizes goals of policy other than regulating monopolies or overseeing competition. Those other goals refer to the security of supply, affordability and public service obligations. The normative constraints of policy makers are often different than the normative constraints appraised by observers of policy and regulators.

[Analysis of restructuring: systemic relations and policy legacies](#)

While the bulk of publications in academic journals appraise the choice and consequences of policy options, there are some fewer examples of academic literature that inquire about the causes and mechanisms at work in policy change. When classifying this other parcel of the literature, E. Tang's (2011) description of integrative paradigms in the social sciences results very useful. With Tang, all the studies that intend to synthesize relations across agents, social structures and the physical environment can be considered integrative. These relations can be studied synchronically or diachronically. The latter form of study can also be labelled genealogical, or evolutionary.

Turning attention to some examples of literature on natural gas, M. Michot Foss (2000) deserves the first mention. She studied how regulation issued by (subnational) Public Utility Commissions (PUCs) accommodated the conflicting relations between LDCs and transport operators in the changing context of local and national restructurings in the U.S. Her statistical analysis shows that PUCs rebalanced the federally imposed requirements for open-access regulation in order not to affect local franchises, and their public service goals, especially on consumer states. This quantitative study unveils a pattern of response of local institutions that serves to illustrate how

technological change motivated institutional change at the subnational level and crystallized reforms that regulators promoted at the federal level. The systemic relations that encompass the whole national jurisdiction express in the ways in which subnational regulation integrated top-down policy. However, some subnational institutions also slowed down policy change and reduced its impact.

Looking at policy change in another *bottom-up* direction, Makhholm (2012) presents a genealogical study of natural gas policy change. In the view of this author, the integration of a highly flexible and continental wide market of natural gas is a uniquely historical result of the evolution of American institutions, at the *macro* and *micro* scales. Federalism, the Supreme Court and the interpretation of property rights in the U.S. have shaped the evolution of regulation just as much as conflict between the State and the industry or within the buying and producing agents inside the industry. For Makhholm (2012), the institutional peculiarities of the United States ultimately led to the possibility of decoupling the sale of a commodity from the sale of the rights to transport it. This study deemphasizes the impact of technology and underscores the importance of institutions, conceived as rules and, more importantly, as legal precepts underlying rules. The private carrier norms that framed natural gas transportation since the start of the 1900s constituted the foundation of open-access and restructuring policy for the sector. The crystallization of flexible transportation markets later in the 20th Century set the example for the rest of the world, even when they have very different political and institutional initial conditions. The revision of Makhholm successfully supersedes previous encompassing studies that centred on the legal and economic aspects of regulation in the United States (Pierce, 1988), and is prolific in comment about the prospects of restructuring of the natural gas sectors abroad. Chapter 3 will review these aspects and abstract the possibilities of comparing the political economy of restructuring in consideration of different sets of actors, the interests and strategic power of which must be harnessed by regulation.

Among the integrative approaches to explain European natural gas markets, Arentsen (2004) has developed a synthetic revision of energy policy that includes natural gas and electricity. The formation of natural gas markets in the European Union has taken place on a different path that has not arrived at crystallization on the scale that exists in North America. Only Denmark, the Netherlands, Norway and the United Kingdom have reserves of natural gas to become exporters, and the network of transportation across the continent, already in place by the end of the 20th

Century, carried a legacy of institutional and physical constraints that supranational policies have struggled to surmount (Arentsen, 2004). While the story of integration of markets in North America piggybacked on processes and the overarching political structure of federalism, the integration of markets in Europe proceeds by communication and collaboration of comparatively weaker supra national institutions. Trade and regulatory laws and doctrine, physical infrastructure and eager constituents served to leverage the sectoral regulator towards restructuring in the U.S. (And yet, supply and debt crises in the 1970s and 1980s served as catalyzers). Barriers to the integration of natural gas markets are embedded in the multiplicity of pricing mechanisms and interfaces of natural gas and electricity across nations and regions in Europe. Constituencies gravitate around national energy policies and do not constitute a continental- scale force (Finon, 2004).

Contrasting frameworks and paths of development between Europe and North America --and within North America itself-- is useful to appraise notions like power and strategy as part of processes of restructuring. For instance, in their analysis of Canada's regulatory framework, Doern and Gattinger (2003) underscore its relatively more robust capabilities for coordination against market failure --specifically considering the then recent example of the California power crisis. There are ways, in sum, to navigate the constraints that liberalisation poses over the public organizations that ultimately bear responsibility for fulfilling the critical functions of the energy system at the national level (and the subnational, where federalism has given shape to the fundamentals of energy policy). Liberalisation does not change that, even in North America, where upstream competition, open-access and decentralized management of networks have taken hold more deeply. An examination of Mexico's policy and regulation must also consider, therefore, how the national interest is defined by the national state, in the different spaces that define its agency and where regulation is now at the centre.

Finally, as explained above, State ownership is still part of the energy landscape of several nations that had set out to restructure their sectors in the sense of liberalisation in the old continent (Clifton et al 2007). That is also the case of the Southern Cone in the new continent (Finon and Glachant 2004; Hira 2003). It might be an irony that restructuring policies sought to reorganize and retract the activity of the state, but the analysis of restructuring cannot retract from studying the persistence of the state. Moreover, the conceptual coordinates to make sense about the persistence

of state ownership are obviously beyond the frameworks that take liberalisation as a conceptual – and sometimes a normative—horizon. This paradox signals the necessity to look elsewhere for concepts and notions to reappraise causality and to evaluate policy.

The theoretical framework (Chapter 2) centers on studying patterns of business-state relations as an encompassing factor that influences policy and regulation. To the best understanding of this researcher, there are no studies of natural gas that have used an integrative look to explain policy change in Mexico (see below). Even when looking for examples in the literature of other jurisdictions, case studies differ significantly in their conceptual frameworks and, consequently, on the causal role of public and private organizations. Two very different studies on energy, however, can serve as inspiration for this research.

One is a dense case study of energy in Japan (Samuels 1987) that sets out to explain how government participates and intervenes in energy policy *without* significant ownership of assets on either coal, petroleum derivatives or electricity but through sophisticated forms of jurisdiction and negotiation. This analysis enriches comparative studies of developed economies by weighting six dimensions of business-state relations where market displacing state interventions are likely to occur (see chapter 3). The study follows a long series of subcases in the energy sector (72 across coal, oil, electricity and renewables). Samuels accounts for the particularities of accommodation between the private and public sectors in Japan and explicitly pits his deep empirical examination against the more abstract notions of state autonomy and state capacity. With more adherence to the inductive side of research, this study orients itself with the notion of *reciprocal consent*, as the driver in the constant accommodations between private ownership and state jurisdiction.

On the other extreme, the closest example of a quantitative study that could frame the study of natural gas liberalisation in Mexico centers on energy liberalisations for electricity and natural gas (Ping Chang & Berdiev, 2011). This article discusses the statistical correlation between liberalisation (the dependent variable) and six explanatory (independent) variables (ideology, fragmentation of political institutions, economic, social and political globalisation, plus demand for natural gas or electricity). liberalisation, in this article, has been defined by reference to regulatory restrictions along the value chain (see chapter 3).

Scholarly literature on the Mexican Natural Gas Sector

In Mexico, the oil rent extracted by the Mexican State from Pemex accounts for between a quarter and a third of the federal budget each year (IEA, 2016). Finding economically profitable oil production and financing its extraction has become a pressing national issue for most of the recent history of oil and gas in Mexico. As it will be explained below in more detail, natural gas does not have that economic relevance for public finances, although it represents a source of revenue for the NOC (National Oil Company) and an indispensable input for the production of oil. Academic and non-specialized attention, therefore, has been consequently scarcer for natural gas until very recently: there are fewer articles than there are for oil, and a highly specific perspective prevails, seldom with an integrative reading of the policy. That scarcity is the reason why this review includes some gray literature, in addition to specialized, academic research. It is also the reason why, instead of categorizing articles and books, the review comments only a handful of items in detail.

Academic revisions of natural gas policy in Mexico are very scarce, although the reforms of 2013 and 2014 and their implementation have stirred academic interest. Most of the literature that reviews the natural gas sector before 2013 and 2014 agrees that the implementation of restructuring that started in 1995 failed: Pemex never complied with the rules of open-access and the overwhelming majority of the systems of transportation stayed under the control of the oil company. The literature also acknowledges the problems of efficiency and reliability in the system, attributing them to lack of policy coherence and weakness of the regulatory institutions, among other factors (Grunstein, 2011) and to the organizational and financial hurdles of the State-Owned Enterprises (Lajous, 2013; 2012). When natural gas forms part of revisions of the total petroleum or energy sector, attention tends to center on problems of production of natural gas and oil and the insufficient growth of demand for natural gas, a critical factor militating against the development of the industry (Elizondo, 2011).

Less attention has been paid to understand natural gas policy from the perspective of regulation. Economic analysis is the most common approach to regulation of the natural gas sector. See, for instance, Brito & Rosellón (2010b; 2005; 2002) which have periodically reviewed –and upheld,

from an academic point of view-- the efficiency groundings of regulation on pricing. However, these examinations seldom surpass the boundaries of purely economic cost-benefit analysis.

Few other academic reviews relate the economic dimensions of regulation to wider policy aspects, such as constituencies, political relations with monopolies and coherence of policy. An exception that needs to be mentioned is the comparison of the Central Bank and the telecommunications and energy regulatory agencies, authored by C. Ballinas (2011). This book reveals the ascendance of power relations over the life of these new constructions in the Mexican policy landscape. More specifically, the book frames the construction and fate of the CRE in the context of the resistance of established bureaucracies and the SOEs against the compact group of liberal technocrats that dominated the pinnacle of Mexican bureaucracy between the mid-1980s and the start of the 2000s. His conclusions regarding the institutional strength of the energy regulator are perhaps among the most pessimistic: the CRE did not attain sufficient institutional autonomy and legal capabilities to enforce regulation over Pemex (that authority only arrived after 2014).

Attention to Pemex is prominent in the literature on petroleum. Rousseau (2015) Stojanovski (2012) and Elizondo (2011) review the set of organizational and financial complications that aggrieved the SOE before the reforms of 2013-2014. These approaches do not directly address the problems of natural gas as a separate sector, and they have tended to favour the critique of upstream issues instead of the problems of regulation that afflict the midstream segment of the sector. This prominent interest for production replicates even in the few recent academic articles on natural gas (Morales, 2013), and it is only until very recently that scholars have started to consider questions that relate the whole new edifice of regulation of hydrocarbons with the national imperatives of an energy sector as regards security, affordability, and environmental safety (Grunstein, 2017).

What is missing, however, is a direct account of the role of the SOEs in the path of policy change and, more specifically, in their interaction with energy regulation. As this research posits, the reforms of 2013 and 2014 imply the consolidation of a process that mobilized the SOEs and public administration, including regulators. The new possibilities of organization of the natural gas and electricity industries may touch and affect structural relationships that have marked the fate of the energy sector writ large, for more than four decades. An integrative view of these structural patterns and their effect over the natural gas industry is still missing from the academic literature.

This review details what this researcher understands are *all of the (actually) few* pieces that have followed the development of the natural gas sector in Mexico.

For a start, (Halpern & Rosellón, 2000) produced a comprehensive review of the natural gas sector.⁶ Although the article does not explain the origins of regulation and its coherence with other features of the energy sector, it does summarize the legal steps, and the intentions of the liberalisation process carried out in the 1990s. This article also dissects some of the implications of the distinctive (but perhaps not unique) characteristic of the Mexican case: maintaining Pemex, the oil and gas SOE, as an upstream monopoly. It seems that the history of implementation until very recently confirmed the fairness of their pessimistic insight as to the challenges of bringing Pemex to comply with the anti-monopolistic regulation. Halpern and Rosellón rightly point at the power asymmetry between Pemex and the –then almost new-- regulatory agency. However, as this research will examine, the asymmetry has been corrected in some ways, in favour of the sectoral regulator.

Shockingly, in more than one decade only a couple of articles covered the issues that Halpern and Rosellón (2000) reviewed. An academic piece of literature explicitly related to the natural gas sector and sponsored by a Mexican think-tank is one of the few thorough revisions of what occurred in the industry since the 1990s. That article was authored by M. Grunstein in 2011, three years before the reforms that opened upstream production to private participation. In it, she describes the decisions made by the central regulatory organ (the Comisión Reguladora de Energía) in its struggle to make Pemex comply with the *General Terms and Conditions for First-Hand Sales*. These *General Terms and Conditions*... constitute the critical regulatory instrument mandating open-access rules, namely: the obligations of Pemex as a supplier of natural gas and as a transporter of natural gas from other suppliers. The article excels in its detailed recording of facts surrounding some regulatory decisions but maintains the analysis within the boundaries of the legal wrangling between the CRE and the NOC.

In three other scholarly articles, A. Lajous (2013, 2012 and 2003), a former head of Pemex, explores the transformation of the natural gas sector over the last ten years. His account reflects the policy concerns of keeping governmental control over hydrocarbon resources while solving

⁶ The first and the last, to the best understanding of this researcher.

the security and reliability dilemmas entailed by the insufficient investments and by the sudden change in economic conditions, unsettled by the rise of shale gas in the late 2000s. It also contains enormously valuable keys to interpret the policy context as it has changed over the years, with attention to the problems of policy coherence implicit in the conflict of pricing schemes and in the necessary but in some sense pervasive roles of Pemex and CFE as dominant players. More recently, A. Lajous has been publishing other conjunctural analysis on the problems and prospects of the implementation of the energy reform (2018 and 2019).

Two former staff of the sectoral regulator in Mexico (Salazar & Cazorla, 2011) have authored the only article that addresses the dilemmas of the expansion of the network of transportation. Their exposition lays out the economic and regulatory underpinnings of the problem of saturation late in the 2000s decade and explains the regulatory alternatives that the sectoral regulator proposed to incentivize more investments: the switch from an incremental (RPI-X) system of regulation to one of the *rolled-in* tariffs. This handy explanatory resource is an essential piece to understand regulation of transportation, although it is only one part of many that should be assembled to explain policy change. Specifically, it behoves researchers to weigh the importance of systems of tariffs in the changing relations between Pemex and the regulators. How did precepts of allocative efficiency adapt to give way to a hybrid system of tariffs? Who accommodated, the regulator or the regulated? Why? Only until 2019, as staff rotated inside the agencies, some of the former officials began to publish illuminating syntheses of how regulation evolved until today (see chapters 6 and 7).

The reforms of 2013 and 2014, which opened the production of oil and natural gas to private participation, and pushed the liberalisation of electricity forward, have been a matter of intensive public discussion. With regards to natural gas, in the months before and after those reforms, attention centred more on the prospects of a boom in domestic production as a result of private investment (something that has only occurred incipiently for natural gas), and on the consequences that the reform could produce in relation to the whole North American energy scene, considering the emergence of shale gas in the United States (Morales, 2013). To be sure, although it has not represented a considerable part of energy production and exports in Mexico, natural gas has had a longer history in North American relations. For most of the last five decades, Mexico was expected to be a mild exporter of the fuel to the United States. The *ups and downs* on these expectations

traverse an already long history where nationalism, liberalism and bilateral trade diplomacy have taken turns as the distinctive driver of policy (Michot Foss, García, & Johnson, 1994) (Grayson, 1981).

At the start of the 2010s, upstream oil and natural gas reforms also provoked a lot of interest and debate on the financial and fiscal risks and benefits of private production under new modalities of partnerships and production licences (Oropeza 2015, Grunstein 2010) . Transportation of natural gas has also received attention for comparative legal studies that evaluate opportunities and risks for foreign investment on infrastructure (Ramos & Mateo, 2016). While theory and contribution to academic research is not the interest of these sources, they offer the most useful descriptions of the normative frameworks and a business-oriented comparison of risks deriving from year to year changes in rules and their enforcement.

As regards the new role and position of CFE, the SOE for electricity, a couple revisions of midstream electricity and natural gas have centred on assessing the changes of the regulatory framework with a predominant legal perspective, placing the sectoral regulators and the IPSO (Independent Pipeline System Operator) upfront and center (Cortés & Pérez Motta, 2017) and without making a retrospective account of what happened in the natural gas sector since the first attempt of restructuring in the 1990s. These examinations of the reform show some optimism about the prospects for strengthening the regulatory agencies and enhancing their capability to jointly manage upstream competition and midstream monopolies. As a caveat, Cortés and Perez Motta (2017) point to the asymmetries between competitors and entrants and the need to correct or mitigate them through effective coordination between government and regulatory agencies.

The OECD (Organization for Economic Cooperation and Development) has also joined (or perhaps led) these normative evaluations of the regulatory build-up, although also highlighting the requirements for internal reorganization, mainly staffing and budget, but also in relation to the normative framework (OECD, 2017). Cortés and Pérez Motta signal the implementation of asymmetrical regulation in the natural gas sector (against Pemex) as a welcome development of the reforms of 2013 and 2014. They also point to the beneficial possibilities of implementing asymmetrical regulation against CFE on the electricity sector (not contemplated in policy at that time). However, this article stops short of commenting on what implications there could exist as

a consequence of the electricity SOE becoming the second most significant importer and trader of natural gas.

With respect to CFE, Bower and Fuentes (2014) update the discussion about the intertwining relationships between the electricity sector and natural gas (for historical accounts on the transformations of the electricity sector see Jano-Ito and Crawford 2016, Rocha 2014 and Carreón et al. 2007). The authors examine and ponder prospective decisions and options to reduce the costs of electricity and to eliminate subsidies for residential consumers while reducing the prices for industrial users. Natural gas is one of the key constraints over the sector, given the expansion of its use in the mix of fuels for power generation. An evaluation of how current natural gas regulation came to exist cannot ignore how the business strategy of CFE has evolved in relation to its growing exposure to natural gas volatility and security and how that exposure has indirectly affected the implementation of the policy of restructuring.

Finally, A. Hernandez wrote one recent analysis of the transformations of the natural gas sector alone (2017). The article breaks down governability to a composite of relations that affect all actors in the industry, and chiefly government writ-large (that is, including regulators and judiciary institutions) along dimensions of diversity, complexity, and scale. Hernandez follows the established theoretical framework of governance (Kooiman 2003) and posits that the overarching system formed by the transportation segment of the natural gas sector has increased its complexity as a consequence of the more significant number of actors and rules relating them. For Hernandez (2017), the potential for social contestation against the deployment of infrastructure adds a new complication to the new landscape of regulation and policy (one not taken into account in this doctoral research). Hernandez (2017) operationalizes the general notion of governability through the theory of *interactive governance*. This article documents the factors that produce heightened complexity in the decisions affecting the natural gas sector. Interest in complexity insinuates possibilities of exploring how to assess the contribution of institutions and interests in the more robust governance of relations at a higher level of aggregation. In particular, a question that stands out asks how the positions of key actors and regulators have shifted across time (the question: *who gets what?*). How the (re)accommodation of relationships affects regulation has become a pressing question for research on the natural gas industry in Mexico.

Conclusion

Speaking of natural gas in Mexico, there are few examples of literature that unpack the factors that resist policies of restructuring in the sense of liberalisation. This gap also exists but in a less marked form in the literature for other jurisdictions.

Perhaps the mentioned dearth has been an indirect consequence of the ideational consensus about economic liberalism that spans the most recent thirty years. Accounting for why and how states intervene in the economy has always been one of the central questions of political economy, and states have continued to intervene and affect regulation, and more generally, the plans of restructuring in the sense of liberalisation.

The above approach, which deemphasizes the role of the state, affecting policy and regulation, also shows in the literature on Mexico --with the additional observation that the literature on Mexico is scarce, overall, and the articles on its natural gas sector compose a very spotty picture. A novice reader could be led to believe that there is not much more to say about the issue. As the introduction has stated, the natural gas sector can be approached through a retrospective review, paying attention to the historical forces that have given shape to energy in the national political economy.

This dissertation uses already existing notions on patterns of business-state relations and SOEs to explain a path of restructuring. The theoretical framework in the next chapter will unpack the analytical directions of the dissertation, and their adherence to the mentioned concepts.

Chapter 2. Theoretical framework and the research question

Energy policy is multidimensional. It can be driven or get hobbled by a range of aspects that go from geology to international security. Analysts try hard to make energy policy fit into theoretical frameworks that can encompass part of this multidimensionality. Theoretical frameworks that are too specific for one part of the policy process (e.g., the ramifications of problem formulation, regulation as implementation or decision-making) gain conceptual traction at the cost of comprehension of the empirical and policy implications of their research object. As Van de Graaf et al (2016: 9-11) point out, those trade-offs between specificity and theoretical grounding may explain that most of the academic literature on energy references grey literature --reports of what is economically and politically relevant and of current interest for a jurisdiction or region although without (sometimes necessary) theoretical articulation.

This dissertation seeks to study an area of energy policy (natural gas restructuring) from a conceptual perspective that can enable comprehension of how public and private organizations participate and make decisions that affect regulation. Public and private firms can resist regulation and, thereby, affect the implementation of policy goals. Attention to the strategies (or rationality) of firms (their resources, goals, tactics) can be expected to identify patterns, resembling what previous research and conceptualizations have already elucidated, even if not exclusively in the domain of energy.

The literature review in the previous chapter reveals that energy policy studies can benefit from the use of more robust conceptual frames. This chapter makes the case for going back to basics by seeking to apply the basic questions of political economy to energy studies. For A. Przeworski (2003: 86), a political economy approach is necessarily imbued in sociology: it makes sense of observed action by identifying classes of individuals (or organizations) and elucidating a *structure of conflict* that can *plausibly* serve to attribute objectives to those individuals.

According to this approach, political economy seeks to elucidate the purposes, constraints, and options that make sense of social action: its rationality. Classes or social configurations (states, bureaucracies, social classes, markets) serve as devices to examine the relations between individuals and organizations, and the larger aggregates of which they are part. Rationality is at the centre of this account of social research, while accounting for causation can be a much more complicated philosophical and methodological endeavour. Classes, categories (of actors, of forms

of interaction, or whole social configurations) can also serve to identify covariation among several cases.

In the broader political economy literature, the research program on Varieties of Capitalism (VoC henceforth), is of particular interest to this dissertation. VoC follows the traditional interest of sociology in elucidating ideal types as the building blocks of a theory of political economy. In express recognition of its common lineage with the new institutionalism, VoC recovers O. Williamson's (1995, 1991) interest in utilizing markets, hierarchies and networks, as discrete forms of organization that can account for economic variation across jurisdictions.⁷ A central premise in the VoC framework states that variations of economic performance, comparative advantage, and responses to globalisation correlate with the type of coordination of each economy (liberal or coordinated in one of its seminal elaborations; see Hall and Soskice 2003).

Types of coordination consist of distinctive configurations of institutions and interests: forms of economic relationships. The statistical correlations among these traits are explained as resulting from complementarities between them: the presence of some institutions correlates to (and reinforces) the presence of structural economic factors and to patterns of behaviour of economic actors (Hall and Soskice 2003). Acknowledging the differences of these mechanisms of coordination and the complementarities that exist within each type of economy amounts to describing relations between economic actors.

This theoretical framework is based on the insight that regulation can be used as a dependent variable in explanations of long-term policy change. The research examines policy change in the forms of restructuring as long-term processes that affect the accommodation and compliance of the key firms in a sector (including SOEs). Attention to the role of the state also positions the research in conversation with the literature on Varieties of State Capitalism (VoSC henceforth), a stream of research that centers on State-Owned Enterprises and their supplementary role in the economy (Musacchio et al. 2015).

⁷ The theoretical framework of Hall and Soskice (2001) has become the prevalent model in the research program on varieties of capitalism. It is important to note that by the start of this century there were other models, with more types or different theoretical premises but also seeking to establish typologies of capitalist systems (see Ross-Schneider 2012). Since expectations are inherent and essential to relations, research on VoC has a direct relation to the study of trust in economic relations.

As stated in the introduction, the current organization of the natural gas sector in Mexico is as much a product of recent ambitious reform, as it is the legacy of strong patterns of state intervention in the economy. Patterns of state-business relationships surface more clearly as they react to trying circumstances.

The following sections of this chapter review the theoretical notions that will be applied to the case. As noted, the key insights of the VoC and VoSC theories pertain to a rationalistic (as opposed to constructivist) understanding of political economy: one that centers on aims that can be plausibly traced to material goals and risks. This heuristic standpoint touches on economic history and sociology. Strategic interactions are central to the analysis, particularly the extent to which they correlate with patterns in the national economy.

Compliance with norms, a key in the analysis of regulation, is understood as resulting from the balance of strategies and resources among the firms in an economy. Moreover, the content of regulation (what falls under the purview of a regulatory agency and by which principles it organizes economic relations) can be examined as an outcome of this balance - therein its character as a dependent variable. However, (logically), compliance cannot be inferred from the enactment of rules. The organization of an economic system has an obvious effect on the reach and limitations of policy decisions (their implementation) and hence, on regulation.

These theoretical and heuristic choices are important in the appreciation of institutions in policy change. Specifically, in this research, institutions are defined more broadly as sets of practices that actors expect to be observed and that can nest downwards into formal regulation or aggregate upwards into types of economic coordination (Hall and Thelen 2009: 9). Public policy analysts take as a premise that rules and norms are at the centre of distributional politics and are affected by them (Simeon 1976; Lowi 1972). It is also important to see that the distribution of resources among the regulated can affect the reach and enforcement of regulation.

This dissertation examines the policy and regulatory change in the natural gas sector in Mexico. The research addresses the following general question: *what forces led the process and outcomes of policy change between 1995 and 2018?* The question targets an outcome and a process, and it presents an explanation of what changed in both policy and implementation and what actions and decisions produced that change.

This chapter lays out a framework of analysis to explore the above-mentioned question. As the literature review foreshadowed in the previous chapter, the research will emphasize that the fate of liberalisation as a compound of principles and policy instruments is shaped by the context in which it is applied. Regulation can be affected by the context of economic relations in forms that can be deemed structural or institutional.

The utility of a political economy perspective is, therefore, that it can use a common conceptual language to connect appraisals of energy policy across periods and jurisdictions, and supersede part of the normative orientations that underlie evaluations of liberalisation. Above all, this research is preoccupied with explaining how markets evolve or get formed in the first place.⁸

Regulation is central to this research because sectoral regulators or central agencies exercising regulatory functions are directly concerned with governing the balance between the (often contradictory) imperatives of an energy system, where efficiency and security are indispensable. Policy relevant observation will always inquire into what to expect from or how to improve the capabilities of regulators and of the general regulatory framework that defines much of the interactions with and between the regulated.

The choice of embedding the energy sector as part of a broader economic whole underscores that strategic interaction occurs beyond a sector and beyond the exclusive oversight or capabilities of policymakers and regulators.

The theory of VoC was proposed by Peter Hall and David Soskice in 2001 as a heuristic device to typify whole-of-economy relationships and to identify and explain institutional covariations that affect economic performance, policy (social security, labour relations and skills, technological diffusion) and the choices of firms. As with most other political economy approaches, the framework seeks to explain variations in economic performance, such as growth and distribution of wealth, as well as more contemporary concerns, like productivity and technology transfer. One novelty of the approach, however, resides in the aggregation of economic organization traits into types (i.e., liberal, coordinated market economies). VoC, as a theory, seeks to identify and observe

⁸ A question that, as the literature review mentioned, is becoming more and more relevant with the refurbishing of energy regulation and policy to favour the transition to low-emitting sources of energy (Van de Graaf, Sovacool, Ghosh, Kern, & Klare, 2016).

social and institutional factors that affect policymaking and the decisions and actions of firms. These factors refer, broadly, to the allocation of capital and technology, the development of labour skills and the relations between firms, governments, and labour (Hall and Gingerich 2009; Hall and Soskice 2003). For instance, the collaborative character of labour relations in Germany (a Coordinated Market Economy) finds its *micro* complementarity in the collaborative style of management inside firms, where unilateral action is rare and of limited scope as a rule. The pervasiveness of collaboration in Germany stands in remarkable contrast to Liberal Market Economies (the U.S. is the paradigmatic example), where management usually interacts with labour in a much less consultative form (Hall and Soskice 2003: 24).

The systemic understanding of institutions and economic structures in the VoC theory has offered a broad conceptual platform to explain correlations between characteristics of economic organization, on the one hand, and the comparative advantage and niches of specialization in the global economy, on the other hand. More recent research has proposed refinements to the logics of complementarity as the basis of models of coordination in whole economies. Witt and Jackson (2016) have underscored that mixture and contradiction of institutional traits, in addition to mutual complementarity, can also help to explain variation in comparative advantage.

Musacchio et al. (2015) have compared the performance of SOEs and private enterprises and found that differences result from the institutional and economic *voids* where the state is the logical option to facilitate access to capital, technology, or infrastructure for trade. As these authors recognize, emphasis on the role of the state as a facilitator or creator of markets has been a recurring theme of political economy – especially for fields other than energy, as Van de Graff et al argue (2016: 9).

The sociological roots of typological inquiries are important to understand the heuristic at work in the framework of VoC.⁹ The approach to the firm, according to Hall and Soskice, is *relational* (2001: 6), because it centers on how firms and governmental and societal organizations interact across a variety of spheres that are mutually entwined by relations of complementarity (or of

⁹ Emphasis on strategic interactions between actors and specifically of firms replicate sociological attention to institutions as expectations (Berger and Luckman 1969). Compliance (and deviance) can be explained by the observer in as much as it reflects how actors perceive one another and interact.

opposition, as indicated above). This perspective suggests ramifications that can apply to the study of regulatory relations (see below).

Some further explanation of the theory of VoC is in order. The categorization of whole economies as liberal market economies or coordinated market economies serves to group patterns of interaction in the firms mentioned above. Importantly, these categories recover the original forms of coordination that derive from transaction cost economics, as proposed by Oliver Williamson in the 1970s and 1980s: markets and hierarchies (see below). On one pole of a gradient, Hall and Soskice place the ideal type of Liberal Market Economies, where hierarchies and competitive market arrangements coordinate their activities. Coordinated market economies represent the other ideal pole of the spectrum, where the relevant relationships for the firm depend on interaction mediated through collaboration, negotiation, or other forms of aggregation of interests. Supply and demand determine equilibrium more directly in Liberal Market Economies. There is a greater necessity for negotiation between capital, labor, and government in Coordinated Market Economies than there is in Liberal Market Economies. Hierarchical market economies --the place in the spectrum where Ross Schneider (2012) locates Mexico-- rely more on bureaucracy and high-level corporatist negotiation between business and the state.

Although the framework of VoC has clear and direct implications for the analysis of policy, by centering the framework on the firm, Hall and Soskice underscored their intention to connect comparative political economy with *private* business (2003: 6). It is worth noting that this theory emerged at a time when international trade and mobility of capital and technology were starting to deepen in the developed world and across developed and some developing nations. Its set of variables was relevant as a new approach to explaining comparative advantage when highlighting different conditions for capital and technology in each jurisdiction that joined globalisation.

Almost two decades on, we live in a slightly different world, and the theory has undergone revisions and modifications. The dichotomy between Coordinated Market Economies (CMEs) and Liberal Market Economies (LMEs) as initially proposed has developed to include at least four types of economies (see Table 2.1).

For its part, the literature on varieties of state capitalism has piggybacked on parts of the VOC framework to examine how states assume different forms of leadership across national industries,

often those with overseas activities. The framework of VoSC centers on how states substitute for the absence of factors of production, the failure of institutions that favour market competition and the development or provision of organizational and managerial capabilities in such voids (Musacchio et al. 2015). The application of the VoSC framework to the study of energy has been highlighted as one of the obvious (but still not sufficiently recurred) ways to employ political economy tools in energy studies (Van der Graaf et al. 2016). It is very important to clarify that VoSC does not put forward a new theory about the rationality (or justification) of state activity in the economy and energy system.

An array of explanatory factors can be cited as increasing the propensity of states to intervene in the economy (as rivals or partners of private firms). These explanatory factors go from the historical (the developmental stage of each industry) to the political (form of the state, role of the bureaucracy in the economy, strength of governing coalitions) and the strictly economic (openness of the economy, structure of the targeted industry; see Samuels 1987).

All its generality notwithstanding, the notion of contingency is also a key to understand how and why states intervene in the economy. Semantically, the notion of contingency stands in opposition to what is certain or foreseeable. And contingency provisions can only be established to some extent.¹⁰ Unexpected consequences come about (everywhere and for every possible reason), and someone must respond to them (e.g., governments). When it comes to energy, governments may intervene because the existing firms or the institutional context in which they exist cannot guarantee conditions like scale, security or economic affordability of goods. Regulation can be taken as a form of intervention, complementing or displacing ownership and direct financing, and it acquires specific forms in each sector.

State-owned enterprises and varieties of capitalism

As noted, the firm is central to analyses of policy in the VoC literature. However, SOEs are particular creatures, and their analysis in this dissertation deserves some discussion. First and foremost, is the rather undeveloped state of frameworks of analysis for SOEs, in comparison to

¹⁰ The Cambridge University Dictionary contains this definition of contingency: “Something that might possibly happen in the future, usually causing problems or making further arrangements necessary”, accessed on July 22, 2020 from <https://dictionary.cambridge.org/dictionary/english/contingency>

the VoC framework. Current research on SOEs, however, can serve as a starting point to flesh out some premises of analysis.

Economic performance has been used as a starting point for the recent scholarly interest in National Oil Companies (Victor et al. 2012). In this respect, performance is the default area of interest as an outcome (or dependent variable) for business studies (Musacchio et al. 2015; Musacchio and Lazzarini 2014). Scholarly interest in SOEs also follows their performance as internationally active champions, where Chinese SOEs stand out as representing a whole paradigm of capitalism (Hua Li et al. 2014; Bass and Chakrabarty 2014; Carney and Child 2013). Research also centers on their domestic reach, on the problems of the principal-agent relationship that pervade SOEs, and, complementarily, on SOEs as vectors or spaces of convergence of domestic politics (Burton et al 2015).

VoSC consist of arrangements in which the state intervenes as an exclusive owner, as a controlling or minority shareholder or as a provider of managerial capabilities. Research on VoSC tries to explain how these schemes of ownership and governance affect or even inform the industrial and foreign trade policy of their national jurisdictions.

As mentioned above, the VoSC framework is not discovering or rediscovering the role of the state in the economy. More precisely, it is seeking to explain how the state and specifically SOEs have redefined their strategic interaction with other private firms within their national limits and internationally. Of direct relevance to this dissertation: *SOEs constrain policy options in ways that can be pivotal*. In particular, SOEs can control large shares or all of the vertically integrated sectors that restructuring policies aim to reshape.

Table 2.1 Concepts and categories in VoC and VoSC frameworks	
Varieties of Capitalism	Varieties of <i>State</i> Capitalism
<u>I. Liberal Market Economies</u> - Markets as the privileged allocative mechanism - Short-term relations among stakeholders	<u>State as whole owner</u> - Typically associated with social goals (affordability, security, scale), political clienteles and rent-seeking
<u>II. Coordinated Market Economies</u> - Negotiation as the allocative mechanism - Long-term stakeholder relations	<u>State as majority (or minority) investor</u> - State seeks to relieve itself from financial and administrative burden - Rent-seeking and clientele still can hobble performance (<i>the case of this dissertation</i>)
<u>III. Network Market Economies</u> - Trust as the allocative mechanism - Reiterated interaction and long-term stakeholder relations	
<u>IV. Hierarchical Market Economies</u> - Hierarchical allocation mechanisms - Order or directive of the central government - Variable term of relations among stakeholders	<u>State as provider of direction and government capabilities</u> - For small enterprises that are part of larger industrial policy
(Ross-Schneider 2012 and Hall and Soskice 2003)	(Musacchio et al. 2015)

The gaps between what SOEs can deliver and what is mandated by policy goals or directives of central agencies (national or subnational) have been documented in the academic literature as examples of principal-agent relations (Clifton et al. 2007). Directly or indirectly, SOEs subsidize affordability for end-consumers, and with that they introduce market signals that may distort competition and regulation. Finally, through their clienteles (when they have them), SOEs possess a political weight of their own that can defy management and policy directives, including state measures that seek to change their corporate governance. Trade unions resist cuts to their perks; suppliers want to stay in the procurement chain and CEOs find ways to conceal their operations from mechanisms of public accountability. These constituencies can wield clout over local and national politics (Clifton et al. 2007).

Given all of these characteristics and cautions, it can be said that the analytical categories of VoC offer a sound basis to explain the activity of the state in energy policy, either in the (old) fashion of public utilities or through other allocative instruments that create or maintain the infrastructure or relationships of trust to materialize exchange or investments. However, it is important not to

overestimate the strategic coherence or the unified agency of SOEs. As this case will illustrate, SOEs may *struggle* to control some of their most important and costly internal processes just as much as the state struggles to control its own SOEs through central agencies, regulators, or accountability mechanisms. What matters most, for the purposes of this dissertation, is how the fragmentation of interests within the SOEs, as within the state itself, affect the conceptual framework and the research question. The following section grapples with that issue.

Policy and regulation. Specifying the research question

This overview of the theory of varieties of capitalism and the complementary development of a theory of VoSC serves as a preamble to reformulate the research question. Instead of inquiring exclusively into drivers of policy change, the research examines the influence of SOEs on the process of policy change and the role of regulation within this process. With the VoC framework, this research centers on the strategic interactions between the SOEs and other government agencies, including regulators. Consumers of all sizes, but especially industrial users, distribution companies and independent power producers (IPPs) are part of this picture, too.

These interactions are relevant when explaining policy inasmuch as they can help to account for the key questions underpinning the study of policy change as laid out by R. Simeon in a seminal introduction to the subject (1976), namely: *how does the scope of intervention of the state change from period t to period t' ?* Moreover, *what are the changes in the instruments of policy deployed in period t and period t' ?* That approach can expand into explaining policy change by characterizing the role of the state and the instruments of policy in accordance with the VoC framework. However, the specific interest of this dissertation is to examine *regulation* within the resulting balance of forces in these strategic interactions. The distributional consequences of policy change are relevant to identify and weight resources and goals -and how they affect regulation.

The research question

The dissertation aims to identify the factors that shaped the reach and limits (the content) of restructuring. This dissertation centers, hence, on the study of implementation and it addresses the general question: *To what extent do the generic political economy features of the nation shape the extent, scope, and pace of liberalisation?*

In line with other accounts of liberalisation in Mexico, the process of policy change that this research frames tells the story of a set of market and regulated activities that *failed to take hold*..

It also observes that, in the first push towards liberalisation (starting in 1995) the state failed to withdraw from one sector and to leave market and regulated mechanisms of coordination in place. In line with the conceptual baggage of VoSC, this research follows the conjecture that, as a pattern, the state filled in vacuums in ways that reasserted the recursive patterns of a hierarchical market economy. As explained above, contingencies come in the form of systemic crises of supply or pricing, or in the form of gaps that preclude actors moving forward with specific projects. Contingencies define implementation stories, often because they signal dysfunctions of policy and because they point to deeper in-built patterns that allocate roles and resources.

To reiterate, this research project is not seeking to rediscover the role of the state in the economy. Instead, it seeks to conceptualize that role and to observe how it works when examining the process of liberalisation and the specific role of regulation within it. It seeks to examine that role through a conceptual prism that can account for how policies play out --how they get implemented. One premise in this research is, therefore, that policies affecting energy will take a particular form in a hierarchical market economy, as is the case in Mexico.

Other factors explaining the course of events in the natural gas sector are the gradual development of financial alternatives to state sponsorship of energy infrastructure projects and the physical constraints affecting the transportation of natural gas. That said, what remains central to the research is that the SOEs and the relations between large consumers of natural gas, regulators and the central government, shaped the process of policy change under examination.

It is important to differentiate the approach of this dissertation, centred on implementation, and not on policymaking. Although the research has a different focus, it could have centred on the decision-making processes that concluded in a legal reorganization of the sector. That view would have had the political parties front and center in the analysis. It would have been dedicated to

explaining a package of policies as an outcome of bargaining: in the first place, at the level of politically represented forces, but also centrally at the level of solution-oriented rationality.¹¹

By contrast to the analysis centred on decisions, attention to implementation follows how policies *play out*, often distorting or even destroying the goals set in policy packages. Answering how an industry or a sector receives a policy package (and reshapes its instruments and goals) is a question of implementation analysis. Accommodation, of the industry and of public agencies, is the matter of the analysis. A framework of VoC serves to identify whether accommodation conforms or not to the patterns that are expected to exist in a given economy.

Hence, this research examines recursive patterns that complicate the emergence of market, competitive, relations.

Against this backdrop, then, the specific research question of this study is the following: *How did the electricity and oil and gas SOEs in Mexico affect (constrain/enable) the implementation of restructuring policies between 1995 and 2018?*

Regulation is a response to those constraints, although this research is not addressing the specific question of how policymakers decide upon regulatory measures.

Methodology: observing rationality and causality in a qualitative study

The literature review in the first chapter revealed the tendency of existing scholarly literature to analyse the economic consequences of regulation or composites of policy and regulation, and to single out the relationships occurring in energy sub-sectors or (more specifically) natural gas sectors as the units of analysis. This research aims to contribute to the literature by seeking to integrate and subordinate the observation of policy and regulation into built-in patterns in the whole of the economy in a jurisdiction.

¹¹ Attention to decision-making centers on questions like the following: what policy solutions are at hand? What factors explain the collective attention given to the possible solutions? How do processes of decision-making affect the outcomes? (See Kingdon 2003).

Some specifications about causality are in order. Theoretical concepts and categories inform observation in case studies. In contrast to a chronicle, a case organizes information with concepts that can be extended to other cases. “Using process tracing, the researcher assesses a theory by identifying the causal chains that link the independent variable to the dependent variable. Her goal is to uncover relations between possible cases and observed outcomes. This procedure can be used in theory testing or theory development” (Vennesson 2008:230).

Among a variety of other goals, case studies can use existing theoretical frameworks to interpret the relations of causality in a case (Vennesson 2008).¹² Critical case studies can also serve to explain why an outcome does not materialize even when the causal factors that should produce it exist, or why the outcome occurs in the absence of one or more causal factors identified in other cases or sets of cases (Gerring 2004).¹³

Ideally, a case study should engage in explicit conversation with other case studies, as well as comparative and quantitative appraisals. A case study must be intensive in the study of a single unit “with the purpose of understanding a larger class of (similar) units” (Gerring 2004: 342). Although case studies may or may not contribute to confirming or correcting theories, as part of social science, a case study seeks to illuminate social phenomena on a broader scale than that of its unit of analysis. Hypotheses or patterns serve to guide observation of the unit of analysis that unfolds across a period of time (Gerring 2004; Yin 1994).¹⁴

D. Levi-Faur (2006), a leading scholar on regulation and methodology, proposed a methodological framework to incorporate critical premises of the VoC into case studies and comparisons that account for how regulation takes shape and attains its goals. Taking that cue, this research takes the sector as the unit of analysis. Changes in policy and regulation refer to changes of rules (as institutions) and to changes in the relations between the actors that are constrained by those rules

¹² Types of case studies: descriptive case study (configurative, ideographic); 2) interpretive case study (uses theoretical frameworks to provide explanation of particular cases); 3) hypothesis generating case study (heuristic; aims to generate or refine existing theories); 4) theory evaluating case study (assesses whether existing theories account for the processes and outcomes of selected cases) (Vennesson 2008: 227).

¹³ Note: this research is not presenting a critical case study.

¹⁴ Diachronic analysis reconstitutes the unit of study in case studies by partitioning it into several units of analysis (often called sub-cases). Gerring (2004) points out that this epistemological and ontological fuzziness is not itself a weakness in the design of case studies. The task of properly defining a unit inheres in case studies.

or that affect the definition and enforceability of those rules. That is the emphasis of this case, which centers on the conditions that made possible the restructuring of an industry.¹⁵

Two additional issues require specification. First, this research undertakes a single case study and not a comparison (although the last chapter suggests points of comparison with other cases). Second, the research examines the process of transformation of the natural gas sector in Mexico throughout 23 years (1995 to 2018). The dissertation highlights the outcome of that process as a reassertion of the relations of exchange that existed within the state, including SOEs in a central role, and between the state and other economic actors. Policymakers had to adapt regulation to fulfil the goals of restructuring in consideration of these relations, and even without the support of the legislation, regulatory agencies accommodated their strategies to salvage some fundamental goals of restructuring.

How can the arguments and observations of this dissertation be supported? This is a qualitative study elaborated with, mostly, official documentation and journalistic sources, complemented with interviews of current and former government officials. The construct and epistemological validity of the study depends on the use of those documents, as information that attests to the interests, constraints, and options of the actors that are theoretically relevant. This interpretation of action emphasizes structure and decisions for each actor.

It must be noted that searching for causal factors can become a daunting challenge. As announced in previous sections, this research takes a moderate approach and zeroes in on the various factors that plausibly explain an action. It is essential not to reify the role of these factors (institutions, structures) as *causes*. From this premise it follows that the research centers on the *rationality* intrinsic in the description of how actors relate. Patterns can reveal that fundamental differences exist between economic systems, without necessarily revealing ontologically distinctive beings. Conceiving *ideal* types, as the term notes, is a heuristic strategy, with a caveat against reification: of causality, and of the possibilities of rationality occurring against the assumed script of ideal structures.

¹⁵ Paraphrased from Levi-Faur (2006: 369). Emphasis is mine.

At some level of abstraction, institutions can be regarded as technologies. They evolve on their own, but also as a result of deliberate innovation and adaptation. Policymakers and other actors understand and try to utilize some rules to transform an ecology of other relationships. I decided to include all the factors that could be necessary to describe their evolution in a way that would still be meaningful for students of public policy and public administration. To this, I am adding standpoints of theoretical and practical relevance: *do we need to appraise cases as this one from the theoretical language of varieties of capitalism? What does the case say to practitioners or scholars interested in discussing the relationship between policy and regulation, or the concepts of state capacity and state autonomy?*

In this description, attention straddles across levels of analysis: from instruments to macro-economic and societal factors. A case study is an adequate methodology to shift lenses and appraise how levels interlock with one another. Of course, there are risks that, by pointing at a variety of levels of analysis, attention spreads too thin and it leaves aside facts that are necessary to factor in or, more commonly perhaps, that it includes too many variables or too much narrative. How to keep focus? As explained above, the approach is relational and highlights constraints that could be labelled as material: economic gains and risks.

The research centers on a process, at the end of which two institutions become effective (open-access and price deregulation). I have trusted that, paying attention to 25 years of policy implementation, I would be able to say something about how institutions evolve. I am proposing a periodization that reflects political turning points and that coincides with other developments of the industry. Those choices can be debatable, but their main *raison d'être* is, precisely, enabling a reflection on what aspects of a process of development are worth of central attention: *what is a hallmark, an origin, a turning point? How and when do interests subordinate or blend with ideational constraints? What is the role of adaptation, innovation and cultivation in the change of instruments and, hence, in policy change?* The research is open to observing policy change through an evolutionary lens, where the relationships around the key institutions of open access and price deregulation –which emerges, finally, in the third subperiod-- constitute the unit of analysis.

I would have liked the case to have a more substantial theoretical resonance, functioning as a limit case study. That is an optimal strategy for a case study, and it works by documenting and explaining an anomaly with the purpose of amplifying or correcting a theoretical expectation (Gerring 2004). One example of a limit case that inspired this case study is R. Samuel's study of energy policy in Japan (1987). While the Japanese state had been approached as highly involved in economic policy, its role in energy policy could hardly be similar to that of other advanced economies with a tradition of state direction of the economy (like France). Japan secured its energy objectives without significant ownership of production assets. Samuel's study of energy policy (coal, electricity, oil and gas) serves as an illustration of modes of economic governance reliant on networked configurations involving clusters of corporations, bureaucracy and political leadership. Back in 1987, that case study helped to understand a modality of economic policymaking and implementation that defied the current bimodal categorizations of state-led or market-led economic systems.

I cannot claim that this case study accomplishes a comparable theoretical contribution. I have pointed out throughout this text that my choice of the unit of analysis and of the methodology was strongly influenced by the state of the academic literature: a monographic review of the sector is necessary, and the applications of political economy to the study of restructuring and regulation can use the typological reasoning that I tried to follow and develop in this study (as per the literature review).

Finally, as a reflection on the design of the research, it is important to note that, as is the case with other political economy studies, the research blurs the distinction between structures and institutions by addressing the composites of rules, expectations, and organizational forms that emerge through iteration and that span a wide array of economic and political factors. That approach is a commonality with the literature on varieties of capitalism, and it is also a theoretical choice that affects the design of the study.¹⁶

¹⁶ To be sure, other designs could have centered on ideational changes. These have been signaled across the text, although as elements that are embedded into choices and their implementation: for instance, the enactment of an Independent Pipeline System Operator (IPSO) in 2014 was a decision that imitated a widespread practice that was not available as an example in 1995, when the first move towards restructuring sought to establish a decentralized system of pipelines. An ideational framework would have entailed greater methodological complications: how to document changes at the ideational level if access to the participants may not be optimal?

Sources: opening black boxes in Mexico, from Ottawa

This dissertation presents a qualitative study. The research is not interpretive, however. Its observations derive from a collection of concepts that have been utilized for the general empirical field under scrutiny, for this and other jurisdictions. Research has used the publicly available information. Most of this information refers to government sources, although I have also relied on official information as reported by trade journals when it has been impossible to find the original official source. Between 2016 and 2019 I also undertook 12 interviews with experts and civil servants (former and current) in the sectoral regulator (CRE), the Ministry of Energy and the electricity SOE (CFE).

I followed a snowball sampling method, choosing senior (elite) members of the government institutions of interest. The recruitment text, interview guide and ethics certificate from the University of Ottawa's Research Ethics Board appear in Appendix 3. I selected the interviewees based on their closeness to the subject matter of the case. The conversations with interviewees helped orient the research, directing attention towards facts and decisions, and their relevance to the processes examined in this dissertation. However, I almost exclusively support the findings of the dissertation by reference to published information. I treat the views of practitioners at the (very valuable) level of opinion in order that the findings of the research rest on the more factual aspects of the study.

In the course of the research it became clear that interviews were going to matter more as guidance for me to interpret documentation than as core material validating my assertions. The most important reason for this resides in the nature and temporality of the processes that I am observing. The study did not concentrate on the insufficiency of support for liberalisation among potential constituencies, like industrial users, or on the party-level negotiations and decisions that were made in 1995, 2008, and 2013. The analysis did review the publicized positions of industrial users and lawmaking processes, along with media reports and congressional debates and hearings.

Nevertheless, as explained above, the focus of the research is on how the consequences of implementation (projects, pricing rules and subsidies, restrictions, permits) or its failure, affect

pathways and foster structural accommodation. This ontological perspective, centered on long-term patterns and their structuring effects, highlights the interplay of contingencies (institutional gaps) and the activity of the state. Interviews proved very useful to identify the critical turning points in a more than two decades-long history of accommodation, mainly involving Pemex and the CFE. However, the more meaningful material for the study's institutionalist (relational) approach was documentary sources.

Who faces which risks and which costs? With what resources? What are the consequences for the dependent variable: the possibilities of having natural gas flow through an open-access system, and ensuring an acceptable degree of upstream competition? The analysis relied predominantly on documentary sources while weaving in some unattributed quotes where they proved especially useful to illustrate key tensions and issues.

It should also be noted that I confronted a methodological challenge. It became clear in interviews that it was difficult for interviewees to provide the level of specificity that would have been required to use their testimony as the main source of validity for the thesis – whether because memories of long past events fade over time or because of the political sensitivity of the issues. Moreover, residing in Canada while interviewees resided in Mexico likewise challenged the use of interviews.

Trying to examine SOEs from the inside can be a tricky path of research. All kinds of testimonies about their opacity abound and talking to their officials is generally not easy. By way of illustration, pricing mechanisms for exchange within the SOEs' units or between the SOEs themselves did not exist until the first moves towards reform of the energy sector in the period covered by this study. In its role as regulator, the CRE continuously struggled to discover the capital and operation costs of transportation infrastructure controlled by Pemex. When it endeavoured to make a ruling about one part of the sector (transportation or wholesale pricing), its rulings over tariffs were overridden by the circumstances and costs affecting the whole system – and often these overriding decisions emanated from higher level policy quandaries.

The intricate implications of subsidization and price controls over the internal accounting practices of Pemex and CFE also constitute an issue that would justify another doctoral dissertation. On top of that is the pervasive mismatch between the written norms and the actual business practices of

these organizations, and the also intentionally opaque speak of public organizations, which often seems to sidestep objectivity (and accountability). Plain language is a challenge for regulators and public authorities in Mexico, just as much as it is for researchers. By way of compelling example, an observer of Pemex recommended that English (in his view, a language lacking the euphemisms and vacuous spins of Spanish) become compulsory in the sessions of the board of the SOEs.¹⁷

Access to credible information is, in this context, one important challenge for researchers. But it can be navigated, nonetheless. Although not all *black boxes* can be opened, the publicly available information can support substantial conjectures and arguments. Guidance of officials and former officials has been of critical assistance to interpret what information is accessible in online archives.¹⁸ That has been the primary methodological strategy for this research: elucidating a theoretically relevant argument by piecing together empirical information, some of which coincides with the views of interviewees. Most often, public officials do not share the frameworks that give theoretical relevance to their statements and to the actions and events that they narrate. Although many have degrees in economics and public administration, they are mandated to approach problems practically. Nevertheless, the intuitions of scholars and the intentions and intuitions of practitioners can coincide. The systemic importance of open access rules can be used as a straightforward example. It is a tool and an indispensable condition to attain upstream competition, economic efficiencies and systemic benefits. Its critical importance is, hence, evident for anyone aiming to develop (or to thwart) a market. And scholarly literature would recognize its relevance in similar ways. This coincidence of views is not always the case. Notions like institutional isomorphism, or input and output legitimacy, for instance, are central to the analysis of public policies. They are useful to explain and understand an array of academic questions, such as the choice of instruments, their potential effectiveness, or their relation to a policy community or a political space and time. But these questions may not be thought in similar forms by practitioners.

¹⁷ George Baker, 2007, “Bilingüismo en Pemex” Reforma, July 18th, 2007. Accessed online from www.reforma.com

¹⁸ To complicate research a little bit more, at some point between 2016 and 2018, the national government reorganized the online public access system. Previously, the sectoral regulator had a very reliable and organized database with all its rulings of more than two decades. After the reorganization, it became much more difficult to retrieve a ruling in a systematic form.

In addition to the quotes that add colour to the narrative dimension of the study, the documentary sources of the research are mostly legal (including some congressional deliberations), policy and regulatory decisions and government databases with aggregate information about supply, demand, prices, and infrastructure. I also relied importantly on business information from the Mexican newspaper *Reforma*, trade journals and reports of private companies and SOEs (quarterly and annual reports). Some synthesized information that I used in this research has been produced by international organizations (IEA, OECD) and by the United States EIA (Energy Information Administration) and different research units of the Congress of the United States.

[The case and the framework. An overview](#)

Contrary to the original intentions of reform in the mid-1990s, partial liberalisation did not drive, on its own, the creation of a natural gas market in Mexico. Instead, the scheme of state intervention that characterizes that part of the Mexican economy reasserted itself through the SOEs. The outcome at the end of the period of study is a landscape of infrastructure, regulation, and policy that has incorporated substantial market mechanisms to allocate resources, thereby replacing part of the activity of the SOEs (see Table 2.2 below). This shift has occurred, in large part, because, under the new formal structure of the industry, SOEs have to compete against other private firms and one another. Some (not negligible) risks of reversal have remained.

In sum, the sector liberalised, although not entirely. Conversely, the state reasserted its activity in the new regulatory framework enacted in 2014. The SOEs must adapt to face competition, but the electricity SOE has kept latitude to assert regional dominance in the commercialization of natural gas and to cross-subsidize its activities as a supplier of natural gas and producer of electricity. Today, regulation has grown as a set of principles and organizations that mediate relations between SOEs and policy but in the past regulatory agents accommodated more frequently than they led the process of change.

Along with Ross Schneider (2002), this dissertation underscores the weight of business-state relations on policy in Mexico. Pressure from constituencies has played a role in the determination of relative prices, of subsidization and, moreover, of the nature and extent of responses of the SOEs to crises of affordability and supply. This case therefore demonstrates in several ways how these relations affected policy change.

Characterization of the Mexican political economy as a hierarchical economy (Ross-Schneider 2009) can serve as the first step to name and study the patterns of business-state relations and activities of the SOEs. It is a structural appraisal that points to the presence of diversified business groups, multinational corporations (MNCs), atomistic labour relations and low skills (page 555). There is a role for the state in this type of economy. In the words of Ross Schneider (2009: 570): “The state is the main external institution that historically reinforced the core features of the [Hierarchical Market Economies] as it regulated markets for capital, labour and technology. States invited MNCs into their countries and regulated the terms of their entry. States encouraged and shaped, directly or indirectly, the patterns of diversification in business groups.”

Against this backdrop, the SOEs constitute an organizational level of their own that encroaches on the policy change under evaluation. This research appraises how SOEs accommodate to external change, even when that source of external change comes in the form of energy security requisites and not in the form of pressure from international competition – although international markets also affect the SOEs in several ways. The SOEs incorporate economic constraints of the firm when it comes to all types of subsidization and the almost unavoidable obligations to serve as sole suppliers or suppliers of last resort. As noted above, SOEs are also agents with considerable leverage over industries and even national policy decisions.

While the leading policy role of SOEs is one of the themes of this research, the dissertation also privileges the observation of strategic relations as a cause of the institutional accommodation and the reorganization of interests that help to explain policy change. Emphasis on contingency also becomes key to explaining compliance, the ultimate test of institutional effectiveness (Mahoney 2010). The case reveals how actual, material control facilitated by the vertical integration of Pemex became one of the most important barriers to compliance with the rules of open-access. Although congressional action bolstered the economic and legal standing of the sectoral regulator in 2014, for most of the period under study, regulation was caught between relations that eclipsed the principles of economic efficiency and fairness that sectoral agencies are supposed to uphold. The rebalancing of relations that facilitated compliance is also a direct and indirect consequence of the entrance of the electricity SOE into the sector. Finally, the prospects of the sectoral regulators to force compliance have grown more robust as the sector has become more complex, with a more differentiated consumer base and the real potential to bring in more foreign suppliers.

Table 2.2 Overview of the process of policy change (policy and regulation)			
	Pre-liberalisation (before 1995)	Thwarted liberalisation (1995-2012)	State-led expansion and overhauled liberalisation (2013-2018)
Policy and coordination	Fuels (production, pricing, access) part of state-led development type of economy. Central agencies and SOEs inhibit formation of markets.	Partial liberalisation exposes fragility and contradictions of plan to create markets while preserving an upstream monopoly. Upstream monopoly and growing demand for electricity produce imbalances. Drift of policy goals (security overrides affordability).	State-led expansion fills in the voids of physical and regulatory institutions, fostering the emergence of a market, albeit one with dominant participation of one SOE. Policy adjusts to support asymmetrical regulation against the NOC.
Role of Regulation	Regulation is poorly institutionalized, and concentrated in central agencies Absence of markets and regulation (poor or ineffective pricing rules, regulation of contracts for first-hand sales, lack of regulatory agencies). Subsidization and pricing rules favour organized industrial users.	Non-compliance with regulation characterizes the period. Regulation has to muddle through and solve contingencies. These emerge in the forms of: -insufficiency of midstream infrastructure to guarantee secure supply (lower domestic production and higher demand); -exposure to foreign price volatility heightened by lack of transportation and storage infrastructure; -supply uncertainties (Pemex-electricity production and new LDCs).	Compliance with revised regulation becomes the norm. De-regulation of first-hand sales facilitates imports and enables upstream competition. Asymmetrical regulation to diminish the upstream market power of the NOC. Departure from decentralized paradigm of regulation of midstream infrastructure and embrace of centralized system operator. This compromise enables the formation of sophisticated markets (transportation).

Contribution to the academic literature

The still dominant interpretation of energy reform in Mexico centers, normatively, on a set of ideals that can make the recently enacted regulatory framework (2013 and 2014) avoid the

problems of the past. For instance, a forum on Mexico's energy reform hosted in 2017 by the Oxford Institute for Energy Studies recalls that the indispensable conditions to make markets work are: "1) clear rules of the game, 2) strong property rights, 3) unhindered information flows, 4) low barriers to entry and exit, and 3) enough buyers and sellers to sustain a competitive process of price formation" (Flores 2017). With this prescriptive perspective, this research seeks to follow the development of conditions to make markets work in the case of natural gas in Mexico. However, by contrast to the prescriptive perspective, this dissertation seeks to identify hallmarks and constraints that marked the path of policy change to where it stands today. The study offers a retrospective examination that highlights the contingency of the decisions that formed the framework under which the natural gas sector is working today. These contingencies have been conceptualized by the dissertation in a way that accounts for the resources, constraints and interaction of the players that have determined the course of policy change where regulation is central.

A key storyline of this dissertation is how the central regulatory and policy components of the original plan of restructuring failed to crystallize as intended but were redeemed, ironically, in the more balanced outcome at the end of the period under study. Examining regulatory change from this perspective serves the purpose of appraising the possibilities of the new regulatory framework to bring about competition. The pursuit of liberalisation and restructuring confronted the SOEs, central agencies and regulators with different dilemmas at every new stage of the period under study. Complex organization and self-regulation were central to the ideational horizon of the reform of 1995 --and remained only as purposes on paper. However, affordability and security became the currency of policy and regulatory adjustments in the first decade of this century. Ironically, by building-up infrastructure to enhance the security of power generation, the SOEs created possibilities of leverage for regulators, and led to a more complex and competitive natural gas industry.

To complete the irony, the adjustments after the *liberalising* reforms of 2014 have sought to recover the potential of efficiency through market mechanisms. However, these reforms also recentralised the intervention of the state in all infrastructure-related matters. It is worth noting how these reforms prepared the nation for a deeper reliance of its energy security on market forces,

where imports had become determinant, due to its proportions and destination (production of electricity).

These relations suggest confirmations and clarifications about policy coherence and the reach and limitations of regulatory frameworks themselves. The balance between the SOEs and between the SOEs and large consumers and IPPs depended much more on the role of central agencies (finance and energy) for most of the period under examination. Reform gradually brought regulation to the foreground, effectively leaving the technical and autonomous bodies created in 2014 to confront the SOEs and other regulated firms. From this perspective, regulation takes on a broader meaning: it includes the ensemble of sectoral and central agencies, and their interplay with firms and other constituencies that seek to influence policy.

Some remarks related to the theoretical relevance of this research are in order. First, the theoretical framework seeks to straddle the normative discussions about, on the one hand, a failure of implementation, and on the other, a lack of policy coherence that permeate much of the academic and non-academic literature on the subject (for examples of the Mexican case, see Grunstein 2011). This case study also acknowledges that there is an increased level of complexity in the relations between regulators and regulated firms (as in Hernández 2017). However, that complexity is not taken as a given. Instead, this dissertation looks into how structures changed to permit it.

Approaching the case from that standpoint reveals how policy change, as an outcome, follows existing patterns that characterize the Mexican political economy and that have expressed themselves in some moments of contingency. As a process tracing case study, this dissertation, therefore, also illustrates the mechanisms at work, in the form of institutional features, voids, and strategic responses of the firms and state agencies in the sector. Resources and risks determine the strategic orientation of these actors, while central agencies of government and regulators themselves are also subject to the functional imperatives of security and affordability of the energy system in all jurisdictions.

Conclusion

Because of its emphasis on the ways in which economies are coordinated, and on the relations and complementarities between the resources of firms (including SOEs), the framework of varieties of

capitalism is particularly well-suited to frame research on energy policy and regulation for the case of natural gas policy change in Mexico. Attention to contingency, present in VoC and VoSC frameworks, is critical to understand the ways in which the state and the SOEs accommodate to serve the requisites of affordability and security of supply and, thereby, how they affect the efficiency criteria sought by regulators. As a last part of the preamble to the empirical study of the case, the following chapter schematizes the more concrete mechanisms of natural gas regulation and the challenges that their restructuring has posed to regulators and policy makers.

Chapter 3. Policy, regulation and the restructuring of natural gas sectors

Introduction

The policies that Mexico adopted in the mid-1990s to liberalise its natural gas sector were part of other policies that Mexico was carrying out to enable the emergence of markets in almost all of the rest of its economy bar oil products and electricity. The move to create a sectoral regulator and to open the market to foreign supply was also one part of the more generalized move towards liberalisation of energy sectors in the world (Michot Foss 1998). The North American example stood as a benchmark for the transformation of institutional settings affecting the energy sector in Mexico (Jimenez 2000), but the implementation process underscored the vast differences between their economies and institutions.

While regulation is central for the purposes and challenges of implementing restructuring in the sense of liberalisation, its enactment cannot be assumed to modify the conditions that exist at the level of policy, and that can only be modified by policy-level change. Regulators seeking to play their script as enhancers or enforcers of liberalisation policies invariably find themselves challenged by the constant variation of their *deck of cards* on that broader game. For instance, regulators often have to fold to the goals and resources or even embedded practices of large state-owned enterprises. Regulation cannot either override the potentially striking contradictions between the goals of security or affordability, and the instruments or actors that represent them at the policy level. Legacies in the forms of subsidizations or the steel-wrought constraints of physical infrastructure also represent a broad category of obstacles against regulation. If regulation is, hence, equivalent to the instruments (Doern 1979), how to include its analysis in the analysis of policy change?

This chapter overviews how regulation works and examines some of the challenges that regulators face as they try to enforce the principles that characterized liberalisation in the natural gas industry. This chapter advances the claim that regulation is much more a piece subordinated to policy and that its limitations must be understood within a context of interests that can encompass economic relations all across a jurisdiction. Definitions of regulation, policy and liberalisation are examined with some detail, especially to highlight their meaning in the context of natural gas sector transformations. The empirical section of the dissertation (chapters 4 to 7) will explore them more precisely.

Organization of the chapter

Basics about the technology and economics of the industry must be presented first in this part of the dissertation. The chapter starts with an overview of the economic aspects that derive from the technologies used to produce, distribute, and use natural gas. From there, the chapter moves to discern the general directions in which the regulatory frameworks for natural gas have changed since the 1970s until today --chiefly, but not uniquely, in the United States. The second section focuses on the emergence of competition in production and transportation, a process that is concomitant to regulatory change. Since upstream competition and transportation is a privileged focus of the dissertation, transformations in storage and distribution will not be addressed in depth. A third part of the chapter builds on the preceding concepts and revisits the components of the general research question. This part examines the economic and institutional problems that can complicate restructuring where regulation is central and lays out a set of 5 general hypotheses that stem from the theoretical framework laid out in chapter 2 and that will guide the interpretation of the case presented in the ensuing 4 chapters.

Technological bases of the economics of natural gas¹⁹

Natural gas is a mixture of methane (CH₄) and variable quantities of ethane, propane, butane, helium, nitrogen and hydrogen sulfide, which can be used to produce other fuels, such as non-sulfur diesel, kerosene, and jet fuel. Throughout this dissertation, the word *natural gas* refers to the methane used as a fuel and not to the other fuel gases and liquids, that are usually found with methane and that give inputs to the petrochemical industry.

Natural gas can exist in oil and coal deposits. In that case, its production is named *associated* with either of these hydrocarbons and as *non-associated* in the opposite case, where natural gas is found alone, forming a mixture with other gases. Recent technological developments have allowed the massive extraction of gas trapped in sedimentary rock and sand formations (*shale* and *tight* gas). These newly available sources of fuel have changed the economics of gas and energy for North America and the world.

¹⁹ This presentation follows Montgomery (2010) and Michot Foss (1995) and EIA (2014).

As a source of energy, natural gas has many advantages over other fuels. The first advantage of natural gas over other hydrocarbons is that its combustion produces lower levels of greenhouse gases (GHG) per unit of caloric content: between 20 to 40 percent less than fuel-oil or coal, by one estimate. Moreover, by contrast to coal, natural gas-powered electricity does not produce the sulfuric acid that causes acid rain (Burnham et al. 2012). It must be noted, however, that methane is a potent GHG gas itself if leaked or released without combustion to the atmosphere. A given amount of CH₄ traps 20 times as much heat as the same amount of CO₂. In 2015, a single but prolonged leak from a storage site in California contributed to rising up to a quarter of the yearly GHG emissions of that state (*The Atlantic* 2016).

Another distinctive characteristic of natural gas as compared to other fuels is its caloric content. A given volume of gas at standard pressure contains a thousandth of the energy potential of the same volume of liquid petroleum. One barrel of oil produces as much heat as six MCF (thousand cubic feet) of natural gas (Weijermars 2010: 84). In other words, natural gas needs to be used in much larger volumes than oil –and through pressure control-- to produce the same heat energy. That physical reality underlies the massive proportions of the facilities required for storage, transportation, and distribution of natural gas, and consequently, the economies of scale that have given rise to all the features of the industry since its origins in the 19th Century (FERC 2012). Technological change and its effects on economies of scale and scope have shaped the options to regulate natural gas.

Throughout most of its history, natural gas has served to fuel industrial processes like the production of steam, drying, cooking ceramics, smelting and other thermic treatments for metals. At the commercial and residential scale, it is mostly used to produce heat, either for cooking or for heating buildings and houses. Natural gas is also an input for a chain of petrochemical products, such as fertilizers. Since the 1980s, natural gas has grown as part of the mix of fuels for the production of electric power. By creating more efficient energy, combined cycle plants have also spurred institutional accommodations to favour the expansion of smaller, lower-cost and in many cases privately-owned facilities.

Currently, the case for expanding natural gas power generation is strong. Economies of scale are far less constraining for natural gas-powered electricity plants than for alternatives like hydro or

nuclear. Put in a slightly technical fashion: in 2015 the LCOE (Levelized cost of electricity) of conventional combined cycle gas could be two-thirds of the same cost of nuclear, approximately 80 percent of that of hydro and conventional coal (Stacy and Taylor 2015: 4) and close to 90 percent of existing wind technologies.²⁰ In other words, it makes economic sense to build natural gas facilities, especially since combined cycle generation technology (CCGT) allows more energy efficiency --less waste of heat per megawatt produced. The availability of connections (pipelines, distribution networks) and the relative costs of transportation (especially against coal, which has to travel by rail) also count when deciding whether to expand the use of this fuel (i.e., building natural gas pipelines has more attractiveness in places or regions where rail connections are poor or non-existing, as is the case of large regions of Mexico). Last but not least, natural gas does not suffer the reliability issues of hydro, wind, or solar energy: a plant can be put to work from inactivity into limited or full capacity rapidly. That flexibility explains the attractiveness of natural gas to replace other baseload fuels, such as coal, fuel oil, and nuclear.

In sum, there is a number of reasons why natural gas has become a more critical fuel at the start of the 21st Century. Technological change has favoured its more efficient use since the 1980s. Environmentally speaking, if used correctly, natural gas is the least harmful fossil fuel, although not with overwhelming advantages over other oil products (Burnham et al. 2012). Finally, world reserves of natural gas are abundant, at 22, 882 TCF, especially since the introduction of shale gas at the end of the 2000s (EIA 2013: 4).²¹ Consider this figure in proportion to the consumption of dry gas in the United States, at 26.6 TCF per year (EIA 2014). Four years ago, the IEA predicted that by 2040, natural gas would duplicate its share in the energy mix in the world (IEA 2015).²²

The expansion in the use of natural gas across the world is, in large part, concomitant to the expansion of smaller producing facilities of electricity that use combined cycle technology (Skinner 2006). At some moment at the end of the last century, it seemed that natural gas would work as a fuel of transition to renewable energy: a temporary and partial replacement of coal and

²⁰ The levelized cost of electricity refers to the total costs of production, in dollars, of each fuel throughout the life of a producing facility divided by the number of megawatts produced (see Stacy and Taylor 2015).

²¹ This figure includes shale, tight and other proved reserves and unproved resources (EIA 2013).

²² IEA, *World Energy Outlook 2015. Factsheet. Global trends to 2040*, accessed from http://www.worldenergyoutlook.org/media/weowebiste/2015/WEQ2015_Factsheets.pdf

oil products while wind, solar and other clean fuels became the centre of the energy systems of the world. However, its current availability and the economic prospects of enhancing its environmental advantages might presage that natural gas will continue to grow its share in the energy mix of the largest economies (Pierce 2012). The cost of renewables has fallen sharply, but natural gas still seems to be the central fuel of the coming decades (IEA 2017).

Regulation and the economics of natural gas

The economies of scale inherent in transportation and distribution explain why regulation bears strongly on the definition of prices of natural gas (see below). It takes much costly infrastructure to transport, store, and distribute natural gas. This characteristic stands in sharp contrast to other fuels, like oil or coal, which lack the complications of distribution to end consumers and in which transportation costs are a much smaller proportion of the value chain (Weijermars 2010). Also, by contrast to renewables and nuclear, natural gas power facilities receive their fuel through a network of transportation that also serves other (industrial, commercial) consumers that use gas under very different requirements of delivery and on a smaller, residential, scale. All of these consumers or their aggregations (industry organizations, LDCs) have a role in the definition of regulation and policy.

Generally speaking, the word regulation can be simply equated to instruments of policy themselves (Doern 1979), or to "all the actions by the state designed to cause some specific actions on the part of individuals or some specific allocations of goods and services" (Przeworski 2003: 100). Public utility regulation took its modern shape in the 19th Century, through the creation of franchises for distribution of natural gas, electricity and the provision of services of transportation and telecommunications (Armstrong and Nelles 1988). In the United States, regulation also came as a progressive backlash to the flourishing of big corporations in the generation after the Civil War (McNabb 2005). Monopolies have a longer history, which goes back to the franchises of medieval times to regulate trade, mining, and which granted barriers against entrants or administered common pooled resources, like fisheries and grazing lands. The first applications of monopoly franchises were purely mercantilist: they sought to concentrate revenue in one authority at the service of the sovereign or contributing to the public treasure. However, the theory and practice of modern regulation evolved in tandem with the high thrust of urbanization and industrialization,

and specifically to responding to the pressing questions on how to channel capital to deliver services (water, electricity) and to connect distant centers producing and consuming commodities and raw materials (Milward 2007). The core balancing dilemma of monopoly regulation, hence, refers to determining attractive rates of return on investment to maintain delivery systems growing while, at the same time, maximizing utility for all users, including potential or indirect competitors, and remotely located and/or low-income consumers.

Monopoly and economic competition regulation seek the efficient allocation of economic resources, amply considered as those of investors and consumers wherever a unique firm is enfranchised to provide a service. An implicit or explicit notion of what the public interest is inheres regulatory decisions. Scott Hempling (2006) considers that all regulatory decisions should explicitly define the public interest and explain how regulated economic activity would differ from unregulated activity. Competition regulation aims to promote efficiency, preclude collusion, or concentrations that would reduce the social welfare produced by an industry. Both monopoly and competition regulators seek to tackle or prevent harmful unilateral practices such as cross-subsidization, unfair discrimination, or other manipulative or rent-seeking actions against clients or other firms.

Like all instruments of government, regulation changes over time. Regulation is affected by the context of other instruments and economic institutions or structures that form policy. In turn, regulation may also contribute to changing the industry it regulates. Observers of the interrelations of regulation and policy must pick one standpoint, assuming that the whole structure formed by regulators and regulated is in constant and mutually imbricated evolution. Put differently, the rules and processes that characterize a sector in each jurisdiction reveal, from one flank, the political economy of the whole. Rules and processes are keys to reveal how the different interests in the industry balance one another, and how public institutions can advance policy goals through a combination of permits and constraints to entry into markets, arms-length regulation (tariffs, pricing regulation, conditions of services) or through state-owned enterprises. The long-term learning or adaptive processes that affect regulation are also part of the political economy of energy and natural gas, and they speak for how regulatory instruments and practice are embedded in larger institutional and economic contexts.

It seems adequate to use V. Schmidt's (2008) conceptualization of discursive institutionalism to consider that the term liberalisation has been a coined term that allowed, as a global but vague concept, the coordination of policies or, more precisely, the coordination of a group of agreement (and disagreement) among policymakers. The different labels of these policies sometimes follow the general notion of *reform*, which can be defined generically as institutional change explicitly mandated by governments (Hall and Thelen 2009: 20). Clarifications about the different uses of the term liberalisation can be addressed better by distinguishing it from other processes of change in economic policy.

Hereon, this research uses the combined term restructuring in the direction of liberalisation as a synonym with liberalisation. In that sense, restructuring refers to a policy that modifies the economic interactions of the different segments that form a value chain in an industry. This modification seeks to foster competition in areas that were formerly in the domain of public and private monopolies (Joskow 2008).

De-regulation can be concomitant to restructuring. It means the flexibilization or repeal of controls over prices or other restrictions over existing markets. Price deregulation is one part of liberalisation, because restructuring in the sense of liberalisation seeks the creation of wholesale markets (in electricity and natural gas) through upstream competition. De-regulation, as a trend to reduce administrative burdens over economic activities, is also part of the wave of public sector transformations that started in the 1990s with the goals of reducing public deficit and improving the quality and efficiency of public services, chiefly by devolving and decentralizing functions, introducing new technologies of information and creating or strengthening regulatory agencies beyond the reach of central agencies (Aucoin 1997; Majone 1997). It is indispensable to bear in mind that rather than the disappearance of rules, de-regulation meant the creation of new rules, where market forces would have a wider but not definitive role. Moreover, the *text-book* components of liberalisation includes regulation of monopoly firms that are still part of the new,

²³ This section follows the definitions and overviews of liberalisation in McNabb (2016); Pollitt (2012) and Joskow (2008).

reformed sectors (distribution and transmission, in the case of electricity, and local distribution and transportation, in the case of natural gas. Joskow 2008).

Although recent examinations have cast a moderately enthusiastic evaluation about their outcome (Pollitt 2012), restructuring policies, as undertaken between the 1980s and 1990s were driven to create more efficient use of public finance and of the extensive economic resources invested in large networked sectors of the economy. In the case of electricity, economic efficiency was sought by privatising state-owned utilities and by creating wholesale markets where investor-owned generators would shoulder risks and costs. For natural gas and electricity, restructurings separated previously vertically integrated segments, in order to enable upstream and downstream competition (except in the cases of retail for small commercial and residential users).

The refurbishment or creation of independent regulatory agencies to uphold the principles of open-access in transmission monopolies and oversee the quality of services or the efficient siting of infrastructure has also been a distinctive part of restructurings in the sense of liberalisation. Regulatory agencies have carried out measures to reduce the market power of former monopolies through asymmetric regulation, and to organize horizontal integration of transmission infrastructure to enable the right scale of upstream markets, in the case of electricity. Independent system operators in electricity and natural gas serve this process of market integration (Joskow 2008:13).

Finally, *privatisation*, which refers simply to the divestment of public assets, deserves a couple of final notes. In some cases, policies were mostly seeking to capture economic efficiencies in newly structured sectors. In others, governments were also or mainly pursuing to relieve from the financial and managerial burdens of ownership. By enabling possibilities of broader coverage and more flexible exchange between producers and consumers, technological change in the 1980s also contributed to building the case against public ownership of networked infrastructure (Milward 2007).

Table 3.1. Textbook components of liberalisation²⁴

Electricity	Natural gas
- Privatisation of state-owned and vertically integrated monopolies; - Vertical separation of potentially competitive segments: generation, marketing and retail supply; - Horizontal restructuring in generation to bring together generation and enable wholesale market competition; - Horizontal integration of transmission facilities to preserve reliability of the network; - Oversight of open-access to the transmission network for all suppliers; - Separation of prices of competitively supplied services from charges of delivery through regulated monopolies in transmission and distribution;	- Privatisation of state-owned monopolies (U.K.) or/and application of asymmetric regulation to reduce market power of previous incumbents; - Vertical separation of previously integrated segments: supply, transportation and delivery; - Oversight of compliance with TPA principles in transportation links - Monopoly regulation of transportation links and storage (tariffs) - Deregulation or flexibilization of pricing regulation (caps);
Electricity and natural gas - Creation of independent regulatory agencies (information, technically experienced staff, authority); - Transition mechanisms	

²⁴ Joskow (2008), for electricity; MacAvoy (2001), for natural gas.

Basics of marketeering, transportation, and distribution of natural gas

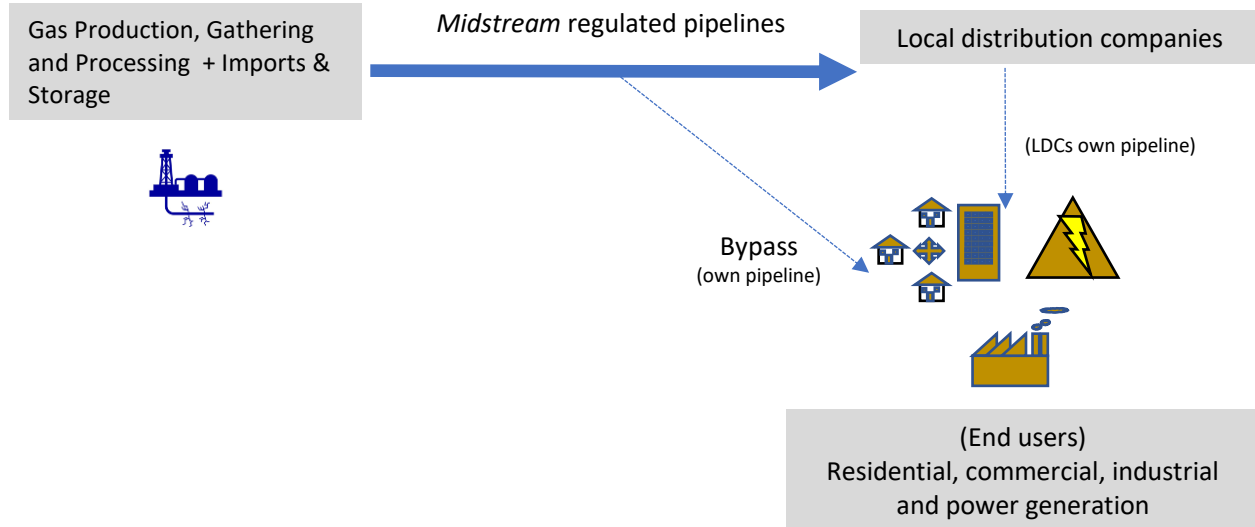
The purpose of restructurings in the sense of liberalisation is to stir competition all over the segments of the sector, markedly on production, transportation storage, and distribution. Before the 1980s, the knowledge of monopoly regulation said that natural gas pipelines were natural monopolies, inevitably poised to integrate with their upstream and downstream ends. In the U.S., the blueprint case of liberalisation, regulation, and other instruments of policy treated all the value chain as inevitably tied to specific economies of scale. It is essential to know and adequately differentiate the rules of exchange for each particular activity in the sector. Competition means a very different thing for each of these activities.

The following sections in the chapter will explain how restructuring has taken place in each segment of the value chain in the natural gas industry.

Marketeering

Marketeering refers to the trading of natural gas by producers or specialized organizations that transact with producers, pipelines, and distributors or large consumers. They sell natural gas and, importantly, they offer rather stable interfaces for consumers that need to secure supply and to mitigate price volatility. The structure of the industry and its institutional settings vary across jurisdictions. There are, at one extreme, nation-wide producers that transact with end-consumers. At the other extreme, there can be a multiplicity of large and small traders or affiliates of LDCs, pipelines or large volume-users that sell and resell gas that they did not produce or that they did not end up using. In 2004, there were, for instance, 1, 800 producers in the United States (McNabb 2005: 28). By contrast to the production, transportation, and distribution segments of the natural gas industry, it can take little capital to start a small trading business (FERC 2015).

Illustration 3.1 The natural gas industry (simplified)



The power of integrated pipeline systems over producers and traders, consumers and even regulators is grounded in the persistence of asymmetry in the information held by pipeline operators or distribution companies (McNabb 2005b 117; MacAvoy 2001). As long as pipelines own the gas they trade, they compete with an advantage over marketers that do not own the pipeline. The former also have all incentives and means to discriminate against the latter and to prey on distribution companies (Makholm 2012; MacAvoy 2001). Discrimination can occur, for instance, by denying the transportation service, heightening charges for some clients or cross-subsidizing activities to displace competitors.

Rules of vertical separation in competitively structured sectors have sought to ensure that marketers and transportation firms or LDCs cannot incur discriminatory practices against other traders so that every supplier can have the opportunity to reach their clients at the distribution end of the system. In disaggregated sectors, traders can get to exchange natural gas through a variety of contracts, which constantly balance needs for reliability and stability of short and long-term.

Liberalisation implied a restructuring of ownership where distributors or other large consumers can directly transact with suppliers at the other end of the midstream pipelines. In vertically integrated systems of transportation, transportation, and even distribution might be under the

control of the same company. That institutional condition tends to favour the capacity of operators of pipelines to use their control over access to their infrastructure and to prey the resources of producers or consumers at either end of the transportation facilities. In sectors that mandate vertical separation, regulators oversee suppliers, transportation firms, and distributors to prevent collusion, and transportation operators cannot own the gas that they transport (Makholm 2012; MacAvoy 2001).

Every restructuring process conducted along liberalising lines has led to the expansion of marketers of natural gas. Complementarily, every restructuring process has sought to limit the power of pipelines that own the gas that they transport so that they do not prey on other players. A variety of producers and traders is not a sufficient condition to create market dynamics in a natural gas sector. A network of transportation must be physically united, linking all the points of production and consumption.

As its name reveals, a network is a web-like configuration with nodes where flows of different directions meet and equalize. Extensive interconnections and simultaneity of transactions allow opportunities for arbitrage to correct more rapidly, hence leveling prices (McCavoy 2007, 2000). The mechanisms of price formation in a network resemble communicating vessels. The more interconnections there are within a system, then the more uniform that prices will be all across, hence integrating a single market.

The image of communicating vessels is as much a metaphor as it is a literal description of the economic and physical system of exchange of natural gas. Imbalances can mean that either there is too much gas in a system --and hence extra-compression is necessary, to keep the transportation within safe limits—or that there is too little. This latter situation also poses physical problems to manage the transportation systems, which need a minimum pressure –or quantity of *packing gas* to operate efficiently.

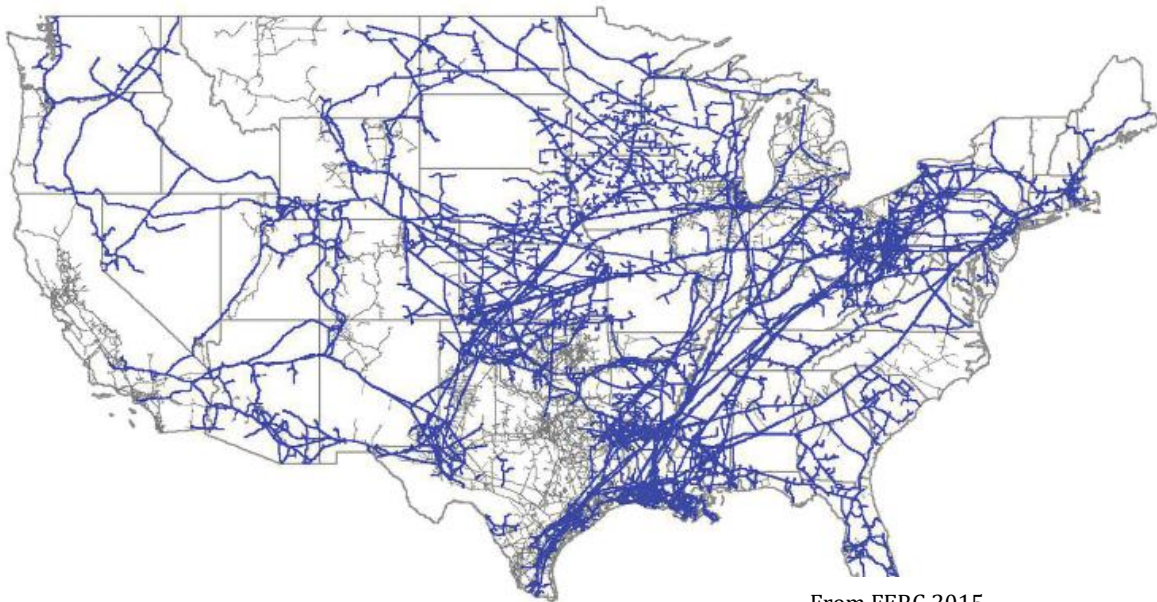
The U.S. has a myriad of trading points and 30 major *hubs*, or intersections of significant pipelines. All these hubs host the bargaining that creates daily prices at the major national hub, currently located in central Louisiana (Henry Hub), where 12 large capacity pipelines converge. The strategic importance of Henry Hub resides in its geographical position, right between the

producing regions in the Gulf of Mexico and the connections that carry natural gas to the large consuming regions in the East and Midwest (FERC 2012: 23 and Illustration 3.1).

Expanding the diversity of traders and producers correlate, albeit not entirely, to the expansion of the spot markets of natural gas against long-term contracts. In Europe, contracts longer than 20 years have ceased to exist since the start of this century, although a sizable share of imports still concentrates in terms that hover 10 to 5 years (Creti and Villeneuve 2005). By contrast, spot markets define prices on hour-by-hour basis, adequately reflecting the balance between supply and demand.

As mentioned already, active governmental promotion of gas-to-gas competition is an important part of liberalising restructurings of natural gas sectors. The United Kingdom built its market with a *virtual hub* where flows of imports, production, and withdrawals converge (Stern 2012). However, despite long-standing continental policy, the rest of the EU has not managed to integrate a single market or a single pricing mechanism (Stern and Rogers 2012).

Illustration 3.2 U.S. natural gas network (2015)



From FERC 2015

Source: Derived from Velocity Suite, ABB

The United States, often exemplary in the question *where to go?* Is seldom an example in the question of *how to get there?* The multitude of traders in the United States, and their capacity to exchange in a market is a consequence of its exceptional circumstances: wide and consolidated

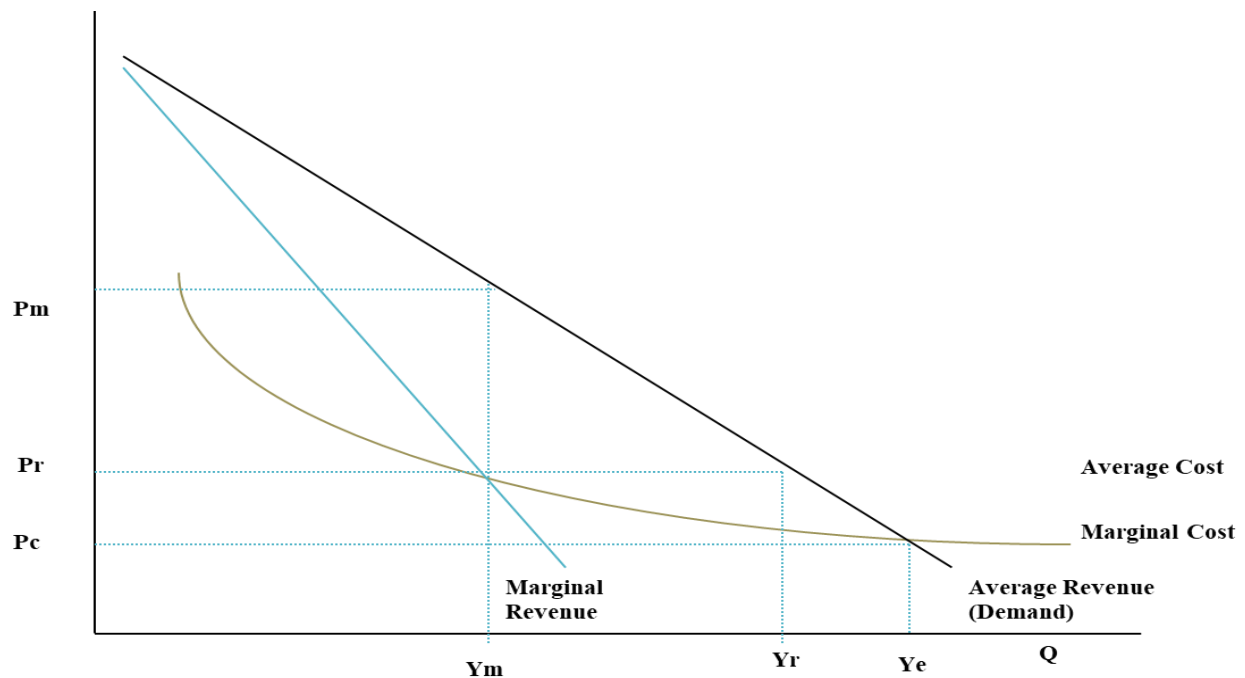
demand, large domestic and exclusively private production in different geographical regions, interconnections between supply and consumption all across a sub-continental territory and a tradition of arms-length regulation that goes back to the 19th Century (although one that evolved locally in its first stage and then consolidated in two waves of federal policy throughout the 20th Century. McNabb 2016). Also, by contrast to the European continental markets, there are no geopolitical complications against trade within the vast North American markets. In sheer consideration of scale, the U.S alone resembles a continent on its own, with northwards and southwards headways and influences into two other jurisdictions.

Unaided by similar conditions of physical propensity and suffering from different forms of institutional or structural voids, other governments have had to press harder to attain competition. The upstream competitive landscape of North America's natural gas industry corresponds and creates reciprocal reinforcement with the other features of the political economy: political and administrative decentralization (including regulatory tradition), mature economic development for the industry and the rest of the related sectors.

Transportation

While production and marketeering of natural gas can be competitive segments, transportation of the fuel can only exist as a monopoly. Economies of scale are evident in the structure of costs of pipelines. Their area, and therefore the volume they can carry, grows in geometrical proportion to their diameter. The consequence is that their average costs are ever-declining, just as textbook cases of monopoly. That is, no surprise, the reason why regulation has treated them as natural monopolies: seeking to ensure that they produce at an output that allows recovery of average costs but not less than that, as their utility function could suggest as optimal for operators (see chart 3.1).

The infrastructure of transportation (and distribution) of natural gas and oil products was built under monopoly franchises (just as was the case of telecommunications and water). After judging the economic convenience of building a new section, regulators grant a franchise and define a system of tariffs to recover costs of construction --the most significant share-- and operation. liberalisation has not changed that fundamental. Pipelines continue to be monopolies, but they cannot own the gas they transport, and regulation oversees that their services can be accessible to all parties.



Put simply, a regulatory system for transportation systems of natural gas refers to the conditions under which monopoly protection is granted to the firms that operate such transportation and to the pricing that is accorded to guarantee a return on the investments of the pipeline (Hunt 2009). Systems of transportation vary by their structure of tariffs, and the incentives that these tariffs create for the investors of existing and new pipelines. Another axis of variation is management. The aggregate of all sections in a region or jurisdiction can be managed in a decentralized form or a centralized form. In that latter case, regulation extends to the planning and operation of the system itself. Public authority, either belonging to the central government or to autonomous regulators, decides by studying the market and pondering goals of policy. Centralized systems exist in most systems of transportation in the world. North America is an exception in that respect. In the U.S. and Canada, transportation operators follow market signals to decide on additions to the system of pipelines and request a franchise and a rate from regulatory authorities. Regulation and the overarching architecture of the natural gas sector can vary in more or less coherent ways. For instance, rules for transportation vary by whether and how competition is allowed and encouraged or not in upstream, storage, and the distribution segments (Hallack and Vazquez 2013).

The basis of tariffs: COSR (Cost of Service Regulation)²⁵

Because they are monopolies, governments regulate pipelines with entry-protection, which frames ways to recover capital and operation costs, as well as to guarantee reasonable profits for investors. Cost of service regulation (COSR) defines tariffs through processes of information requests, analysis, and hearings on the side of the regulators. This traditional method to regulate pipelines can work fine under conditions of economic stability, but volatility exposes its weakness, for apparent reasons. Alone, cost of service regulation does not incentivize proper management, but regulation can add complementary incentives in the form of benchmarks, for instance (McNabb 2005: 117). Maybe the most significant inconvenience of COSR is that, under conditions of volatility, the regulatory lag –that is, the time that elapses between the filing for new regulation and the actual issuing of that regulation-- is long and costly.

The other leg of monopoly regulation is *entry regulation*. It refers to the protection that public authorities guarantee to allow a monopoly to exclusively serve a route and thereby to collect its investment back. Entry regulation exists so that other potential entrants cannot challenge the original monopoly with smaller investments that would eradicate the returns of the incumbent. That risk is referred to as *inefficient entry* because, in sum, it implies rendering a large investment obsolete, leaving a large part of consumers with very costly access or without access at all.

For this case study, which involved the regulation of tariffs of a large trunk pipeline and some ramifications. The Mexican regulators have had to define tariffs for an old system, already depreciated, and several newer pipelines that require higher rates of return to compensate investors --SOEs and private. The next chapters will show that Pemex, the Mexican NOC that kept a monopoly of natural gas production until 2014 preserved an important power resource by controlling the depreciated but useful transportation assets. Some privately owned links added to the infrastructure that existed before the start of liberalisation, but the control of the main trunk line resulted critical for the capabilities of Pemex to keep discretionary power down the line and inhibit competition.

²⁵ This section and the next follow MacAvoy (2001).

Operation and planning

The operation of a system of transportation refers to the physical management of the network and, importantly, to the monitoring and, in some cases, to the planning of expansions to secure reliable supply. These functions can exist in decentralized or centralized structures. On the latter, a central authority makes decisions on a day-to-day flows of natural gas and plans to organize how the network should grow in the future. Centralization is inherent to monopoly and self-contained systems, which can be public or private, but it can also accommodate systems with a variety of owners and coordinated by a TSO (Transportation System Operator), a relatively new form of authority for energy networks.

A variety of tariffs can work in centralized systems (incremental, rolled-in, etc.). However, decentralized systems charge transportation per use of each section; this condition represents an advantage for regulators, because they can count on the information of transactions, and especially of secondary markets (where they exist) to estimate the convenience of expanding the system. The higher the costs of transportation rights, the clearer the indication that new transportation towards the demanding region can enter into service.

Asymmetry of information is a constant problem in centralized systems of transportation because the operator can hide or manipulate the data about flows to favour some shippers over others (undue discrimination) or to manipulate decisions about the expansion of storage or transportation capacity. Independent TSOs mitigate this hazard, by placing the control on an entity that is separated from the operators and with a mandate to secure equal conditions of access to all suppliers (D'Arcy and Finger 2014; Salazar and Cazorla 2011).

Decentralized networks, as the adjective suggests, have a lesser degree of management, limited to their operation, but not including centralized decisions to add new infrastructure. They reflect market dynamics, although they form by the addition of monopoly-regulated sections. Regulators may issue certificates of public convenience when a firm files an application to expand a system of transportation and justifies that demand exists for the additional throughput of natural gas. In the United States the Federal regulator (FERC) retains the capacity to issue certificates, but in practice, the information provided by secondary markets of the capacity of transportation signals

whether a pipeline expansion is necessary or not (Fagan, Hindus, et al. 2010: 198). In decentralized systems of transportation, the actual operation of the network is carried out by each of its sections, and there is no overarching authority to determine how the system ought to expand to grant supply or to improve prices or other efficiency parameters in the network. The complex order allowed in these structures allows substantial efficiency advantages, of course: less regulatory burden and competition, to be sure. However, decentralization only seems to work in highly efficient forms with very large markets and little-concentrated industries, as perhaps only exist and can exist in the United States.

Finally, the emergence of a new market where transportation rights trade independently of the commodity of natural gas is considered the crowning piece of processes of restructuring of natural gas sectors (Makholm 2012). Besides from facilitating exchange and preventing asymmetries, the costs of rights of transportation are also indispensable signals about the balance between supply and demand. Auctions for capacity rights (open seasons) are often the tool to plan and finance expansions of the system –that is, new pipelines. As such, they indicate the need for new infrastructure. New pipelines, compressor stations and storage capacity get built by gauging demand directly with potential consumers, which will own the rights for transportation without owning the pipeline. This is a fundamental element of the responsiveness of a decentralized system towards changes in demand and supply. On the other hand, where transportation rights are tradeable, regulation ensures that information about availability is in place, hence undercutting asymmetries that could favour collusion between operators of pipelines and traders or large consumers.

It is indispensable to underscore that the emergence of a market for transportation rights does not abolish monopoly regulation. Instead, it can create competition *between monopolies*, called pipeline to pipeline competition, in routes that bridge the same producing and consuming areas (MacAvoy 2001). Pipeline to pipeline competition can also occur as a systemic outcome, in a sufficiently integrated and redundant network, and without secondary markets for transportation rights. In all cases, regulators still evaluate the economic convenience of granting monopoly franchises and define tariffs for the operation of the pipeline.

Regulation of natural gas and restructurings in the sense of liberalisation

Restructurings pose complicated policy challenges for regulators. Policies more than often find hurdles that put to the test the autonomy and capacity of the state and its central or arms-length regulatory institutions, for the logical reason that, although they apply policy, regulators operate in a broader context that their instruments cannot affect. It is even fair to state, as a general premise, that regulators cannot solve conflicts between policy goals or instruments (McNabb 2016; Majone 1997). The literature review and the theoretical framework introduced the issues. Now that the basics about the regulatory instruments of natural gas have been presented in this chapter, it is possible to examine in some detail how these general challenges occur in the particular context of natural gas regulation and policy.

For natural gas, regulation consists of instruments to price the commodity and guarantee returns on investments of large scale infrastructure (natural monopolies in transportation or distribution), and to create or maintain conditions of competition between providers of these services (prevent or correct concentration, collusion or unilateral predatory practices) or between them and firms in lateral industries (power generation, for instance).

For its part, policy consists of overriding decision-making with market-wide effects. Subsidies, tariffs or controls on exports and imports and pricing of substitute fuels are the most critical policy decisions that affect regulation. As D. McNabb synthesizes in a generic way: “external policy is a reflection of the environment that shapes and constraints the range of choices from which management policy may be selected”. External policy varies with attitudes and political priorities, and it can span relevant aspects for the energy and natural gas industries, even when decisions are not directed exclusively towards those sectors, as can be the case of tax policy, investment policy and anti-trust policy. Another part of policy is the decision making over the authority of regulators, to expand it or to reconfigure it by concentrating or dispersing the functions and the scope of regulatory decisions. The U.S. and Canada spearheaded the creation of national and independent regulatory agencies in the 20th Century while other advanced economies kept regulation within central agencies (Majone 1997). In the 1980s and 1990s, the developed nations of North America refurbished their regulatory frameworks, seeking to enhance economic competition but also

allowing the growth or *stacking* of clusters of rules and processes impinging on energy, and dedicated to protecting human and environmental safety (Doern and Gattinger 2003).

In sum, liberalisation policies notwithstanding, regulation –and its study-- have become more complicated. Its examination should also problematize how the regulators perform their tasks, especially considering that these tasks often imply impinging on strategic goals of the regulated while significant asymmetries of information and control of resources exist. Mandate and all the features of institutional strength (financial and technical autonomy) are essential but not sufficient conditions for regulators to enforce their directives. In order to enhance their capacity, energy regulators need an adequate environment of institutions, such as courts or competition watchdogs, which can collaborate and uphold (or obstruct and complicate) their decisions. Some scholars have referred to the judiciary as the ultimate regulator because it solves controversies about the fundamental principles of equity or property rights that regulators uphold (Makholm 2012; Hempling 2015). In as much as some judiciary decisions can reorganize entire economic sectors, it may also be said that the judiciary participates in policy.

In order to materialize a restructuring, policymakers and regulators have to successfully manage to bring existing interests into compliance with rules that will affect how they operate and their business strategies for the near and long-term future. Often, as is inherent to vertical separation, restructuring implies breaking down firms, taking away part of their share of the markets and placing strict oversight over participants in a new market. By controlling or eliminating asymmetry of information, complex systems to collect, validate, and share information have become the backbones of new regulatory and self-regulatory schemes. Possibly, the two quintessential institutional goals of restructurings in the sense of liberalisation on natural gas sectors have to do with vertical separation and open-access (not the same but the latter is inherent to the former), and the innovative role of information in the management of exchanges, and hence on regulation. Some thoughts are in order.

Open-access- Open-access works as an underlying condition that couples with other complementary principles of operation to preclude undue discrimination in the access to the network or accumulation of idle capacity, also known as *hoarding*. Implementation of open-access crystalized the vertical separation of merchant pipelines in the United States (Makholm 2012).

Vertical separation.- As explained above, vertical separation seeks to promote competition in the upstream and retail segments of the industry, and to prevent that operators of midstream infrastructure can interfere in that competitive segments. Restructurings have deployed Chinese-wall separation rules in order to prevent cross subsidization and unfair discrimination of shippers and traders. These provisions mandate financial and managerial break up of formerly integrated firms and their activities on trading, distribution, transportation, and storage. Asymmetrical regulation (the mandated breakup of a firm or a monopoly's market power) can accompany measures of vertical separation (Makholm 2012; MacAvoy 2001)

Information.- In traditional regulation, the asymmetry of information between operators and regulators corrects through one-to-one interaction. Hearings, in all their characteristic parsimony, aim to discover the total costs of infrastructure (pipelines, compressor stations, storage facilities) and to set reasonable rates. While hearings still are central to monopoly regulation, shared platforms about the use and capacity of infrastructure correct the asymmetry of information in novel ways. Monitoring the trade and transportation in shared platforms facilitates decisions on expansion and prevent hoarding (Makholm 2012; McNabb 2005).

Secondary markets.- Secondary markets that trade rights to use natural gas transportation are the crowning characteristic of liberalised markets. However, they are a possible and desirable outcome of liberalisation, *not a cause of it*. The success of restructurings depends more on the existence of established markets that can support the functioning of the new. Current appraisals of liberalisation coincide that flourishing of energy markets requires the existence of robustly protected property rights, expandable demand, physical infrastructure, clear policy signals, reliable and capable regulatory agencies, and sufficient flows of information (Makholm 2012). It is difficult that all these conditions exist at the same time. Regulators and policy makers have to deal with what they have and adjust tactics or strategic goals in order to balance competing goals. The last section of this chapter reviews that.

Table 3.2 Challenges for regulators within restructurings of natural gas		
Goal	Instruments	Examples of challenges
Wholesale markets or pricing that reflects competition	Indexation or referencing to other fuels or to other markets.	Coexistence of different pricing rules derived from flows and types of contracts in the same jurisdiction (Stern 2012)
Planning and pricing of operation and expansions of networks	Franchises v. independent operators Rates	Rates pose dilemmas: caps can limit investment and result in bottlenecks (MacAvoy 2007) or unused capacity, rolled-in tariffs.
Compliance with third party (open) access	Electronic platforms of information to monitor use (prevent undue discrimination and hoarding).	Technical and legal capabilities to identify and propose corrections or sanction non-compliance.
Physical functionality and open-access in the network of transportation and transmission	Oversight and controls or incentives on injections, extractions, and physical operation of the network.	Maintaining adequate pressure can produce problems of cooperation among users. U.K. uses a cooperative code based on shared information (Stern 2012)
Prevent or correct collusion or cross-subsidization	Legal, administrative and financial separation of affiliates (<i>Chinese-walls</i>)	Need to coordinate with other regulators and the judiciary. Complications can defy technical capacity of regulators, or pose problems beyond their legal mandate. Example: Overlap and conflict between SEC and FERC on regulation of electricity (Hempling 1995: 347).
Correction of concentration and market power	Review of mergers and acquisitions Asymmetric regulation (take clients away from dominant firm or monopoly)	Need to coordinate with other regulators and the judiciary (Political momentum). Executive and or congressional resolve to take on large firms (SOEs).

In sum, although regulators can have a very salient role in the implementation of restructuring, it is adequate to consider that the overhaul of economic relations that come with such restructuring often, if not invariably, calls for decisions at the level of policy. Moreover, restructurings on the economic dimension of an industry occur in long periods, as other transformations also take place and affect the whole policy and regulatory set of institutions. These other set of influences can take place at the level of environmental policies, of policies (and regulation) for other fuels, or as responses to medium and long-term market conditions, like the increase of domestic reserves or the structural changes in demand.

Policy, regulation and SOEs

The analysis of policy change appears, therefore, as a conundrum that occurs in the intersections of several institutional spaces and that may catch policy makers and regulators in the middle. Policy change implies a change in power relations and the use of levers to force compliance with rules, to implement a plan or to accommodate and *muddle through* the political and economic consequences of past decisions going awry. Paradoxes and compromises can be, hence, illustrated by tracking the instruments of policy (laws, tariffs on trade, economic incentives, and principles of anti-trust policy) and exploring the limits between goals and outcomes. While regulators also accommodate, their latitude is constrained by procedure, and by the principles and goals that inhere such procedures.

SOEs add another layer of complexity (or of complication) to the interface of policy and regulation. As mentioned in the preceding chapter, the entanglements of SOEs in the fabric of policy constitute a particular field of challenges for regulation. While I was not able to find a comprehensive revision of how these challenges differ from the challenges that regulators confront in industries where SOEs are not dominant, three specifications are in order.

A first refers to the requisite of SOEs (and public utilities in general) to cover public service obligations (PSO), and more broadly, to provide and manage services that represent a substantial part of the quality of life and the affordability of other goods and services. SOEs, as is the case in Mexico, have spawned complicated entanglements with clients. Entire swaths of the population are --or consider themselves to be--part of a network that benefits from cheap and sometimes free electricity. One way or the other, subsidization of prices of gasoline, LPG (Liquefied Petroleum

Gas) and natural gas also adds to the welfare functions of all types of consumers, including industrials. All in all, subsidization can work as a legitimate and legally authorized crossed payment of the better off to the distant or less affluent consumers, but it can also complicate into a pervasive source of distortion of regulatory decisions seeking to foster competition or making prices and rates to reflect costs more fairly.

As this research will show, from the governance perspective, restructuring in the sense of liberalisation also confronts a whole set of challenges in the presence of SOEs that occupy a dominant role in their industry and/or that are vertically and/or horizontally integrated. Applying asymmetric regulation to reduce market power can be politically costly when those policies threaten subsidization or *clienteles*. Lack of supportive judiciary institutions or political will can be another problem. And, in the more detailed aspects of the restructuring, vertical and horizontal integration are a logical barrier against policies that seek to reconfigure and open the transmission or transportation infrastructure to suppliers in competition with one another. So are crossed subsidization and unilateral practices to keep competitors away. Finally, SOEs can also leverage their political and economic clout to contravene monopoly regulation on the midstream infrastructure and its connected segments.

How much can regulators tackle these multiple challenges depends on their legal and technical capacity, and on a favourable context of policy. It is difficult to explain it, conceptually, but that is what this research is essentially about: trying to discern an explanation of restructuring that unpacks (and deemphasizes) technical capacity as a causal factor and that emphasizes the relations and strategic interactions that obstruct or facilitate liberalisation.

Thus far, this review of restructuring policies and of regulation has mostly centred on the effects of each relevant aspect in a reform, including policy and regulation. Those aspects can be integrated to appraise how each part contributes to the whole. As a process-tracing case study, this research seeks to present a dynamic description of a process of policy change. The horizon of liberalisation, as described in this chapter, means that the state, which includes the regulatory agencies, creates institutions that enable competition where it did not exist formerly. At the same time, policymakers and regulators have to foster and harmonize the goals of security of supply and reliability that are inherent to an energy system.

Conclusion

The success of sectoral regulation, embodied in independent regulatory agencies, hinges on a context of economic and legal resources at hand for policy makers, regulators, the regulated, and consumers (in some cases). The existing physical infrastructure also works as a constraint for policies that seek liberalisation. These factors must be understood in relation to the goals of regulation within restructured sectors: vertical separation, open-access, reduction of asymmetry of information through new technologies and shared information. A more precise valuation of the capacity of the state to implement policy comes from examining the relations between the regulated and the regulators, and --more broadly—between the regulated themselves,

These relations should consider, especially for a case like Mexico, the strategic orientation of the SOEs, their resources and constraints amidst the dilemmas and opportunities opened by restructuring, including those posed by the less powerful actors. The final conditions of this case say that markets could not form or could only form under conditions that reasserted the resources of the SOEs. A reading of the process of policy change in Mexico would be too narrow if it only followed the regulators, and their resources, as tools that the state deploys to test its capacity against the regulated. More precisely, the constant rebalancing of resources, risks and priorities that occurred in a 25-year time frame should speak for the possibilities of those instruments to succeed in the implementation, and about the constraints that forced accommodation to fulfil the goals of security, reliability and affordability that inhere all energy systems.

The following chapter offers a historical overview of the energy and natural gas sectors in Mexico. That chapter seeks to characterize, therefore, the initial conditions that are relevant to examine the path of policy change as one determined by relations that are characteristic of the Mexican economy. The chapter serves as a preface to explain the processes of restructuring, and the responses and accommodations that, throughout two decades, gave shape to a new balance of state-owned enterprises, and a new diversity of interests in a transformed and much more liberalised natural gas sector.

Chapter 4. Energy policy and natural gas in Mexico. Geographical and historical considerations

This empirical part of the dissertation will describe how the natural gas sector of Mexico has changed between 1993 and 2018. The present chapter overviews the physical aspects and a historical contextualization of the energy sector as a whole. Chapters 5 to 7 review the process of policy change, divided into three sub-periods. These periodization reports differences in the economic context and on the approaches to policy and regulation. The periodization fits the shifts of governments at the national level, although the sixth chapter condenses two periods of government in one, given their similar conditions with regards to natural gas and energy policy. These empirical chapters center on describing both institutional conditions and, as importantly, shifts of expectations and power affecting regulation and decision-making.

The present chapter is divided into four parts. The first presents a historical overview of the supply and demand fundamentals of natural gas as part of energy policy in Mexico. The successive parts of the chapter complement this basic approximation by depicting the organizational and political factors that have influenced energy and natural gas policy across the decades and specifically during the first years of the neoliberal turn in economic policy (roughly starting in 1982). Considerations about SOEs, business-state relations and the effects of foreign trade agreements have been included in order to give a richer perspective on the forces that have affected energy policy during the period under examination (1993-2018).

Geology, infrastructure and basics of demand and supply

The current scene of natural gas in Mexico is fraught by paradoxes. Mexico has abundant reserves of the resource, but it has limited access and economic capabilities to develop and transport those resources. For most of its contemporary history, domestic production used to cover most of the domestic consumption of natural gas. However, for years now production has been hindered by problems of investment. As importantly, access has been poor until very recently, due to insufficiencies in the network of transportation. Until the Burgos and the Cuenca de Veracruz Basins started production in the 2000s, almost all natural gas used to be produced in the south as a by-product of oil extraction (associated gas). The south is where most upstream pipelines are, but since the 2000s, supply has been coming increasingly from the U.S., and the pipeline system has been insufficient to carry all the flow of growing demand in the north and the centre.

Shipments from the United States only ramped up meaningfully from the late 2000s, with the emergence of shale gas. However, the physical insufficiency of the system of transportation also complicates access to this source of fuel. A significant share of the natural gas policy of this decade has centred on how to revamp the system of transportation, so that imports of very cheap natural gas can flow southwards from the United States. LNG imports alleviated supply insecurities between the mid-2000s and the mid-2010s when new infrastructure for land transportation from the U.S. started to go on stream.

The expansion of the system of transportation does not consist of only building more pipelines. The preceding sections of this dissertation have explained that regulatory frameworks contain incentives that can foster (or relent) expansions. Policy decisions on subsidies, prices, foreign trade, and taxation also affect supply, demand, and the systemic requirements that regulation is bound to address: reliability and affordability. Policy is partly an explicit and partly an implicit script that governments deploy to navigate and lead these elements in constant change.

Geology

Mexico produced 1.74 Trillion cubic feet (TCF) of dry natural gas in 2011. It ranked 18th in the world on this count. That same year, the production in the United States was 22.90 TCF, and 5.22 in Canada, which ranked first and fourth, respectively. According to the EIA (Energy Information Agency 2014), Mexico holds 2 percent of the reserves of natural gas in the world, and it has the fourth largest reserves, only trailing China, the United States, and Argentina.

As mentioned above, Mexico has more than enough reserves to serve its needs, but the SOE that monopolized domestic production until 2014 had severe financial constraints to produce. On top of this contradiction, the practice of flaring was still common in oil production sites until the start of this decade. Flaring is the burning of associated natural gas in wells when there is no capability to transport or to store the gas in oil wells. Pemex has deployed different programs to expand its infrastructure to store or transport associated natural gas, but flaring has continued to be a pervasive environmental and economic problem for the NOC (as is for other oil producers around the world).

In 2016 Mexico flared 500 mmcf of natural gas every day; that is more than 5 percent of its daily consumption (SENER 2018: 14).²⁶

Imports and exports

Foreign trade never constituted a sizable share of production or consumption of natural gas. Since the 1990s, however, Mexico became a net importer, on quantities that have been growing steadily. In 2018 Mexico imported 4 BCFD, more than four times what it imported in 2005 (SENER 2018). Since 2006 Mexico imports LNG, at much higher prices than the levels of North America since shale production started, through facilities located in the north and center of its Pacific coasts (Ensenada and Manzanillo) and the Gulf of Mexico (Altamira). In 2018 LNG imports amounted to 720 MMCFD. Imports make 68 percent of total supply of natural gas, although they constitute 90 percent of consumption if the consumption of Pemex is considered separately.

Until very recently, this outlook of hydrocarbon energy had been largely the result of the accumulated financial constraints of Pemex. The production of natural gas has been not a priority for the subsidiary of the SOE that is in charge of exploration and production, at least considering its economic benefits in contrast to those of oil. In 2016 reserves of natural gas of fields operated by Pemex were 38 percent lower than those of 2011 and sales of natural gas represented less than 6 percent of the total revenue of Pemex.²⁷ Between 2011 and 2016 natural gas production decreased by more than 10 percent, from 6.59 BCFD to 5.79 BCFD. Of course, the production of Pemex and private firms might stay shy as long as the compound of continental prices and infrastructure do not offer profits for the firms that have already got licenses to exploit gas. To date, private production amounts to slightly less than 10 percent of the total domestic production (CNH 2019).

²⁶ The installation of technology to store, compress and transport natural gas, and the reduction of production of oil, helped to diminish flaring to 142MCFD in 2018. SENER, 2018: 14.

²⁷ USD 2.8 bn out of USD 52 bn of its total sales, according to a factsheet available at <http://www.pemex.com/en/investors/investor-tools/Paginas/factsheet.aspx>

Consumption

Production of electricity accounts for the most significant part of the expansion in the use of natural gas. IPPs and CFE account for more than half of it (3.8 BCFD in 2015). Since 2003, IPPs consume slightly more natural gas than the electricity SOEs. Private production of electricity for self-consumption has also grown and in 2015 it represented a seventh of domestic demand (0.5 BCFD). That said, Pemex is the largest single consumer of natural gas. Its exploration and production subsidiary took more than a third of demand in 2015 (2 BCFD). Major industrial consumers, although using an outstanding share of the national supply (around 20 percent), account much less for the increase in consumption of natural gas: their consumption was half of that of electricity production in 2005 and now stands at a third of it.²⁸ They are still important, however, and they have been critical to policy because some industrial organizations have shown capacity to influence decisions on pricing and transportation (chapters 5 and 6).

Finally, at proportions that never reach two percent of total demand, residential and commercial consumption has been historically very low. There are no more than 60 franchises for LDCs, for around 2 million consumers (less than a 50th of the total population). By way of comparison, the network in the United States serves, since decades ago, dozens of millions of residential users plus all type of industrial, commercial, and independent producers of electricity. Heating is seldom necessary for most of the territory, for most of the year. This is only part of the reason why there are relatively few LDCs in Mexico, although their number has been growing slowly in the last decade (SIE 2017).

²⁸ All these were taken from www.sie.gob.mx (Balance de Gas Natural Seco).

Table 4.1 Total Primary Energy Supply (Petajoules. Mexico)						
	1985	1995	2000	2005	2010	2015
Coal	127.52	209.73	274.27	480.35	533.23	531.54
Oil products	2,427.64	2,846.88	3,492.55	3,810.52	3,662.06	3,462.18
Natural gas and condensates	1,516.51	1,739.53	2,213.70	2,936.57	3,390.10	3,791.01
Nuclear	0.00	92.99	90.33	117.88	63.94	120.41
Biogas	N/D	N/D	0.02	0.69	1.30	1.87
Hydro	102.34	99.36	119.07	99.75	133.77	111.21
Geo, wind, solar	0.00	109.09	114.27	167.54	159.36	176.17
Biomass	315.51	368.64	373.02	370.22	347.54	358.67
Net trade	N/D	N/D	3.15	-26.08	-20.25	-24.18
Source: Sistema de Información Energética.						
http://sie.energia.gob.mx/bdiController.do?action=cuadro&subAction=applyOptions						

Transportation

Mexico is a vast country, but the national system of pipelines in Mexico is still relatively small. In 2017 it covered around 19 thousand kms.: 94 percent of which corresponds to open-access pipelines (the rest are upstream and private use pipelines. CRE 2017: 27). Pemex operated over 60 percent of the length of this system in 2015, just before transferring its infrastructure to the new IPSO (Independent Pipeline System Operator), CENAGAS. The whole network was composed, as of 2017, of 22 regional monopolies (Pemex included), with thirteen land interconnections with the United States. The CRE regulates the tariffs of transportation for all these monopolies.

After the legislative changes of 2013 and 2014, CENAGAS became the operator of the network and the legal owner of the system that was previously owned by Pemex. Privately owned pipelines have been going on stream since the start of this century. They all formally work under a formal regime of open-access, although until 2018 they only transported gas produced and imported by Pemex, or imported by CFE, the SOE and former monopoly for supply and transmission of electricity (below). In March 2019, BP was the only importer of natural gas other than the SOEs. Private operators have the choice of continuing to coordinate with CENAGAS while they operate

their systems or opting into the system operated by CENAGAS, and thereby handing in their day-to-day operations to it.²⁹

Importantly, although the transportation pipelines are formally referred to as a national *system*, they still do not have the defining quality of one such thing: loops that create redundant routes and enhance reliability.³⁰ The sections that are coming on stream just at this moment are connecting injection points from the U.S. that travel into the Pacific coast traversing the states of Sonora and Chihuahua (see map 4.1 and appendix). Through these new intersections and hubs, gas from different regions will meet and level. With adequate systems of information, the capacity of these new sections (which are not owned by CENAGAS) can enable the formation of a hub covering the northwest side of the nation: a long-cherished goal towards integrating a national market of natural gas.

As this research will explain, natural gas has become an important fuel for Mexico only in recent times. Historically, natural gas had an accessory role in energy policy. During five decades as a monopoly of the whole petroleum industry, Pemex used natural gas mostly for itself: as an input for the petrochemical industry and the production of oil. Its domestic use had been limited to a small demographic area, closer to the production regions in the Gulf of Mexico. Moreover, natural gas competed with other fuels for industrial use before environmental regulations started the phase-out of fuel-oil in the 1990s.

The next two sections of this chapter will review the historical and economic aspects of energy policy that are relevant to the regulation of natural gas.

Energy and the national political economy

The basic information provided above offers an idea of the growing economic weight of natural gas and its importance in Mexico today. An explanation of the institutional features of Mexican energy policy should complete the picture. Three factors deserve consideration when examining

²⁹ Eduardo Prud'homme, "The birth of the Sistrangas. Isolated network to national pipeline system", Natural Gas Intelligence, March 22nd, 2019, accessed from Factiva.

³⁰ Note: because the system is not interconnected, it should strictly not be called a system. That is a recurrent remark of public servants in the sector. This dissertation will continue to name the system a system, for lack of a shorter and better term.

the place of natural gas in the landscape of energy policy: 1) the organizational layout of energy policy, with the SOEs at the centre and not much left on the sides; 2) the emergence of monopoly and competition regulation, as a substitute for economic coordination from central agencies; 3) the preparation and consolidation of institutions to protect private investors from risks of expropriation and to guarantee their participation in procurement processes for the SOEs –a significant modification that corresponds to the deepening of trade relations in North America. The historical overview of these factors affecting energy policy can be presented as part of a national political economy, aiming to elucidate the forces that have affected decision-making and implementation.

The energy SOEs and the rise and fall of the state-led industrialization policies

The nationalization of the foreign assets of the American, British, and Dutch oil firms in 1938 is generally considered the start of a whole period of state direction in the Mexican economy (Meyer 2010).³¹ That year coincided with the preparation of the United States for WWII and with an enduring transformation of the dominant-party system, from an umbrella of disparate political organizations into a more defined corporatist political apparatus that granted legal recognition and political representation to labor, peasant and civil organizations in exchange for their political support (Medina 1994). The nationalization of foreign oil companies was a shrewd maneuver that leveraged the imminency of future international conflict to weaken the lobbying efforts of the American, British and Dutch firms that lost their assets to expropriation. It is worth noting that, between 1938 and 1958, foreign oil companies were allowed to explore and produce oil and gas in Mexico, under contracts of shared profits that kept the ownership of resources in the Mexican state (Grunstein 2010).

Economic policy in the three decades following WWII would utilize Pemex and, later on, the electricity monopolies (CFE and the regional CLyFC) as engines of industrialization. The SOEs would play a role as sources of almost invariably subsidized electricity, fuels and petrochemicals. Their coordination followed a typical late-developmental script to direct the growth of

³¹ - The above-mentioned notwithstanding, it is also useful to see that the oil industry in Mexico developed since the late XIXth century as part of the oil and industrial economy of the United States. Before the Mexican Revolution (1910-1917), U.S. oil producers in Mexico developed and subordinated the networks of production and refining of oil to their own networks. Policymakers of the late XIXth and early XXth century in Mexico understood the importance of balancing these tendencies towards monopolization. The chosen and fruitful strategy was the promotion of an oligopoly, in cooperation with British entrepreneurs (Brown 1992).

manufacturing industries through a scheme of import substitution (Morales 1992; Solis 1970: 6). Throughout the first three decades of the postwar world, the Mexican economy grew looking inwards, through a scheme of import substitutions in tandem with the growth of exports of raw material, manufactures and tourism destined to (mostly) U.S. customers. Oil did not constitute a vital part of exports in this period (Morales 1992).³²

It is important to note that nationalization and the vertical integration of monopolies did not occur simultaneously. Pemex took more than 20 years after the nationalization of foreign enterprises to become the national monopoly of all oil and gas production, transformation, and sales (Morales 1992). And so was the case of the electricity companies. CFE was created in the 1920s, but it took almost five decades to consolidate the myriad of private local and regional integrated monopolies into a two regional SOEs that worked as a system (Jano-Ito and Crawford 2016: 569).

In the case of Mexico, the combination of the mentioned goals of policy and their embeddedness in a state-led economic organization contributed to the poor institutionalization of market mechanisms as more stable and predictable options of exchange between the SOEs and between the SOEs and the rest of the economy. As years and policy decisions went by, centralized policy and the politics of industrial development with SOEs at their center reinforced one another. Maybe it is useful to recall that Mexico or Pemex are not unique cases in the world, in this respect. By nationalizing and concentrating the power industry, the Mexican government was not departing but was following the cue of other developing and developed nations in their dealings with their energy sectors, not excluding France, the United Kingdom or even Canada during the years of the National Oil Policy (Milward 2007; Lanthier 2007; Street 1985; McDougall 1982).

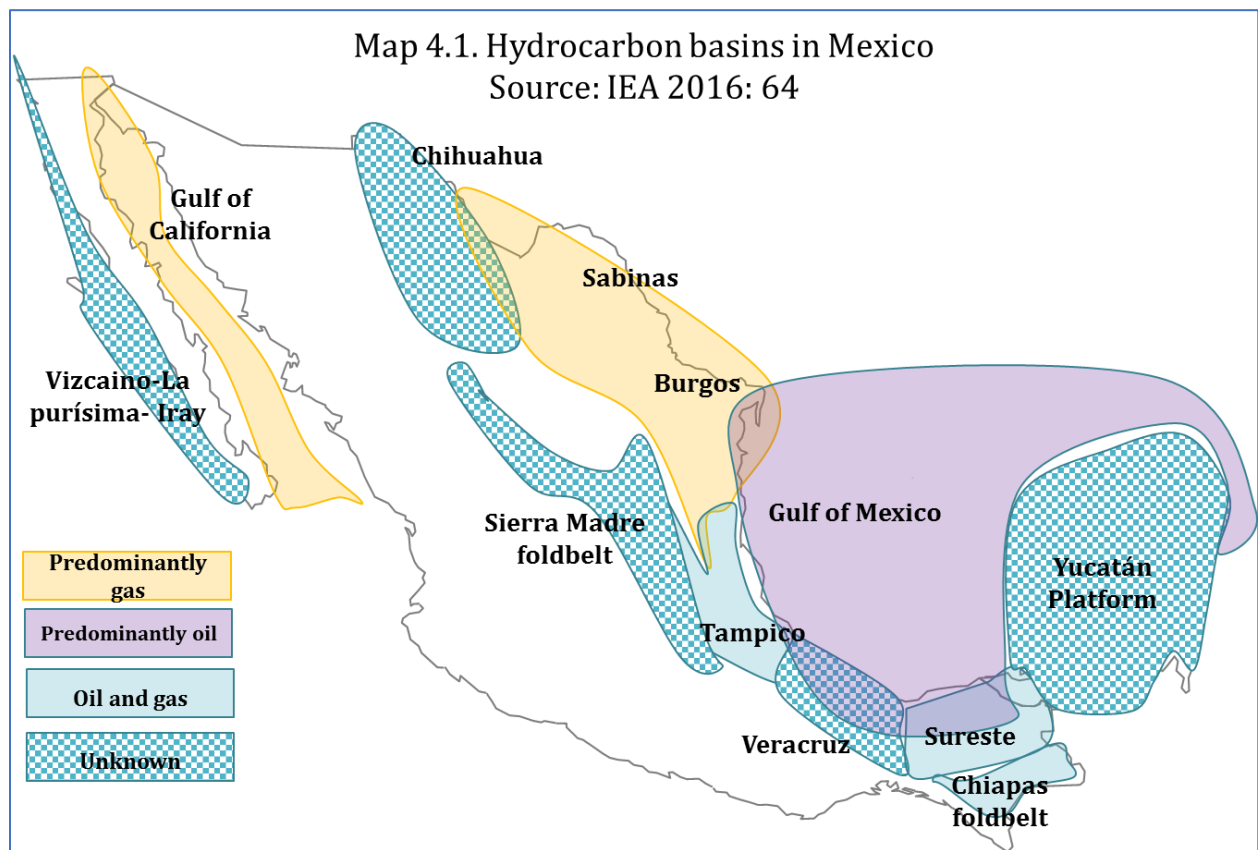
Limitations to foreign ownership and exports also responded to considerations of energy security that tended to occupy a prominent and explicit place on energy policy (Philip 1999; Morales 1992). However, in the case of Mexico, the energy SOEs were only one significant part of a much larger group of public enterprises. State ownership spanned the broadest range of economic activities, including all infrastructure and the provision of social services. By 1966, nearly 50 percent of total

³² For instance, shortly after expropriating the foreign assets of the oil industry, the nationalist government of Lázaro Cárdenas and those of two successors, M. Ávila Camacho and M. Alemán, upheld the participation of foreign companies in joint exploration and production contracts with the new national oil company (Grunstein 2010: 197; Morales 1992: 211).

public spending was allocated to economic development (Solis 1986). Also, by the start of the period of privatisation in the 1980s, the Mexican State owned more than 1,100 firms in 70 percent of the different areas of the economy as classified by statisticians (Clifton et al 2007: 177; de la Rosa 2006).

The above-mentioned notwithstanding, the patterns of business-state relations that emerged after WWII can hardly be seen as scripted towards deep state debt and bureaucratic overreach. State ownership extended over telecommunications, energy, and transportation infrastructure. The state also controlled prices and income of the rural population through subsidization and control of commercialization and prices of agricultural products. These were years during which the Mexican peso stayed in a fixed relation of 12.50 with the U.S. dollar (1958-1970) and the finance minister and the governor of the central bank were the same two public officials. Debt had been mastered, falling from 40 percent of the GDP in the years of the Great Depression to only 10 percent between the 1950s and the early 1970s (Kessler 2000: 18).

Low inflation and high economic growth rates became the brand of the *desarrollo estabilizador* (stabilizing development) years. It is not exaggerated to say that the golden era of technocracy in Mexico's XXth Century occurred in the dozen years before 1970, and not in the 1980s and 1990s, when a cadre of foreign-educated bureaucrats coordinated the alignment of economic policy to the recommendations of international financial organizations and the *Washington Consensus* (Kessler 2000: 18). Importantly, oil exports *were not* a significant part of that macroeconomic stability because they were not large enough. Inward orientation of the NOC also was present in its redistributive policy towards the generous creation of local employment. The NOC, in short, was a tool for social and industrial policy.



The ambivalent legacy of an oil exports boom

The economic strategy of import substitutions reached its limits by the 1970s, as international economic stability shook and domestic demand proved insufficient to keep in step with industrialization.³³ Since 1968, at least, Mexico started an unusually politically fraught decade, and the national government used macroeconomic policy to buy time to stabilize the growing demands over the whole system. Expenditure in the parastatal enterprises as a proportion of GDP rose from 7.6 percent between 1958 and 1964 to 22.6 percent between 1976 and 1983 (Alberro 2010: 91). The legacy of economic-social commitments of the public sector, combined with mistaken policy responses led to unprecedented inflation and levels of public sector debt (Ortiz and Solis 1979). To make things worse, low interest rates for international credits and the financial backing of oil reserves and production facilitated a new, and this time deleterious, overstretching of state ownership and debt. The new and sudden central importance of oil was the result of surprising discoveries, which brought proven reserves up from 7 billion barrels in 1976 to 70 billion in 1982 (Rousseau 2010: 309). This new abundance was first backed by geological surveys, and prodded a borrowing spree since 1978. By 1979, a single geological discovery in the southeast Gulf of Mexico region (the Cantarell field) triggered a cycle of unprecedented state-led pursuit of rapid industrial development.

As one analyst summarizes, the 1970s mark the end of oil as a resource of industrialization and the start of oil as a guarantee for international credit (Rousseau 2010). It is important to acknowledge, for this case, how much the long-1970s created initial conditions that the market-oriented policy makers of the 1990s could hardly counter and that might still be transcending in current times. Organizational expansion and strict internal control do not go along well as a rule. The entrance of Pemex as a full exporter in the community of oil producers became a curse in disguise: plaguing the NOC with corruption and inefficiency.

The bonanza brought, first by the foreign resources backed by the geological reserves and then by the production of Cantarell, tilted the balance away from the control of central agencies (the

³³ In the years after the U.S. abandoned the gold standard (1971) other nations, Mexico included, abandoned the fixed parity of their national currencies to the dollar. By 1970, excess capacity and insufficient savings and investment confronted a government with the difficult choices of cutting down public spending.

finance and energy ministries). Growth of reserves, production and exports masked poor management (García Reyes 1996), and they also brought about and dissimulated schemes of frank profligacy and corruption under the mantle of a strategy of rapid state-led industrialization.. The imbalances within Pemex and the national economy grew into more serious proportions across the 1980s, another tumultuous decade for Mexico. Interest rates started to climb and oil prices started to decline, but Mexican authorities continued to pursue a strategy that depended on cheap capital and expensive oil. By the beginning of 1982, the Mexican peso was evidently over-valued. Everyone who could borrow in pesos and buy dollars did so. By September, when authorities allowed the exchange rate to float again, the accumulated devaluation throughout 1982 was close to 500 percent. Interest rates soared to 60% in mid-1982 while inflation skyrocketed. By the end of the year, the central bank had almost run out of foreign exchange reserves and the national government had to negotiate a moratorium (and more lines of credit) with its foreign private and government creditors.

Macroeconomic policy matters a lot when explaining the particular creatures that Pemex and two state-owned electricity regional monopolies (CFE and CLyFC) were becoming. The national oil company and, especially, the electricity SOEs accumulated enormous bureaucracies with shiny perks for their unionized workers and subsidizing end-consumers while all nature and size of other constituencies got direct and indirect energy subsidies (Rousseau 2010; Carreón et al. 2007). The boom of exports that followed geological discoveries in the late 1970s permitted affording for this uncontrolled organizational expansion (Loyola and Martinez 1994; Grayson 1981). Governments could only withdraw the overspread state resources spasmodically, taking advantage of disruptive contractions in the interface of business and political cycles to impose some punishing reductions of the payrolls and procurement commitments in the SOEs (García Reyes 1996).

After the Cantarell discoveries (1979), the Mexican economy grew with an important dependency on exports of oil. The tax structure of Mexico had been very weak before that and oil exports became instrumental in supporting public finances. . By then, oil exports mounted from a value of USD 1 bn in 1977 to USD 14 bn in 1981 (Solís 1986: 72). That accounted for 75 percent of foreign exchange, and taxation and royalties extracted from Pemex had grown from MX 133 bn in 1975 to 683 in 1980 (Rousseau 2010: 304; Solis 1986: 73). The interplay with weak taxation became one other systemic implication of the relation of dependency on oil exports. As one scholar

comments, “the most powerful business groups are more interested in maintaining the current fiscal policy, based on the heavy taxation of Pemex, than in the total or partial privatisation of the latter” (Puyana 2006: 81).

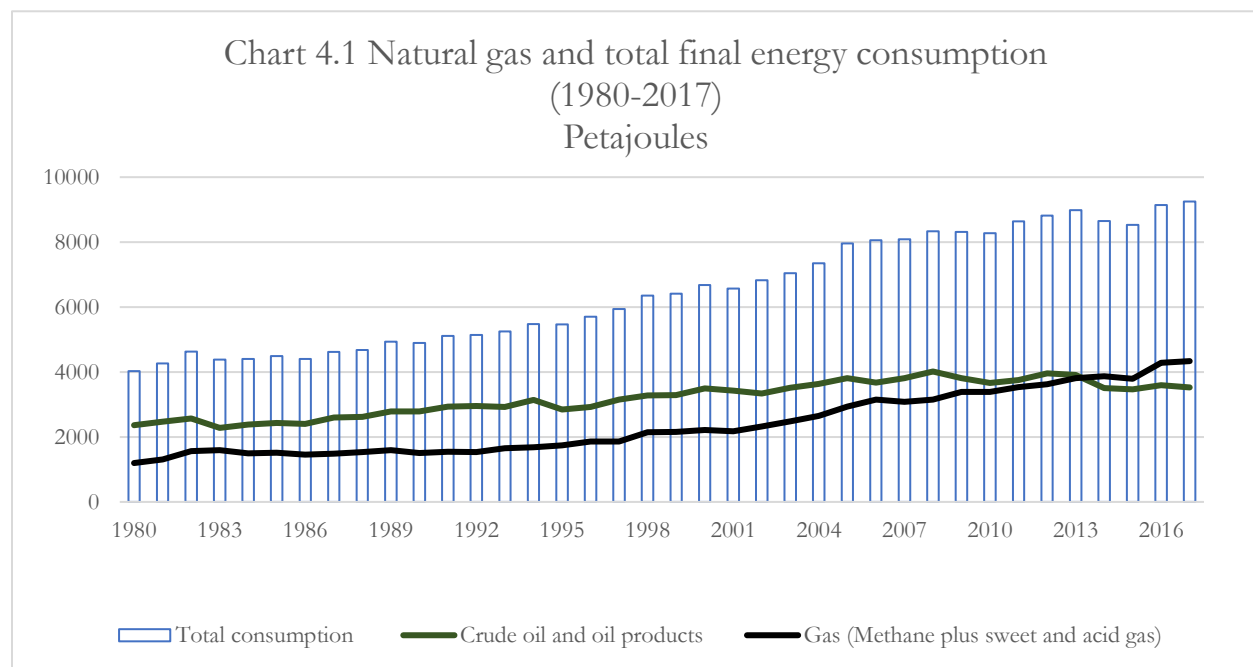
In specific relation to natural gas, industrial users benefitted for years from a heavily subsidized price. In Nuevo León, natural gas was sold in 1975 at less than half its estimated costs of production and transportation (Marquez 1985: 43). Interestingly, the main system of transportation, flowing to Nuevo León from the processing plants in the southern coasts of the Gulf of Mexico was built or, more precisely, reconceptualized, as a serendipitous by-product of a failed plan to export gas to the U.S. At the last minute, and when the 40-inch pipeline was already in place, the U.S. Senate cancelled a bilateral plan to buy Mexican natural gas. Confronting that very unexpected twist of energy relations with the U.S., Mexican authorities decided to spare the new pipeline to supply Nuevo León, and to promote a switch away from fuel-oil, at the time a much better priced oil product that did find its way to the U.S. (Ojeda et al 1979; Grayson 1981). Cheap prices and availability for more than 2 decades may provide useful clues to understand why, during the years of partial liberalisation (1995-2013), industrialists were not very interested in transitioning away from Pemex as their single supplier (see chapters 5 to 7).

The interface of the SOEs to one another was equally governed by the political logics that affected policy. A convoluted overlap of functions and messy trade involving Pemex and the electricity SOEs resulted from poor centralized command. A legal, organizational and procedural void affected how fuels or electricity were exchanged between the SOEs. Creating and enforcing such a framework did not seem to have been a priority throughout the years in which these enterprises served as levers of industrial development.

The processes of electricity and petroleum converged in a particular way. CFE bought fuel-oil from Pemex at prices that varied between 30 to 70 percent of the estimated international reference price in any given year between 1970 and 2001 (Carreon et al. 2007: 186). Of note, well into the 1990s, an overwhelming share of hydrocarbon-produced electricity in Mexico used fuel oil, not natural gas or coal -which is scarce and difficult to transport without a robust railway system. One other key complementarity between the SOEs rested on the availability of fuel oil that traveled small distances from refineries to power plants, either via pipeline or also commonly, by freight.

Power generation in the Pacific coasts was supplied by a maritime terminal that shipped fuel oil from the southern state of Oaxaca all way north to the California peninsula. The practice was economically efficient although costly from an environmental perspective.³⁴

In sum, the combination of the goals of policy and their embeddedness in a state-led economic organization contributed to the poor institutionalization of market mechanisms as more stable and certain rules in the exchange occurring between the SOEs and between the SOEs and the rest of the economy. As years and policy decisions went by, centralized policy, organizational growth, fiscal necessity and the mentioned constituencies reinforced one another. These are, in a nutshell, the factors that have hindered the entrance of new players into the energy sector and the control of central agencies over the energy State-owned enterprises.



³⁴ These relations of industrial complementarity started to change as clean air regulation became effective in the 1990s but, as Carreón et al. (2007) point out, CFE could switch to natural gas because alternatives were not as cheap as in other places. Europe and Asia had more abundant coal resources, the infrastructure to transport it and the constituencies to press for its continued commercialization. Natural gas suggested itself as a palatable and secure alternative.

Structural adjustment, international trade and energy policy change in the 1990s

The crisis of 1982 led to a structural revision of the economy. The PRI administration of Miguel de la Madrid (1982-1988) concentrated political attention on reducing inflation, diversifying exports by joining GATT (General Agreement on Trade and Tariffs) in 1986 and cutting down public expenditure and bureaucracy. As part of a crusade against corruption, the federal government initiated an investigation that led to the imprisonment of a former CEO of Pemex, J. Diaz Serrano (Philip 1999). By 1988, the administration of Carlos Salinas, also from the PRI, continued and intensified the agenda of structural economic adjustment. Policy centred on the privatisation of public enterprises, maintaining control over fiscal and monetary policy and negotiating NAFTA, a free trade agreement with the U.S. and Canada.

Importantly, the Salinas government intensified a strategy of bureaucratic control that concentrated key functions in the Finance Ministry (SHCP. Secretaría de Hacienda y Crédito Público) and the Presidency. The *neoliberal* turn, with its components favoring free trade, divestment of public enterprises and downsizing of bureaucracy, generated intense resistance in the political bases of the PRI and in its connections inside public administration (Ballinas 2011). Later during his term, and in order to enhance the credibility of his macroeconomic policies, Salinas promoted a reform giving autonomy to the Central Bank (a process that was completed in 1995). Other organs with potential regulatory functions in the economy were created by the governments of Salinas and E. Zedillo, in the first half of the 1990s. The spectrum of new regulatory commissions included banking, securities, economic competition, pensions and telecommunications. As with the CRE (see chapter 5), some of these agencies grew first under the umbrella of the existing bureaucracy and developed later on with different degrees of legal, technical and economic autonomy. The functional necessity of making policies credible by consolidating regulatory functions in coherent bodies weighted heavily in the initial build up of these agencies (Ballinas 2011: 100). The CRE and the commission for telecommunications (COFETEL, Comisión Federal de Telecomunicaciones) faced the most complicated political and economic challenges, due to the nodal importance of the network industries they aimed to

regulate, and to the presence of state-owned monopolies.³⁵

The reorganization of the energy sector in 1992

Pemex figured atop the priorities of President Salinas (1988-1994), a Harvard-educated cadre with experience in the Ministry of Finance. Weeks after taking office, Salinas ordered an investigation that ended with the incarceration of the leader of the workers union of Pemex: J. Galicia. Three years after that, and once his party (the PRI) recovered political support in the mid-term congressional elections, Salinas led the NOC through a restructuring intended to make it more profitable. Having grown dependent on the oil rent, the stringent requisites of public finance in a new period of financial crisis forced the national executive (the presidency, and the Ministry of Finance) to seek discipline and efficiency that would translate into more rent for the state, more production for exports and, when possible, a higher rate of recovery of reserves (Puyana 2008; García Reyes 1996).

Far-flung reform was not an option, however, because there was substantial political opposition against privatisation of even part of the oil and gas industry. The Salinas government did not want to give any political fodder to the challengers of the regime on the left, led by Cuauhtémoc Cárdenas: the losing but very competitive candidate in the 1988 election, and a candidate again in the elections of 1994 and 2000. What is evident is the intention to instill a sense of economic efficiency through a corporate structure that separated the more productive areas from those that lost money.

In order to prevail, the moderate position against deepening private and foreign participation in exploration and production only needed to point at the potential profitability of new investments, while the fundamentals of ownership of mineral resources and monopoly over production stayed untouched. Managerial reforms --singling out and strengthening the profitable from the unprofitable-- looked both politically palatable and economically convenient. As long as production costs of oil stayed low, Pemex could enjoy the upper hand in its dealings with foreign

³⁵ Telmex, the State-owned telecommunications vertical monopoly, was privatized as such during the government of Salinas. For years, the new private monopoly was capable of fending off potential competitors (Ballinas 2011: ch.6).

oil companies (Philip 1999: 46). The reform also restructured Pemex, organizing it into 4 separate subsidiaries, respectively in charge of exploration and production, gas and basic petrochemicals, refining, and secondary petrochemicals (Rousseau 2010: 313 and 2007: 13).

Importantly for natural gas, the legal changes for Pemex harmonized the methodologies to account for reserves in accordance with international standards. The reform also mandated the formalization of pricing rules to exchange fuels within Pemex and between Pemex and the other SOEs. Pricing was critical to managerial reform because, in the absence of consistent pricing schemes and accounting standards, it was impossible to know how to improve efficiency and profits, or to justify the abandoning of some lines of business. There was a precedent. In 1986, reforms to the general law organizing all SOEs had mandated that pricing of goods and services exchanged between public entities should be based on the cost of opportunity of selling those goods and services in competitive markets, inside or outside Mexico. Of note, the first contract to regulate the supply of natural gas for CFE was defined in 1992 (Baker and Blume 1999). That year Pemex and the two electricity SOEs also defined the first objective and public rule to determine the prices of natural gas (Baker 2001).³⁶

Table 4.2. Pemex before and after the restructuring of 1992³⁷	
(Before 1992) General direction	
(Sub-directories) Planning Commercialization Transformation Finance	(Sub-directories) Primary production Petrochemicals Projects Technical administrative
(After 1992)	
Pemex Holding	
Exploration and Production Refining	Gas and Basic Petrochemicals Petrochemicals

³⁶ G. Baker, “Mexico’s natural gas pricing crisis: will confrontation lead to policy liberalization?”, Oil and Gas Journal, January 22nd, 2001, Available online via Proquest.

³⁷ From Rousseau (2010: 313)

The enmeshed relations between the different functions inside Pemex were difficult to disentangle. The decision to centralize command by having the President appoint the directors of each subsidiary (besides the chief executive) only offered mixed results. Some specialists and commentators of energy policy pointed towards the importance of enhancing the capabilities of the Director-General and the Board of Directors and giving more independence to Pemex from the federal budget (which was mandated by Congress). Managerial reforms could never be sufficient as long as Pemex stayed so needful of capital. In 1994, for instance, Pemex had sales income of USD 17 billion, 16 of which were sent to the public treasure. The reserves of oil, plus the exploration and production program, and refinery capacity were all lower in 1994 than in 1988. The budget for exploration and production was also lower in 1991 than in 1983 (Phillip 1999: 47; Michot Foss et al. 1993: 24).

In tandem with the reforms to Pemex, Salinas also introduced a bill to modify the legal framework for power generation. The new legal framework of the two power SOEs broke their monopoly over a generation in mild, initial steps, by allowing the private sector to produce (as IPPs) electricity to be purchased by the SOEs. Besides this, the new framework habilitated small-scale production for rural areas or exports, co-generation of electricity (as a by-product of generation of thermal energy and steam) and production for self-supply for large, industrial users. Some subsidies were rolled back and prices for electricity and fuels for industrial use were also adjusted to better reflect opportunity costs (Jano-Ito and Crawford 2016; Carreon et al 2007).

It is noteworthy that new modalities of power generation did not affect the standing of the SOEs in transmission and distribution. Moreover, CFE continued to own and operate plants through new financial schemes that spread costs of capital over longer periods of time and/or took debt off the books of the SOEs (Carreon et al. 2007). Chapter 5 will review projects to illustrate the complications of that process of accommodation and its entanglements with the implementation of natural gas reforms.

Examining these initial steps towards opening the energy sector leads logically to asking who the proponents of such policies were. The financial need for privatisations and liquidation of many SOEs was evident. However, the push towards restructuring in a sense that mimicked liberalisation in the U.S. was not as evident, except for that part of the Mexican elite that had

received the knowledge of economic governance in vogue in the United States. Twenty years on, research has shown that the Mexican cadres that took control of the government and –far less firmly—of the dominant political party, were part of the international elite riding the waves of the Washington consensus (Salas-Porras 2014). Not more than 50 people, all men, made the core of this compact, held together by the belief that the economy could be reshaped through foreign trade, fiscal discipline and restructuring of most of the sectors that the state dominated in the preceding decades.

NAFTA as a lever of economic transformation

The North American Free Trade Agreement became one of the centrepieces of the economic restructuring of Mexico. For political reasons, the Mexican negotiators excluded energy from the treaty (Puyana 2006; Philip 1999), but NAFTA turned out to influence the energy sector in Mexico over time and as a consequence of the crystallization of institutional changes of the free trade era. Energy was discussed throughout the negotiations of Chapter VI, but Mexico kept reserves in the treaty, consistent with the Constitutional protection of petroleum and electricity as exclusive activities for the Mexican SOEs. These reserves were included in Annex 602.3 of NAFTA, which also limited foreign participation in electricity and nuclear energy (Jimenez 2000). Mexico refused to: “reduce domestic control of oil resources, to guarantee supply to Canada or the U.S., to accept risk contracts for exploration and to make changes to domestic distribution within the control of state monopolies” (Puyana 2006: 87). The obligations of Mexico within NAFTA stood in clear contrast to those acquired by Canada and the United States in the CUSFTA, signed in 1988. It has been claimed that NAFTA laid out a framework that was even more protectionist of the Mexican energy sector than the *status quo ante* (Puyana 2006: 87).

It is essential to note, however, that in NAFTA Mexico committed to the sustained and gradual liberalisation of energy and basic petrochemical goods (Art. 601.2), and to a 10-year phase-out in tariffs over imports of natural gas. The most transcending changes triggered by NAFTA were the provisions on the treatment of energy-related investments. The NAFTA guarantees built on the legislation that the government of Miguel de la Madrid, the predecessor of C. Salinas, had enacted to appease the Mexican private sector after the expropriation of banks in 1982. NAFTA also

ratcheted the institutional changes that sought more favourable conditions for foreign direct investment in the 1980s. Chapter XX, on arbitration and resolution of disputes, turned to be paramount in this respect, since it included energy. The procurement provisions of NAFTA also included services and construction, and thereby secured the participation of North American firms and foreign firms in general, due to the GATT regime that Mexico also had joined in the 1980s (Jimenez 2000: 171).

Other provisions of the treaty, related to procurement, and bidding procedures, would also prove instrumental in opening the electricity and natural gas sectors and petrochemicals to firms from the U.S., Canada and other nations that were gradually joining trade agreements with Mexico. Importantly, article 606 of NAFTA anticipated the principles of regulation consistent with the goals of vertical separation and open-access. Specifically, article 606 prohibits discriminatory treatment by regulatory agencies (federal and subnational) against foreign companies; it also prevents the application of import and export restrictions by the regulatory agencies and assures that supply contracts will not be interfered by actions of sub-federal entities (Jimenez 2000: 173). In other words, NAFTA predated and prefigured some of the regulatory principles that were about to come in line.

With NAFTA negotiations concluded and ratified in 1992 and 1993, respectively, the national government turned to harmonize domestic laws with the new obligations towards the U.S. and Canada. The laws that deserve mention are: a) the Foreign Investment Law (Ley de Inversión Extranjera), which envisioned further protections against nationalization of foreign assets; b) the procurement code (Ley de Adquisiciones y Obras del Sector Público), which adopted provisions for fair bidding and equal treatment for domestic and foreign firms in the supply chains of SOEs and government agencies; and c) the Law of Economic Competition (Ley Federal de Competencia Económica), which created the first autonomous competition watchdog. This last legal instrument contained provisions to prevent concentration and collusion by means of oversight of mergers and acquisitions.

Liberalisation and the beginnings of independent regulation

As revised in the previous chapter, liberalisation in the United States and Canada was a policy with a bet on privatisation of some public assets, deregulation of potentially competitive segments of

industries, restructuring (vertical separation), open-access to transmission and distribution infrastructure, and strengthening of regulatory agencies to prevent and correct market failures. Regulation of natural gas and electricity incorporated incentives and mechanisms that relied on shared information. By creating and regulating a market of capacity rights in the system of transportation, the policy to liberalise natural gas sought a fluid integration of a national market. All these features relied on *arms-length* regulatory agencies, backup of the judiciary, and a wealth of market practices that provided a support for the innovation that accompanied restructuring (i.e., secondary markets to trade futures and derivatives tied to commodities and transportation rights).

As this chapter shows, Mexican policymakers that got inspiration from the reforms occurring in North America counted on very little of that original context. Regulation had a different role in the trajectory of transformation that policymakers were envisioning in the 1990s (while restructuring of the natural gas industry in the U.S. was still underway). This is so for two general reasons. The first is that economic restructuring was almost concomitant to privatisation of state-owned enterprises. The second reason is that some regulatory agencies were established for the first time with the intention of shielding their technical governance from politics and signaling consistency of restructuring policies across executive terms --chiefly the case of monetary policy, by giving constitutional statutory autonomy to the central bank (Jordana 2011; Kessler 2000). For energy, the sectoral regulator would be centred on regulating both the incipiently competitive segments (transportation, supply) and one small part in the electricity SOEs (see Box 4.1).

It is also important to note that, besides incorporating a mandate to promote competition where possible and allowed by legislation, the new regulatory agencies for economic competition and energy re-concentrated functions that were previously dispersed among the central agencies. Much unlike the U.S. and Canada, but like a large share of the rest of the world (including developed nations in Europe), energy regulation in Mexico had not resided in technically autonomous bodies beforehand. To the contrary, in Mexico the central agencies (and more often the Ministry of Finance and not the Ministry of Energy) had had the ultimate say on matters of pricing of fuels and tariffs of transportation. Policy decisions on foreign trade of oil, gas and oil products were also under the purview of the Ministry of Finance.

Box 4.2 Sectoral reforms since 1990

Foreign investment (1996). Increased levels of foreign investment allowed in restricted activities. Limits on financial institutions rose to 49% and were totally abolished for U.S. and Canadian institutions. The law enables foreign controlled financial institutions to participate in auctions of airports and railways.

Electricity (1992-1993). Self-generation and cogeneration allowed for the first time since the concentration of the industry in SOEs.

Maritime ports (1991-1993). Enabled granting operating licenses to the private sector.

Telecommunications (1995). Enabled asymmetric regulation against the dominant operator and competitive bidding for the radio spectrum. Competition in long distance calls started in 1997.

Civil aviation and airports (1995-1998). Deregulation of prices and routes, except in specific routes where operators continue to hold market power. Private investment in airport administration.

Railways (1995-1999). Breaking up of the national enterprise into four firms, auctioned to the private sector.

Judiciary procedure in civil and mercantile law (1996-1997). Streamlining judiciary procedure in Mexico City and Nuevo León, in order to shorten them to between 6 and 18 months.

Translated and synthesized from OECD (2000: 17)

Conclusion

Some comparative thoughts can be useful to conclude this chapter. First, natural gas in Mexico has never had the importance and diffusion that it had for residential consumers in the United States and Canada. In the economic model that dominated after WWII, the NOC and two State-owned franchises provided fuels and electricity, at prices that were regulated by the central government, taking more consideration for goals of industrial policy, universal access, and political clienteles, than to recovery of costs or optimization of energy and economic welfare. With regards to natural gas, distribution companies served a tiny proportion of the population and started to grow mildly only after the reform of 1995.

It can be noted also that liberalisation in the U.S. was tantamount to vertical separation and the possibilities for utilities, IPPs and all kind of investors to engage in mergers, acquisitions and crossed activities in the energy sector and in other neighboring sectors (Joskow 2008; Hempling, 2006).³⁸ In Mexico liberalisation meant something very different, especially in the energy space,

³⁸ The repeal of the PUHCA is the relevant turning point.

where the --mild but politically attainable—reform had to content itself with seeking managerial reorganization and improvements of efficiency within the paradigm of state ownership. Private participation in supply chains and in the financing and operation of new electricity generation capacity were the first steps contemplating partial liberalisation in midstream natural gas (1995. See chapter 5). Importantly, these steps also built, by legal obligation, on the guarantees included in the free trade agreements that Mexico negotiated in the early 1990s.

In sum, the institutions, procedures and tradition of public utility regulation were simply absent. Furthermore, some characteristic tensions that led to the establishment of the North American type of regulation since the XIXth Century were not present in Mexico in the late XXth Century. Chiefly, in Mexico there were no constituencies that could press to materialize open-access rules in the system of transportation (LDCs or industrial users wishing to bypass pipelines trading arms). Although the changes of partial liberalisation set in motion in 1995 were inspired by the ongoing experience of Canada and the U.S., Mexico counted on different initial conditions and policy legacies to deal with. However, in the 1990s policymakers and the newly formed regulators would have to continue with the legacy of *market de-institutionalization* (for lack of a better term). Policy, regulation and the specific implementation of plans to restructure the energy sector can be understood, therefore, in relation to this more ample context of economic and political relations.

Chapter 5. Partial restructuring as a project of liberalisation. Natural gas in Mexico between 1995 and 2000

Introduction

Some of the most important trends that would define the fate of policy change in the second decade of the 2000s were visible since the early 1990s. As noted previously, legal changes in 1992 enabled the entrance of IPPs and other privately financed generation facilities to supply the network governed by the electricity SOEs; environmental policies kicked in and built pressure towards replacing fuel-oil, coal and LPG from industry, commercial use and power generation; finally, NAFTA reinforced already existing tendencies towards economic openness and, more specifically, sped up the maturation of institutions to foster competitiveness and to protect private and foreign investment.

Between 1995 and 2000, the policy affecting natural gas continued to follow a route map: it aimed to get as much as possible of limited access to private investment, and to hope for the best effects from stable and low prices of natural gas and the economic expansion that swayed North America in the late 1990s. The new frameworks for regulation of energy, economic competition and trade disputes did their part in transforming the relationships affecting the natural gas industry (Jimenez 2000). Prices of natural gas started to reflect international costs, distribution zones were auctioned and started to grow, and a large privately owned pipeline went on stream. After the dramatic crisis of 1995, recovery took an also very determinant impulse. For four of the five fiscal years starting in 1996, Mexico's GDP grew at yearly rates that were higher than 5% (Banxico 2019), with exports (manufacturing, oil) accounting for a central part of that recovery (Fernandez 2010: 135). Domestic demand increased accordingly, from 2.9 to 3.9 BCFD (see table 5.1).

But the expansion of capacity to generate electricity and to transport, store and distribute natural gas did not occur exactly as desired. By the end of the 1990s, there was an evident need to readjust regulatory instruments on pricing and open-access conditions. By law, Pemex had preserved the monopoly of the production of natural gas. But its control over transportation and distribution was not on the plan –and neither in the law. Against the desire of policymakers, Pemex deterred marketers from importing natural gas through its system of transportation. After a new failed attempt to reform and open the electricity market (in 1999), CFE preserved its monopsony of privately produced electricity and central agencies continued to define highly subsidized rates. Officials in central agencies struggled to compose new administrative procedures that would

cement the much required trust of bankers and operators to bring capital and technology in --and to reduce risks and the financial costs associated with them.

This empirical section seeks to identify patterns of response of the Mexican authorities throughout the shifting contexts of the first half-decade of implementation of a policy of partial liberalisation. The theoretical framework underscores the role of the state in the economy, centering on the central agencies, the SOEs and the regulators, and specifically on how these interactions reframed the constraints of regulators to carry out a project of liberalisation. For the years between 1995 and 2000, constraints obstructing the goals of liberalisation expressed most visibly as the obvious asymmetry of resources between Pemex, on the one hand, and the regulatory agency, on the other. Moreover, these constraints are also represented by the legacy of institutional voids that hindered the materialization of projects to ramp up demand.

Organization of the chapter

The chapter has five sections. The first presents the goals of the partial reform as envisioned in 1995. Regulation was expected to be central in this policy of restructuring. However, implementation of third-party access, the cornerstone of restructuring, never got to be enforced. There were other tests for the regulator in the first years of implementation: the auctioning and oversight of distribution zones, the regulation of a new large private pipeline and the pricing regulation of gas sold by Pemex in its system of transportation, reviewed in the second part of the chapter. For the five years starting in 1995, central agencies would stay at the centre of policy and a determinant factor on regulatory decisions: *filling in voids* in situations of contingency, eking out the expectations that partial liberalisation could work, and rebalancing goals of security, reliability, affordability and even social acceptance of new projects. The third and four parts of this chapter reviews some important projects on the generation of electricity, distribution zones and the associated links for the transportation of natural gas. The chapter concludes with a review of the SOEs and of the modification of economic variables affecting energy and natural gas in North America at the start of the 2000s.

The examination of these factors in this first sub-period of implementation serves to explain the specific situation of the regulatory agency with regards to its mandate within the policy of restructuring. Indeed, as the OECD (2000) pointed out at the time, legal attributes and the

distribution of power resources among the regulated made restructuring a very complicated bet for the nascent energy regulator.

The restructuring of natural gas in the energy policy of the 1990s

Natural gas had a relatively modest position in the energy mix in 1995 because almost half of the consumption of natural gas was attributable to Pemex itself (table 5.1). Industry consumed less than a third of total demand, and power generation accounted for only a portion of industrial use. If we situate our views in the early 1990s, we may agree that the plans to reform the sector should be seen, more precisely, as plans to create the sector almost afresh.

There were several advantages in attempting a partial reform of the natural gas industry, and policymakers at the time were aware of them. One was the clear-cut contrast between oil in general and natural gas, as a rather small part of the oil industry at the time. As noted in the previous chapter, natural gas *per se* (almost) never stirred political contention inside Mexico. In spite of its considerable weight in the energy mix, most of the domestic economic rent of Pemex came from oil products, while Mexico never exported considerable quantities of natural gas to the U.S. The few pipelines linking both nations flowed southwards. Also, and despite of the highly controversial and failed negotiation to export natural gas to the U.S. in the 1970s, the fuel had not stood at the centre of resource nationalism (see chapter 4). To be sure, there was no notorious pushback from public opinion against the partial opening of the natural gas sector –perhaps because the reform took place amidst one of the worst economic crises that hit Mexico in the century.

Of note, opening the sector to foreign operators in storage, transportation and distribution departed from the energy specific clauses of NAFTA, but kept with the commitments, also within NAFTA, to open the procurement chain of Pemex to foreign participation (Puyana 2006b: 273).³⁹ Finally, although natural gas had been historically tied to policy and administrative decisions about oil and electricity policies, it had not been a political good in the sense and extent that electricity or oil had been. Clienteles in the forms of unions, communities in producing sites and suppliers or

³⁹ During ministerial negotiations in 1997 Mexico resisted pressure from Canada and the U.S. towards accelerating the phase-out of tariffs on imports of U. S. natural gas. “Mexico informally rejects U.S. request to expedite phase-out of tariffs on natural gas imports”, [SourceMex Economic Analysis on Mexico](#), May 14th, 1997, accessed from Factiva on September 12, 2017.

distributors grew around the electricity SOE and the local businesses of distribution of LPG. Large, industrial, consumers had enjoyed access to subsidized natural gas and fuel-oil. But none of these potential constituencies was in a position to block a national initiative, taken in a moment of national urgency and seeking to relieve pressure on public finances.

While modest in their scope, the reforms of the natural gas sector aimed to supplement public investment: significant changes in a rather small piece within the whole energy sector. Given the introduction of IPPs in 1992 and the guarantees for private and foreign investment that were included in NAFTA, a partial liberalisation promised to potentiate more ambitious liberalisation (Jimenez 2000). The interlocking effects across sectors and institutional settings were also part of the persuasive ideas selling structural reforms in the 1990s and aiming for policy convergence (Hoj et al. 2006). In sum, while the entrance of private capital into the production of petroleum was still a political taboo in the 1990s, liberalisation of the midstream activities of natural gas could be sold as an acceptable and actually a promising step among the several long-haul measures of economic restructure of the epoch.

When reviewing the lawmaking phase of reform, it is interesting to note that the necessity of the restructuring was not hard to sell. Although the political balance stood on the side of the PRI, proposals to transform electricity production had encountered and would continue to encounter significant opposition within the ruling party (chapter 4 and below). As mentioned above, voices were raised inside the PRI (Partido Revolucionario Institucional) against privatisation of gas, but mostly when the reform had not been tabled. Objections to the initiative centred on an aspect that the national executive never intended to modify: keeping the monopoly of Pemex over production (Elizondo 2011; Philip 1999). A revision of public opinion and general coverage in the media of those days leaves the impression that while reforms of the electricity firms would encroach on existing (refractory) interests, the reforms on the natural gas sector could deliver expanded benefits for the existing SOEs and new participants.

Surprisingly, one of the voices that opposed the reform came from the ranks of government itself. A heavyweight hardliner of the PRI, I. Pichardo, the first energy minister of President E. Zedillo, publicly opposed to the privatisation of natural gas.⁴⁰ The situation of economic distress of the first

⁴⁰ “Mexico energy investment hopes raises questions”, [Reuters](#), January 11th, 1995, accessed via Factiva on July 12, 2017.

months of 1995 may have heightened the relevance of this position. However, within months the internal and congressional ranks of the PRI aligned with the president. Reassurances were expressed that exploration and production would remain an exclusive prerogative of the SOEs and I. Pichardo was replaced by J. Reyes-Heróles, a young, M.I.T. minted doctor in economics with clear reformist credentials.

Table 5.1. Natural Gas Balance (BCFD)					
	1995	2000	2005	2010	2015
Domestic production	2.72	3.65	4.24	5.00	4.07
Imports	0.17	0.28	0.91	1.46	3.55
LNG imports	--	--	--	0.55	0.64
Demand	2.87	3.89	5.09	6.34	7.50
Oil extraction	1.41	1.78	2.03	2.24	2.20
Industry	0.80	1.02	0.94	1.05	1.38
Power generation (public)	0.59	1.01	2.01	2.94	3.80
IPPs	--	0.03	0.92	1.54	1.72
Power generation (private)	0.09	0.11	0.33	0.37	0.57
Self-supply	0.09	0.08	0.13	0.17	0.29
Co-generation	0.00	0.04	0.09	0.10	0.14
Small-scale	--	--	--	--	0.00
Exports of electricity	--	--	0.12	0.10	0.14
Residential	0.06	0.06	0.09	0.09	0.09
Commercial	0.02	0.02	0.02	0.03	0.03
Exports	0.02	0.02	0.02	0.08	0.01
Source: Sistema de Información Energética (México) www.sie.gob.mx					

The restructuring proceeded swiftly in its lawmaking stage, in part because the party in government held a majority of seats in Congress from 1991 to 1994 and from 1994 to 1997 (Lustig 1998). The fundamental step of the reform was a constitutional change that put natural gas away from the dominion of energy-related activities that were considered strategic and, hence, subject to the exclusive purview of the state.

With the NAFTA obligations effective since 1994, the restructuring also included a plan to phase out the control of the foreign trade and tariffs on natural gas (set to disappear by 2003) and gave new attributions to the regulatory agency, the CRE (Comisión Reguladora de Energía, formed in

1993) to oversee the development of the sector (chapter 7).⁴¹ In the first five years after the reform of 1995, this agency designed a framework to promote the entrance of marketers other than Pemex, and of operators of transportation and LDC's. Consistent with previous legislation for the SOEs, the reform also enabled the CRE to define market-mimicking mechanisms for the fuels sold by Pemex (Halpern and Rosellón 2001).⁴²

The reform respected the state monopoly over the production of oil and gas. However, in order to break away with restrictions over the midstream and downstream segments, Congress modified the legal framework that defined what the petroleum industry actually comprised (Jimenez 2000: 178). From then on, natural gas distribution, transportation, storage and foreign trade were not considered part of the petroleum industry and hence, they were formally taken away from the scope of exclusive activities of the state.

The integration to North America should not be overstated, though, especially opening the way to more imports from the United States, as is the current structure of bilateral trade today. The opposite more accurately reflects the motivations argued by the proponents of the reform. Back in 1995, the opening of the midstream and marketing segments of the industry was presented in the political scene as a *dynamic complement* to the activities of the state: a measure that would also relieve the NOC and help it concentrate on production and basic petrochemicals (Cámara de Diputados 1995; Halpern and Rosellón 2001). Actually, the preamble of the legal initiative reads: *in the long run, it is foreseeable that Mexico will become a significant exporter of natural gas in the regional market of North America* (Cámara de Diputados, 1995).⁴³ This optimism about the prospects of exports reflects the assumption (a constant in Mexican energy policy?) that easing the financial worries of Pemex would have positive impacts over production and growth of reserves

⁴¹ The Energy Regulatory Commission (CRE) was created as an advisory organ of the Ministry of Energy. It was originally conceived as a regulator for the electricity sector, one year after legal reforms allowed private participation (IPPs, BOTs). Nevertheless, the CRE stayed financially attached to the Ministry of Energy. Since its creation and until 2008, the energy minister had the authority to appoint the board of the energy regulation agency.

⁴² "Mexico puts its gas framework in place", *Platt's Oilgram News*, November 9th, 1995, accessed from Factiva on July 12 2017.

⁴³ Cámara de Diputados del Congreso de los Estados Unidos Mexicanos, 21 de abril 1995, "Iniciativa de Reforma a la Ley Reglamentaria del Art. 27 constitucional en el ramo petrolero. (Exposición de motivos)".

through exploration –an expectation that has met mixed outcomes, as the following chapters will show.

The balance of supply and demand was very different from what it would become twenty years later: in 1994 Pemex announced self-sufficiency in natural gas and, for some months in that year, Pemex exported more than it imported, although only in minimal quantities.⁴⁴ The expectations that the demand for natural gas would hike are also evident in the justification of the reform, which touts the complementarity of natural gas as part of the shift towards combined cycle gas technology in power generation. Regulatory changes would make Mexican gas reach *from the Yukon to Yucatan*, hailed A. Lajous, Pemex’s CEO in 1998.⁴⁵

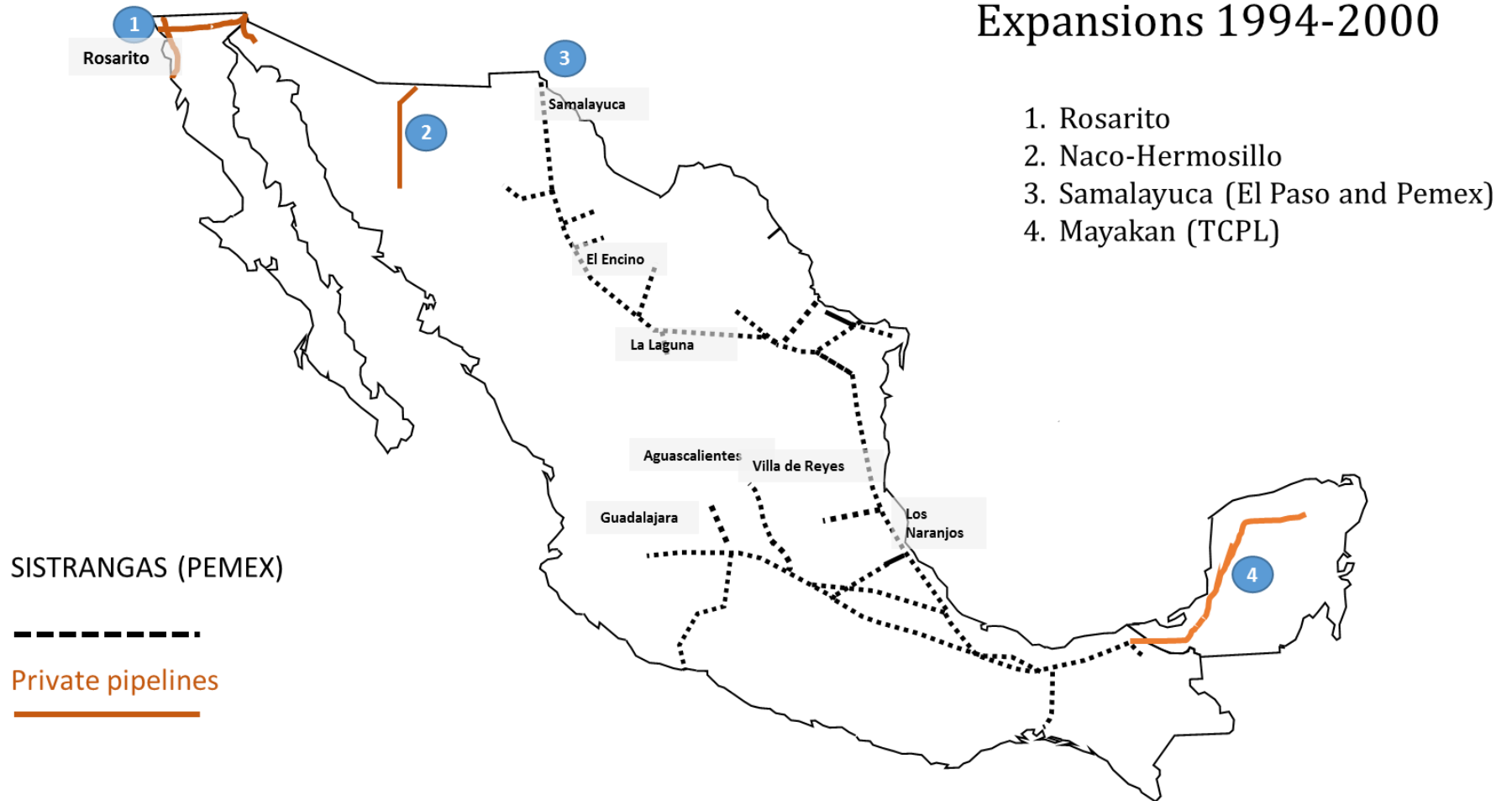
The complications of making Pemex *fit to compete* would only emerge as implementation went by (see below). The preparation and willingness of Pemex and the electricity SOEs are somehow trickier to establish. These considerations lead to query whether Pemex trumped the reform out of deficiencies in its own capacities to plan and to control its operations, unwillingness to cede market share or to a combination of these reasons. As per the theoretical framework, I can only try to answer that by looking at the distribution of resources, of risks and by interpreting government’s and SOEs’ relevant decisions. To that end, the rest of the chapter examines the role of the CRE in the enactment and implementation of the new regulation. Subsequent sections take into consideration the incentives and constraints as they were emerging through the implementation of specific electricity and transportation projects.

⁴⁴ “Pemex announces self-sufficiency in natural gas”, [SourceMex](#), January 5, 1994, accessed from Factiva on May 31st, 2017.

⁴⁵ Starr Spencer, “Mexico says it’s taking steps towards gas-market links”, [Platts Oilgram News](#), July 27, 1998. Accessed via Factiva.

Map 5.1

Expansions 1994-2000



Implementing a policy of partial reform. Pricing and open-access regulation between 1995 and 2000

As noted, while the monopoly of Pemex over the production of natural gas was left without change, the reform of 1995 was embedded in the NAFTA policy to phase out tariffs on imports of natural gas (Halpern and Rosellón 2001). Accordingly, Pemex and CFE or other large consumers and LDCs were formally capable of importing natural gas and promoting the construction of infrastructure to secure those imports. Alternatively, these users would also keep the possibility of using the transportation under the control of Pemex. For that to happen, open-access and a robust edifice of first-hand sales and tariffs regulation had to be formally effective and operative.

The restructuring of the sector was supported by the creation of a regulatory agency: the Comisión Reguladora de Energía (CRE). This agency was born in 1993 as a technical advisory office *within* the structure of the Ministry of Energy. Congress passed a new legal mandate for the sectoral regulator, in 1995, strengthening it as a technically and financially autonomous organ. The CRE would become a full-shaped arm-length regulator only after the overarching energy reform of 2013 and 2014 (see chapter 7).⁴⁶

Between 1995 and 2000 the CRE helped the process of restructuring of the natural gas sector by defining the rules of open-access for the system of transportation operated by Pemex (and the private systems that started to be built since the reform) and overseeing the tendering processes for midstream infrastructure and distribution zones. The CRE also defined transportation tariffs and the wholesale price of domestic gas by updating an international benchmark methodology that had been utilized since 1992. The regulatory functions over wholesale pricing (known in Mexico as *Ventas de Primera Mano*, or first-hand sales) were justified under the principle that monopoly regulation was necessary whenever the economic watchdog would not expressly indicate that conditions of competition exist (OECD 2000: 74).

With the exception of some northern border cities that could import directly from the United States, the physical control of the transportation system owned by Pemex made open-access rules indispensable to attain upstream competition. Open-access rules were enacted also to enable the

⁴⁶ The purview of the CRE on electricity extended over self-supply, cogeneration and independent power projects selling surplus generation to the SOEs. It did not regulate tariffs or generation, transmission and dispatch within the SOEs.

commercial and physical bypass of LDCs. This means that industrial users and self-supply communities (sociedades de autoabasto) could justify a direct connection to a transmission pipeline. Users above a certain consumption level (60 MCMD) could also request a distribution company to transport gas from other suppliers. The law mandated the divestment of the distribution end of Pemex's operations (Halpern and Rosellón 2001: 18).

Pricing of natural gas sold by Pemex

Given the competitive nature recognized in marketeering, the reform left private traders free to import natural gas and resell it. A levy was in place between 1995 and 1999. But the production monopoly of Pemex on natural gas and its control over the system of transportation required the definition of a pricing rule. The netback methodology to price natural gas sold by Pemex was one of the most important instruments of regulation in the years after the CRE was born. It consisted of pegging domestic prices to the markets in one hub in the U.S. (the Houston Shipping Channel, HSS, which later changed to the Waha-hub, both in Texas).

The regulation also utilized a physical balancing point close to the industrial zone of Monterrey, where physical flows and prices were assumed to level. The netback rule replaced the single price that Pemex charged for natural gas until 1992. It was consistent with the legal mandate that SOEs must price fuels by reference to competitive markets whenever competition was not possible (see chapter 4). The rule designed by the CRE estimates the fair price for the gas sold in Ciudad Pemex. The price was established for that city in the South as equal to the price in a reference market (Houston Shipping Channel) plus transportation costs to the balancing point minus transportation costs from that point to Ciudad Pemex (see map 5.1 and appendix). The balancing point (punto de arbitraje) was established close to the industrial region of Monterrey, on the Northeast side of the country. Notionally, the domestic and imported flows equated at that point (Los Ramones. see map 5.1)

For methodological reasons, the pricing model used some assumptions about supply and demand: 1) that the gas pricing in Mexico remained insensitive to variations in demand in Mexico; 2) the production of U.S. was considered infinite (an assumption that could still work today but that was put into question in the 2000s, when the U.S. seemed to approach a structural deficit in production), and 3) that the production of Pemex was fixed and not under the control of Pemex: that is, that

Pemex would not behave strategically, reducing its production in order to increase the price by moving the balancing point closer to its upstream sources (Brito and Rosellón 2010). Industrials and LDCs generally accepted the pricing mechanisms defined by the CRE, although contention would rise, especially when prices turned volatile, about the parameters of the rules, like the market of reference in the U.S. Importantly, the volume of gas regulated by this benchmark rules tended to diminish over time, as LNG imports and other small separate connections to the U.S. went on stream.

Although 1997 registered an overnight hike of prices in the United States, overall the price levels between 1995 and 2000 stood between 2 to 3.5 USD per MBTU (EIA 2018b). Long-lasting price increases starting in 2000 would trigger pressure of different nature against policy and the pricing mechanisms established by the CRE.

Open-access

Defining a framework to bring Pemex to operate under principles of open-access was the other, and perhaps most important, aspect of the functions of the CRE. There are two aspects to underscore. In 1995, the CRE issued a ruling that envisioned open-access within the system of transportation of gas as an *option* for Pemex and its customers. The ruling included, alas, a so-called *original sin clause* (10.2) that allowed Pemex and its clients to keep the alternative of purchasing natural gas as a bundle of molecule and transportation (CRE 1995).⁴⁷ In other words, TPA was not enacted as a mandatory condition, but as an option, that none of the clients of Pemex took, and therefore, thwarted the whole effectiveness of open-access principles. The result was that neither Pemex nor a single purchaser of gas took serious steps towards contracting the supply of natural gas as two separate operations.

Although interviewees and testimonies at the time recurrently lament the lack of a more determinant mandate to enforce open-access in the system of transportation of Pemex, there might be some overstatement of the importance of this decision. The mentioned clause did indeed offer an alternative for Pemex and some large industrial users not to support the change of regulatory regime to one where TPA was the only alternative. However, it is difficult to believe that this one

⁴⁷ CRE, 1995, “Reglamento de Gas Natural”.

decision, had it made open-access mandatory and not optional, would have succeeded in the implementation. The failure to enforce the General Terms of First-Hand Sales (General Terms hereon) contributes to that point.⁴⁸ On and off, between 1996 and 2000 the CRE led consultations and negotiations with industrials, LDCs, Pemex and central agencies to define a the General Terms that would organize the modalities of sales of gas from Pemex to all other private and public sector purchasers (CRE 2000).⁴⁹ The General Terms included a provision so that the CRE could revoke the permit of transportation of Pemex as a measure against non-compliance. However, the legal framework and the economic reality of the sector would have made it impossible to utilize that clause.

Given the material impossibility of enforcing the open-access regulations, the CRE determined a *period of transition* wherein Pemex would continue to sell natural gas bundling the sale of gas and the transportation services (CRE 2001).⁵⁰ The period created and formalized a regulatory limbo that would last for almost two decades.

Sluggish starts and supply uncertainties. Natural gas between 1995 and 2000

Although the formal level of regulation is an indispensable basis to explain this case, the opposition of Pemex to the reform has to be explained concretely, and in consideration of the broader context of energy policy. During the first five years of the new, partially liberalised model, the SOEs, and central agencies struggled more visibly with the problems of defining adequate conditions to attract investments, and therefore to contribute to expand demand and deconcentrate the ownership of all the mid-stream assets of the industry. The activity of central agencies to materialize specific projects laid out the real shape of policy, and the position of Pemex and the electricity SOEs were

⁴⁸ The exact term is General Terms and Conditions of Firsthand Sales (Términos y Condiciones Generales de Ventas de Primera Mano). See Resolution CRE 158 2000. The terms and conditions define: 1) principles of equality of treatment for all shippers and customers under principles of “most favoured nation”; 2) mechanisms of pricing (pegging national prices to “relevant competitive markets”; 3) modalities of payment and service of delivery (firm, interruptible and occasional basis, swing service, tunnel, volumetric); 4) casuistry for defining and redefining responsibilities and liabilities of parties in the cases of non-compliance with prices, terms, quantities, ending contracts; 5) a model of contract (Acuerdo Base) to organize exchange of gas; 5) mechanisms to settle disputes; 6) disclosure (confidentiality). Importantly, and inherent to the General Terms is that these characteristics apply to PEMEX as to any other firm in the sector (in the foreseeable context of future competition. Chapter VIII).

⁴⁹ CRE, 2000, “Resolución 158 2000”.

⁵⁰ CRE, 2001, “Resolución 100 2001”.

one factor among several others that explain the setbacks of the strategy in place since 1995. Prominently, these conditions referred to obstacles delaying the financing and construction of new gas-powered generation and to the location and creation of new demand for residential and industrial use. A handful of energy projects explain the constraints over the implementation of policy. Some of them are related to the generation of electricity.

National policy and local entanglements. Distribution zones

The reform of 1995 also sought to increase residential and commercial use of natural gas. Previous to that year, CFE and Pemex owned all of the (few) distribution zones. The CRE defined the terms of each tender: the geographical zone and a minimum target of coverage that the winner committed to attaining in the first 5 years of operation. Exclusivity of distribution zones was granted for 12 years. The CRE also established the pricing rules for the distribution zones.

By 1996, there was still some enthusiasm that LDCs would continue to grow and boost demand.⁵¹ The Ministry of Energy bid 18 new zones between 1996 and 2000 for a total committed investment of USD 1 bn.⁵² Most of them were adjacent to industrial zones or other distribution zones connected to the system of transportation, and all had no choice but to buy gas from Pemex.⁵³ Despite one objection of the economic watchdog to one participant taking part in an auction for a zone in Mexico City, it can be said that the processes of bidding were reasonably successful (OECD 2000: 90).

The most publicly acknowledged barrier against the expansion of distribution was (and still is) the local resistance of firms that distribute LPG for domestic and commercial use. Pemex has a part in that sector, too, since it kept the monopoly for the very sizeable domestic market. As of 2000, it represented USD 3 bn and 300, 000 bd.⁵⁴ Subsidization of prices of this fuel has played actively

⁵¹ John Kingston, “Despite questions, Mexico holds appeal”, Platt’s Oilgram News, 19 April 1996, accessed from Factiva on May 31st, 2017.

⁵² Anthony Harrup, “Mexico Awards Year’s Last Natural Gas Distribution Zone”, Dow Jones Newswires, June 21 2000. Accessed via Factiva.

⁵³ Three were not: Cuernavaca, close to Mexico City, the Bajío, in the industrial zone of central Mexico, and Baja California. “Mexico issues list of possible natural gas distribution zones”, Latin American Energy Alert, September 27, 2017. Accessed via Factiva.

⁵⁴ Anthony Harrup, “Mexico Awards Year’s Last Natural Gas Distribution Zone”, Dow Jones Newswires, June 21, 2000, accessed via Factiva. That year, the energy ministry associated the price of LPG to the price in Texas, utilizing a rule similar rule to the one that the CRE defined for natural gas. The measure

against increasing the demand for natural gas, and they only disappeared until 2017 (within the period of study). Moreover, the hundreds of local firms controlling LPG (grouped in two consortiums) actively blockaded local initiatives to introduce natural gas. And, as local politics go, LPG distributors have tried to capture politicians or to delude public attention by promoting distrust of the general public and deter residential users to switch to natural gas. There were efforts of the distribution companies to gain leverage through a collective organization. Nevertheless, as their spokespersons recognize, the response of public authorities is complicated given the need to coordinate the national, subnational and municipal levels of government.⁵⁵

The CRE had planned to attain a goal of nearly 3 million clients by 2005, but by the end of that year LDCs only managed to cover 63 percent of that goal.⁵⁶

The most illustrative *plot* in the series of hurdles against distribution occurred in the industrial city of Monterrey. The Ministry of Energy had been holding on to auction the area while its officials and the regulatory agents gained expertise and cemented trust with potential bidders. However, by 1998 and amidst high expectations among potential bidders, the federal government allowed Pemex to keep exclusive lines to distribute gas to the most significant industrial clients. What makes the case more interesting is that this move was a request of industrial groups themselves. *“Monterrey industrials staged a rebellion and said to the Energy Ministry and to Pemex that they wanted to stay clients of Pemex,”* an analyst reported to a trade journal.⁵⁷

It is noteworthy that successive attempts to introduce open-access rules would also find the resistance or at least the non-cooperative position of industrials, among other reasons, because as a group they were not comfortable with the reorganization implicit in managing their own supply through a commercialization system other than that of Pemex (chapter 6).

intended to put competition between natural gas and LPG on fairer terms. However, the pricing rule only lasted a month.

⁵⁵ “Pierde atractivo el gas”, Reforma, December 12, 2003, accessed via www.reforma.com on June 27, 2019.

⁵⁶ Alberto Aguilar, “Exigen distribuidores política de estado definida para gas y Pachuca-Tula vía ampliación”, Reforma, November 28 2005. Accessed online via www.reforma.com.

⁵⁷ Timma Tanners, “Few firms left to bid for Mexico natgas service”, Reuters, March 17, 1998, accessed from Factiva on July 12, 2017.

To summarize, the manifold aspects in which the NOC blocked the implementation of the reform serve to problematize the role of the NOC itself. Instead of a single actor, it was the single actor and the space where other actors that also opposed the restructuring converged.

Advancing a comparison to other cases of restructuring in the world, it is not far-fetched to claim that these barriers at the local level were critical to hurting the goals of the restructuring. In the U.S. and the U.K., the existence of physical infrastructure and local constituencies to benefit from open-access were instrumental for national and subnational regulators (Makholm 2012; Michot Foss 2000). That propitious condition did not get to maturity in Mexico, and regulators could not count with that lever to pressure policymakers and the NOC towards implementing open-access rules. In 2002, the CRE unsuccessfully auctioned a distribution zone in Veracruz, a coastal city in the Gulf of Mexico, relatively close to the production zones of Pemex. This would be the last distribution bid in almost ten years.⁵⁸ By 2011 distribution zones would be serving less than 4 percent of the total population (Salazar 2012).

Natural gas and power generation

Distribution was one important end of implementation. The other was transportation, serving electricity generation and LDCs.

Pemex unnerved private investors on the distribution segment of the sector, and it did so also with CFE and its projects. The Mérida III power generation plant (500 MW) in the Yucatan peninsula may be mentioned as an illustrative example or plot to show the continuation of the stories of mistrust between the two energy SOEs.

The project started construction in 1997, three years after negotiations between Pemex, CFE and TransCanada arrived at an agreement for the building of a natural gas supply pipeline (700 km). Plans for a privately-owned generation plant existed since 1993, just following the partial opening of generation with IPP and BLT (build lease transfer) schemes that would sell electricity exclusively to CFE. Mérida III was bid as under the IPP scheme.⁵⁹ The reform of 1995 opened the possibility of having a private operator financing and operating the pipeline instead of a new

⁵⁸ “No Bids Made For Gas Distribution in Mexico's Veracruz”, Dow Jones International News, October 3, 2002, available from Factiva.

⁵⁹ “Energy and mining. Mexico: Building for Growth”, LatinFinance, September 1st 1996, accessed from Factiva on September 23, 2017.

Pemex-owned plan. However, Pemex was *ambivalent* –the expression of one analyst-- about having a wholly private pipeline supplying the generation facilities with Pemex’s gas from the processing plants in the state of Tabasco (700 kms. from the generation plants. Baker and Blume 1999).

CFE and the lenders of the project grew uncertain that supply would be controlled altogether by Pemex, hence hindering the financial viability of the project –and raising its financial costs. CFE also had its part to learn. For instance, it was looking to have preferential treatment for its own supply, in the Mayakan pipeline supplying the Mérida plants, an already existing distribution zone and an industrial region.⁶⁰ According to the trade journals following this project, TransCanada and the CRE teamed to bring down CFE’s expectations about obtaining unfair prerogatives, which would not have had a place in the transportation permit. The project, which went on stream in 1998, ended up costing almost USD 1bn.⁶¹

An executive of TransCanada confided to a trade journal: “*CFE, without whose sponsorship this project would never have materialized, wanted to receive preferential treatment relative to other shippers (...) however, the CRE’s mandate is to ensure non-discriminatory treatment of all shippers on transportation systems*”.⁶² Another participant in the negotiations for the pipeline added: “*(...) when we were ready to close on the financing, CFE (for whom we would be transporting gas) had not signed their contract actually to purchase the gas from PGPB (...) This did not prove to be an impediment only because we were working with a reasonable lender group who elected not to make it an issue*”.⁶³ Years before national supply crises emerged as the central problem of natural gas policy, insecurity of supply had become an issue in negotiations leading to new capacity.

It is noteworthy that CFE used an agreement *to supply gas* to the Merida III project --besides the PPA (Power Purchase Agreement) for the electricity. This agreement implied that CFE shouldered all the costs and risks of the supply of fuel. These *tolling* agreements were used in some IPP

⁶⁰ Mareta Tubb “Mayakan’s precedent setting pipeline. Under budget and ahead of schedule!”, Pipeline and Gas Journal, August 1999, Accessed from Proquest.

⁶¹ “Energy and mining. Mexico: Building for Growth”, LatinFinance, September 1st 1996, accessed from Factiva on September 23, 2017.

⁶² Mareta Tubb, supra, note 57.

⁶³ Mareta Tubb, supra, note 57.

projects sponsored by CFE and they became a federally mandated directive for granting supply of IPPs since 2003.⁶⁴ However, for a short period of time before 2003, some IPPs had to deal with Pemex.⁶⁵ ⁶⁶ What matters for this research is that the stakes for CFE in the natural gas policy rose sharply and in direct relation to its pursuit of CCGT to replace and expand existing capacity. Conversely, as CFE shouldered risks, IPPs had less if any motivations to secure their fuel, --and to press for implementing more robust regulation over Pemex.

The reliability of the relationship of Pemex with CFE and electricity generation is one flank of the insecurities afflicting the plan to enact open-access and bring on the upstream competition. But there were other ways in which Pemex tampered directly with the reorganization of supply, and they speak about the readiness of Pemex to cooperate in the creation of an open sector. On a number of occasions, Pemex pushed or tried to push the CRE to accept controversial definitions of its infrastructure. Specifically, Pemex sought to treat midstream pipelines as if they were upstream sections, thereby eluding the applicable open-access and tariff regulation. Pemex also sought that the CRE allowed it to bypass LDCs to supply users with consumption below the accepted levels (2MMCFD).

A culminating decision shaking confidence in the reforms occurred when, in 1999, Pemex decided at the very last minute to build a pipeline (in alliance with a private operator) competing against one built by TransCanada between its processing plant in the state of Querétaro and Aguascalientes.⁶⁷ The regulatory framework at the time allowed competition under the condition that operators shoulder their risk as merchant pipelines, and TransCanada bet on its project because it had an agreement with General Motors in the industrial area of Silao.⁶⁸ TransCanada publicly denounced the intentions of Pemex, and trade journals reported that Pemex was asking industrial consumers in that region to support their own project.⁶⁹

⁶⁴ E. Nothorpe, "CFE, Don't". Project Finance, June 2003. Accessed via Factiva.

⁶⁵ That was the case of plants Altamira II, Tuxpan III and IV, Campeche, all for a combined 2.3 GW. Nothorpe, supra, note 61.

⁶⁶ B. Manchlin, "Heavy Fuel", Project Finance, May 15, 2002, accessed via Factiva on June 27 2019.

⁶⁷ A. Aguilar, "Denuncia TransCanada competencia desleal de Midcoast. Los de EU con Pemex tendrán otro gasoducto en el Bajío". Reforma, June 28, 1999, accessed on July 15, 2019 from www.reforma.com with subscription.

⁶⁸ R. Buchanan, "Dueling pipeline projects for Mexico's Bajío. TransCanada, Midcoast Energy competing", Platt's Oilgram News, August 30, 2000. Accessed on July 11, 2019 via Factiva.

⁶⁹ Latin America Energy Alert, August 18, 1999, accessed on July 11, 2019 via Factiva.

In sum, part of the uncertainties illustrated by the two mentioned cases had to do with Pemex, but in complicated ways. When explaining the obstacles to the growth of residential and commercial demand, the dominant position of Pemex as a supplier of LPG is only one part of the equation. The other is formed by the entrenched and more decentralized network of distributors. They successfully lobbied and maneuvered locally and also took advantage of complicated national, subnational and local coordination issues to create new distribution zones. It is not necessary to see Pemex as part of a plot, but all of these machinations occurred in the space that Pemex and a myriad of clienteles had been occupying prior to reform. Just as important were the complications pertaining to a learning curve and procedural accommodation of the SOEs and the central agencies. Financing new generation capacity turned to bring about problems that relented the growth of demand for natural gas and, in the meantime, strengthened Pemex's hand towards blocking new suppliers to use its transmission and distribution infrastructure.

The above-mentioned sub-cases enrich the appreciation of the context of the SOEs in the implementation of the reforms affecting the natural gas sector. The practical ineffectiveness of open-access principles, and the weakness of the regulatory agency against Pemex complemented the uncertainty about LDC and IPP projects and relented the growth of demand for natural gas. Nevertheless, financing new power generation turned to be a problem on its own count: it derived from the novelty and incompleteness of the schemes that the electricity legislation of 1992 made possible, by the ensuing learning curve for regulators and central agencies, and, perhaps more crucially, by political conditions that marked a limit to further opening of the electricity sector.

[New problems for the \(not so\) new solutions. Pemex, CFE and the partial reform at the turn of the century](#)

By 2000 open-access remained still as an unfulfilled promise. The accumulated experiences showed more clearly the nature of obstacles that would have to be surmounted. Prices of natural gas started to rise significantly since 1999 in the U.S. . Price-caps for the natural gas sold by Pemex to industrial users were put in place in 1997, but the increases between 1999 and 2000 were of a different magnitude and elicited pressure for a stronger response. Pemex offered financing and coverage but industrial groups continued to demand subsidization and would eventually get it,

effectively cancelling the possibilities of implementing open-access rules to import the fuel from the U.S. (chapter 6).

Also, the pricing crisis started to ripple energy policy and highlighted the shortcomings of the strategies of Pemex to boost domestic gas production. Prominently: *why did not Pemex invest more in its natural gas sector?* Two reasons are central when accounting for that insufficient level of production. One is the mentioned fact that Pemex produced most of its gas as associated with the production of oil. Ramping up the production of gas implied different technology and new projects with new forms of finance and infrastructure that only took off until the 2000s (mainly those in the Burgos basin in the onshore southern tip of the Western Gulf Basin). Second, bottlenecks in the midstream infrastructure and lack of upstream links sometimes led to absurdly suboptimal outcomes, like the venting and flaring of associated-gas in oil production sites. The overriding priority that oil production took above the exploration, production and transportation of natural gas also led to other flawed decisions that would affect the production of natural gas in the future, like the depletion of nitrogen in the Cantarell field.⁷⁰

The question is not exactly how and why Pemex changed its strategic position specifically on natural gas, but, more precisely, *if it could have been brought to discipline to allow competitors to utilize its own infrastructure*. In their analysis of the industry at the turn of the century, Halpern and Rosellón (2001) see that the new generation of regulatory instruments deployed by the CRE (*Chinese-Walls* style) lacked the adequate institutional and economic fundamentals to guarantee compliance.

The importance of these cases is that they show problems where regulation would have little latitude to affect the development of infrastructure despite the new legal framework. Since the CRE lacked sufficient *teeth* to enforce reliable conditions of delivery, the regulatory framework represented a limited advantage in the new strategy to expand power generation with private financing.

⁷⁰ According to one analyst, in 1998 then Energy Minister L. Tellez sold out nitrogen from Cantarell at the cheapest prices, under the assumption that oil prices would stay at very low levels for the next decade. That decision made it nearly impossible to inject gas with enough pressure to get oil or natural gas from the wells in Cantarell. “Interview with David Shields”, *Mexico Energy Intelligence*, August 6 2013, accessed from <http://www.energia.com/interview-with-david-shields/>

Pemex clearly came to represent a growing risk for IPPs and CFE: more gas was necessary overall while production did not rise significantly (Table 5.1), and Pemex kept effective control of transportation, deterring all possible newcomers to import gas through its pipelines. Given the actual impossibility of supplying fuel by firms other than Pemex, central agencies and regulators had no choice but to accommodate to that condition.

The trail of resolutions on terms and conditions for sales of natural gas that the CRE re-designed by 2000 attests for the fits and starts that ended with legalistic but not actual enactment of open-access. As an exception, the resolution 100 of August 2001 summarized the special situation of IPPs, and sought to create a special regime, wherein the IPPs would all be able to demand equal conditions from Pemex, although later on most of their risks were picked up by CFE.⁷¹

Pemex, according to the interviewees and to documentary sources, had been intermittently enthusiastic about allowing upstream competition via open-access in the pipeline system that it still controlled (Baker 2001; Baker and Blume 1999). The reforms and the guiding documents of the central agencies also insist on the purpose of restructuring Pemex to make it competitive against other suppliers.⁷² Public declarations of Pemex officials at the time are contradictory, however, in that respect. For instance, R. Ramirez, then head of the new gas division of Pemex (Pemex Gas y Petroquímica Básica) publicly expressed his concerns that Pemex could rapidly reorganize in order to comply with TPA and enable competition with importers using the system of transportation owned by Pemex.⁷³ Ramirez also pointed out in 1996, that a large trunk-line of the system controlled by Pemex had to be reversed in order to permit competition.⁷⁴ What happened instead is that imports brought into Mexico by Pemex grew, but competition didn't. By 1999, L. Tellez --the energy minister since 1997-- charged against Pemex, claiming that energy reform, which badly needed to attract financing for power generation, would only work under the condition that the upstream monopoly of Pemex ceased to exist.⁷⁵

⁷¹ CRE, 2001, "RES-100-2001", accessed online www.cre.gob.mx

⁷² See Plan Nacional de Desarrollo 1995-2000. Accessed online at http://zedillo.presidencia.gob.mx/pages/f_busqueda.html

⁷³ John Kingston, *supra*, note 48.

⁷⁴ John Kingston, *supra*, note 48.

⁷⁵ R. Buchanan, "Key Decision on gas market competition facing Mexican anti-trust agency", *Platts Oilgram News*, September 14th, 2000, accessed from Factiva on July 12th 2017.

That new sense of mistrust towards Pemex was behind the (failed) application of *Chinese walls* rules of vertical separation (starting in 2000).⁷⁶ However, as observers noted, the burden of enforcement of those regulations did not correspond to the legal and technical resources of the CRE, despite its much-praised record as a new energy regulator in those years (OECD 2000).

On that end, it is difficult to agree that the redesign of the corporate structure of Pemex in 1992 (explained in Chapter 4) worked as desired for the goals of restructuring natural gas. As some scholars have pointed out, the size and importance of Pemex in the Mexican economy underlie a contradiction of goals for that SOE: short-term profits take precedence over long-term continuity in the exploration for new reserves, production and utilization of associated natural gas.

To sum up, there was a gap, or more precisely a series of gaps, between what Pemex could promise and what it could deliver. Part of the problem entails an apparent paradox: Pemex was unable to operate in a competitive environment when that new competitive environment was composed of or could be reduced to a few things other than Pemex itself. Central agencies, despite the coherence and cohesion of the cadres pushing for reform, were vulnerable to the well-organized lobbying efforts of some industrial users and could not impose the necessary discipline to enforce open-access. The local strategies deployed to protect LPG distribution against natural gas took advantage of the difficulties of coordinating implementation in a decentralized, federal system. Absent a mechanism of asymmetric regulation to thwart Pemex from the source, the implementation of upstream liberalisation had to stay on hold. Finally, expectations existed in 1995 that private power generation could take off more easily if natural gas could be supplied competitively. But those expectations turned out to be delusive, in part because open-access regulation did not materialize, but mostly because of financial difficulties pertaining to the electricity sector and policy. By 1999, the prospects were that natural gas could enter and compete against Pemex with the finalization of the phase out of import duties over natural gas (Baker and Blume 1999).⁷⁷ As the next chapter explains, those expectations did not materialize.

⁷⁶ These conditions were laid out in the “Directiva de Gas Natural” (2000) and the Bases de Coordinación (2001). Both were issued between 2000 and January 2001, only days after the new national executive took office.

⁷⁷ The duties were expected to phase out by 2003. However, in 1999, the national government announced it was coming to an end in July 1999. See Ronald Buchanan, “Mexico signals end to tariff on gas imports”, *Platts Oilgram News*, May 24, 1999. Accessed via Factiva on July 12, 2017.

Analytical summary

Contrasting state capacity against state autonomy can be one way to start an analytical wrap-up of this sub-period. According to one member of the regulatory agency at the time, the reform of 1995 was as much a moonshot, seeking convergence with the ambitious transformations of the natural gas sectors in the U.S., as it was an opening move, pursuing a ratcheting effect in unforeseeable circumstances. As mentioned above in this chapter and the introduction, there was a sense that there was little to lose and much to gain. Experimentation was, hence, inevitable. And it is not inadequate to use that perspective to re-wrap an examination on the instruments of policy deployed in the period under the constraints presented by politics and energy policy.

Starting with the context of politics, the reforms of 1995 navigated the opposition of resource nationalism but could not go past very strict limits. First, pricing rules confirmed the tendency of previous administrations, seeking an institutionalization of benchmarking against competitive markets. The sectoral regulator's technical capacity served the purpose of proposing pricing rules, but their application stayed in the hands of policymakers. Technical input and validation of the netback rule by academic consultations added a colour of modernization of regulation. But the application of these rules remained the core problem for policymakers and regulators. The sectoral regulator could not have gone further in the implementation of this or other rules governing open-access. It is adequate to see that these limitations are rooted in the legal framework and, hence, reflect a political equilibrium. The balance upheld interests linked to the nationalistic wing and the clienteles and cadres that had grown around it. Despite the coordination with the private sector that enabled stabilization and the opening of the Mexican economy since the mid-1980s, the same business organizations that upheld those early stages of economic restructuring were not a driver conducive to openness of the natural gas sector.

The hierarchical coordination that characterized economic policy took a different (and in one sense opposite) meaning: hierarchical coordination had to include central agencies and the SOEs, primarily, and the outcome of their balancing forces was not conducive to aggressive opening of the midstream sector.

The sectoral regulator, in its incipient state, embodied a project of economic policy that aligned with liberal-technocratic goals, but it had to abide by the legal and material limits of an industry dominated by the NOC. Pemex did not see its market share threatened by the new policy (and its

regulatory framework), largely because that was the interest of a sufficient number of political leaders and their bureaucratic and congressional allies. Also, industrial users in the Monterrey region lacked appetite to support the materialization of open-access and a degree of upstream competition via imports.

State capacity could be tested by all the range of instruments. A review can start with the hard end, that is, those requiring compliance and involving some degree of redistribution of resources. Small, building steps, however, were attained through instruments that relied on the technical capacity of the regulator. These achievements concern the rules to price wholesale natural gas, the terms and conditions to trade natural gas, the tariffs for existing and new pipelines and the oversight of auctions for new distribution zones. For all the progress on these flanks, open-access stayed without implementation.

It is important to recall that, for all its shortcomings, the openness of information involved in most of these processes constituted an innovation in the energy sector of Mexico. The CRE concentrated functions that had been previously dispersed across other agencies and, simply by fulfilling its limited mandate, it started to use information to give coherence to the governance of natural gas as a potential system, autonomous of Pemex and with regulation at the center of its midstream and downstream activities. (It must be said, also, that they were reinforced by legal developments aimed at securing private and foreign investment). From a developmental standpoint, and regardless of the modesty of what was achieved, these steps created a stronger foothold for further change in subsequent years. No policymaker or regulator can completely anticipate the ways in which instruments start taking hold and *ratchet on*, giving way to new functionalities. But trying to attain those systemic transformations (i.e., the development of markets) is what restructuring policies have been all about, ideally.

Transformations can be cultivated, in conditions of stability and gradualism, or through more uncertain moments of disruption. A noteworthy aspect in the implementation of policy and regulation for these first five years of restructuring is the absence of a significant contingency affecting the energy sector. To be sure, variations of price did not challenge the capacity of Pemex to offer financing alternatives to large consumers, hence cementing its hold over its market share. Put differently, contingencies did not put in question the distribution of resources, regardless of the frustration that some policymakers felt and expressed about the subsidiary of

Pemex in charge of natural gas. Similarly, the cumulative weight of new demand for distribution and power generation did not create a constraint that could counter the dominance of Pemex. The slow pace of development in the downstream end of the industry had roots in the structure of energy demand, more than in the recalcitrance of Pemex.

Conclusions

A revision of the *sub-cases* related to the expansion of demand for natural gas in the years that ran from 1995 to 2000 illustrates the limits of restructuring that policymakers and regulators found. These limits refer to the strong dependence of IPPs and CFE on the supply of Pemex and on the problems to expand demand at the distribution level. It is necessary to understand how the resources of the key actors were deployed and how they created risks for other actors. That intuition percolates better on the subcases that can be reproduced from journalistic and official sources, and this chapter has sought to organize them in a way that speaks for the interaction that affected the relative power of the regulator as an agent promoting restructuring. One last aspect to underscore for his period is that, although the reform intended to produce effects rapidly, the slow pace of implementation compromised the expectations of success about partial liberalisation but did not compromise assumptions about energy security.

The initial steps in opening distribution to private participation were successful, and private pipelines came on stream. The first years of partial reform were, in sum, years where policymakers expected the outcome of the reform to be successful, even if coming in a slower pace than first thought. However, starting in 2001, shifts in pricing, demand patterns, and their bearing on physical infrastructure would bring down the prospects of continuing the plan that the reform of 1995 defined. By the mid-2000s, supply crises would bring new and unprecedented sense of urgency to the activity of the central agencies and the regulators. Those issues will be reviewed in the following chapter.

Chapter 6. Natural gas and security of supply (2001-2012)

Introduction

The arrival of President Vicente Fox on the 1st of December 2000 became a hallmark in the political history of Mexico. The businessman-turned politician led a coalition of small parties and the centre-right PAN (Partido Acción Nacional), a party almost as old as the PRI.⁷⁸ Although the PRI technocrats enjoyed the approval of big business, since the 1970s, and markedly after the government expropriated the banking sector in 1982, the PAN had become an option for some entrepreneurs to voice their criticism of the hegemonic party (Loaeza 1994). In any case, toppling the PRI from the national office did not mean a turning point in the economic policy pushed by the two previous administrations.

Not entirely unlike the previous federal government at the start of the executive term, V. Fox and his picked CEO for Pemex, R. Muñoz, resolved to address the efficiency problems afflicting Pemex's production of oil and its capability to augment reserves. The key differences between the new and the old government did not reside in their overarching goals of policy. Fox's government also sought to intensify integration within NAFTA (through a myriad of other international trade agreements) and to boost the competitiveness of the Mexican economy in the context of globalisation. The new government also pushed a moderate fiscal reform that relieved some resources to improve exploration and production in Pemex (Elizondo 2011; Pastor and Wise 2005).

On energy matters, differences of human talent and coordination of first-rank government teams marked a clear and unfavourable contrast between the new government and the old. The technocratic compact that had maneuvered the restructure of the Mexican economy since the late 1980s was gone. Some of its cadres stood in important positions, but without the capacity to coordinate as it had occurred in the last two presidential periods. Although the administrations of the PAN between 2000 and 2012 also vied to revamp the capabilities of Pemex, the politically sensitive aspects of the relationship resulted more difficult. Notably, despite the efforts of the central agencies, the payroll of Pemex grew unnecessarily during those years (Elizondo 2011: 17). Other reforms on the fiscal burden and the autonomy of Pemex had mild results (see below).

⁷⁸ They were founded in 1939 and 1929, respectively.

An assessment of the OECD authored in 2000, before the new government took office, gave a positive look on the prospects of having open-access principles enforced despite the persistence of vertical integration of production and transportation (OECD 2000). Policy and the regulatory framework enacted in 1995 still enjoyed the benefit of the doubt, and bode well with the expectation, more implicit than explicit, that the efficacy of policy depended, to a substantial extent, on the whole new machinery of institutions (including regulators) formed during the preceding 12 years.

This chapter reviews a 12-year period that comprises the two administrations of a party other than the PRI in the national government. Political discontinuity does not seem to be the key characteristic of this period. Instead, what marks the difference is its place in the sequence of implementation, accommodation and shift of paradigm and instruments that goes across the 23-year period (1995 to 2018). This period shows both the reasons and the mistakes of policy that complemented and strengthened Pemex's factual opposition to the restructuring plans followed since 1995. As the possibilities of restructuring fell into disarray, the motivations of the NOC and the electricity SOE became clearer and prefigured their stance once crises of supply broke out in 2007. Incremental solutions prefigured a change of paradigm, while rendering the preceding project, and its instruments, almost obsolete.

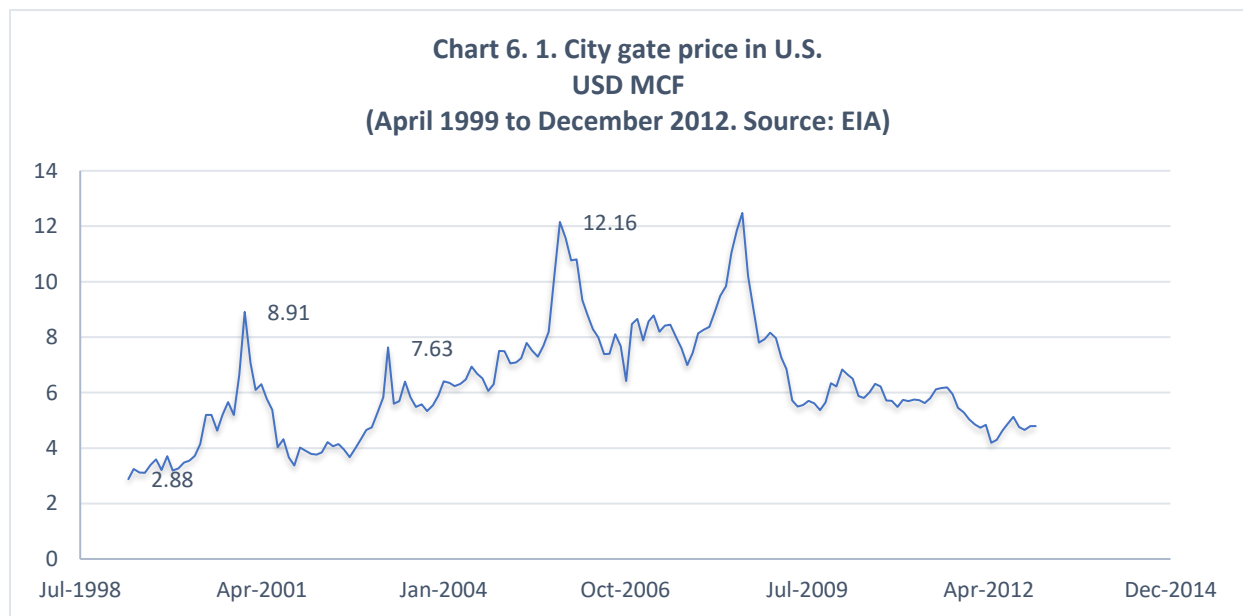
Pricing and open-access

By 2000, prices were becoming again the most salient factor pressing for the accommodation of the relationships within the natural gas sector. From \$3 USD MMBTU in April 1999, prices started to climb steadily to as much as \$ 9 USD MMBTU in January 2001.⁷⁹ Industrials in the north and center regions openly claimed that the hike in prices and their corresponding increase in Mexico would hurt their competitive edge.⁸⁰ U.S. prices would continue to reach historical peaks throughout the decade (chart 6.1), as the production of conventional gas failed to respond and the

⁷⁹ The reference is the city-gate price in the series compiled by the U. S. Energy Information Administration. Accessed on July 23, 2019 from <https://www.eia.gov/dnav/ng/hist/n3050us3m.htm>

⁸⁰ It seems that some firms in Mexico and perhaps in the U.S. closed as result of hikes (Tepeyac Glass Co). It can also be a coincidence that served the purpose of making pressure to obtain a more favourable pricing scheme from government (Baker 2001).

U.S. prepared to meet its demands via imports and unconventional production (EIA 2004: 39). Only weeks before the start of Fox's presidential term, Pemex had offered financing, grace periods and penalty waivers to its large customers (Baker 2001). As mentioned in chapter 5, Pemex only succeeded partially in persuading LDCs and industrials to contract coverage to hedge volatility risks (in 1997). During the late months of 2000, the exiting federal government also set up a task force to defend the netback pricing rules.



The report that the task force put together underscored that the legal framework in place since 1986 mandated Pemex to price natural gas in a way that reflected relevant competitive markets (see chapter 5 and Baker 2001). All throughout those months, the CRE had also publicly voiced the need to uphold the reference to the Texas prices.⁸¹ But pressure against the pricing system did not relent. Industrials wrote public letters in national newspapers and spoke to the media, requesting that the new government grant them some form of protection. The industrial associations called for the abolition or suspension of netback pricing pegged to the U.S. The mechanism had

⁸¹ "Descarta CRE subsidios al gas", *Reforma*, July 20, 2000, accessed online from www.reforma.com

conveniently reflected the low prices of the U.S. for most of its existence since 1995 but now was provoking pain. Some of the representatives of industrial users made their case by suggesting that natural gas had to be priced in a way that bolstered the competitiveness of whole supply chains. Some plainly called for lower prices on the (bogus) basis that costs of production of associated gas were negligible. One spokesperson of some mining firms went as far as claiming that the high prices of gas could compromise up to 700 thousand jobs; others warned that closures or migration of production capacity to Venezuela and other countries were imminent (Baker 2001).

Barely one month after taking office, V. Fox and his energy minister, Ernesto Martens, publicly stated their resolution to maintain the netback pricing rules in place, and to move ahead to increase domestic production.⁸² The president of the CRE, Héctor Olea, also defended the netback pricing rule and pointed out the necessity of opening imports from traders other than Pemex to supply the Monterrey area through the existing, Pemex-owned, pipelines and new, necessary, links.⁸³ Officials of the natural gas subsidiary of Pemex continued to defend the policies of the NOC, while reinstating that financing options existed to mitigate the volatility.⁸⁴

Something occurred in those days out of the public eye that commentators and interviewees refer as the working of privileged access of some business: *door-knob privilege* is the coined term. The Ministry of energy established a fixed cap to the price of natural gas sold by Pemex. Without legal capabilities to fend off the instruction, on February 13, 2001, the CRE approved Pemex's request to enter into domestic natural gas supply agreements for the period between January 1, 2001, and December 31, 2003, for pre-determined amounts at a fixed price of \$4 per MMBTU.

The measure, known as the 4 x 3 policy, was a total blow against the pretension of attracting any upstream competitions through imports (Lajous 2013; Grunstein 2011). And to make things worse, for more than a year after the subsidization started, the reference prices in the U.S. did not climb

⁸² Of note, Ernesto Martens, like Fox, built most of his career as a businessman. Moreover, for 17 years he was the CEO of Grupo Vitro, one of the biggest glass makers in the world (*Oil and Gas Journal*, November 24th, 2000. Accessed online at www.ogj.com on July 22 2019).

⁸³ CRE, 2000, “Versión estenográfica de la conferencia de prensa sobre la situación del gas natural”, September 26 2000.

⁸⁴ The wrangling about the parameters of the rule of pricing (market of reference, location of the balancing point (punto de arbitraje) and fixed prices or subsidies is a theme that continued until after the reform, although with different shapes at every stage.

much higher than the cap of \$4 MMBTU. Pemex was able to buffer part of the cost of the price controls through returns in the futures markets. By the end of 2003 the whole policy, which Pemex shouldered as a direct subsidy, had caused an estimated cost of around USD 90m: not a high tally, but at an enormously damaging cost against the restructuring policies (Lajous 2003). The subsidy precluded the entrance of gas competing against that of Pemex.

Separate to the issues of open-access, the rules of pricing in place since 1995 were a question of continuous controversy between Pemex, the regulatory agency and consumers. After the maximum prices ended in 2003, the netback pricing rule established by the CRE continued to raise discontent between Pemex and some industrial consumers because fluctuations in the American markets affected the parameters adopted in Mexico (chapter 5). The netback pricing worked through a reference to a hub in the United States (Henry Hub and Houston Ship Channel have alternated as markets of reference over the years). But the regional flows in the U.S. and the volumes of imports to Mexico changed over time, affecting the relevance of the chosen reference hubs. In subsequent years, as production, imports and demand changed, the geographical localization of the predetermined arbitrage point inside of Mexico would become another disputed issue (Lajous 2013; Brito and Rosellón 2010 b).

Pricing across the territory became patchier with the entrance of LNG with their specific long-term negotiated prices, with augmented land imports through new or revamped connections to the U.S. (Baja California and Chihuahua). Finally, the differential between the pricing of natural gas through land imports from different points in the U.S. and LNG cargoes complicated the definition of what a market of reference should be for the natural gas sold in Mexico. And, although that did not formally affect the rule applicable to the gas sold by Pemex, the disparity created pressure over regulatory processes as they existed (see below).

Open-access

As explained in chapter 5, two central instruments in the definition of the new regulatory system were the General Terms and Conditions for First-Hand Sales of Natural Gas (TyCVPM, is their acronym in Spanish), and the Bases of Coordination (a.k.a. *Chinese-wall* rules). The General

Terms and Conditions (GTS hereafter) organize the contracts between Pemex and its large consumer clients and LDCs. Specifically, these GTS enshrine principles of equality of treatment for all consumers. They also organize the modalities of payment and service of delivery (firm, interruptible and occasional basis, swing service, tunnel, volumetric), and the casuistry for defining responsibilities and liabilities of parties in the cases of non-compliance. Inherent to the GTS is the principle that what applies to Pemex applies to every other firm in the sector (and assumes that gas to gas competition occurs in the system, CRE 2005: 64).

The GTS make explicit the formal power of the CRE to cancel the license of Pemex as a consequence of a serious breach of regulatory decisions and principles (CRE 2000). On their part *Chinese-wall* rules followed the example of regulation issued by FERC to implement vertical separation in merchant pipelines (see chapter 3). The code mandated Pemex to effect the *strict* separation of administrative and accounting processes and personnel, so that its transportation and trading branches would not tamper with upstream competition or open-access procedures.

Neither these nor other directives forced Pemex to comply. According to interviewees, there did not seem to be an initial opposition of Pemex, through its natural gas subsidiary, against the implementation of the new open-access rules (in 1995). The transition to a so-called *permanent regime*, where open-access would be the operating principle, in essence, looked to change the nature of contracts between Pemex and its consumers and to provide the latter with more certainty. However, as the materialization of open-access approached, Pemex dithered in carrying out the internal reorganization to comply with it. As will be discussed below, IPPs would grow increasingly demanding that Pemex abided by the regulation that could make their consumption of natural gas more predictable.⁸⁵ (It is worth mentioning that the exchange of electricity producers and Pemex got a more formalized shape because, starting in 2002, the GTS applied to them, although that did not become a sufficient reason to materialize open-access and the arrival of independent traders).

In relation to industrial consumers, the reorganization of internal processes to contract transportation and molecules separately also became too difficult to implement. A sufficient

⁸⁵ “Demandan reglamentar gas natural”, *Reforma*, May 6, 2003, accessed on July 12, 2019 from www.reforma.com.

number of industrial users demanding to contract their gas separately from the transportation was critical to force change in Pemex. The perambulatory sections of some regulations or communications of the CRE openly highlight this Gordian knot (CRE 2007). As long as the CRE could not force Pemex and its clients to reorganize their exchange accordingly, the materialization of open-access stayed as an unfulfilled promise. In the end, none of the principles and rulings for third party access came into force until 2017. The CRE set out to convince industrial users about the importance of this matter, and to legally Pemex to make it comply. But recalcitrance prevailed, thanks to the factual control of the main transportation system and of all LDC, industrial and (almost all) IPP clients.

Liaisons dangereuses: trading and transporting Pemex's gas

All the private pipelines constructed before 2000 supplied electricity generation facilities, although they could also serve to interconnect to other systems or to serve LDCs and industrial users. Since 1995, policymakers, regulators and industry players had expectations that links could be developed without an anchor on electricity generation. The Palmillas-Toluca and the Palmillas-Bajío links were the only privately-owned systems not tied to a contract with the electricity SOEs or to IPPs. As all other pipelines, they supplied gas from Pemex.⁸⁶ The former section refers to a 127 km pipeline with a capacity of 3.2 BCFD that runs from a compression plant owned by Pemex in the central region of Mexico (state of Querétaro) to three industrial areas in the state of Mexico, also in the centre of the country.⁸⁷ For its part, Gasoducto del Bajío is a 200 km, 16-inch pipeline, running from one petrochemical complex of Pemex in Salamanca, Guanajuato, to Aguascalientes, serving a manufacturing region that started a boom with the automobile industry and NAFTA.

As mentioned, the high expectations about the Palmillas-Toluca pipeline were centred on the demand that a new distribution zone in the centre region of Mexico would emerge on its own. Interviewees underscored that the Palmillas-Toluca pipeline was going to be a hallmark because

⁸⁶ Comisión Reguladora de Energía, 1998, “La región de Bajío contará con gas natural”, Boletín de Prensa. “Authorities planning new gas-transport model to drive investment”, Business News Americas, 8 October 2007, Accessed through Factiva.

⁸⁷ This section was initially proposed by Shell and changed hands several times, in part because of the growing perception of risk that the project would entail.

it did not need any anchor from CFE. Gas Natural, the owner of the LDC, announced in 1997 that it would have 300 potential clients waiting for the pipeline and that plans were to get industrial consumers switching away from other fuels (and/or from Pemex).⁸⁸

Nevertheless, as the project moved on, optimism gave way to disappointment. The marketeering branch of Pemex joined the distribution firm to form a commercialization firm. It is important to note that the transportation firm obtained a special waiver of the CRE to participate in transportation and distribution and that distribution permits do not confer exclusivity to commercialize gas.⁸⁹ The joint venture, CH4, which inherited all the industrial clients of Pemex, reserved a disproportionate amount of capacity in the pipeline, thereby crowding it out and precluding other commercialization firms to use it.⁹⁰ The economic watchdog (CFC, Comisión Federal de Competencia) released a resolution against the concentration case in 2006.⁹¹ As a consequence of this concentration, no commercialization firms could establish in the region -- contracting natural gas from the LDC or directly from Pemex. The result was higher prices for all residential, commercial and industrial users alike, and the capabilities, for Pemex and the LDC, to restrict supply.⁹²

For its part, the Palmillas-Bajío pipeline (also mentioned in chapter 5) was about to go on stream when the natural gas subsidiary of Pemex announced, at the very last minute, that it would build a parallel pipeline to the same zone. Although the pipeline announced by Pemex was smaller, it would destroy the economic prospects of the TransCanada link. The consequences of these two small plots were, in short, that private transportation firms became very wary of entering into projects unless an anchor was granting that the infrastructure would create sufficient demand.

⁸⁸ “Gas Natural: retrasa instalación de ductos el desarrollo”, Reforma, November 21 2001, accessed via www.reforma.com.

⁸⁹ CRE, 2003, “Resolución RES-121-2003”.

⁹⁰ The exact proportion of the capacity that CH4 was erased from the available version of the resolution. Comisión Federal de Competencia, 2006, “Expediente CNT 61 2006”, Page 16.

⁹¹ A description of this case is in the watchdog resolution of 2006. Comisión Federal de Competencia, 2006, “Expediente No. CNT-61-2006”; CRE (2006); Chapter 4. By 2003, the LDC (Gas Natural) requested a waiver from the USD 25M penalty in case that the coverage of distribution did not grow as requested in the licence. See CRE, 2003, “Resolución 121-2003”.

⁹² Comisión Federal de Competencia, 2006: 2.

These two subcases add to the --perhaps most illustrative-- story of private supply in Monterrey. Since 1997, Midcon, an American energy infrastructure firm, had been publicly touting the construction of a link between Texas and Monterrey, to complement the existing links and to bring gas competing to that produced or imported by Pemex. The firm got the trading permission from the CRE, but KinderMorgan shelved it after acquiring Midcon's rights.⁹³ Pemex ended up building the pipeline to the complacency of the industrial users.⁹⁴ Pemex, again, is not only a multifarious enterprise but also a champion of several constituencies across the Mexican economy. This subcase shows that even when industrial demand justified a new link, the inertia of the old system could frustrate new infrastructure and the development of independent suppliers.

Running short of options. The disarray of partial liberalisation and the build-up towards crises of supply

It was during this period that the momentum for the growth of residential and commercial demand came to a sudden halt. The CRE had organized bids for 16 new LDCs between 1996 and 2001, but no new LDCs were granted after that, for almost a whole decade.⁹⁵ The culprits of this situation were high prices of natural gas, relative to those of subsidized LPG. As explained in chapter 5, this latter fuel also counted with strong sponsors that opposed the diffusion of natural gas. The tactics against natural gas were varied, from dispersing false information about the perils of land distribution networks on seismic terrains to sabotaging the local government decisions that favoured the entrance of natural gas (MEI 2013). In 2014, LPG still represented the main fuel for 76 percent of domestic consumers (Cazorla 2017).⁹⁶

⁹³ "North Mexico industry may import gas in 1997", Reuters, November 5 1996, accessed online via Factiva. October 19, 2019; Anthony Harrup, "Mexican Gas Discount Underscores Lack Of Competition", Dow Jones Newswires, August 2, 2000, accessed via Factiva.

⁹⁴ David Shields, "Interview with Francisco Salazar. President of the Energy Regulatory Commission", Mexico Energy Intelligence, December 1, 2013. Accessed from Factiva.

⁹⁵ There were no bidders for the last LDC tendered by the CRE in 2002 (the coastal city of Veracruz). Ronald Buchanan, "Mexico set to resume gas utility concessions", Platts Oilgram News, October 17th 2011. Accessed from Factiva.

⁹⁶ Biomass is still today a widely used fuel. It represented 20 percent of domestic energy supply in 2014 (Cazorla 2017).

The CRE could not do more than it was doing already (especially after suffering a considerable cut in its budget in 2004).⁹⁷ It is worth of note that the sectoral regulator was legally incapable, before 2014, of obtaining revenue through fees paid by the regulated firms.⁹⁸ In 2005, the head of the CRE, D. Pérez-Jácome, was publicly voicing the need to strengthen the legal capabilities of the regulatory agency to fulfil its duties as an economic regulator. These demands found support among the part of the administrative and policy-making elite (OECD 2007: 128). Mr. Pérez-Jácome continued to press publicly for the overhaul of the legal mandate and the organizational capabilities of the agency for the rest of his tenure, which ended in 2005.⁹⁹

By 2005, natural gas seemed to have lost the appeal it had a decade earlier. The prospects of a structural supply deficit growing all across North America were the visible and overriding part of the policy problem. Prices reached the highest watermark levels after the disruptions of production brought about by Hurricane Katrina in August 2005 (chart 6.1).¹⁰⁰ At 354 BCFD in a month (15% of its total consumption), natural gas imports from Canada in the U.S. were also about to hit an all-time record in December 2005 and another two years later (the highest thus far).¹⁰¹ With import duties already abolished in Mexico and a U.S. government eager to increase cooperation to intensify energy trade, the likelihood of deeper integration seemed more plausible than ever (Salazar 2007; NAEWG 2005). Through the Energy Policy Act, passed in 2005, the U.S. accelerated steps to secure its own supply and to mitigate volatility through more imports.¹⁰²

Nevertheless, for all the possibilities of integration through free trade institutions, risks associated with national energy security loomed more visibly than they had in decades in the U.S. As one

⁹⁷ The CRE had a budget of around MXN \$186 m for the year 2000, and 144m for 2004. In that same period, personnel reduced more than 10 percent. José Vela, “Demanda CRE poder sobre Pemex y CFE”, *Reforma*, August 31, 2004, Accessed via www.reforma.com

⁹⁸ According to the head of the CRE, the sectoral regulator should have been legally capable to determine electricity rates and verify terms and conditions of service of electricity supply. “Demanda CRE poder sobre Pemex y CFE”, *Reforma*, August 31 2004. accessed online at www.reforma.com.

⁹⁹ *Reforma*, July 25, 2005.

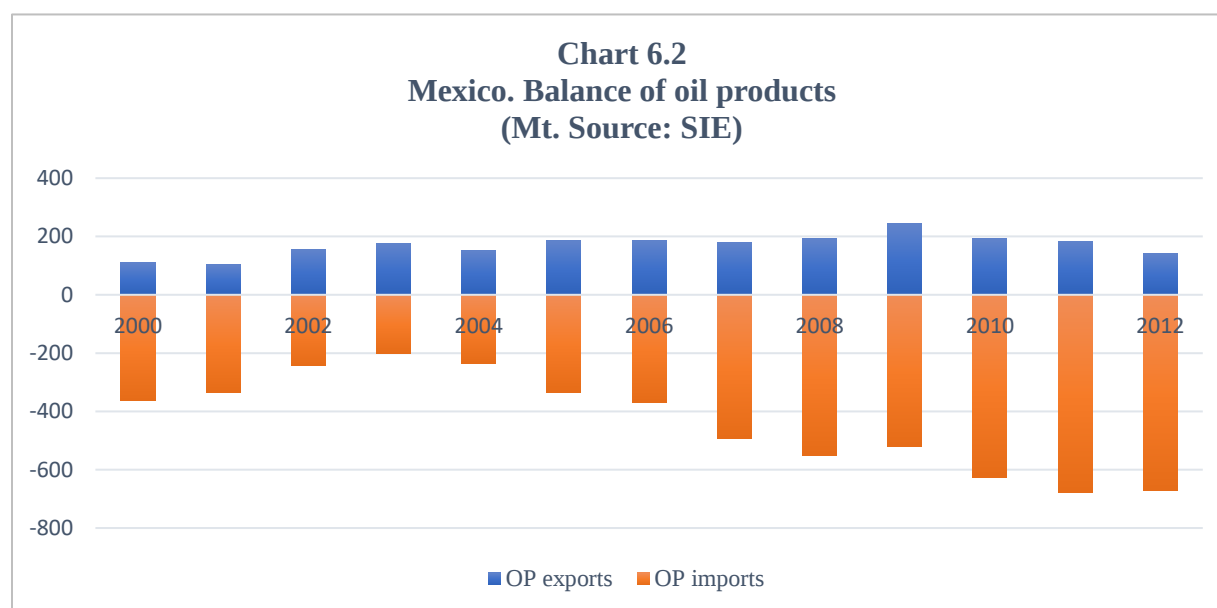
¹⁰⁰ Production recovered only until May 2019. For two months, production diminished in levels of around 12 percent after the hurricane. “Hurricane impact on natural gas could lessen amid evolving US production landscape”, *S&P Global/Platts*, accessed on July 22 2019 from <https://blogs.platts.com/2018/06/01/hurricane-us-natural-gas-evolving-production-landscape-060118/>

¹⁰¹ U.S. imported 372 BCFD in December 2007. Source: <https://www.eia.gov/dnav/ng/hist/n9102cn2m.htm>

¹⁰² The EPA of 2005 included provisions to speed up the regulatory processes over LNG and storage facilities (construction and definition of market-based rates. FERC 2005).

specialist recalled, inadvertently, the new IPPs and CFE-owned gas-powered plants had become a national vulnerability, subject to geopolitical risks and potential blockades from the U.S. One precedent existed already in the post-liberalisation era, when exports to one electricity plant in Baja California were interrupted amidst the crisis that was hitting California.¹⁰³

By the mid-2000s, the production outlook in Mexico called for a more balanced mix of fuels. Natural gas did not seem to augur affordability and security in the long term. Domestic production did not reach the levels expected by the start of the decade. The modalities of surrogate (private) production of non-associated gas through so-called multiple services contracts (CSM) became effective in 2004 and they would bring about partial and moderate success that could not keep up with the expected increase in demand. As for oil, the largest conventional oil field in Mexico (Cantarell) had reached a peak in 2005 (see charts 6.2 and 6.3). Other conventional fields were serving as complements, but they required more technology and capital to produce. Higher costs of investment and operation in new and less accessible fields continued to complicate the finances of Pemex. Due to its taxation structure, the NOC could not reap the benefits of high oil prices to shore off these problems, either. Mexico was bound to stay as a net and large importer of oil products and natural gas, despite its geological resources (charts 6.3 and 6.4).



¹⁰³ David Shields, “Se acabó la moda de gas natural”, *Reforma*, March 29, 2005. From www.reforma.com.

Chart 6.3 Balance of natural gas (Mexico)
(2000-2012. MMCFD. Source: SIE)

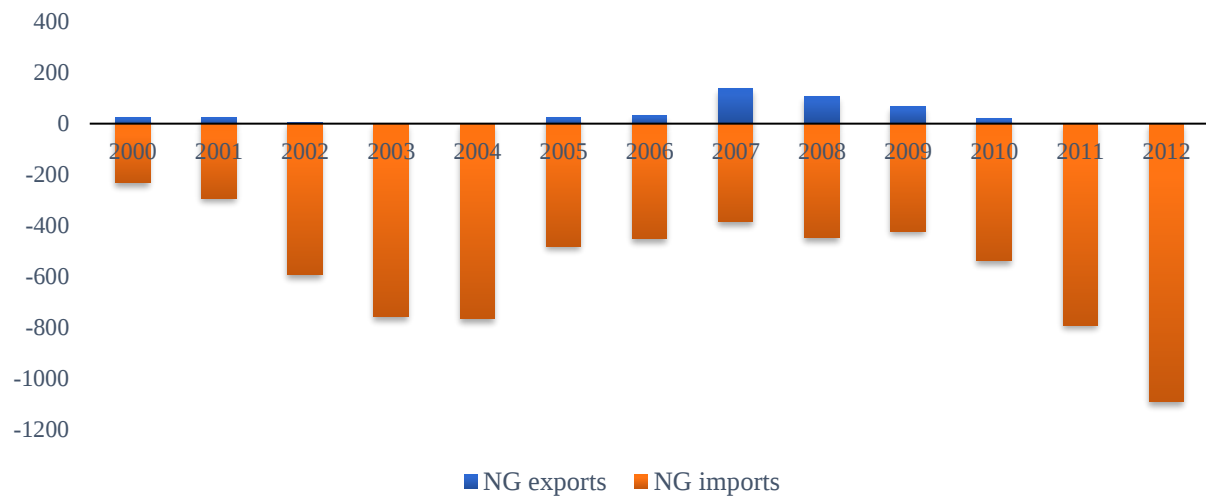


Chart 6.4 Associated and non-associated gas (Mexico)
MMCFD

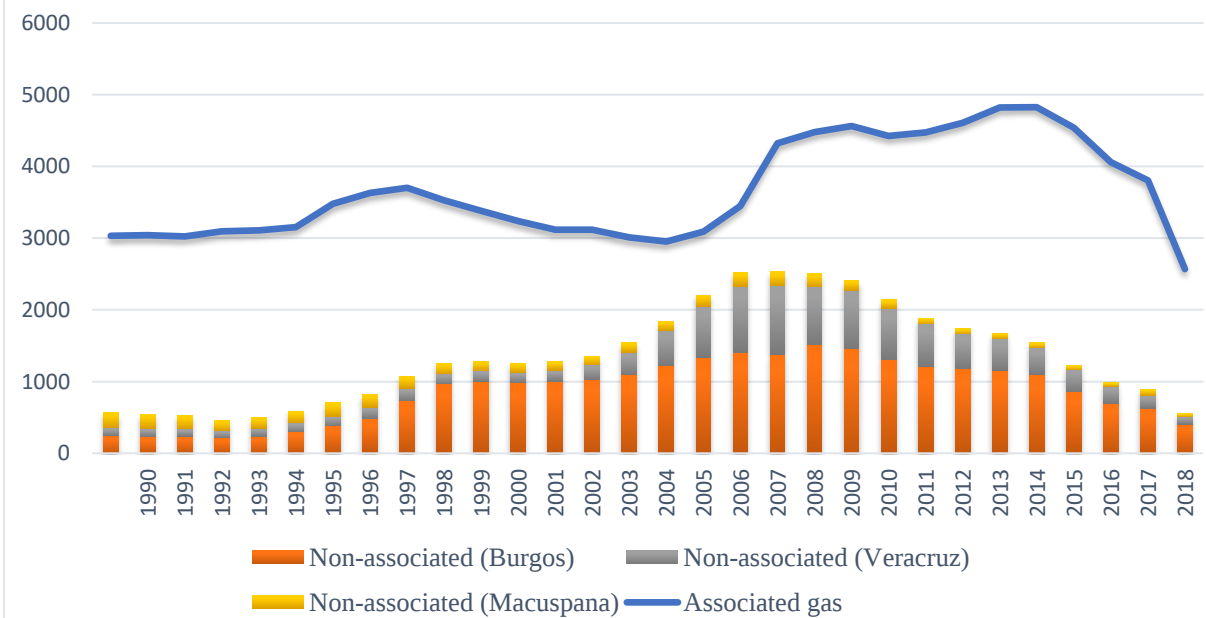


Table 6.1. Industrial use of oil products and electricity (petajoules)						
	1990	1995	2000	2005	2010	2015
LPG	15	17	42	38	44	42
Diesel	42	30	49	50	51	75
Fuel oil	276	262	195	133	56	22
Natural gas	453	494	458	446	488	609
Electricity	185	224	334	430	478	540
Source: SIE 2019. Balance Nacional de Energía: Consumo de energía en el sector industrial						

Supply insecurity and incremental change (2007 to 2012)

A new national government came into office in December 2006, troubled from the start by a contentious electoral process and a very narrow victory of the presidential candidate: F. Calderón, also of the centrist-right PAN (the party of V. Fox). The government of Calderón was motivated to push forward an ambitious energy agenda. He appointed three of the energy cadres of the PRI administration (1994-2000) that started the reform of the natural gas sector. J. Reyes Heróles, minister of energy between 1995 and 1997, became the CEO of Pemex. Luiz Tellez, also an energy minister of Zedillo (1997-1999), was appointed minister of transportation and communications. A. Elías Ayub stayed, for the *second* consecutive time, as the CEO of CFE. Furthermore, Calderón, a former congressman and Minister of Energy, set out to promote a reform that could ease the flow of capital and technology to the production of hydrocarbons and electricity.

The government promoted reforms to the energy sector in a couple of legislative cycles. The reform of 2007 followed other incremental change of 2005, both with the dominant interest of relieving some financial pressure from Pemex and enabling it to bring up production levels and reserves. As was the case of the previous administrations, from the start of the legislative cycle the reformist efforts considered a delicate compromise between the financial needs of Pemex, and the public budget (Elizondo 2011; Rousseau 2010). These legislative changes affecting Pemex were moderate, although they had some effects on the production outlook of non-associated gas (Lajous 2007).

In the reform of 2008, the government set out more ambitious goals to strengthen the autonomy of Pemex and to facilitate access to capital and technology. This time, in the negotiation of the

initiatives, the government sought to divide and placate the opposition in the left and center by involving part of the PRI before presenting the initiative in the Senate. That move aimed for a quick discussion almost resembling a blitz (Elizondo 2011). The result did not go well and the initiative provoked an almost theatrical occupation of the floor by the largest left party, the PRD, which demanded a long period of discussion, involving all voices in society.

A series of open debates (fora) ensued. And, as commendable a deliberation as they can be, the legislative outcome was a much-watered down reform in comparison to the initiative (Elizondo 2011).

The emphasis of the final legislation (and also that of the discussions) was on Pemex and specifically on production. The question of land imports from the U.S. was not central. The onus of discussion stayed on the upstream segment of the industries, and the attention on energy security centred on the whole mixture of fuels and LNG imports (see below). Skimming discussions in Congress and media reports leaves the impression that the CRE had given up on the purpose of forcing Pemex to comply with third-party access. Asymmetric regulation was mentioned and discussed, but it did not take the central place that it would acquire after the reform of 2013.

This second cycle of legislation in 2008 produced innovations for the sectoral regulator. In a move that anticipated the opening of the production of petroleum to the private sector, the reform also created a national regulator for the production of hydrocarbons (Comisión Nacional de Hidrocarburos). Legal changes also expanded and strengthened the autonomy of the CRE, and it also got capabilities to integrate systems of transportation (a precedent of the centralization in an IPSO) and to regulate storage. The reform also enabled the CRE to regulate the distribution of all fuels, including renewables, and to regulate the price of fuel-oil (Salazar 2009; Jimenez and Ortega 2008). Albeit the CRE did not wield decisive power against the oil and gas upstream monopoly and could not affect subsidies, the legal reforms helped its organizational maturation.¹⁰⁴ Further changes to the Law of the CRE during this period (2011) cemented its political independence by giving the Senate the faculty to appoint the board of the regulatory agency.

¹⁰⁴ The reform of 2008 did not fulfil the long-held expectation that the CRE could determine electricity rates (Salazar 2009). Alberto Aguilar, “Falta de recursos y atribuciones limitan a la CRE para empujar más en electricidad y gas”, *Reforma*, November 17, 2005, accessed on July 22, 2019 from www.reforma.com.

By the mid-term elections of 2009, the national administration had found the limits of what it could expect at the legislative level, and the poor performance of the party of the incumbent did not leave high hopes for more ambitious change. The economic context --with the Great Recession and a sanitary outbreak (H1N1 flu) hitting in the middle of that administration-- was one of extremes. As noted above, prices of natural gas in North America were at all times high in 2007. Henry Hub prices were around 6.5 USD/MBTU. Prices surpassed the average 5 USD/MBTU mark in all months between January 2004 and January 2009, the month when the production of shale gas started to grow meaningfully in the U.S (EIA 2017). Oil prices, more directly related to the global economy, also reached first-ever historical peaks just before the recession in the United States: falling from 145 to 34 USD per barrel between July and December 2008 (EIA 2017 b).

The above-mentioned parameters show that the start and end of the administration of Felipe Calderón (2006-2012) faced diametrically different international and regional energy security conditions. The key development of the period inside Mexico was the steady rise in demand for natural gas, in spite of the volatility of prices. The increase of demand was almost exclusively attributable to electricity generation. Most new IPPs used natural gas and CFE had started to convert fuel-oil powered generators to natural gas. Between 2002 and 2010, combined cycle technology grew more than 140 percent, representing 34 percent of the whole mix of electricity generation (see table 6. 2). Against this rapid increase of demand, the interconnections facilitating the flow of domestic and foreign gas resulted insufficient. The system of transportation experienced bottlenecks both at the level of large land and maritime injections, and, as importantly, in the more regional and local derivations of the network. The volume of transported gas increased by 42 percent since 1999, and in a critical section (Estación 19-San Fernando) it increased 128 percent. The average uptime (a measure that refers to the percentage of time that a system operates safely at its highest level of performance) was at a historical high of 78 percent for all the system and 100 percent for a third of the strategic sections in the system (CRE 2007b: 2). By 2012, economic losses attributable to shortages only for that year would take a toll of more than USD 1 bn (SENER 2013).

To make things worse, in July 2007 the EPR (Ejército Popular Revolucionario), a small guerrilla group with a very spotty presence in the centre and south of the country, detonated explosives in

at least a dozen oil, natural gas and petroleum liquids pipelines.¹⁰⁵ The pressure at which some sections of the natural gas system were working was already very high. And the additional losses due to the terrorist attacks increased this pressure further and brought some areas of the system of transportation into greater risk of an accident. Energy security would start to take a more pressing and central relevance in the policy space.¹⁰⁶

Table 6.2 Demand of fossil fuels for power generation (CFE and IPPs)			
Thousand barrels of oil equivalent per day			
	2005	2010	2014
Total	713.4	737.9	775.4
- CFE	554.8	474.4	476.6
- IPPs	158.6	263.5	298.8
Coal (only CFE)	129.0	127.1	129.0
Fuel-oil (only CFE)	288.5	168.1	121.3
Diesel	6.0	6.2	7.3
- CFE	5.7	6.2	6.8
- IPPs	0.3	0.0	0.6
Natural gas	289.9	436.5	517.8
- CFE	131.6	173.1	219.5
- IPPs	158.4	263.5	298.3
Figures for CFE in the year 2005 also include consumption of CLFC, the regional State-owned electricity monopoly that disappeared in 2009.			
Source: Sistema de Información Energética. Available from www.sie.gob.mx			

LNG, IPPs and the role of CFE tackling insecurity of supply

Before reviewing the responses of policy and regulation to the dilemmas of energy security that surfaced in 2007 it is important to look at the question of reliability of supply for power generation. The supply dilemmas facing the IPPs offer a good starting point to appreciate the decisions of the SOEs in this long 12-year period. In June 2003, the Ministry of Energy issued a directive to make

¹⁰⁵ L. Adams, “Attacks on Mexican gas pipeline force factories, businesses to temporarily shut down”, *Associated Press*, July 11, 2007, accessed via Factiva.

¹⁰⁶ The merge of the two electricity SOEs that occurred in that year came as an executive response to an already long and contentious confrontation with the union of *Compañía de Luz y Fuerza del Centro* (CLyFC), the SOE that distributed electricity in Mexico City and some neighboring states. The federal government decided to dismantle the company and merge its assets with those of CFE, which became the only electricity SOE thereafter. By the time of the merge, CFE controlled 51.4 GW of installed capacity against 1.3 GW of CLyFC. *Global Power Review*, 2011, Accessed through ProQuest documents.

CFE the guarantor of supply for IPPs, through the equivalent of tolling agreements. This directive implied that CFE would deal directly with Pemex to shoulder the risks of supplying existing and new IPPs with natural gas. According to the measure, CFE would not only buy the power sold by the IPPs through its PPA contracts but also the not utilized fuel (what is also known as a tolling agreement). Prior to this date, the few existing IPPs on stream had to buy their fuel from Pemex while separately negotiating their offtake contracts to supply power to CFE.¹⁰⁷ Only a couple of IPPs could obtain gas from LNG or land imports separate from Pemex.

As the previous chapter explained, the potential mismatch between supply of fuel and purchase of electricity created risks, and there were no institutions in place to remediate them. Prior to the entrance of private electricity producers, CFE and Pemex dealt with one another through mechanisms that are hard to document and most likely suffered from poor formality. In 2002, the GTS that could not operate for all other users in their trade with Pemex took effect in the exchange of the NOC with CFE and IPPs (CRE 2002).¹⁰⁸ The practicalities of this relationship, however, left much to desire. IPPs were “caught as in a sandwich” between the --framed but ultimately unpredictable-- demand of the electricity system managed by CFE, and the --also not very reliable-- supply of Pemex. Pemex also charged a financial penalty to IPPs not taking all the contracted fuels.¹⁰⁹

By making CFE the guarantor of natural gas, the ministerial decision of 2003 intended to favour investment for new capacity of IPPs. However, according to some observers at the time, the decision also buried the prospects of developing such market-oriented solutions: that is, of creating pressure towards crystallizing open-access regulation and competition in supply. Enthusiasts of upstream competition expected that the emergence of a new constituency could increase pressure to materialize open-access rules and enable the entrance of new suppliers. However, after CFE was formally put in charge of securing fuel, IPPs were content to pass the buck.¹¹⁰

¹⁰⁷ E. Nothorpe, *supra*, note 63.

¹⁰⁸ CRE, 2002, “Info-CRE: Comenzó el régimen definitivo de ventas de primera mano de gas natural para los productores externos de Energía” and “Resolución /11/2001, accessed from www.cre.gob.mx

¹⁰⁹ “Official: IPPs sandwiched between Pemex and CFE”, *Business News Americas*, July 6 2004, Accessed via Factiva.

¹¹⁰ “Genera polémica contrato con CFE”, *Reforma*, June 24 2004, accessed online via Factiva on November 16 2018. “Atrae a más empresas nuevas reglas de CFE”, *Reforma*, June 7, 2004, accessed online via Factiva on November 16, 2018.

That said, perhaps the most transcending consequence of the obligation of CFE to guarantee supply to IPPs was that it led the electricity SOE to pursue a more aggressive strategy to secure its sources of natural gas. Even if the ministerial decision finally did not materialize, as CCGT and other converted plants multiplied across the territory, natural gas had become, obviously, a strategic matter for CFE. Fuel insecurity, therefore, became a source of concern and driver of policy that put CFE at the centre of natural gas policy.

CFE, therefore, emerged as the viable solution to anchor investments in transportation infrastructure. First, the high prices in North America favoured an increase in imports via LNG tankers. These projects were planned to supply already existing combined-cycle power plants owned by CFE and by IPPs. Although no new IPP-owned CCGT plants were built between 2005 and 2010, generation relied more on the existing CCGT plants and drove the demand for natural gas, especially in the industrial northeast region. Between 1995 and 2005, the share of gas-powered generation tripled (table 6.3).

Table 6.3 Combined cycle (ng) increase and share of power generation capacity (2002-2010)		
	Change 2002-2010	Generation capacity (GW)
Total	+145.4%	18
CFE	+58.9%	6
IPPs	+240.7%	12
Total generation capacity (all fuels) ¹¹¹		52.9 GW

As to securing supply, since 2003, CFE auctioned an LNG regasification facility in Altamira, the coast in the Gulf of Mexico. The project was entirely built and operated by Shell and started operations in October 2006 with an average of 80 MCFD (SIE 2017).¹¹² Although Shell partnered with other firms, it kept control of the whole project, which bundled everything, from overseas production in Nigeria, maritime transportation in its tankers, regasification and transportation via

¹¹¹ Data from SIE (Sistema de Información Energética), 2017.

¹¹² Sistema de Información Energética, 2017, “Comercio exterior de gas natural por punto de interconexión”, available at www.sie.gob.mx

pipeline to the system operated by Pemex and to three combined cycle plants (490 MW) in a neighbouring area.¹¹³ The 15 year *take-or-pay* contract established a supply of 500 MMCFD at a price pegged to the Henry Hub LNG index plus a fixed quantity.¹¹⁴ The pricing rule allowed CFE to make a slight saving in comparison to prices of domestic and imported gas sold by Pemex.

When the project went on stream, critics argued that CFE should have negotiated a long-term contract at a fixed and lower price, but high prices in the U.S. at the time reduced the leverage of CFE in that respect. The resulting contract left CFE exposed to variations of price, but a realistic prognosis did not estimate that these would go much higher than the peaks experienced in 2005 – after hurricane Katrina. In fact, they only surpassed the 7 dollars threshold for the year between August 2007 and August 2008 (EIA 2017c). Nobody could have foreseen that prices in North America might drop significantly, least to say that they would stay very low for an extended period of time.

By the time that CFE started receiving its first cargoes in the Gulf of Mexico (October 2006), the SOE was already promoting another LNG regasification facility in the Pacific, at relatively close distance from the centre, where industrial and CCGT use had been mounting (Manzanillo , see Map 6.1). This time CFE issued separate tenders for the construction and operation of the regasification plant. CFE also anchored the pipeline serving a converted plant in the town of Manzanillo and running eastwards, towards the Guadalajara region, to serve new CCGT plants. It also negotiated a long-term supply contract separately, with a more advantageous pricing rule tied to international prices, for LNG supplied by Repsol-YPF from Peru.¹¹⁵ This LNG regasification terminal started operations in 2012 (SENER 2016: 41).

In the view of one official that participated in this research, the separation of contracts in Manzanillo proved to be the right strategy to hedge price volatility and the risks associated with it. In turn, the ownership and financial scheme of Altamira turned into a painful lesson for CFE.

¹¹³ The plants are Tuxpan V (IPP 490 MW), Altamira V (Iberdrola, 1.2 GW) and Tamazunchale (Iberdrola, 1.13 GW) “Mexico’s LNG Debut”, World Gas Intelligence, 19 July 2006, accessed from Factiva.

¹¹⁴ 0.36 per MMBTU. See “CFE to save US \$5mn/yr buying gas from Altamira terminal”, Business News Americas, 8 February 2006, accessed via Factiva.

¹¹⁵ “Manzanillo LNG: your move Pemex”, Project Finance, October 19th 2009, accessed via Factiva.

When prices rocketed in Asia due to Chinese demand and the (temporary) turning away of Japan from nuclear energy, Shell started to deliver much less gas and pay the corresponding penalisation for its deliveries in the Gulf of Mexico. As mentioned above, the pricing of that LNG gas was tied to Henry Hub, and due to the abundance of shale gas, prices were hovering the \$4 per MMBTU. The improbable happened. CFE had to renegotiate the supply contracts in order to keep the gas flowing, at much higher prices than Henry Hub. According to one interviewee in CFE, this experience was the last drop in the bucket of patience of the SOE. It triggered CFE's appetite to enter commercialization of natural gas in a more substantial form that could offer levers to protect itself from contingencies such as this one.

It should be mentioned that a third LNG facility in Baja California, south of Tijuana, started operations in 2008. This LNG regasification terminal was totally planned and owned by Sempra, with the prospect of supplying CFE and California --in the U.S. Sempra signed a 20- year contract with BP and Tangguh to import LNG from Indonesia. Pricing of the natural gas sold to CFE was pegged to the spot market in California. The importing facility has a capacity of 1BCFD, but the low prices in the U.S. have also contributed to the diversion of flows.¹¹⁶ The facility has not been utilized at its full capacity (see Table 6.4).

Table 6. 4 Imports. Volume and port of entry (mcf/d)¹¹⁷			
	2005	2010	2014
Total imports	905.5	1,458.9	2,861.1
Via pipeline	905.5	911.8	2,004.8
Pemex	480.4	535.7	1,250.4
CFE and IPPs	280.5	261.7	419.6
Private firms	144.6	114.4	334.8
LNG Imports	0.0	547.1	856.3
Pemex (Manzanillo)	0.0	0.0	107.4
CFE and IPPs (Manzanillo and Altamira)	0.0	351.0	715.2
Private imports (Ensenada)	0.0	196.1	33.6
Exports	23.9	83.3	12.5
Pemex (all through Reynosa)	23.9	19.3	4.1
Private exports (all from BC)	0.0	64.0	8.4

¹¹⁶ Joshua Starnes, "Obstacles remain for LNG deliveries to Mexico's Costa Azul import terminal", Platts Inside F.E.R.C., March 15th 2010. Accessed via Factiva.

¹¹⁷ Sistema de Información Energética, cit supra at 113

One final aspect of the nascent priorities of CFE relates directly to regulation. By the end of the decade, through the persuasion of the sectorial regulator, CFE started to match its plans to build or convert natural gas power facilities in a way that also drove the creation of new distribution zones. The mentioned LNG regasification facility in Manzanillo is one of the most salient examples, because the plans for import sought to expand access to the large metropolitan area of Guadalajara *via the western coast*. Also, supply to CCGT plants serving the metropolitan and industrial area of Morelos intended to create synergies by supporting the creation of new distribution zones (CRE 2012 and interviews). This small-scale policy of persuasion departed from the previous approach of CFE, which only sought to convert or build new plants where infrastructure to transport natural gas was already available. In sum, CFE was covering larger regions with transportation sections anchored by IPPs or CFE investments. Importantly, the new price trends at the end of the decade renewed the potential of LDCs (IDB-SENER 2018).¹¹⁸ Finally, this new rationale of siting, championed by the CRE, managed to persuade CFE to place facilities in the Pacific north coast, where new demand for natural gas could flourish better.

Shortages and regulatory adjustments at the end of the decade

This last section of the chapter reviews the three flanks in which regulators, the SOEs and policy makers responded to the shortages that reached critical levels after 2007. All of these can be considered incremental, because they still existed within the limits of the framework of partial liberalisation and, moreover, because they did not correct the structural problems affecting the sector (chiefly the failure to implement open-access).

Regulatory adjustments comprised, hence, the overhaul of the system of transportation by means of a restructure of the system of tariffs and a concentration of the operation of several private links in the hands of Pemex. Once cheap U.S. natural gas became part of the long-term prospects of the continent, the federal government and the SOEs embarked on ambitious plans of pipeline transportation using land imports. These plans also revealed the resources, styles and priorities of the SOE and the NOC: one seeking to secure its own supply and the other to preserve its domestic

¹¹⁸ Ronald Buchanan, *supra* note 95.

market. Finally, the sectoral regulator also had to find a way to distribute extra costs for operating with more complex conditions of demand and a large differential of prices and volumes in supply.

The shift to *rolled-in* tariffs and integrated systems was the first regulatory innovation, centred on solving bottlenecks and favouring the expansion of links. Acknowledging the lack of a more propitious policy environment (persistence of subsidies) the goal was to use regulation to promote a more rapid development of the infrastructure of transportation. Since the 1990s, COSR (Cost of Service Regulation), also referred to as incremental tariffs, had been the choice of default by the regulatory agency. As it has been explained in Chapter 2, the incremental system of tariffs implies that each new section pays a different toll, independent of other sections. The cumulative result of incremental tariffs for consumers is that the total fees paid for each transportation route become a combination of different vintage tariffs (one for each section). As explained in chapter 3, incremental tariffs also are more compatible with pipeline-to-pipeline competition, but pipeline-to-pipeline competition makes more sense in regions or jurisdictions where a robust network exists already and can offer alternative routes between two points. That was not the case of Mexico.

Implementing rolled-in tariffs implied a departure from the COSR model. The new model utilized the part of the existing system that was already depreciated as a lever to finance new expansions. This adjustment tackled the problem that the relatively high cost of new sections discriminated users of private transportation systems from those that directly and uniquely used the system operated by Pemex, which had depreciated already (Salazar and Cazorla 2011: 18). The European systems were the model this time, and particularly Spain. Regulators had recognized the virtues of emulating that latter jurisdiction because its initial conditions were similar to those of Mexico: low penetration and a small network. With rolled-in tariffs also came the possibility of creating an IPSO in the near future (Lajous 2013).

Hence, in 2010, Pemex took control of a system in the northern region of the Gulf (Gasoductos de Tamaulipas), bordering with Texas (Reynosa). Under the new rules, Pemex collected all tariffs and paid their recovery to the owners of the links, but it operated the integrated system. By 2011 another set of pipelines (Gasoductos del Bajío) merged with the system managed by Pemex (Salazar and Cazorla 2011: 20). (By 2016 the IPSO took control of all the former assets of Pemex. The momentum for change towards a centralized system came from the over-encompassing

reforms that were passed in 2013 and 2014, and in 2019 CFE started to tout that it might *opt in* by joining with the systems that it anchored since 2012. See chapter 7).

The CRE made new adjustments to the open-access regulation but the circumstances of shortages gave grounds to the objections of Pemex against implementing these open-access principles. CRE had no alternative but to agree to the objections of Pemex (CRE 2012: 26). That was the greatest shortcoming of the new rules. There were also other downsides. For a start, rolled-in tariffs are overall higher than incremental tariffs and although there are fewer operators to oversee, the regulatory burden itself is greater than it is expected to be under the more *off hands* paradigm. However, the most notable inconvenience of integrating systems is that centralization can be handy to political decision-making but detrimental to the welfare maximization criteria advocated by regulatory agencies (Salazar and Cazorla 2011). In summary, the decision to shift from a system of incremental tariffs to one of systemic tariffs would have disadvantages against an ideal framework designed to maximize efficiencies. But the rolled in tariffs system was, in fact, more adequate to the historical conditions of the system and to the imperative need to attract investment to produce a faster expansion. As officials that participated in these adjustments have said: there was no optimal solution, and that was all the more a reason why regulation was necessary.¹¹⁹

The other flank of responses to the crisis of supply (shortages) consisted in building new infrastructure for land transportation: reaching out for more gas from the continent through new pipelines that the national government or the SOEs, more directly, would anchor. By contrast to the adjustments that sought integration at the regional level, here the solutions had a *big artery* rationale and in the case of Pemex, a centralized and very discretionary basis for decision. Also, Pemex partnered with private operators, and not directly but through second and third-tier companies that circumvented accountability (as it had been the case with other pipelines and projects. Escamilla 2015).

The project envisioned a natural gas pipeline of around 1200 kilometres, 48 inches in diameter and 2.1 BCFD of capacity, running from Agua Dulce, Texas – in the vicinity of the producing fields in Eagle Pass—to Los Ramones, in the industrial state of Nuevo Leon and, from there, to the

¹¹⁹ Prud'homme, *supra* at 29.

nascent industrial parks in the Bajío region.¹²⁰ The construction of the pipeline was divided into two sections. One, from the importing point in the border with Texas and south to Los Ramones in Nuevo Leon was developed in partnership with IENova (a unit of Sempra Energy). The second section, to Apaseo el Alto, Guanajuato (42 inch-diameter with 1.43 BCFD capacity) was further divided into two different sections, one running to Guanajuato and the other running to Aguascalientes and developed through similar partnerships through firms controlled by Pemex. The section running to Nuevo León went on stream in December 2014, and the other two sections went on stream in 2016.¹²¹

As mentioned, what made the project all the more questionable, from the standpoint of regulation and restructuring was the discretion that Pemex displayed when deciding about it. The decision-making process obviated procedures of consultation to gauge demand regionally and granted the projects to firms controlled by Pemex, securing that the NOC kept operational control of the new infrastructure, hence obstructing once again plans for vertical separation.

Starting in 2011, CFE also bid a set of new pipelines, running (in the United States) from Waha (Texas) to two points on the border, and from there running east to west to Sásabe, in México and southwards along the Pacific coast to Mazatlán. Sempra and TransCanada won two and one bids, respectively (see map 6.1).¹²² Observers of the processes pointed out that CFE had been more diligent by allowing third parties to oversee the tenders, while Pemex decided to execute the project itself, harming the accountability and transparency that should exist in all projects.¹²³

Some specialists observing the possibilities of upstream competition criticized the decisions to boost infrastructure through contracts anchored by CFE and Pemex. "Mexico is just continuing the government monopoly, and the whole vision of 1995 of having a market driven economy in gas pipelines and gas pipeline infrastructure is getting delayed another generation", observed one

¹²⁰ Specifically: Apaseo el alto (see map 6.1).

¹²¹ Pemex has been selling its stakes in the pipeline since 2015. M. Brain, "COFECE authorises IENova's acquisition of Pemex's stake in duct". *Esmerk Latin American News*, November 12, 2017, Accessed via Factiva on October 19, 2019.

¹²² "Mexico's state oil and power commission each pursuing gas pipeline projects", *Platts Commodity News*, November 1, 2012, accessed online via Factiva on October 19, 2019.

¹²³ Although Pemex was not in breach of the law, the way that Ramones got decided rose justified criticism. By contrast, the Mexican chapter of Transparency International oversaw the biddings for the links sponsored by CFE.

specialist to a trade journal.¹²⁴ More moderately, the head of the CRE admitted in an interview that electricity started to serve as an anchor of the system for the reason that industrial use cannot anchor all projects.¹²⁵ In sum, against issues of such pressing importance, the sectoral regulator had to accept reality, adjust and accommodate.

The third flank of adjustments to the supply crises related to the distribution of costs for extra LNG cargoes while land imports were still insufficient. Here regulators had to stretch their role, with the acquiescence of the rest of the parties. In 2012 the regulator proposed a *balancing adjustment* charge as a way of distributing the (much higher) costs of LNG among all the users of the system, regardless of their location and of whether Pemex (or CFE) supplied them with domestic or imported gas (CRE 2013 and 2012). During these critical years, LNG coming in from the Pacific coast permitted CFE to convert or substitute natural gas for coal and fuel-oil generation capacity. LNG was equally important to maintain pressure inside the system of transportation, given the decrease of the output of Pemex in the south.

It might be worth highlighting how much the balancing charge represented the culmination of the (anti) open-access saga. The failure in the implementation of open-access was one of the root problems of the crisis. At the same time, spreading costs among all users independent of their supplier and modality of contract implied that open-access would not be effective in the near term.

Although public discrepancies were confronting the SOEs, large consumers (IPPs) and CRE, the measure seemed unavoidable. The CRE proposed the balancing adjustment as an *ad hoc* measure with the purpose of distributing the higher costs of LNG relative to US prices. Pemex would be in charge of the system of collection of payments and CFE would also have to contract and make fuel available with an eye on systemic requirements, and not only on power generation needs. The mechanism implied a new burden of technical oversight on the side of CFE (verifying information on the balancing and collections of tolls of Pemex). Besides, as the CRE itself recognizes, the

¹²⁴ “Pipeline business needs market-driven reform, says market consultant”, *Business News Americas*, November 18, 2011, accessed online via Factiva on October 19 2019. CFE had previously anchored the Manzanillo-Guadalajara pipeline (2008) running from the LNG regasification plant in the Pacific to the second largest city of the nation. Pemex anchored a pipeline connecting the national system of Pemex to the Bajío region (Tamazunchale). Alma Hernandez, “Preparan ductos Pemex y CFE”, *Reforma*, September 22, 2008, www.reforma.com.

¹²⁵ David Shields, *supra*, note 94.

scheme relied on the unilateral good will of Pemex to optimize the costs of balancing (CRE 2013: 18).¹²⁶

The challenges facing regulators

The role of regulators was central in the accommodations that the crisis brought about, although through instruments and with immediate goals that were not part of their original mission. Accounts of energy regulation for this period point at the powerful interests that beset the rather principled rationality of the regulatory agency. In the view of some, the legal and technical capabilities of the CRE could not change the advantage of Pemex, especially when policy incoherence, in the form of subsidies and fixed prices, so deeply hurt the implementation of open-access rules (Grunstein 2011 and Ballinas 2011). Without disputing that view, this last section of the chapter intends to point at real although missed opportunities to make regulation a lever of restructuring.

As a starting point, it is tempting to inquire whether there were options to continue restructuring within the limits of regulation and economic parameters of these years. By one count, imports of LNG opened the possibility of stirring competition through imports, also by land. Within the existing framework, the CRE (and the central agencies behind it) could have taken a clearer responsibility of forcing large consumers to adapt to the discipline of open-access transactions while taking steps to reduce or ban the imports of Pemex. In the view of a specialist who headed Pemex between 1994 and 1998, that incentive could have forced the NOC to get fit to compete while keeping its dominant position in the market (Lajous 2003: 9). From this point of view, the availability of LNG imports and continental gas would create a welcome pressure on the pricing rules, eventually leading to their dismissal (as it happened, much later, in 2017. Chapter 7).

That was not how things turned out in 2000 and 2012. Pricing disputes were a problem before 2007 (supply crises came afterwards to force an overhaul). Between 2001 and 2006, fixed prices and subsidies were still covering a variable but substantial part of the volatility affecting large industrial users. Pemex, actually, surrogated its own hedging services to industrial users that

¹²⁶ CENAGAS would continue to collect the distributed costs when it inherited the transportation system of Pemex in 2016. This time, the collection would be blended with the transportation costs paid by users of the system. (Prud'homme supra at 29).

refused to hedge their risk for themselves.¹²⁷ Some large users preferred to continue asking for protection, through a repertoire of technical or intuitive arguments, some more realistic and moderate than others.¹²⁸ CRE had been effectively pushed aside from every decision that capped the prices of natural gas (2001, and the renewal of subsidizations in 2005).¹²⁹ Formally incapable of resisting policies of subsidization, the sectoral regulators could only offer technical advice to policymakers to resist the pressure of Pemex and industrial consumers.

The aforementioned notwithstanding, the community of large users should be much more complex than this synthesis can show. As observers of Mexico have been pointing out for decades, there is a dearth of studies about the industrial use of energy and of the politics of industrial consumers of different sizes and affiliations (Michot Foss et al 1993; Lajous 2012). Their day-to-day and long-run necessities are essential information for the regulatory authorities (CENAGAS is now, as an SOE, in a position to obtain much of this). The ways in which they have organized around energy regulation on this essential fuel seem to require a more detailed look.

For its part, throughout these years Pemex (wishing to sell at higher prices) advocated frequently to modify parameters in a way that made them fairer to its declining rate of production (relative to the growth of demand and absolute once shale gas started to supplement Mexican gas). The key parameter that Pemex wished to change was the balancing point: arguing that as production decreased in relation to demand, the balancing point had to move southwards, where flows of foreign and domestic supply would meet, more realistically. The CRE conceded the change in 2010, after repeatedly resisting the requests of Pemex, and directed it to improve its productive efficiency (to no avail).

Moreover, one unfortunate combination of the failures on pricing regulation (and policy, considering the subsidies) was its deleterious effect on open-access prospects: there could be no

¹²⁷ Alma Hernandez, “Ofrecen atenuar aumento en gas” *Reforma*, July 25th 2008, accessed from www.reforma.com.

¹²⁸ One illustration of an unreasonable demand was advanced by the CONCAMIN, one industrial association that, in 2002, requested the return of a unique price for Mexico all throughout the nation. J. Ruiz, “Desean costo único”, *Reforma*, November 15, 2002, accessed via www.reforma.com

¹²⁹ Karla Rodriguez, “Amplían Decreto Gasero hasta enero”, *Reforma*, September 13, 2005; Alberto Aguilar, “Subsidio en gas natural otro apoyo clientelar de Fox a gran empresa y nuevo golpe a Pemex”, *Reforma*, September 13, 2005. Accessed from www.reforma.com

interest of a potential trader in competing against Pemex under those conditions. When high prices and supply shortages started to hit (in 2006 and 2007).

To summarize, in the mentioned episodes concerning regional transportation, local distribution and pricing policies, central agencies and large consumers have played a role that often has doomed the intentions of the regulator. When ambitious energy reform started to become politically possible, some observers underscored that the CRE could have a larger impact through a more active role, promoting the creation of hubs, and regulating other areas of the energy space, like other products of oil (LPG, diesel. See Lajous 2013: 34-35). Also, in consideration of the repeatedly failed efforts to enforce open-access since 1995, enthusiasm grew towards enacting an IPSO and applying asymmetric regulation against Pemex. While an IPSO also needs to be regulated, inheriting the system of transportation from Pemex would materialize the much-desired vertical separation of the NOC. Regulation of bypass connections that hindered the growth of distribution also figured as a priority for the immediate future.

Finally, what seems worthy of underscoring about these 12 years, at this moment, is the more evident requisite variety that the whole energy system had become --with natural gas now as a central part. Balancing supply and demand became a complicated matter, both on the pricing and on the transportation flanks --segments that the supply crises mingled in a way that confused the role of the regulators. Crises of supply would be covered by the media as a problem of large arteries and injections from overseas. However, as this chapter has explained, the geographical profile of demand also played an important role. The need to distribute costs and to consider this distribution systemically also resonated in the ways pricing came to be discussed and regulated. At the end of the day, crises made regulation all the more relevant and, for those reasons, better accepted by the players in the industry. That is a point on which several observers of policy have started to agree recently and that the following chapter will develop.

[Analytical summary](#)

An analytical summary of this sub-period can underscore, for a starter, that the limits of state capacity and state autonomy became strikingly clear and consistent throughout these 12 years.

These limits are of different nature in this period. The persistence of subsidization and the prolonged suspension of open-access regulation was based on the combined resistance of the NOC and its most important set of consumers. While natural gas did not become political in the sense of drawing partisan attention, the resolve of the national government to bring about solutions to the supply crisis led to political action after 2007. Following the initiative and promotion of the Executive, Congress strengthened the autonomy of the regulator. This move contributed to further differentiate the border between policy and regulation, by placing more regulatory functions in an increasingly autonomous body. J. Jordana observes that during the 2000s, Mexican governments pushed to strengthen autonomous regulators as a strategy to signal credible commitments to potential and current investors (2006).

The move to strengthen the CRE was, hence, part of a trend affecting bureaucracy in other sectors. However, the CRE was at the center of a sector consisting of little more than the state-owned enterprises. Political resistance against reforming this sector showed more clearly in the failure of initiatives to allow more private participation in upstream electricity and oil and gas. Nevertheless, the fundamental transformation of the sector did occur in these years.

It is also important to highlight that there was a role for the regulator as a piece in a fluid process to muddle through and find out new sources of coordination for the sector. Two instruments stand out as outcomes of these volatile coordination affecting policy: the provisional rules to balance extra costs for the use of LNG, and the integration of systems of transportation, which foreshadowed the recentralization of pipelines to come after 2014. In those two decisions, policies sought to establish a new set of instruments administering the losses incurred by shortages. Policies aimed at overcoming the crisis and finding more stable solutions where the role of the state would continue to be central. The coordination of state agencies, including the sectoral regulator and the SOEs, exemplifies the supplementary role of the State facing a contingency.

The analysis of contingencies for these years reveals the most consequential pattern affecting policy change in the case: the steady deepening of the insecurities of supply affecting CFE. The fact that the ministerial policy mandating tolling agreements between CFE and IPPs was not fully implemented did nothing to correct that ambiguity. In fact, it was part of it. The crises of supply that started occurring in 2007 only heightened the stakes for the electricity SOE and undermined the stances of Pemex. If there are patterns deserving the name of negative feedbacks in this case

they are the tendencies of policy to undermine Pemex, and to leave space and nurture CFE's motivation to develop its appetite to enter into the natural gas business. By the end of this subperiod, the prominence of CFE was not the result of an intended policy but the consequence of the series of responses of policymakers and the SOEs to events and contingencies as they unfolded.

Policymakers had to solve the consequences of policy incoherence when they became critical. After 2008, the new capabilities granted in the reform aligned regulatory decisions towards a policy that was already eyeing the reduction of the dominance of Pemex and that helped to accelerate the build up of infrastructure by 2012.

In sum, as emergencies and ad hoc measures mounted, the necessity of a different and overarching restructuring became self-evident. Chapter 7 will describe how, between 2013 and 2018, a major legal overhaul of the energy sector started to bring about the implementation of upstream competition, asymmetric regulation against Pemex, open-access and price deregulation. The pathway of implementation in the years between 1995 and 2012 created particular initial conditions for the new cycle that started in 2013. In the absence of upstream competition, the crisis helped to crystallize competition between the NOC and the SOE. The reach and latitude of regulatory instruments after 2014 would be supported by legislation but constrained by the dominant role of the electricity SOE.

A final thought can be added about the role of information-based instruments. Policymakers need technical argumentation to justify policies. The CRE fulfilled that role, even if it could not take it further or make the decisions itself. The disputes around pricing in early 2001 showed an ephemeral episode in which the sectoral regulator provided input to defend an unpopular pricing rule. Soon, the subsidies thwarted the possibilities of nurturing a new standing for technical argument. As regards open-access, the effectiveness of information-based instruments was still left to materialize for a further stage. It would take a whole reorganization of the industry, and its growth (in scale and complexity) to bring about components of self-regulation alongside the centrality of autonomous regulatory agencies.

Conclusion

The first years of the 2000s show a progression of missteps that weakened the prospects of the restructuring policy started in 1995. Supply contingencies that broke out in 2007 and combined with high international prices of natural gas turned the process of restructuring on its head. The SOEs and central agencies had to search for policy solutions that required adjustments to the role of the energy regulator by the end of the 2000s. The unwillingness of Pemex to comply with open-access rules, the resilience of subsidies to natural gas and other fuels, and the persistence of insecurity of supply for electricity generators became considerable factors shaping implementation. More importantly, insecurity led CFE to pursue more control over its supply requirements and those of independent power producers. The reconstruction of a policy design took shape as a set of limited legal and regulatory steps, looking to enhance the power of the regulatory agencies and, moreover, preparing for a recentralization of ownership and authority in an independent pipeline system operator. Accommodation to crises of supply had to rely on the resources and needs of the SOEs, with regulators and policymakers muddling through. The necessity of regulation became clearer for the players.

Chapter 7. Regulation as part of deep policy change (2013-2018)

The political context of the energy reforms of 2013 and 2014

Enrique Peña Nieto made a popular candidate, despite notorious lack of preparation for office and of a record of service that was not free of corruption. Building on promises to bring back the expertise of previous PRI administrations, his party recovered the presidency in the election of 2012. The triumph was not overwhelming but represented a clear advantage over the leftist Andrés Manuel López Obrador (38% against 32%). The party of Peña Nieto also captured a comfortable plurality in Congress: 214 of 500 seats in the lower chamber and 55 of 128 seats in the Senate. The PRI also retained or seized 21 out of the 33 subnational governments in the country (Casar 2012). From this relatively stable political position, which included alliances with the small Green Party, the team of Enrique Peña also recovered the possibility to take the initiative on large-scale economic and social reforms. These reforms came to represent the most ambitious transformative agenda seen in contemporary history, and they affected education, the electoral system, economic competition, telecommunications, and energy (Pipitone 2018).

The constitutional reforms that Congress passed in 2013 removed the foundations of the Mexican energy sector as it had existed at least since the 1950s. The reform broke the monopoly of Pemex on the production of oil and gas and opened it to private participation. Interestingly, the initiative of Enrique Peña proposed to revert the framework for the production of petroleum to the conditions as laid out initially *after* the nationalization of the oil industry in 1938, when private production was still legal (Pemex absorbed all production until 1954. See chapter 4). The reform also created a wholesale market for electricity and mandated a transformation of the State-Owned Monopoly to make it a competitive generator of power. These two foundational changes gave way to a streak of legislative activity that, throughout 2014, redefined the mandate, organization, and finances of the SOEs, and that of the upstream and midstream energy regulators. A new SOE was created to serve as a system operator of natural gas, inheriting the infrastructure owned by Pemex.

Concerning energy policy and regulation, the years between 2014 and 2018 show an acceleration of steps that had been devised since years before, and not necessarily in a radically new direction for natural gas. Specifically, the regulator got a stronger mandate that enabled it to reduce the market share of Pemex in the transportation and commercialization segments and to enforce open-

access rules. Combined with the entrance of injection points and very modest private production, the regulator found itself in a more favourable position to materialize pricing liberalisation.

As the former president of the CRE summed up recently, by the end of this sub-period (2018) the transportation and commercialization ends in the natural gas sector were no longer in a nascent stage, but in one that displayed some clear signs of maturity (NGI 2019).¹³⁰ What those adjectives can mean, and what they can say about the evolution of the sector and the role of the SOEs and other actors requires a description. That is what this chapter intends to provide, by revising the third and last chronological sub-period of the case. The first part reviews the political aspects of the constitutional and legal reforms to the domain of energy, centering on the description of the changes of the natural gas industry as one important --although still not central-- piece of that transformation. A second part and a third part examine, respectively, the changes in the instruments of policy for natural gas and their effect on supply and demand trends --several of which were visible at the time of the reform in 2013. The two final sections revise the roles of Pemex and CFE in the new natural gas sector, and their combined contribution to an overhauled set of regulatory relations.

2013 and 2014: ground-breaking reforms

Favourable opinions towards opening the upstream energy sector to private and foreign participation had been growing for years before among political parties and the public at large. By 2013, however, the nationalistic opposition to private participation in the petroleum sector was still majoritarian (Moreno 2013). The reported trends in public opinion, as reflected in surveys, referred exclusively to the question of whether the private sector and foreign companies should be allowed to participate in the production of oil and gas --as the reform, ultimately, enabled. Those themes, along with the prices and availability of gasoline and some concern about the environmental impact of hydraulic fracturing, occupied the lion's share of what the media communicated to the broad public in the months preceding the reform and after it.

¹³⁰ “Q&A with Francisco Salazar on Mexico’s Natural Gas Market Development”, Natural Gas Intelligence, April 12, 2019, accessed from Factiva on April 19 2019.

By late 2013, with the constitutional reform already in the legislative process, there had been much less, if any, public discussion about natural gas as part of the overhaul of national energy policy. A revision of the opinions voiced in a handful of venues before the reform shows that security of supply figured already as a prominent concern for experts, industrial users and public servants (Senado de la República 2013). Shortages had become pervasive throughout the months preceding the constitutional reform of 2013, affecting industrial users disproportionately. Interestingly, participants in the discussions previous to the reform gave credit to the view that allowing private production in Mexico could rapidly boost production of shale gas, mimicking the experience of the United States. As frequently happens with on energy policy in Mexico, the production of fuels captured more attention than the complications of transporting and distributing them.

The debate inside and outside Congress centred much more on calibrating the new contractual modalities to attract investment and distribute risk in exploration and production, and not on midstream themes. Debate was intense, nevertheless, on how private participation could help or hinder the purpose of improving the operational capacities of the NOC. The dilemma opposed the desire to keep as much of the oil-rent in the hands of the State against the recognition that Pemex and the State in general cannot optimize public resources and welfare through monopoly. The main divergence centered on what activities related to exploration and production would be optimal to maintain in the sphere of activity of Pemex, and which incentives would be adequate to guarantee that the nation benefitted from the rents of the industry. The right-wing PAN and the ruling party, the PRI, favored constitutional modifications to allow the State to participate with private actors and to grant licences to producers. For its part, the leftist PRD proposed legal (not constitutional) modifications to further relieve the finances of Pemex (Petersen 2016: 272-273).¹³¹

The reconfiguration of the natural gas sector also deserved attention, particularly with regards to the strengthening of the financial and political autonomy of the CRE. As explained in previous chapters, the legal fundamentals of autonomous regulation had started to be deployed decades before, and there was not –as there is none still today-- an ideational alternative with significant

¹³¹ In 2020, the former CEO of Pemex during the reform, E. Lozoya, alleged that the government of Enrique Peña and his Finance Minister managed a bribery scheme to get the PAN on board with the energy reform. The revelations were brought to light in the course of a criminal investigation targeting Mr. Lozoya. “Lozoya revela que EPN y Videgaray sobornaron a panistas para apoyar reformas estructurales; ellos lo niegan” *Animal Político*, July 24, 2020.

robustness to resist taking such autonomy to the extreme (see below). Very little discussion revolved around the measures addressing the market power of Pemex and the creation of a new SOE to plan and operate the system of transportation. There was input from the staff of the CRE, but not all that the CRE proposed materialized in the reform. For instance, E. Tellez, staff of the highest rank in the CRE, publicly criticized that the new SOE in charge of the system of transportation would not be only an independent operator but also an owner.¹³²

With a different emphasis, large industrial consumers welcomed the move towards a consolidation of the regulatory framework that could make the principles of open-access effective. The CONCAMIN, for instance, had been adamant in cautioning that the new independent system operator not be allowed to commercialize gas.¹³³ The CCE and the COPARMEX also voiced their support for the midstream aspects of the reform. Beyond natural gas, the industrial conglomerates represented by the CCE were also centred into the opportunities for exploration, production, and procurement throughout the value chain in the energy sector, including electricity and renewables.¹³⁴

2013 was a year of very high oil prices in the world and very low natural gas prices in North America. Appetite for profiting from the former and for consuming the latter needed little more justification, and the support for the reform followed those interests. There was a *demand* for new institutions. However, the legal changes that affected natural gas had security in a central place, and these changes also considered a new balance of instruments. The experience of the sectoral regulators was crucial in determining the shape of the *supply* of those institutions.

The energy reform as a general framework of policy and regulation

How can the reforms of 2013 and 2014 be characterized as part of a policy change for energy in general and for natural gas in particular? On the one hand, it was a mixture of upstream

¹³² Alejandra López, “Advierten conflicto de interés en gas”, *Reforma*, March 11 2014, accessed online from www.reforma.com on February 7, 2019.

¹³³ Alejandra López, “Piden dividir nuevo operador de gas”, *Reforma*, March 31 2014, accessed online from www.reforma.com on February 7, 2019.

¹³⁴ Alejandra López, “Delinea CCE propuestas para reforma energética”, *Reforma*, May 19, 2014, accessed online from www.reforma.com on February 7, 2019.

liberalisation, riding the wave of the opening towards exploration and production by private and foreign firms. On the other hand, the reform, as part of policy change, consolidated a correction of the liberalisation attempted almost two decades before. The centralization of planning and management of the network of transportation enshrined new government capabilities to secure supply. The change of instruments indicated the extent to which natural gas had become a priority for energy policy already by the start of this decade.

Instruments of policy. Maybe that question will be answered by looking at the instruments first. The Hydrocarbon Law (Ley de Hidrocarburos)¹³⁵ enshrines open-access and deploys a series of instruments to secure its implementation. These instruments gave the new IPSO SOE (CENAGAS) key capabilities to determine the development of new infrastructure. It also stipulated the role of the CRE and CENAGAS in the redistribution of the transportation network previously owned by Pemex. Besides breaking up the control of Pemex over the transportation system, the most transcending feature of the legislation is perhaps its aim to frame a new environment of relations within all the policy system: one where central agencies will have to rely on the input of several types of actors to plan and implement policy (see below).

Open seasons and electronic bulletins. Interest for transportation and storage projects must be gauged through open-season processes, authorized by the CRE (article 69). Private firms, Pemex and CFE can initiate the development of merchant pipelines and “anchor” the investments through long-term supply contracts, but they must execute the construction through third parties (articles 69 and 74). The CRE, not CENAGAS, gained the mandate to establish terms and conditions for the use of the system of transportation, including the systems owned by CENAGAS. Article 73 of the same law mandates that permit holders with idle capacity must publicize its availability through Electronic Capacity Posting Bulletins (CENAGAS 2015).¹³⁶

Five-year planning and a natural gas policy. While these developments enhance the principles of open-access that underlie competition, the new regulations also include shifts towards centralized

¹³⁵ Decreto por el que se expide la Ley de Hidrocarburos y se reforman diversas disposiciones de la Ley de Inversión Extranjera; Ley Minera, y Ley de Asociaciones Público Privadas. (Published in the Diario Oficial de la Federación, August 11, 2014).

¹³⁶ The electronic bulletin is available on this link, but for users of the system and not for the general public <https://qcloudprd.qbsol.com/CMXIPWSSP/?tsyno=3>

management and planning. Previous chapters have underscored that coexistence of centralization in management and planning of the infrastructure of transportation is not functionally at odds with the principles of third-party access. As part of the new regulatory framework, centralization of planning is stipulated in article 69 of the Hydrocarbon Law, which gave CENAGAS the mandate to propose a five-year plan of “expansion and optimization” of transportation and storage of natural gas, with the technical assistance of the sectoral regulatory agency (CRE). The five-year plan must serve as an input for the Ministry of Energy, which took the responsibility to give coherence to the policies of the sector. The law contemplates that the Ministry of Energy must issue a document with the guidelines of such *public policy* (article 69).

Strategic pipelines. Planning at the federal level of government also occurs through the auctioning of strategic pipelines and storage facilities. CENAGAS has the mandate of auctioning strategic projects of transportation and storage. For its part, the Ministry of Energy can consider that a project is strategic when at least one of the following four conditions exists: a) the pipeline has a diameter of at least 30 inches or length exceeding 100 kilometers; b) the pipeline or storage facility gives redundancy to the system; c) the pipeline opens a new source of supply for a relevant market; or d) when the Ministry of Energy considers and justifies that a project is relevant to secure supply of natural gas (article 69). In sum, central agencies were granted considerable latitude when making a decision to push forward the infrastructure of transportation and storage.

Asymmetric regulation. In addition to this new framework of regulation for transportation of natural gas, the new legislation mandated one-off actions of asymmetric regulation to abate the dominance of Pemex (Hydrocarbon Law. Transitory article 13). Capacity release programs reduce market share by directly taking contracts away from the NOC. According to the new legislation, no actor should exceed 50 percent of the market share on either the marketeering or pipeline markets.

Vertical separation. During 2016, the Ministry of Energy issued directives to legally secure the separation between the branches of CFE trading natural gas (CFE Energía) and those that use it to produce power. Similar *Chinese-wall* provisions were devised between subsidiaries of production,

transmission and distribution, in accordance with the new statute for CFE (Law of CFE, art. 10).¹³⁷ The central question regarding the vertical separation of CFE, as was the case with Pemex previously, referred to their effectiveness (see chapters 5 and 6). By 2018, the implementation of vertical separation stood halfway to its goal, and in 2019, with the new national administration, CFE started to regroup the generation subsidiaries, seeking to give privilege to CFE over other producers.¹³⁸

Consultation on implementation of policy and management of the network. This time, the legal and regulatory framework was effective opening access to foreign suppliers and integrating the national market. Moreover, as implementation has been making progress, the interface between policy and regulation has been changing. The implementation required legally *and functionally* that consumers give their input in the definition of goals and timetables for the attainment of goals in a route map. Consultation on policy sought the views of consumers, distribution companies, traders, and energy firms with interest in IPPs on issues ranging from the new pricing indexes published by the CRE, to the modalities of contracts, the programs of asymmetric regulation and the quality specifications of gas (CRE 2017c).

Relationship between central agencies and regulators. The relationship between central agencies and regulators has changed, too. Although central agencies could formally sideline regulators under the new framework, it can be argued that it is not in their best interest to do so, or to do so in the way they were sidelined prior to the reform. At least until the end of 2018, when the new national administration took office, policymakers and regulators seemed to share the understanding that security of supply could depend on their coordination –while backstops were available if necessary. The hierarchical lines of command have not been erased, and, to the contrary, the new legal framework has made them clearer. However, the aggregate landscape that is resulting from the implementation of reform heightens the need to coordinate regulation substantially: gauging where demand and bottlenecks exist, on the system of transportation and through the instruments to collect information on pricing.

¹³⁷ Ley de la Comisión Federal de Electricidad and “Términos para la estricta separación legal de la Comisión Federal de Electricidad (CFE)”. (Published in the Diario Oficial de la Federación, January 11 2016) http://www.dof.gob.mx/nota_detalle.php?codigo=5422390&fecha=11/01/2016

¹³⁸ “This is the new CFE: more generation, more control —and less private companies”, CE. Noticias Financeras, February 22nd 2019, accessed via Factiva on October 30 2019.

The new instruments of policy, grouped in the paragraphs above, reveal a new distribution of authority and a set of new expectations on the role of information and self-regulation as mechanisms of governance. Implementation before 2018 did not find insurmountable obstacles, although, according to interviewees of the Ministry of Energy, it did not reach the level of consolidation that policy-makers started to envision in these years. Importantly, problems of social acceptability slowed down the finalization of links in the North, and delayed the integration of the system as a national network with alternative routes allowing arbitrage domestically.¹³⁹ Also, asymmetric regulation did not reset all the relations between the new IPSO, the CRE and Pemex. The NOC did not completely deliver the information systems that it had acquired to manage the system of transportation (interview with officer of CENAGAS). However, it seems indispensable to highlight that, as trend, these steps reconfigured the space in which regulation and energy policy were formulated.

Supply and demand

The constraints and motivations of the NOC and the electricity SOE are determined by their legal framework and their new capabilities to engage in trade of electricity and natural gas. They also are constrained by their own financial situation: by mid-2018, the liabilities of Pemex were compromising the national economy, systemically; CFE, for its part, enjoyed a relatively better financial position and took advantage of the reform to undertake an ambitious program of commercialization of natural gas (see below). Before turning to the description of these aspects it is important to give a backdrop of the transformations of supply and demand.

The key economic variable that defined the start of this period is, obviously, the emergence of shale gas in the United States. As late as 2009 there were still expectations that LNG could rebalance the shortages while domestic production recommenced: Manzanillo's LNG regasification terminal went on stream in 2010. By late 2012 it was clear that natural gas from the

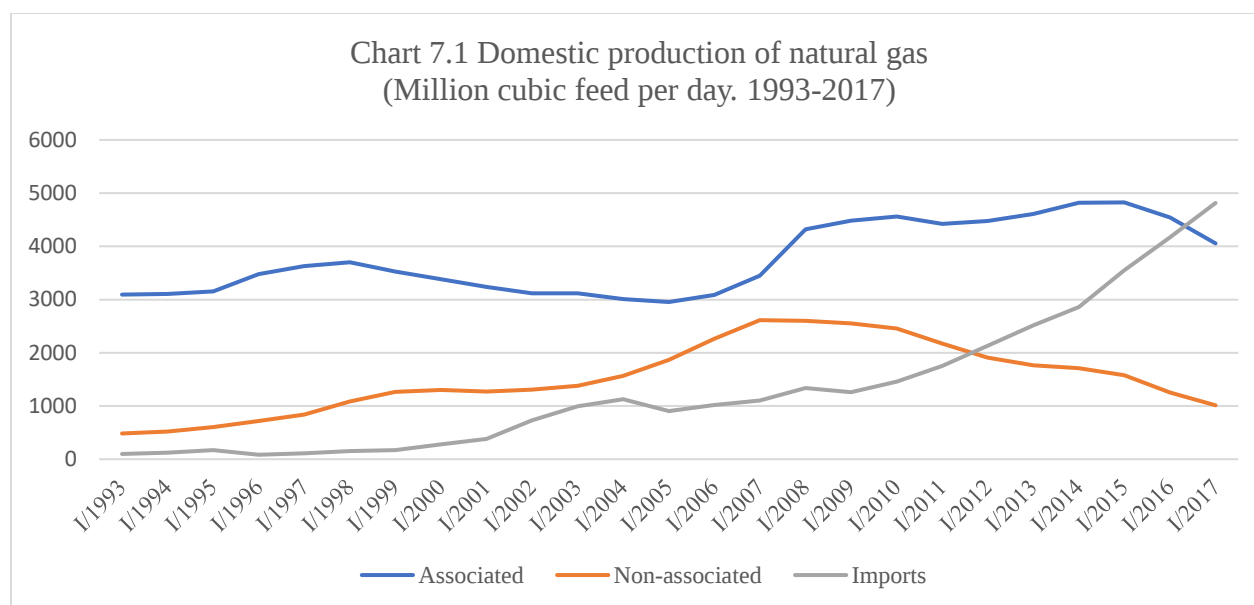
¹³⁹ Several important links were affected by protests. The Wahalajara system, which only went on stream in 2020, was one of the most affected, with members of one of the Indigenous populations of the Norty (Yaqui) removing whole sections of the infrastructure. NGI, "Grupo Carso Mexico Natural Gas Pipeline Delayed but Relief in Permian Forecast as Wahalajara Nears Start", March 3rd, 2020. Accessed from Factiva. Upstream production also met some social acceptance concerns, centered on fracking (Lajous 2019). However, as has been pointed out elsewhere, the problems afflicting upstream natural gas were also of a much more diverse nature (legal, public safety, and economic comparative advantage against production in the U.S.).

United States represented the best supply option. The new structure of trade of energy in North America started to take hold at the start of this decade and, contrary to expectations of earlier periods, Mexico would be a net and substantial importer of oil products and natural gas. By way of illustration, in 2007 North American prices were comparable and even higher to prices in Europe (around 7 USD per MMBTU), but in January 2012 Henry Hub spot prices hovered 2.75 USD/MMBTU against 9.4 USD/MMBTU in the U.K. LNG traded at nearly 17 USD/MMBTU in Japan as a consequence of that nation's turning away from nuclear generation.¹⁴⁰ Although prices of LNG have been falling throughout the last decade, bar access considerations, they were not competitive against continental prices in North America.¹⁴¹

By 2013, Pemex's production of oil and gas had been dwindling. Decreases were due to the maturity of existing fields and insufficient investment for the discovery and production of new fields. As of 2020 there was also relative unattractiveness of the production of gas, in consideration of the low costs prevailing in the U.S. For its part, non-associated gas fields in the Burgos basin (the southern tip of the Cretaceous Eagle-Ford play) did not sustain enough production to counterweight the losses of offshore output in the Gulf of Mexico. With a diminished financial capacity to explore and produce oil, natural gas came second, although at considerable costs for the oil company (Chart 7.1; Lajous 2019 and 2013).

¹⁴⁰ Prices are from British Petroleum database, accessible from https://www.quandl.com/data/BP/GAS_PRICES-Natural-Gas-Prices-vs-Crude on July 14, 2017.

¹⁴¹ In 2018, prices of LNG imported by Mexico through the Gulf terminal Altamira stood at around 10 USD/MBTU (SENER 2018: 35), while the price for that national region was around 4 USD/MMBTU. Secretaría de Energía, 2018, [Prontuario Estadístico de Gas Natural](#). Accessed on September 26, 2018 from www.sener.gob.mx



As explained above, the expectations that the energy reforms of 2013 and 2014 could ramp up domestic production with new fields of shale gas were real, although perhaps not widespread. However, these expectations have stayed unfulfilled as late as 2018. After the reform, in 2015, Pemex started a new program of exploration and production of shale gas in the southern end of the Eagle Ford play, but the complications were numerous, all of them revealing the differences in resources and institutions between the U.S. (or, more specifically, Texas) and Mexico. According to one count, Pemex could not recruit adequate expertise or manage the procurement chains of services and goods. Access and conflicts over water and about the potential environmental risks of production also stood in the way (Lajous 2019). (These constraints also apply for private production, which by the end of 2018 had only just begun).¹⁴²

In sum, the complications of production were not solved readily with the implementation of the energy reform. One specialist claims that Pemex would be better off consolidating its position by limiting the commercialization of its now small production to the southeastern states, close to the production fields while leaving the rest of the country to new entrants and CFE (Lajous 2019). Other specialists also shared the view that, despite its dire financial situation, Pemex could still profit from its natural gas sector in a more limited share of the national market, while still acting

¹⁴² In 2017, private domestic production represented less than 1 percent of the total production (SIE 2018). “Mexican oil output edges higher in March, but down on year”, *Platts Commodity News*, May 1 2017. Accessed via Factiva.

as a central instrument of energy policy. That is what the current government is also betting towards Pemex, although in a way that has not been articulated coherently and convincingly.¹⁴³

By contrast to the structure of supply, demand evolved in ways that were foreseeable years before the reforms of 2013 and 2014. The lion's share of demand is on the side of the electricity sector, IPPs and CFE.¹⁴⁴ Although the combined size of other consumers continued to be minor, they multiplied and have become more diverse. It is tempting to characterize this set of new and old consumers as a foundation for a set of constituencies, with different alignments depending on their capability to influence policy and their economic exposure to volatility and supply risks.

¹⁴³ J. Webber and M. Scott, "Mexico: López Obrador makes a big bet on oil", *Financial Times*, October 3 2019. Accessed online from <https://www.ft.com/content/d5c3c1c0-e432-11e9-b112-9624ec9edc59>

¹⁴⁴ In 2016, IPPs and CFE combined took around 40 percent of all dry natural gas supply, which amounted to 70 percent of imports. Self-generation added other 18 percent of total demand, completing slightly more than 90 percent of imports (Sistema de Información Energética, 2021, "Balance nacional de energía: gas natural seco", available at www.sie.gob.mx)

Implementing policy change under the new conditions of supply and demand

Open-access and price deregulation. The much-protracted General Terms and Conditions for the exchange of natural gas that enshrined third party access became operational rules in 2017. Natural gas maximum price rules were abolished that year, too. To the effect of facilitating exchange based on information, the CRE also started to compile and publicize pricing indexes for five regions across the territory. These indexes are an essential information resource to understand demand and to facilitate the future deployment of links and hubs.

Implementation of asymmetric regulation. During 2017 and 2018, the sectoral regulator, CENAGAS and the central agencies implemented the most important measures of asymmetrical regulation: a program to take supply contracts away from Pemex and a program of capacity release for the transportation rights of Pemex inside and outside Mexico. Neither of the two programs reached their goals, as stated in the legislation. However, some progress can be acknowledged, because BP acquired part of that capacity (see below).

As regards the redistribution of supply contracts, the CRE carried out the first phase of the program by randomly selecting contracts for an equivalent of 20 percent of the volume of gas traded by Pemex. Holders of those contracts were offered the possibility of switching to other suppliers without paying a penalty. Pemex, on the other hand, retained the possibility of bidding to keep the contracts. The first phase finished in February 2017 and did not go very well. It released 20 percent of the complete volume and released 111 contracts, for an amount of 758 MMCFD. Pemex kept 133 other contracts for an approximate 1104 MMCFD. CRE had to speed up and strengthen the process, and the outcome was acceptable by the end of 2017 (CRE 2017).

Asymmetric regulation measures on pipelines had a similarly positive but not conclusive outcome. To the effect of distributing the capacity that Pemex controlled until 2017 at the injection points north of the border with the U.S., CENAGAS carried out a series of auctions to assign capacity in four pipelines. That capacity existed in American private carriers and was assigned to Pemex previous to its transfer of assets to CENAGAS. Only three companies participated in the first auction: BP, one of them, got 200 MMCFD at a rate of 0.31/MMBTU (190 MMCFD in a section that connects to Nueces-Los Ramones). Other firms won 20 MMCFD (16 and 4) in another section

connecting to Los Ramones, too. Some sections did not receive offers, and CENAGAS returned them to Pemex.¹⁴⁵

Also, in 2018, CENAGAS carried out the first non-binding open-season in order to gauge demand and plan for storage and transportation projects. The operation of electronic bulletins for the capacity of transportation, and the concentration of information relative to contracts between consumers and suppliers were two additional steps in the direction of enhancing self-regulatory mechanisms in the operation of the system of transportation. Information is expected to complement or supplement the regulation of prices and other provisions to secure third-party access (CENAGAS 2019).

The reforms of 2014 set a deadline to abolish maximum prices for gasoline and diesel by 2017. Liberalisation went forward, despite the unpopularity of the policy, because prices took a hike. In 2018, before the change in the national government, subsidization of LPG continued, but only through a targeted support scheme whereby lower-income consumers were getting compensation in the form of direct cash transfers (Cazorla 2017).

Winners and losers. The roles of Pemex and CFE in the transformed natural gas sector

The new structure of the natural gas industry only started to take visible shape in the last couple of years of the executive term that finished in December of 2018. Changes forced a new balance between the SOEs, now rebranded as *state productive enterprises (empresas productivas del Estado)*, and other participants in the sector. Formally, CFE entered the natural gas market as an importer and trader, and Pemex was allowed to produce and sell electricity in the wholesale market. However, each state-owned enterprise faced very different challenges and opportunities. Five years after the reform took place, Pemex's losses derived more from its untenable financial contradictions and less from the programs of asymmetric regulation that finally were carried out in 2017. For its part, CFE got a much softer treatment and was poised to strengthen its grip over the commercialization of natural gas.

¹⁴⁵ “BP wins big in Mexico’s pipe capacity auction”, *Platts Gas Daily*, 22 February 2017, accessed from Factiva.

The energy reform was explicitly agreed as a plan to make CFE and Pemex competitive: literally, by making them one player among a multiplicity of other upstream competitors. This expectation notwithstanding, the energy SOEs have a role as tools of policy: to secure supply by producing hydrocarbons, by anchoring transportation projects and LNG supply contracts (the case of CFE and Pemex), or to manage the system of transmission (the case of CENAGAS, which is an SOE also, but one hardwired and centred on attaining the goals of restructuring).

A revision of the role, resources and strategic situation of the SOEs is a necessary step to explain the new balances that constrain and enable regulators and policymakers.

CFE

In the case of CFE, the privileged mechanism to promote competition was the creation of a wholesale electricity market (MEM, is the Spanish acronym). The wholesale market works as a *pool market*, where all generators bid their available capacity (including transmission), and qualified users and retailers submit demand bids (article 104 Law of the Electricity Industry). The MEM is operated by an ISO (CENACE) that determines a level of generation that covers demand and determines a price.¹⁴⁶

As part of its accommodation to the new market, in 2016 the Ministry of Energy decided on the separation of CFE into six production subsidiaries, plus seven other subsidiaries for the rest of the functions in the SOE (see figure 7.1).¹⁴⁷ The separation of production subsidiaries that would compete against one another in the wholesale market was planned to balance their competitive advantages and to secure their reliability, considering that each contained a different mix of fuels and older and newer plants. Before this internal restructure, *Chinese-wall* provisions had been

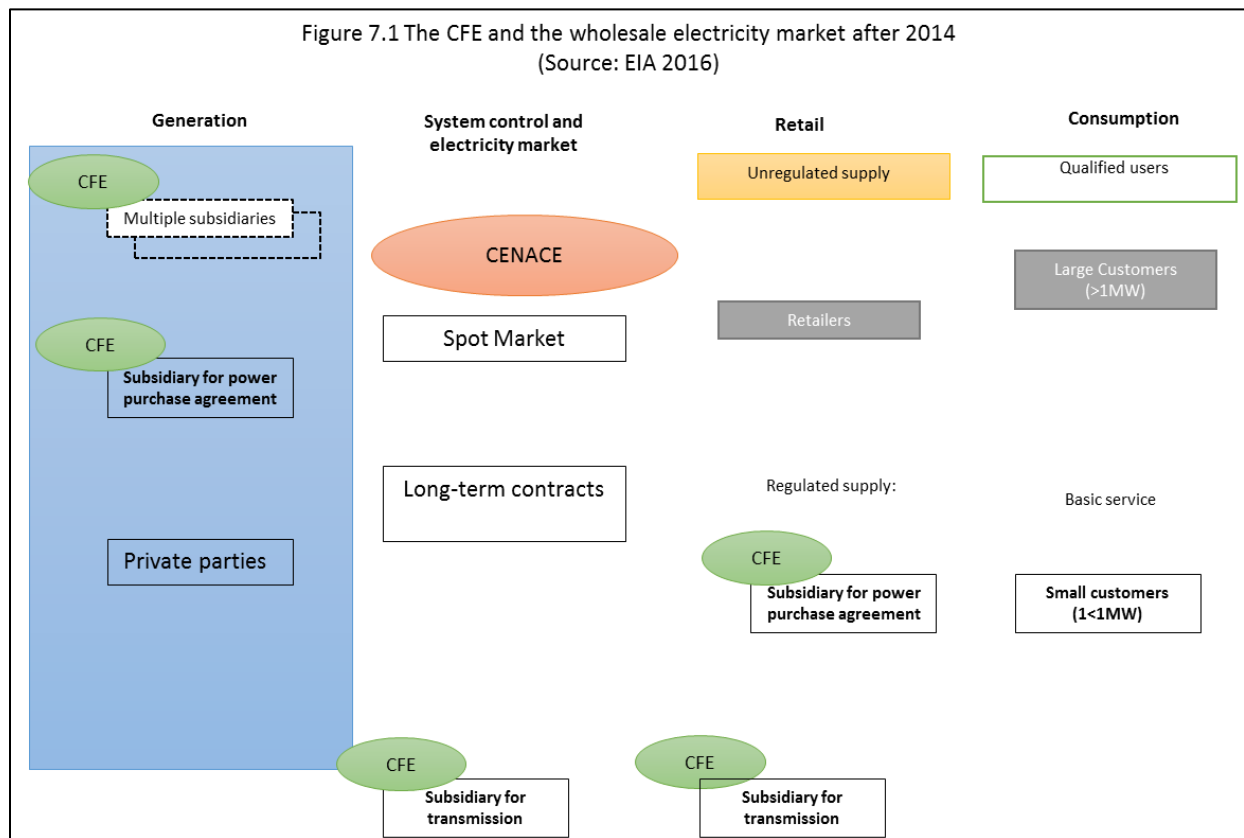
¹⁴⁶ Parallel to the daily market, participants can arrange long-term contracts, without regulation of price. The CRE, not CENACE, determines the rules of transparency and access to information in the electricity market. Pricing of the electricity that CENACE buys has a basis on marginal local price (PML is the Spanish acronym). (Ley de la Industria Eléctrica. Arts: 59-64, 94-106, 157-161). The mathematical model can be consulted here:

<https://www.cenace.gob.mx/Docs/MercadoOperacion/Formulaci%C3%B3n%20Matem%C3%A1tica%20Modelo%20AU-MDA%20y%20PML%20v2016%20Enero.pdf>

¹⁴⁷ Diario Oficial de la Federación, Enero 11, 2016.

https://www.dof.gob.mx/nota_detalle.php?codigo=5422390&fecha=11/01/2016

issued by the Ministry of energy, seeking to organize the vertical separation of the activities of production, transmission, distribution, and commercialization.^{148 149}



As commented in previous chapters, enacting *Chinese Walls* is much easier than making them work effectively. The legacy of vertical (and horizontal) integration cannot be undone rapidly, and ambiguities and uncertainties flourished immediately, especially about the sources of cash and the

¹⁴⁸ The segmentation of generation capacity sought to optimize each of five subsidiaries to compete in the wholesale market. The reorganization did not follow regional criteria. A sixth subsidiary kept all the contracts of IPP producers (CCGT and renewables).

¹⁴⁹ The scheme of separation was in effect for slightly more than 2 years. In March 2019, the government inaugurated in December 2018 issued an order modifying the terms of separation so as to enable the re-concentration of generation subsidiaries. The executive order also included provisions to have personnel working for more than one subsidiary at the same time. *Diario Oficial de la Federación*, March 25, 2019, http://www.dof.gob.mx/nota_detalle.php?codigo=5555005&fecha=25/03/2019.

contributions of the subsidiaries to the liabilities of the SOE (Shields 2016).¹⁵⁰ ¹⁵¹ Cross-subsidization has stayed a strong temptation for the SOE, considering that CFE has kept the control of transmission and distribution of electricity, and that it has a large fleet of plants with different technologies, subject to variable exposures to fluctuations of prices of fuels (see Ch.8 and conclusions).¹⁵²

Hence, the big question that the reform did not answer refers to the potential conflict between the goals of regulation, on the one hand, and the needs of CFE to be price competitive in its role as generator and trader of natural gas. CFE Energía, the subsidiary that manages the commercialization of natural gas, has been looking to become the largest national trader of natural gas (NGI 2019).¹⁵³ In 2018, CFE was one of the top 20 marketers *in the United States*. Nevertheless, the profits from the sales of natural gas are not remarkable for CFE: profits for the year finalizing in September 2018 were around USD 100 MM (CFE 2018).

More importantly, CFE kept the incentive to reduce its costs, not those of its competitors. The question is: can CFE maneuver to obstruct the price-competitive and reliable supply of fuels to its competitors in electricity generation? Specifically, the risks are that CFE uses its leverage over transportation and trading to favour its subsidiaries against other traders of natural gas, or other large consumers, including distributors of natural gas and IPPs. During the presentation of a recent report of the OECD (2018) on public auctions of CFE, the head of the economic competition watchdog warned that CFE Energía, the subsidiary that commercializes natural gas for the SOE, must not sell gas to the generators of CFE under more favourable conditions than it sells to other

¹⁵⁰ D. Shields, 2016, “CFE: incertidumbre y limbo jurídico”, *Reforma*, July 16, 2016. Accessed from <https://www.reforma.com/aplicaciones/editoriales/editorial.aspx?id=92626>

¹⁵¹ As Ballesteros and Moreno (2019) point out, the reform that started in 2013 did not create clarity about the governance of CFE in the most substantial question: who is the legal owner of the entity? and what is, therefore, the mechanism of accountability that should apply? The juridical nature of the subsidiaries and of CFE also carry other ambiguity: is CFE a company subject to administrative or to commercial law?

¹⁵² D. Shields, 2017, “CFE. Reformas y polémicas”, *Reforma*, July 4, 2017. <https://www.reforma.com/aplicaciones/editoriales/editorial.aspx?id=115685&lcmd5=2c6a16ce07945f1dfb1fdc3ac42f4235>

¹⁵³ “Q&A with Rosanetty Barrios on Mexico’s Natural Gas Development”, *Natural Gas Intelligence*, 15th March 2019, accessed via Factiva.

generators (IPPs).¹⁵⁴ Conversely, suppliers other than CFE Energía must have the actual opportunity to sell gas to the generating plants of CFE. As a former head of the same economic competition watchdog acknowledged in 2017, the new legislation had not addressed how to tackle threats to competition from enterprises that participate in both the electricity and natural gas sectors (Cortés and Perez Motta 2017: 18). Problems of collusion involving CENAGAS with CFE and Pemex started to surface in 2019. However, these problems don't seem to be produced by shortcomings in the coordination of the regulators. Instead, the new administration is backing up those policies (chapter 8).

Table 7.1 Examples of subsidies and price/cost ratios (2015)			
Tariff	Sales (GWh)	Subsidy (million pesos)	Price/cost ratio
Household	20 139	37 601	0.37
Household high energy consumption	2 384	Overpriced	1.58
Commercial users	13 125	Overpriced	1.25
Public services	1 261	Overpriced	2.08
Agriculture	9 565	92 91	0.33
Medium voltage	14 613	Overpriced	1.22
High voltage	25 560	Overpriced	1.07
(Label) indicates the type of tariff and user as per the classification of the Ministry of Energy. Source: IEA, 2016: 45.			

The electricity SOE, it can be summarized, became a pillar and vehicle of natural gas policy for the central agencies. However, there were limitations as to how much those instruments could favour upstream competition through open-access and other accessory regulation. The dilemmas of the preceding periods gave way to new conundrums.

¹⁵⁴ The speech of the head of the competition watchdog of the national government can be consulted here <https://www.energiaadebate.com/blog/2953/>; OECD, 2018, “A review of CFE procurement rules and practices”, <https://www.oecd.org/daf/competition/OECD-CFE-report-2018.pdf>.

First, CFE could anchor new sections in the west and make natural gas with spillover benefits for industrial users and LDCs. But there are risks of dominance by CFE, plus potential for unused capacity in areas where demand is still growing. As outlined in the previous chapter, the current position of CFE is the result of the interventionist policies that took place as response to contingencies and in which only CFE and Pemex were capable to provide a solution, by anchoring new pipelines. Also, as remarked in the theoretical section of the dissertation, state intervention can be expected to occur in jurisdictions where the said sector is crucial for economic development. This expectation obtains, in the present case, as a necessity to respond urgently to contingencies affecting supply, at the time when demand was on the rise. But once in place, that infrastructure can serve to preserve the control of either of the SOEs and drive away new suppliers using the said transportation capacity.

Pemex

The financial situation of Pemex has aggravated after the reform, although not because of it. The decline of international oil prices in 2014 and the accumulation of liabilities, bloated structure, and the persistent insufficiency of investments in exploration and production have been accumulating inertia for years. By one count published in 2013, Pemex used 6.5 times the staff of Norway's NOC (Statoil-Equinor) to produce twice its volume.¹⁵⁵ By 2018, Pemex paid USD 6 bn (MXN 122 bn) to service its debt (Pemex 2018: 9). That amounts to 20 percent of the whole amount of debt service in the public sector.¹⁵⁶ The total debt of Pemex hovered around USD 120 bn for 2018. Pemex was, in 2019, the world's most indebted oil company, according to the Financial Times.¹⁵⁷ It accumulated a net loss of USD 9 bn for the year 2018, while capital expenditure decreased from USD 27 bn in 2017 to USD 11.2 bn in 2018.¹⁵⁸

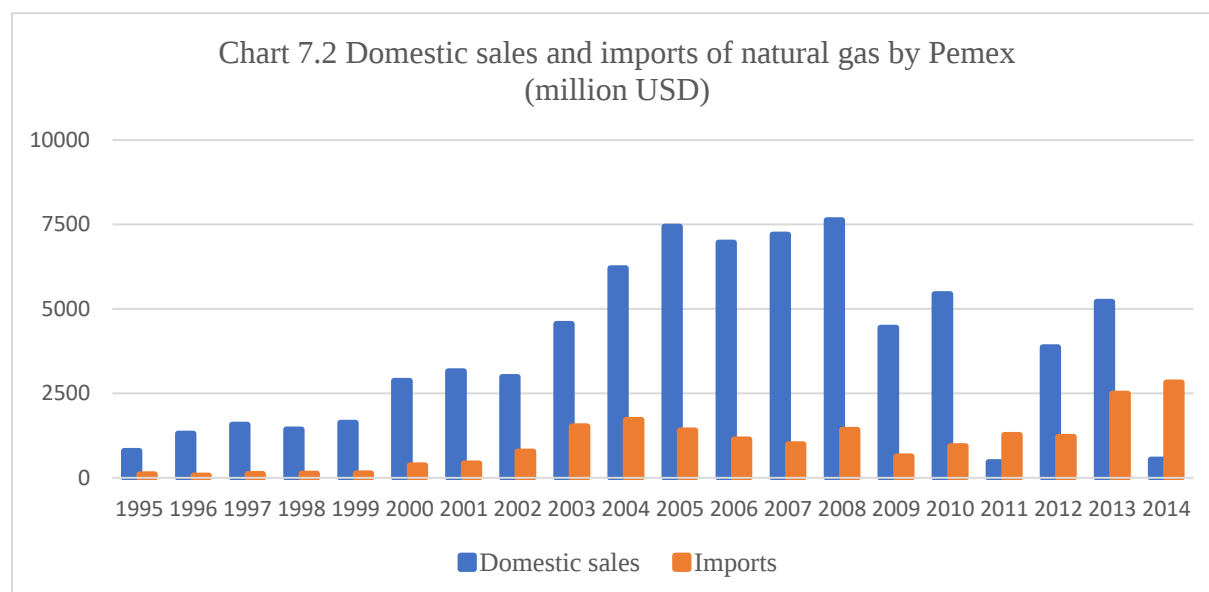
¹⁵⁵ J. Webber, "New chief faces big challenges in Pemex", Financial Times, February 26, 2016, accessed from Factiva on May 10 2019.

¹⁵⁶ E. Albarran, "Servicio de deuda de Pemex creció 15% en 2018", El Economista, February 4th 2019, <https://www.eleconomista.com.mx/economia/Servicio-de-deuda-de-Pemex-crecio-15-en-2018-a-122057-millones-de-pesos-20190204-0096.html>

¹⁵⁷ Jude Webber, "Doubts grow over Mexico's rescue plan for Pemex", Financial Times, February 19 2019, Accessed on May 10 2019 through Factiva.

¹⁵⁸ Pemex, 2019, Inversión en Cifras, accessed on May 10 2019 from <http://www.pemex.com/ri/finanzas/Paginas/InversionCifras.aspx>

Since before the reform, Pemex had been cutting budget (personnel, renegotiation of contracts with suppliers), and renegotiating debts. In 2015 it reached an agreement to reduce and defer pension liabilities which, by one count, amounted to USD 90 bn.¹⁵⁹ The new national government that started in late 2018 revamped and doubled on the promises to relieve and restore Pemex through tax cuts and capital injection, and it has carried out some of these commitments in draconian style.¹⁶⁰



For Pemex natural gas is more a solution than a problem, but still, one that carries little relief to its gravest problems.¹⁶¹ Domestic sales of natural gas amounted to around 4% of all sales of Pemex between 2011 and 2017.¹⁶² Moreover, the recovery of domestic production of natural gas, where Pemex is still the largest player, has become a welcome and perhaps indispensable condition to preserve the functionality of the network and the possibilities of forming an integrated market. The supply crisis in the Yucatan peninsula illustrates the point clearly. In that region, a decrease in domestic production aggravated after the explosion of a platform in 2015.

¹⁵⁹ Jude Webber, “Pemex reaches pensions deals with powerful unions”, *Financial Times*, November 11, 2015. Accessed on May 10 2019 through Factiva.

¹⁶⁰ J. Webber and M. Stott, “Mexico: López Obrador makes a big bet on oil”, *Financial Times*, October 3, 2019. Accessed online from <https://www.ft.com/content/d5c3c1c0-e432-11e9-b112-9624ec9edc59>

¹⁶¹ Enrique Rojo, “Análisis de la estrategia de negocios de Pemex con matriz BCG”, *Energía a Debate*, January 2018, accessed on June 20, 2019 from <https://www.energiaadebate.com/blog/3003/>

¹⁶² Pemex, 2018, *Pemex Factsheet*, accessed on May 5th, 2019 from at <http://www.pemex.com/en/investors/investor-tools/Paginas/factsheet.aspx>

Production in the Gulf has not been enough, however, to keep enough pressure in the system and supply the centre, south and Pemex's own production needs, despite imports.¹⁶³

Moreover, national and energy security considerations surface from time to time, pointing at the obvious dependency on natural gas from Texas --all LNG imports come from the U.S. also.¹⁶⁴

Although it would not make market sense to cut supply from the U.S., it is impossible to rule out price volatility or even political maneuvering (in the Trump era). The lack of storage capacity, a chronic problem of public policy and regulation that this research has not explored, underscores the risks associated with this dependency on land imports and LNG.

As for regulation and restructuring, one former official recalls that Pemex has been cutting access to other traders alleging operational difficulties. Moreover, the data published in the Electronic Bulletin Board of CENAGAS, suggest that the capacity that should not have been used was used indeed, because a physical restriction did not occur... and the capacity was reallocated to other users. In the view of a former official of CENAGAS, this is an indication that the independence of CENAGAS can be compromised if the national executive does not have an active policy to keep its SOEs and NOC separated.¹⁶⁵

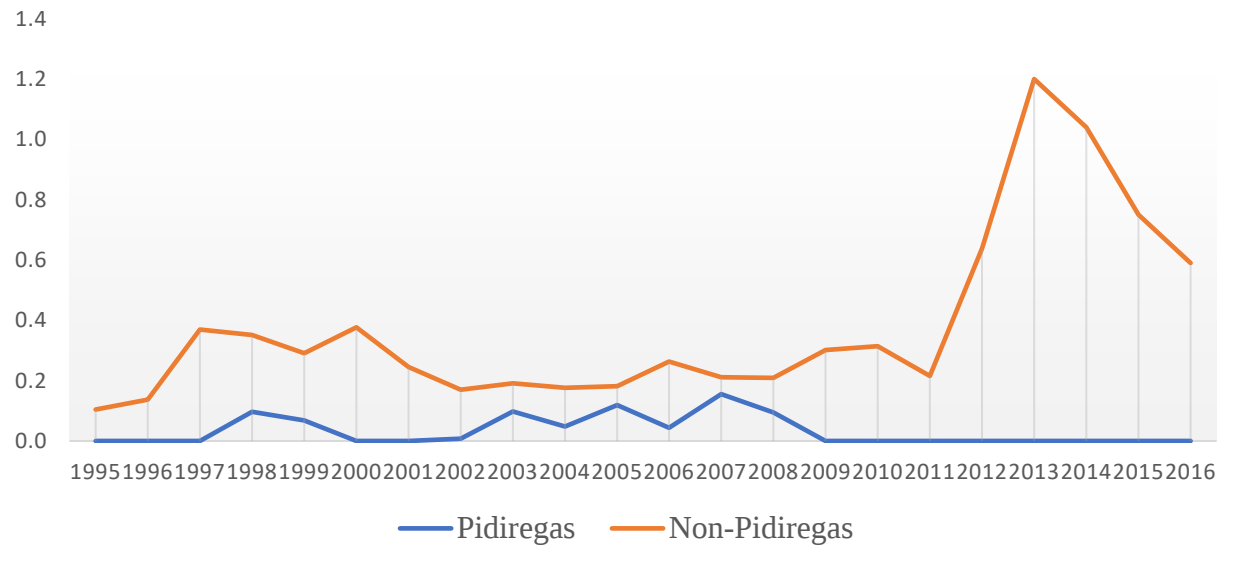
In sum, the overall problems of the new instruments of regulation are still centered on the risks of collusion and unilateral practices affecting open-access. However, they are taking place with a different distribution of authority and technical capacities.

¹⁶³ V. Ramirez, "Desbalances en el sector energetico", Nexos, November 14th 2019, accessed from <https://www.nexos.com.mx/?p=45763>

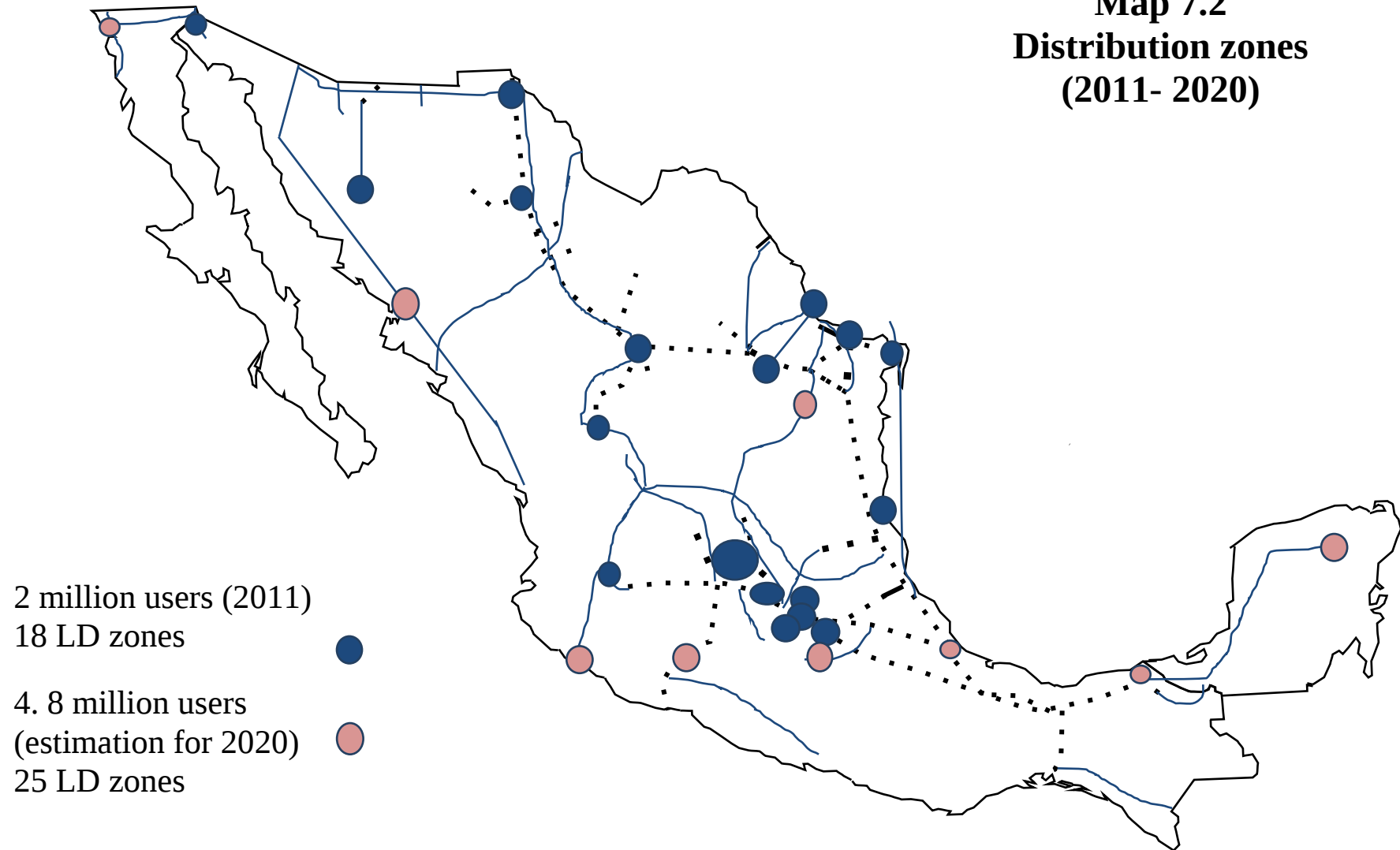
¹⁶⁴ Adam Williams, "Q&A with David Rosales on Mexico's Natural Gas Market Development", Natural Gas Intelligence, April 26, 2019. Accessed online at www.naturalgasintel.com

¹⁶⁵ Prud'homme, E., "In Mexico's natural gas market, plenty of politics, not much policy", Natural Gas Intelligence, August 9 2019, Accessed via Factiva.

Chart 7.3 Capital Expenditure in gas subsidiary of Pemex
1995-2016
(bn USD)



Map 7.2
Distribution zones
(2011- 2020)



The sectoral regulator and the challenges of regulation in 2018

One pertinent question to finish the empirical revision of the case should center, therefore, on how the new legal and economic conditions of the sector work as constraints (or vehicles) of policy and regulation. Relationships resulting from the legal and regulatory frameworks represent new strategic orientations of the participants in the sector and have a consequential effect on its governance. Recalling an economic study commissioned by the CRE (2015) one former official characterized the new sector as an *emerging market* that is giving way to a *transition market*.¹⁶⁶ This means, that *with adequate regulatory and policy measures* new entrants can create competition where it is possible (commercialization, transportation). New participants and their organic integration may eventually give maturity to the Mexican natural gas market, as an extension of the North American market.

It is worth saying at this moment that the new sector is more complex because there are possibilities of an aggregate organization that did not exist before. Concretely, there is a system in which supply and demand can form prices, and there are also more distributed mechanisms to manage information to make decisions on infrastructure. After asymmetric regulation has been applied, the instruments granting open access and the deregulation of prices work as mutual complements, and other instruments mentioned above serve to continue correcting the effect of asymmetries due to the large shares of the SOEs in the industry. The system is, nonetheless, not a market but a hybridization that distributes authority among government and autonomous agencies and that has, as explained above, strengthened hierarchical command in some areas of decision. The sections that CFE anchored have also stayed apart of CENAGAS, although they interconnect (because CENAGAS promotes the interconnection).¹⁶⁷

¹⁶⁶ Adam Williams “Q&A with Francisco Salazar on Mexico’s Natural Gas Market Development”, Natural Gas Intelligence, April 12 2019, accessed online via Factiva.

¹⁶⁷ Six pipelines: Submarine pipeline (Texas to Tuxpan); Tuxpan Tula; Tula-Villa de Reyes (all three of TC Energy); Guaymas-El Oro (IENova/Sempra); Samalayuca-Sásabe (Grupo Carso); Laguna-Aguascalientes and Villa de Reyes-Aguascalientes- Guadalajara (both of Fermaca). is presently seeking that the large submarine pipeline (2.6 BCFD) that went on stream in September 2019 connects with its system of pipelines. It is noteworthy that, when auctioning the project, the interconnection of that big artery to the rest of the system was not one of the priorities of CFE (E. Prud’homme, “Don’t let start of Mexico’s largest import pipe halt advancing modern natural gas market”, Natural Gas Intelligence, September 20, 2019, accessed online via Factiva on October 12, 2019).

To begin with the infrastructure for transportation, the breakthrough is that pipeline expansions are formally and materially the outcome of formalized processes that gauge demand and foster a coupling of private participation with the direction of the ISO. The new regulatory framework constrains central agencies and the SOEs from undertaking projects without some shared and objectively validated understanding of demand. As explained in the previous chapter, the Los Ramones pipeline, which went on stream in 2015 became a culminating example of the style of decisions that the new regulatory framework intends to eliminate (chapter 6). Regulation binding CENAGAS and all other private operators makes it mandatory to gauge the interest of potential shippers in new links. Open seasons are to be conducted whenever new capacity is available in order to prevent hoarding.

Importantly, pipeline expansions have been based much more on open seasons to gauge demand. The use of these processes speaks for the distributed nature of decisions affecting regulation and policy. Complementing these processes to gauge demand, the Ministry of energy carried out consultations on natural gas policy, including the issues of transportation and storage infrastructure. A first of its kind exercise for the energy sector in Mexico, the consultation is mandated by the new legal framework (Ley de Hidrocarburos, art. 66). The proceedings of the consultation showed that central agencies and regulators have started to organize themselves as part of a more extensive and more diverse policy community: one that seeks the validation of large industrial consumers (Vitro, ACERO, CCE, large traders (BP) and international distribution companies (Enagas)). Even if the consultation has started as a formal but not legally binding mechanism, it speaks volumes about the new needs and uses of information in the central agencies and regulators. The most interesting flank in the development of public policy is now at the interface of the sectoral regulator, the IPSO and the growing array of consumers. As liberalisation and the development of a market takes hold, the instruments that collect information and respond to the community of consumers will be critical to create input legitimacy for the operation of the CENAGAS and for the implementation of open-access policies in general. This study does not consider that these constituencies had a critical importance in facilitating the liberalisation of the sector, but they may be important to secure that liberalisation, as the profile of demand and supply takes a new form.

Moreover, as one former official of CENAGAS said, CENAGAS is a tool with some centralizing traits, but not all the accessories that exert centralized command have to be used. A former officer from the CRE recognizes that it is up to policymakers to make the best (or the worst) of those capabilities, including now that government is championing a discourse centred on energy nationalism as opposed to what it labels a defunct or superseded *neoliberal* era. As mentioned above, there are risks that CENAGAS could be a tool for manipulation seeking to strengthen the control of either of both SOEs in the sector, and with a cost that will be distributed among all users.

On the pricing flank, the most relevant transformation is the deflection of political pressure over the pricing rules thanks to the deregulation and effectiveness of information-based tools to guide day to day transactions. As long as prices stay low and infrastructure fends off shortages, large consumers will not have a reasonable way to contest regulation or policy. Nevertheless, a test for the new regulatory institutions will come if continental prices rise.¹⁶⁸

As mentioned previously, for years, officials and policy makers in the energy sector have considered that an *integrated and open* system of transportation of natural gas was a key trait of the desired systemic transformation of the sector. Even if that ideal has not been attained in full, the current state of affairs is sufficiently different to change some dominant patterns of relationships that had characterized previous periods of regulation.¹⁶⁹ The two five-year plans that the CENAGAS has released since 2015 have been promoting the physical integration that would favor redundancy and hence favor security of supply and opportunities for arbitrage.

¹⁶⁸ For instance, as a result of more exports or a slowdown of investment on non-conventional production. Not an unlikely scenario (“Investors starve US shale drillers of capital”, *Financial Times*, October 23, 2019, accessed online on October 24, 2019, from www.financialtimes.com). It can be noted that policies undertaken after 2019 have recentralized and debilitated the sectoral regulator. Should prices or security of supply suffer some meaningful disruption, the pressure of large consumers will be directed towards central agencies, as had been the case before the reforms of 2013 and 2014. (Therefore, a reversal is occurring on that flank)

¹⁶⁹ It is worth noting that the Hydrocarbon Law includes one paragraph on consultation with indigenous communities. Article 120 establishes the principles of previous, free and informed consultation, which must be carried out by the Energy Ministry with the assistance of other relevant agencies. However, in comparison to the same regulatory field in Canada, the U.S. or Australia consultation with indigenous peoples and communities is still in a very incipient legal and organizational state (see Rousseau 2017).

Competition started to emerge, although one step at a time. After the programs of release of contracts and transportation capacity, the number of marketers has been growing slowly. In September 2018 there were not enough reliable private supplies to make it feasible for large customers to switch away from either Pemex or CFE.¹⁷⁰ By August 2019, 26 traders reported transactions in August 2019.¹⁷¹ Despite this increase, most of these traders are very small and exist as local accessories of industrial consumers that sell back small quantities of excess fuel within Mexico. Pemex controls all the international links supplying the Los Ramones pipeline, while CFE controls the rest.¹⁷²

Only a few can access the infrastructure in Mexico offering confidence to their clients that their supplies will go through. Large marketers like BP, and Shell have been able to negotiate with the Mexican SOEs because they have a stake in upstream and midstream assets in the United States. As of March 2019, only BP has bought capacity in the auctions that the CRE organized to re-assign the capacity that Pemex held in the United States.¹⁷³ That stake can give BP a lever to get bargains in Mexico. As an energy manager of an industrial user of gas told a trade journal, even when the capacity release program was well drafted, the lack of reliable infrastructure hampered the migration of contracts away from Pemex and CFE.¹⁷⁴ In other words, and as underscored above, compliance with the open-access regime on the transportation segment does not suffice to preclude that large players (i.e., CFE or Pemex) keep dominance by using their leverage on demand (LDCs, IPPs, and own facilities).

On the demand side, the most remarkable development is that IPPs and industrial users can now *formally* opt to contract their supply from CFE, from Pemex or from the pool of traders that are starting to get their licenses, although, as mentioned, only a few have contracted capacity in the

¹⁷⁰ “Concerns Raised in Last Stage of Pemex Gas Contract Release Program in Mexico”, S&P Global Platts, September 7, 2018, accessed via Factiva on November 30, 2018.

¹⁷¹ “Mexico Natural Gas Marketers Transact Record Volumes in August”, Natural Gas Intelligence, September 26, 2019, accessed via Factiva on October 4, 2019.

¹⁷² A. Williams. “Q&A with Rosanety Barrios on Mexico’s natural gas market development”, NGI, March 15, 2019, accessed from Factiva.

¹⁷³ A. Williams, “Q&A with Rosanety Barrios on Mexico’s natural gas market development”, NGI, March 15, 2019, Accessed from Factiva.

¹⁷⁴ “Concerns Raised in Last Stage of Pemex Gas Contract Release Program in Mexico”, S&P Global Platts, September 7, 2018, accessed via Factiva on November 30 2018.

system of transportation to import gas from the United States. IPPs have long-term contracts with CFE-Energía, the trading arm of CFE, and that reduces the pressure to make gas available from other sources.¹⁷⁵ Nevertheless, as one former official says, there are sophisticated consumers in Mexico who would like to bypass CFE and Pemex and import gas under different conditions. It is important that regulators and Mexican authorities in the sector encourage these connections.¹⁷⁶ Moreover, distribution zones are bound to expand as transportation makes natural gas available in new regions.

It is worth inquiring whether IPPs can press to sustain a policy encouraging the entrance of imports through traders other than CFE and Pemex. IPPs have tended to promote generating plants linked to major industrial consumers (IEA 2016: 42). In 2016, IPPs (most of which produce with natural gas CCGT) accounted for 30 percent of the total installed capacity and 34 percent of the generation for public supply (12953 MW and 88.41 against 166 TWh generated by CFE (CFE 2016b: 52)).¹⁷⁷ IPPs can formally buy natural gas from sources other than CFE, but they are not doing it in significant measure. The reality is that there have not been strong incentives to pursue the shift all across, since CFE supplies them with long-term contracts.¹⁷⁸ With higher natural gas prices, and the corresponding translation into higher electricity prices, the behaviour of CFE and the IPPs could take a turn towards less cooperative relations. The current approach of the national government towards maximizing the use of all the generation capacity of CFE (despite its efficiency problems and higher environmental footprint) underscores another source of conflict between the IPPs and CFE.¹⁷⁹

Looking at the regulator, after the reform, the CRE became a constitutionally mandated creature. That means, on paper, that the CRE has a statute from Congress that can only be removed or

¹⁷⁵ A detailed examination of the sources of fuel for each IPP will also help to clarify these potential new constituencies.

¹⁷⁶ E. Prud'homme, "The state of Mexico's natural gas market today", *Natural Gas Intelligence*, February 22nd, 2019. Accessed from <https://www.naturalgasintel.com/authors/37-eduardo-prud-homme>.

¹⁷⁷ Self generation produced 17 percent of supply in 2016, according to the Sistema de Información Energética, "Balance Nacional de Energía: electricidad", available at www.sie.gob.mx.

¹⁷⁸ A. Williams, "Q&A with Rosanety Barrios on Mexico's natural gas market development", *Natural Gas Intelligence*, March 15 2019, Accessed from Factiva.

¹⁷⁹ "This is the new CFE: more generation, more control —and less private companies", *Noticias Financeras*, February 22nd, 2019, accessed via Factiva on October 30 2019.

affected by a qualified congressional majority: two-thirds of the votes. To illustrate this point: it would be more difficult for the national executive to remove the head of the CRE or to eliminate the agency than to eliminate a ministry (LORCME 2014). The framework of 2014 also gave full financial and technical autonomy to the CRE. This autonomy is based on a trust funded with revenue from the fees paid by the regulated firms (LORCME 2014, art.29). Moreover, legal autonomy has been complemented with some long-pursued *teeth*. The CRE finally got the legal attributions to establish limits to the market power of firms in its regulated industries (including the SOEs, naturally) and to take away their operating license.¹⁸⁰ Unfortunately, the political pressure exerted since 2019 against the CRE has decimated these strong legal barriers.

As announced above, some particularities of the new system can represent a challenge for regulation. The relevant dimension to assess is compliance and, in this case, this has to do with the capabilities of the whole system to make powerful players comply with regulation. Put more specifically, to preclude cross-subsidization, collusion and to make all players abide by the principles of open-access. It is also important to examine the limits or potential challenges to this effectiveness. The CRE's role in the formation of a market is different today, hence, and it corresponds to new legal capabilities but, moreover, to a new position among the regulated. The combination of the legal attributes and the position within the policy sector creates a different state of affairs.

The other is the burden of breaking away with the past, making sure it does not repeat in the future. Implementation of asymmetric regulation has been the instrument to reduce the market power of Pemex. The warning signs flash, however, in relation to the dominance that Pemex could keep in the south and to the possibilities of collusion between CENAGAS and Pemex, and/or CENAGAS and CFE. In the west, where CFE has anchored new capacity of transportation and distribution has not flourished, CFE can exert its leverage as a trader of natural gas to hinder access of other traders to the links of transportation where CFE is the primary client.

¹⁸⁰ Previously, that was the exclusive role of the economic competition watchdog.

Analytical summary

The implementation of reforms after 2014 allowed the flourishing of the class of instruments of policy that characterize the more fluid natural gas industries in the world. These instruments refer, chiefly, to the information systems to disclose the usage of the pipeline links, consultation with users about the planning of future infrastructure. These instruments needed a hard basis: the asymmetric regulation measures to reduce the market share of the NOC. They also offer a new source of support to a more complex policy because they enhance credibility. These instruments promoted (and required) bureaucratic coordination that was unprecedented for the sector. In doing so, they also redraw boundaries between regulators and policymakers. If there is an emerging property in the new system, that is the *demand for regulatory institutions* and, given the centrality of natural gas for energy security, the reliance of policy on the new regulatory institutions. Policies require decentralized and information-based instruments.

The push back of the NOC against the new policy did not surface in a way that could challenge implementation of the restructuring before 2019. Pemex was the big loser of the reforms, although the legal changes had as much an intention to formalize the current situation as they were redrawing lines and reconfiguring the ownership of the transportation system. It is difficult to separate the push back of CFE and Pemex after 2018, because the national government embraced a nationalistic policy favoring them. In other words, the backlash of the energy SOEs did not occur against the national government policy but as part of it.

Table 7.2 Evolution of legal capabilities of the sectoral regulator (CRE)			
	1993 and 1995	2008¹⁸¹	2014
Autonomy of the agency	First design (1993) left the CRE as an adjunct department (órgano desconcentrado) of the Ministry of Energy. In 1995, the CRE was granted technical autonomy: independence to choose staff.¹⁸²	Immunity of board from demands of economic damage (protection against regulatory capture. Art 4). Capacity to interpret the Law.	Statute protected by Constitutional law (board and framework can only be changed with a two-thirds majority in Congress). Self-funding from regulatory activities. Legal status: co-coordinated energy regulator (along with upstream regulator, CNH).¹⁸³
Natural gas	Terms and conditions (t & c) for wholesale (first-hand) transactions and definition of pricing methods.	Definition of tariffs and distribution zones enshrined in Law, not through executive rulings (art. 3). Capability to create integrated systems of transportation. Regulation of storage and imports/exports.	Cancellation of price controls (June 2017) Oversight of one-off program of asymmetric regulation.

¹⁸¹ CRE, 2008, Informe 2008. Cap. 2 (Instrumentos de regulación); Jimenez and Ortega (2009).

¹⁸² In the Mexican public administration system, de-concentrated agencies enjoy technical independence, although they stay under the financial and administrative authority of ministries.

¹⁸³ The constitutional reform of 2013 and its secondary legislation of 2014 give financial and managerial autonomy to both the CRE and the CNH (Comisión Nacional de Hidrocarburos). See the Law of Regulatory Agencies/ Ley de los Órganos Reguladores Coordinados en Energía).

Conclusion

The natural gas sector evolved slowly in the years preceding the reform of 2013 and 2014. The regulatory agency became a key actor in the implementation of that second cycle of policy change. With the right legal capabilities and the urgency to solve supply crises, the regulatory framework became critical to solving the problem of energy security. The sectoral regulator has been central in the application of asymmetric regulation and putting in place the contract and information bases of the new system to transact natural gas.

The fact that policymakers and regulators have to rely on new *input* mechanisms (open seasons, pricing indexes) to define the key aspects of policy (transportation and storage infrastructure) or to promote the connection of demand and supply speaks substantially about the reconfiguration of relations within the sector, including those that affect the SOEs. All this said, it is difficult to assert that they can create sufficient pressure to neutralize an implicit policy that, since the new national administration took office in December 2018, seems to be repealing the restructuring philosophy started in 2013 and 2014.

Some aspects have changed structurally, and they create a momentum of its own. As it gets implemented, open-access, vertical separation and upstream liberalisation of prices and imports can create (and may have been creating) a positive feedback, reinforcing the demand for institutions (rules and processes) to enforce it and keep it working. Part of these positive effects include a new salience of information of network flows replacing, where possible, oversight and monopoly regulation. Finally, the number and diversity of actors can serve to give more leverage to the CRE in its institutionally bounded rationality of securing open-access, vertical separation and optimization of the use of infrastructure in the interest of all users and consumers (according to whom).

Chapter 8

Political economy and regulation: what does the case show?

The two attempts at restructuring the NOC-dominated natural gas industry in Mexico (one in 1995 and the other starting in 2013) were inspired by examples of policies reorganizing other natural gas sectors in the world. The most prominent obstacles that these policies encountered derive from the structure of the energy sector in Mexico: dominated until today by State-owned enterprises. The possibilities of restructuring were also determined by these enterprises, by their strategies and by the shifts in the relative resources they held in the sector.

Thinking from a structure-agency perspective, this case seems to leave little weight to the former term of the dyad. However, it is always risky to infer too much from structural factors. The process under revision also highlights critical moments, where decisions could have accentuated problems (*original sins*, ch. 5) or directed the evolution of the industry in directions that would affect policy later on (supply risks shouldered by CFE since the early 2000s). Moreover, the coordination between high-rank officers implementing the reforms approved in 2013 and 2014 should also be part of an assessment of the process of restructuring that this dissertation examines.

Decisions mattered, and while some had the effect of reinforcing an SOE-dominated sector, other decisions have brought the industry away from that paradigm. Today, there are signs that the policy package adopted since 2013 is giving way to a system of transportation and trading with acceptable openness, (see below). At the end of the period under consideration, the enactment and implementation of asymmetric regulation through restructuring of public ownership is showing signs of resilience against the centralizing policies of a new government. In other words, a new structure, constraining centralizing drives, is guarding off a liberalised sector.

This last chapter of the dissertation aims to bring together the description of the preceding sections, and make sense of them, analytically. I argue that, while the energy SOEs have been prominent as limits of the restructuring towards liberalisation, it must also be noted that the new structure of the industry can fend off or limit centralizing policies. With an eye on methodology, this argument highlights the possibility of treating this process-tracing case as a limit case where an economic organization emerges (and converges in substantial aspects with the exemplar cases) due to sector-specific requisites. Those possibilities can speak about the relevance that this case can have as part of the scholarly discussion on regulation and policy: the boundaries between each domain when

both are aspects of economic governance and when both are subject to ideational trends affecting their goals and structure.

Organization of the chapter

This chapter has four sections. The first revisits the organization of the natural gas industry in Mexico today, taking stock of the changes that could signal the limited albeit irreversible consolidation of an open system to trade natural gas. A second section develops a political economy perspective, underscoring the structural constraints that seem to have influenced the process of policy change occurring in this case. As advanced previously, this interpretive chapter argues that there is more to say about the powers that be in this case than the classifications of political economy alone can suggest. With that in mind, a third section reflects on the processes of institutionalization that took place (or could have taken place) in the case and that can shed some light for scholars interested in policy change as a process affecting regulation. The current state of the natural gas industry and the policies that a new government has started to promote highlight a conjuncture where there is a concrete possibility of consolidating liberalisation, even against policies that have been pursuing a stronger dominance of the SOEs over energy.

For liberalisation to consolidate, restructuring efforts must accomplish two critical conditions: 1) guarantee that a multiplicity of suppliers and consumers trade natural gas through infrastructure governed by open-access rules; and 2) concomitant to that, that pricing rules associated with long-term contracts give way to spot markets, ideally physically placed in regional (or national) balancing centers (hub-based pricing).

These two conditions depend on several other conditions and phases of institutional development (see below).

Box 8.1. Developmental milestones in liberalisation¹⁸⁴
Third-party access pipelines and terminals of regasification Bi-lateral trades Price discovery and disclosure Balancing rules and standardized trading contracts Over-the-counter brokered trading Non-physical players enter Futures exchange Liquid forward curve develops Indices derive for long-term contracts

Natural gas sectors can attain a degree of maturity that leaves restructurings protected from reversal –i.e., increasing the risks and costs of such backtracking policies. Liberalisation would *lock-in*. The essential question is, hence, whether one particular natural gas sector has attained that state: whether a stable new system can rest on its new self-regulating features in combination with a given degree of regulation. It is not an easy question to answer: the opinions and measurements of practitioners and observers have not formed a clear body of knowledge in this respect. However, it is worth looking at the question more closely, as an introductory theme to analyze the whole case study.

For this case, two conditions seem necessary. First, as consumers become more sophisticated and as producers and traders identify new possibilities of exchange, they may feel the need to press for a regulatory and policy framework that convenes to these interests. Second, the SOEs must be ready to compete on a level playing field, addressing more complex requirements. For that reason, regulation must ensure that traders of all scales can participate, averting the possibility that SOEs or any other participant tamper with the transportation and storage systems, or that they exercise their market power and reach across segments to prevent competition. That is the (new) importance of regulation.

Progress in the implementation of the restructuring that took momentum after 2014 has changed already the role of the state and the role of regulators (as part of the state) – even without

¹⁸⁴ From Stern (2014).

considering the policy preferences of the government that started in December 2018. CENAGAS is at the center of these transformations because it is planning and promoting the growth of the network of transportation, while it manages day-to-day operations of a core section of that network.

In contrast to the course of events after the reform of 1995, there was a satisfactory degree of policy coherence and institutional capacity of the regulator during the five years of implementation of the package of reforms enacted in 2014. With only minor delays and setbacks, the regulatory agency, the transportation IPSO (CENAGAS) and central agencies, attained the milestones of a route map towards liberalisation (open-access, asymmetric regulation and price deregulation).

Organizing a secondary market for transportation rights is a complicated endeavor. However, as a basic condition, secondary markets for transportation require deeper spot markets for the commodity, which do not exist in Mexico at this moment. As of December 2019, private shippers had reserved 16 percent of the capacity available in the system operated by CENAGAS. Although there are relatively few independent firms trading natural gas in Mexico today, an electronic bulletin board (EBB) started working in 2018 and is displaying information about the use of transportation capacity in the SISTRANGAS.¹⁸⁵ This helps to prevent hoarding of unused capacity. The principle *use it or lose it* must be upheld in regulatory decisions on the use of that capacity.

Box 8.2. Milestones of implementation since 2014¹⁸⁶
2014. Approval of secondary legislation and creation of CENAGAS (Congress and Federal Executive)
2015. Release of first five-year plan of CENAGAS
2016. Approval of Program of Capacity Release (CRE)
2017. Auctions of capacity in injection pipelines (CENAGAS)
Open season (CENAGAS)
Abolition of pricing regulations (maximum prices of FHS. CRE)
2018. Release of Electronic Board Bulletin of SISTRANGAS (CENAGAS)

¹⁸⁵ This is the case for March 2018. Natural Gas Intelligence, March 9, 2018, “Mexico revising secondary market rules for capacity rights on natgas pipelines”, www.naturalgasintel.com

¹⁸⁶ Developed by the author, with information from SENER (2018).

Also, there is physical infrastructure in place, enabling the interconnection of multiple sources of fuel (appendix 2). Complementary to that, the economics of continental flows have made natural gas very difficult to resist as a power generation fuel: Mexico has become the country that produces the most electricity from natural gas. Before the Covid19 pandemic hit the world economy, natural gas production (at a historical peak in 2019) started a slight decrease in the U.S., helping prices to rebound (EIA 2020).¹⁸⁷ The expectation for the U.S. has also been also that prices are set to increase as new LNG export points go on stream.¹⁸⁸

The availability of connections creates positive feedback loops over policy: more consumers and more suppliers get a stake in the adequate functioning of the system, and the costs of turning back increase. Everyone can win, and there is a framework of processes to integrate the views of suppliers and consumers in the decisions of the regulatory agencies and of the IPSO. However, part of the incipient maturity of the sector resides in the absence (still today) of strong constituencies supporting the permanence and consolidation of the restructuring. In the first 18 months of the new administration (December 2018 to June 2020), policy has been much more responding to the requests of CFE than to those of new consumers of natural gas.

Studying regulation through the prisms of political economy: varieties of capitalism and varieties of state capitalism

This section revisits the case and addresses some of the scholarly discussions surrounding the restructuring of natural gas sectors. The section aims to suggest the theoretical links that may be built to integrate some notions of political economy in the study of regulation.

A starting point might say that, if Mexico has been characterized as a hierarchical market economy (Ross-Schneider 2012 and 2002), it must also be added that policymakers have been historically very constrained by the SOEs on all things energy. Economic policy and trade have been the preferred space for business-state relations resembling the typical hierarchical mode of capitalism:

¹⁸⁷ On average, the U.S. produced 89 BCFD of natural gas in 2018, and 99 BCFD in 2019 (EIA 2020).

¹⁸⁸ [NGI](#), November 2, 2018, “Winter Preview Part 2: Demand a Critical Component of South Central Landscape”, [NGI's Daily Gas Price Index](#). Accessed online from Factiva, on July 17th, 2020.

through coordination between vault business organizations. These decision-making patterns have persisted across substantially different periods of the recent economic history of Mexico: the era of import-substitution industrialization (which came to a close in the 1970s) and the era of integration to the world economy through trade agreements (from the 1980s to our days. Ross-Schneider 2002).

Scholars have pointed out that, after the demise of import substitution industrialization, industrial policy has mostly consisted of institutional construction and transformation to attract investment (Bizberg 2019). Since 2018, announcements of multibillion-dollar packages of public and private investment in infrastructure are becoming (again) a symbol and a testimony of a type of coordination with an effect on energy. It is more adequate, however, to say that the new coordination resembles more a public relations strategy where private investors have a symbolic and/or subordinate role.¹⁸⁹

A notable development of the last two decades has been the gradual but resolute transformation of the expectations of big business with respect to how upstream energy must be governed. The reform of 2013 and 2014 materialized a consensus in which the high-level business organizations have been demanding expedient improvement of Mexican competitiveness through less expensive energy prices. However, speaking of natural gas, this research did not detect that business organizations or large industrial consumers had been constituencies consistently seeking for restructuring in the sense of liberalisation (Grunstein 2013, Chapter 7).

It can be reiterated, therefore, that the process of liberalisation that this case study observes has not been directly promoted by the mechanism of economic coordination that characterized Mexico as a hierarchical market economy. Before gaining full legal autonomy, regulators occasionally referred to the necessity of promoting systemic change by bringing in industrial users (chapter 6).

¹⁸⁹ The most recent example, in late 2020, is a package of five big projects, led by Pemex, CFE and the Port Authorities (Administración Portuaria Integral), for around USD 5 bn. The projects are upgrades of two refineries and an LNG terminal, the construction of which has been continuously put off. The announcements, made by the national government, did not contain details on how private contractors would contribute. R. Buchanan, “Private Sector Sees Potential New Opening to Invest in Mexico Energy Sector”, *Natural Gas Intelligence*, November 25, 2020, accessed from <https://www.naturalgasintel.com/private-sector-sees-potential-new-opening-to-invest-in-mexico-energy-sector/> on December 17, 2020.

These scattered efforts reflect the interest of the sectoral regulation in creating better conditions to implement liberalisation. But pushing for reorganization of the sector has to be considered a matter of policymaking, beyond the role of regulators. If industrial users have benefitted from the new access to low-priced natural gas, that is a by-product of the opening and expansion of infrastructure that the energy SOEs (and chiefly CFE) promoted.

What does this mean for a researcher interested in categorizing the economic coordination leading to restructuring after 23 years of failed implementation? Before 2013, the technocratic elite that promoted the restructuring in 1995 found itself alone in its efforts to bring in private trading of U.S. gas and LNG. Also, hierarchical coordination with high-level business organizations was out of the array of potential tools to bring the NOC into compliance with the intended restructuring. The restructuring is owed, structurally, to the accommodations occurring between the NOC and the SOE, and hierarchically decided policy had little choice or agency to attain the outcome.

At this point, it is convenient to recall two comparative aspects. First, that in the U.S., open-access regulation was introduced, in substantial part, thanks to the positive feedback of LDCs, independent traders and large consumers seeking to bypass vertically integrated pipelines (Makholm 2012 and Chapter 3). Conflict between merchant pipelines and LDCs offered opportunities for insightful federal regulators, but restructuring found limits at the level of state regulation. In the EU, liberalisation has been mostly pushed *top-down*, following economic competition directives, and has found limits in the gaps and contradictions of the national energy systems. Regional enterprises are still shaping the pace and scope of restructuring, sometimes aided by the dilemmas of security that integration can carry about (Correleje et al. 2014; Westphal et al. 2014).

The paradigmatic cases of restructuring took place in other liberal market economies, but the critical difference may reside in the fact that the U.K., Canada and the United States could count on physically redundant and reliable systems of transportation. Where physical infrastructure exists, policy and regulation can concentrate on the transition problems of open-access. Where mature financial markets exist, these can support the more rapid development of secondary markets for capacity rights (as well as financial derivatives. Makholm 2012; Juris 2000).

None of these conditions were fulfilled in the case of Mexico. Absent these institutions or economic structures governing day-to-day transactions, government coordination had to make do with top bureaucratic decision-making that reasserted the known and established pathways. Also, Mexico has lacked the diversity of consumers and traders that could engage in the politics of restructuring and favor openness and price deregulation. The poor state of physical infrastructure for transportation and storage points to a supplementary role for state enterprises: covering gaps which otherwise would not be overcome. The policy since 2009 has been articulated around the availability of cheap U.S. gas. Industrial users have been on board with all the aspects of policy to take advantage of that availability. A test of the support of industrial users will come if prices become volatile at some moment in the future, although the complications of new subsidies are difficult to imagine in a landscape of physical interconnection and independent trading.

When trying to reform Pemex and CFE, all the national governments studied in this research took steps to correct the dependence of the Mexican economy on the oil rent and to reduce the financial burden of the electricity system. These efforts necessitated and failed to surmount the ultimate obstacle posed by these SOEs, namely: that they are prizes for interest groups and large constituencies (firms in the procurement chains, unions, and the population receiving subsidized energy). The possibilities of bringing about a new game on the whole energy system came because of the undermining dynamics of this scheme.

Was the energy reform of 2013 and 2014 a correction of the whole *rentist* political economy of Mexico? It was touted as such from some corners. At its best, the liberal paradigm that underlies the reform attempts to maximize a considerable degree of State-ownership on both hydrocarbons and electricity, with the potential of independent regulation to attract private participation and make markets develop.¹⁹⁰ Its aims are coherent with a liberal paradigm of governance of natural

¹⁹⁰ In the summer of 2020, testimonies and evidence of kickbacks to lawmakers came to light. This evidence surfaced during a process of investigation into a CEO of Pemex during the last administration (2012-2018). In the context of Mexican lawmaking processes that the evidence has revealed, it is possible to imagine that domestic and foreign firms that wanted to produce oil, gas and electricity could have used corrupt Mexican brokers to shape the reform and to make it happen. How much those events speak for a critical problem of cronyism that affects the possibilities of transforming energy governance is a question

resources through contracts, regulation and private associations with the NOC. More fundamentally, the electricity and hydrocarbons reform are designed to bring in the abundant capital that the Mexican economy and the SOEs do not have. The critical unsolved question (and debate) concerns the NOC and the capability of governments to improve its management and productivity in the new institutional landscape.

It may be adequate to recall here, with two scholars studying varieties of state capitalism, that (...) *the positive effect of having state ownership to fill institutional voids and implement government capabilities is stronger the larger those voids are and tends to disappear as financial markets grow, and the rule of law improves.*¹⁹¹

Consistent with this rationale, which underscores developmental timing, the discretionary (rather than hierarchically organized) governance of the SOEs are more clearly factors explaining the centralization and reliance on SOEs in the buildup of transportation infrastructure. To be sure, a higher degree of state *planning* was necessary to make reforms work. This necessity stands separate to the interest of the Mexican state, in the reforms, to keep SOEs competing and bringing in revenue and control over energy security. However, these commitments combine a rationality of restraint with the capability to bridge gaps: there are instruments that enable market displacing intervention (sponsorship of critical infrastructure) , and others that prevent non-desirable forms of intervention (i.e., asymmetric and *Chinese Wall* regulations).

Regulation and the process of policy change

Scholar attention has been turning towards the VoC literature in search of keys to explain differences of regulation: its organizational foundations and the outcome of regulation as an attributable to those foundations (Guidi et al 2019: 11). These differences may be relevant for several economic sectors, but in the light of the findings of this dissertation, if I were to undertake a comparative analysis, I would start with a skeptical eye. The reason may be that sector-specific trends seem strong in determining the blueprint of reorganization. I would bet, now, that open-

that deserves a separate analysis. Such a study could put to the test some of the arguments that this dissertation has developed.

¹⁹¹ From Musacchio et al. (2015).

access and price liberalisation are core, discrete, characteristics that can exist within state-dominated sectors. As pointed out above, some institutions of developed nations facilitate restructurings towards liberalisation (even if these are not complete or not completely efficient). Although I did not test these factors in the research, they are: the maturity of financial markets, the robustness of the judiciary and the simple scale and diversity of participants in the supply and demand ends. It may be evident, but maybe also necessary to highlight: the existence and maturity of market institutions beget a stronger push to reproduce themselves.

There are observations that relate to the process of change, and that need to be brought together. It is important to note that the sense of urgency, the absence of physical infrastructure and the institutionalization of policy coordination can only be assessed through an interpretation. The organizational layout that characterizes the Mexican economy as a hierarchical market economy is clear, as is the centrality of the energy SOEs in the implementation of policy. The point suggests possibilities of analysis beyond the present conjuncture in Mexico. *What degree of institutionalization and what degree of urgency have been necessary to bring about and to consolidate the institutional change that this dissertation has observed?*

As chapter 7 points out, coordination could have gone further, to materialize the growth of infrastructure and, from there, to materialize a much more complex industry, with a variety of traders and consumers that would have made new levels of market integration more palatable. Since before the reforms, the regulatory authorities had been touting a secondary market of transportation as a possible goal, aligning policy and regulatory change (chapters 6 and 7). However, (as stated in chapter 7) the creation of secondary markets did not become a central and explicit purpose of coordination. It has not materialized, as of 2020 (CENAGAS 2020). Until 2018, attention had to stay on solving the most pressing problem: creating physical infrastructure.

Therefore, it might be important not to overstate the intentions of policymakers as architects of a new policy and regulatory framework: open-access and price deregulations were made possible by the existence of new physical infrastructure to bring in imported natural gas that Pemex could not produce. The reforms of 2013 and 2014 only translated that material state of affairs into a new, more coherent, legal framework. It is also necessary to assess fairly the role of regulators. The

sectoral regulator in this case gained legal and financial capacities as part of a policy design requiring delegation and credible commitment of the agency. The last bout of reforms (2013 and 2014) took an almost radical strategy with regards to the autonomy of the agency –while keeping a more moderate approach in the dismantling of the dominant position of the SOEs. Interestingly, interviewees remark that the necessary condition for adequate coordination was the sense of urgency and the shared vision that came to prevail in the circles of government since before the reforms of 2013, but especially after the reforms (interview with officers of the Ministry of Energy at the time). The transformation of the natural gas industry depended critically on the political will to take on the NOC, and to continue permitting the electricity SOE to gain clout over the new infrastructure. What remains yet to be acknowledged is the space where possibilities of change depended on a shared, mostly implicit, understanding, between the relevant actors deciding energy policy.

Interviews say that the vision emerged fleetingly, without taking hold in coherent and consistent policies to favor a consolidation of the plans of open-access and integration of a wider, privately operated, network of transportation. The outcome (or more precisely, the lack thereof) is evident. It is difficult to document the process or processes of communication that would prove what alternatives were pondered at what moment. A closer examination of high-level bureaucratic coordination during periods of stability and critical junctures could have shed some light into decision-making patterns, their institutional boundaries, and the latitude of policymakers trying to implement policy. This dissertation has noted that a common theme in critical moments was the drive of policymakers to try to rein in the discretionary power of the NOC, and to institutionalize aspects of the policies affecting natural gas (open-access, subsidies, information).

From sociological perspective, there might be forms to explore how trust is made and broken that could ratchet into more ambitious and coordinated implementation. A handful of conjectures on decision-making and choice of instruments insinuate themselves when one is looking at how much *agents* could resist structural patterns... or compete with other agents. As this research has argued, the literature examining elites and epistemic communities underscores that critical junctures can offer disproportionate sway to officers and policy makers pushing for innovation. Like-minded

officials can also influence decision-making and implementation when their common knowledge offers an advantage in a field with requisites of high technical knowledge and coherence across policy subsectors (Davis-Cross 2013), as is the case of energy. In spite of the relative capacity of the cadres of high-level bureaucrats implementing economic restructuring, the *epistemic communities* approach has clear limits in this case. Pushback in the form of open resistance to policies combined with political opposition protecting the NOC and the SOE left the natural gas industry to transform mostly through the effects of one state-enterprise displacing the other.

Another question of relevance for public administration scholars concerns bureaucratization. To be sure, processes of restructuring can be seen as transformations of centralized into decentralized bureaucratic layouts. A large share of the preoccupations of the decision-makers had to do with institutionalizing a space of technical neutrality, expertise and adherence to procedure, as a way of reconfiguring the boundaries between policy, regulation and the power politics that left so much clout to the State enterprises. Autonomous regulatory agencies have been seen as indispensable to the success of liberalisation policies (Joskow 2008 and 2005).

Students of regulation have attempted explanations at both ends of these processes. Seeing regulatory agencies and their constitutional and legal underpinnings, as a consequence of political processes, the emergence of *non-majoritarian* regulators beyond America has embodied national and supranational intentions to reconcile credibility, technical capacity and accountability in the governance of complex economic sectors (Majone 1997). Extended trends of institutional imitation have also come as consequence of internationalization of enterprises and of expansion of international trade. Studying the *consequences* of regulation from a public administration perspective, for Cohen and Thatcher (2005), can consider sociological processes involving the language, technical functions and relations between the new agents, industries and governments. Institutional mimicry can coexist with innovation, hybridization and mission creep. Further, as Jordana and Levi-Faur (2006) discuss, liberalisation and the enactment of autonomous regulation can also coexist with policy goals favoring national champions.

For this case, as pointed out above, it is fair to assess that one salient consequence of the push towards autonomous regulation was materializing, albeit ephemerally, the possibility of simply *governing* the SOEs. Regulatory agencies (including the several other environmental and upstream commissions created or strengthened after 2014) can sustain a whole new array of policy goals. These are market friendly, although coexisting with a legacy of planning, subsidization and public ownership (as is the case in most other developed and developing nations). On the other hand, it is interesting that, in its aim to re-concentrate decision-making, the current government has been revealing the minimal and at the same time sufficient aspects of liberalisation *that don't require autonomous regulation to persist*. It is worth asking how much can essential requisites of liberalisation (open-access, price deregulation) persist under politically subordinated regulators. Thus far, there is a limited, but still discrete, openness of the system, and, to present it in terms of the policy-regulation dyad, open-access and price liberalisation have become principles of policy that policymakers can commit to respect. Contrary to how policy was organized 20 years ago, alternatives to open-access and price deregulation are now more costly and complicated to implement.

Conclusions

This case study presents the pathways of two policy packages seeking to establish open-access and trade liberalisation in a natural gas industry dominated by a NOC. If hypotheses were presented as conjectures about what factors can enable or hinder such policy goals, then the most obvious among these hypotheses would need to center on that NOC, and on its relationships with the rest of the economy and the institutions of the state.

The dissertation documented how the structural characteristics of the Mexican political economy affected the process of transformation of the natural gas sector.

1. First conclusion of the dissertation. Regulation matters for reasons that go beyond the mandate that regulators had (in this case). I have tried to study whether the State organizes responses to institutional voids. Regulators are obviously part of the State. They had a way of dealing with contingency that affected their functions. That extraordinary role of regulation since before the reforms of 2013 resided in the technical capacity that the agency had garnered throughout the

years. Perhaps the key for that extraordinary role, in which the sectoral regulator was one piece in the policy of restructuring, resided in the credibility that its technical capacity lent to the measurers backed by central agencies. However, it is important to underscore that this credibility depended just as much on the disposition of policymakers to move ahead with the plans of restructuring. That extraordinary role in the transition tended to subside as the sector ceased to stand on one leg (one producer, a small system of transportation) and started to resemble a nascent market, with a new SOE in charge of the largest share of pipelines.

From then on, a new normalcy, where regulation differentiated from policy in clearer forms, started to emerge. The refurbishment of instruments of policy governing natural gas kept some keys to energy security in the new IPSO (also an SOE), and in the coordination that the central agencies must promote. Other instruments redistributed authority, finally upholding a model of arms-length regulation (although it has been weakening since 2019). It is essential to see, across all subperiods, but especially before 2013, that regulators do not create their own mandate, and that policy coherence (and incoherence) has been a matter for policymakers to navigate –often through reaction to the consequences of those problems of coherence.

Questions of state autonomy and state capacity deserve some further comment. The political elites carried out a reform against the market power of the NOC, complemented by concrete options to maintain a check on the electricity SOE. How and why that happened should be an interesting question on its own, although it was not the original scope of this research. Coordination between agencies depends, at different times, on an array of changing conditions, like supply, demand, timing, leadership and a shared vision on how regulation and policy should be delimited from one another. Critical circumstances strengthened the shared vision on the necessity to expand the system of transportation and to regulate it in ways that would favor private participation. At the level of state autonomy also, it is still an interesting question knowing how and why policies finally happened in ways that countered clienteles and groups (although not entirely, and for sure not without nourishing other clienteles and interest groups).

This dissertation centered on regulation, which can be understood as a part of state capacity, because its critical characteristic is applying a technique (and not defining policy goals). After 2014, legal provisions distributed roles and assets in a way that permitted regulators to gain

leverage against the regulated, and especially against the state-owned firms (although not in an overwhelming way). As the previous chapter underscored, the leverage of regulators, and hence the capacity of the state that they represent, grows in tandem with the diversity of consumers and suppliers in the sector. Liberalisation needs neutral institutions as much as neutral institutions need competition to take hold.

A note on security is also necessary. Private investment and international trade have become more and more important for the energy security of Mexico. In the case of natural gas, the potential political problems of dependency on foreign natural gas can only be offset with private domestic production, some of which will depend on foreign investment. (Put differently, there is no way out of this process. As one specialist said: *the energy reform is baked into the USMCA*).¹⁹² It can be added that reverting the rights that private investors acquired in the reform would need deep changes (some of them at the constitutional level). The instruments to enhance and expand private participation in the electricity industry also redefine the limits of State participation. Considerations of energy security are explicit parts of the justification of some of these instruments in the electricity sector (IESO, input of central agencies to plans of expansion, electricity rates, and monopoly of distribution and retail). Whether those limits are effective safeguards against energy security contingencies can be a matter of much controversy, in a discussion that is beyond the scope of this research.

The legal and regulatory framework shapes the latitude of policymakers and regulators. A government with inclinations for nationalism and centralization can use some instruments creatively while keeping up with the role for private operators that characterizes the new system. One former official considers that privately operated pipelines, for instance, can be used to transport natural gas for export through LNG facilities on the Pacific Coast.¹⁹³ CFE could, hence, boost demand more rapidly and facilitate the recovery of the costs of the new infrastructure. There is nothing in the nationalistic script of running energy that would stand in the way of such a

¹⁹² The United States Mexico Canada Agreement that replaced the NAFTA in 2020. Natural Gas Intelligence, November 12th, 2019, “Energy reform in place despite rhetoric, say experts”.

¹⁹³ E. Prud’homme, “Mexico’s Once Sleepy Pacific Coast Could See New Natural Gas Options as Development”, Natural Gas Intelligence, March 6, 2020, Accessed via Factiva on March 23, 2020.

scheme, which would have the additional benefit of maintaining the attractiveness of natural gas for power generation.

As a final thought, it would have been interesting (and desirable) to observe the CRE -with its overhauled legal and technical autonomy- carrying out a different policy script: one with a more nationalistic bent, while still respectful of the tenets of the restructuring. Goals of industrial policy have been outlined by the new administration, although the coordination of industrial policy and energy policy seems to be missing (even in the form of an explicit plan of what its intentions would look like).¹⁹⁴

Moving into the theoretical level, there are also some things to remark. First, it is reasonable to think that regulation can be placed somewhere in the relations of coordination that political economy, and VoC especially, utilize as their matter of study. This intention of analysis requires some unpacking related to the aims of the research, the necessary heuristic and theoretical building blocks and their more direct relationship with the interests of the literature on regulation. Current scholarly literature has been pointing in that direction (Guidi et al. 2019).

To the extent that scholarly attention is only starting to develop those links, this research might yield interest, both for what it delivers and for what, in this final balance, are possibilities yet to be undertaken.

Some dilemmas seem worth mentioning in relation to applying categories of varieties of capitalism straight into a case like this one. The inner workings of a hierarchical market economy, when it comes to explaining a process of policy change like this, reveal themselves as strongly influenced by institutional voids and lack of control over the SOEs. The mechanisms affecting decision making can be observed, through responses to contingencies. However, the term hierarchy

¹⁹⁴ The Ministry of Economy issued a guideline with 10 goals that lay out what an industrial policy may look alike while preserving market-oriented policies. Up and center, the guidelines propose: fostering national and international direct investment, fostering economic competition, reducing regulatory delays and costs. The industrial policy goals that portend a moderate turn towards nationalism: use government procurement to help national SMEs, increase the scale of development banking for industrial projects, especially in the poorest regions. (*Reforma*, October 4, 2019, “Lanza SE política industrial”, V. Gascon, accessed from www.reforma.com).

resonates more as a euphemism than as a fair category when observing this case more closely. This is so because the central aspect of hierarchical market economies, namely, the coordination with high-level business organizations, is only tangentially observed in this case. That mechanism of economic coordination still characterizes the Mexican economy, but is not as relevant as other processes affecting the outcome in this case.

It is useful to bear in mind, however, that theories are not necessarily supposed to work as sets of deductive principles. Ideal types are that: ideal, heuristic classes. Statistical regularities can group cases in the categories defined by a theory (as empirical tests continue to confirm; Witt 2018). However, exceptions, limit cases and residual facts still make the substance of knowledge in social inquiry.

Other categories, not centered on the relationships of the whole economy, but on how institutions reflect economic and political relations in the energy sector, could also give way to meaningful observations. Following that cue, it is possible to say that hydrocarbons and electricity have been mostly a political good in Mexico –each with particularities of their own. And the packages of reforms of the last 30 years have constituted more or less effective attempts to transform (overcome?) deeply rooted traits. This research has pointed out how much pushbacks against transforming energy into a marketable good can be personified by the NOC and the electricity SOEs. It is also important to reiterate, following the research, that while State enterprises may develop strategies, these rarely persist as such across time. A large SOE can be an economic actor and also a space for other economic actors, in pursuit of potentially conflicting goals –some of them with very deep and strong societal and economic roots.

In sum, in this research I also tried to go a little further, into seeing how the decisions affecting this particular sector are embedded in sets of other relations that (maybe) can be understood through a categorical lens. I must admit that I did not succeed in that purpose. I would have required a more accurate and theory-oriented description (and comparison) of the complementarities between institutions, interests as part of a structure encompassing the energy sector, its ramifications to industry, society and politics. With the intention of building types based on empirical observation, one author proposes to classify energy systems and sectors in accordance to the ownership of resources and institutions guiding their use. Energy and the economic and

political relationships around it may be understood as the production of a political, a public or a marketable good (Heidrich upcoming). Another research strategy could be centered simply on the instruments of policy and the processes of institutionalization that they propitiate (accepting, resisting and modifying relationships). A clearer focus on the types of instruments of policy, regardless of the type of economic structure in which they exist, may be a sounder first step in the study of processes of policy change.

Beyond those possibilities, the case still can speak to researchers interested in the processes of policy change that bring about a reorganization of regulatory structures. This case study follows cycles in which decision-makers succeed, or fail, in their purpose to challenge some persisting, unchangeable, characteristics of the political economy of energy. Seen as a process of institutionalization, this case follows a prolonged series of cycles in which the importance of a neutral bureaucracy was intermittently recognized as critical to govern the industry. As the new legal and economic organization of the sector took hold, the border that separates policy from regulation institutionalized.

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Appendix 1. Timeline

1938. The national executive puts an end to a labour conflict between oil workers and American, English and Dutch oil enterprises, expropriating their assets. The national executive creates a national oil company, Pemex.

1958. Legal modifications crystallize the process of consolidation that gives Pemex the monopoly of all oil and natural gas-related activities in Mexico, including petrochemicals and refining.

1960. Conclusion of the process of concentration and nationalization of the electric industry.

1976. Mexico and the U.S. negotiate an agreement to export natural gas from Mexico at USD 2 MMBTU. The agreement is rejected by the U.S. Senate after a northward trunk-line had been already built in Mexico.

1978. U.S. Congress kicks off the long process of liberalisation of natural gas in the U.S., bypassing the Natural Gas Policy Act, which starts the deregulation of well-head prices.

1979. Start of the oil export boom in Mexico, prodded by the strike of a large deposit in the Gulf of Mexico: Cantarell. The field reaches a production of 1MMBD. Foreign debt had been growing staggeringly since 1978 and backed by geological surveys that pointed to the oil potential of Mexico. Pursuing an aggressive but ill-administered strategy of industrialization through oil exports, the national government disregarded the risks of mounting foreign debt and the appreciation of the currency, which relied on the illusion that low interest rates and high oil prices were stable conditions of the international economy.

1982. As the macroeconomic fundamentals of the nation deteriorate, a silent but steady capital flight starts to drain foreign reserves. Later in the year, the Mexican government decides to devalue the currency and to control capital movements. A financial meltdown creates a major economic crisis, which leads to a moratorium of payments of the foreign debt, and to a vindictive expropriation of banks.

New presidential cycle starting in December: Miguel de la Madrid (PRI).

1984. Mexico stops exports of natural gas to the U.S. as consequence of a dispute on pricing. Volumes were always very small (less than 30 MMCFD).

1985. FERC Order 436 enacts the option for all natural gas pipelines in the U.S. to serve on through open-access rules.

Halloween agreements in Canada scrap down controls over exports and foreign direct investment on oil and gas.

Mexico adopts the Helsinki protocol, triggering the phasing-out of technologies that produce SO₂ (coal, fuel-oil).

1988. Start of Canada-U.S. Free Trade Agreement. The treaty prevents backsliding into nationalistic policies of preceding decades.

New presidential cycle starting in December: Carlos Salinas de Gortari (PRI).

1992. Order 636 of FERC (final restructuring order), reorganized the natural gas firms by enforcing vertical separation (trade-transportation-storage) and making open-access mandatory for all natural gas pipelines.

First model of contract of supply between CFE and Pemex.

In NAFTA, Mexico commits to sustained and gradual liberalisation of energy and basic petrochemical goods (Art. 601.2).

Changes to the Electricity Law enable generation by private firms for purposes of self-supply and co-generation. The reformed law also enables the entrance of IPPs to supply the SOEs (CFE and CLyFC), which keep the monopsony of all privately produced energy.

Changes to the Pemex law reorganize the oil SOE into four financially separated subsidiaries with management autonomy.

The law mandates that pricing of fuels sold by Pemex must be competitive. That is, they should reflect the cost of opportunity of not selling them in foreign markets.

A private consultant elaborates the first netback pricing rule (pegged to South Texas market) for Mexican gas produced by Pemex. The CRE will adopt a similar benchmarking methodology for wholesale natural gas sold by Pemex.

1993. In preparation of the NAFTA era, Congress enacts the Foreign Investment Law, which envisions further protections against nationalization of foreign assets.

The Energy Regulatory Commission (CRE) is created as an advisory organ of the Ministry of Energy.

1994. New presidential cycle starting in December: Ernesto Zedillo (PRI).

1995. A currency devaluation gone awry propitiates a deep financial crisis (*tequila crisis*) three weeks after the new national government is sworn into office.

Congressional approval of the new legal framework opening transportation and distribution of natural gas to private participation.

1996. The CRE issues the Reglamento de Gas Natural (Natural Gas Ruling), allowing private investment in new transportation projects, storage, distribution and marketing. The Ruling contains the highly controversial article 10 (sections I and II) which allows the permanence of “bundled service” in supply of natural gas (the so-called “original sin” of the restructuring of Pemex’s natural gas activities).

A Gradual Open-Access Program aims to institute open-access practices in Pemex, but fails. Initiatives of the sectoral regulator to impose open-access principles in the system of transportation fail repeatedly until an IPSO takes away the physical infrastructure of Pemex in 2016.

1999. The national executive unsuccessfully promotes an initiative to reform the electricity sector enabling private generation and supply, including for supplying consumers and traders other than the CFE.

2000. The candidate of the PRI loses the presidential election for the first time in 70 years. The cabinet of Vicente Fox (Partido Acción Nacional, center-right) sets out to continue a reformist and liberalising agenda but confronts growing political opposition from the left and fails to rein in the tendencies for mismanagement of Pemex.

2001. The national government responds to a hike in prices in the U.S. by issuing *Rule 4 x 3*. This rule directly favours industrial user and guarantees a controlled price of first-hand sales of natural gas (4 USD per MBTU) for three years. Similar subsidization policies will be applied after 2003.

2002. The CRE unsuccessfully organizes an auction for a distribution zone in Veracruz, a city on the Gulf, relatively close to the production zones of Pemex. This auction will be the last in a period of almost 10 years.¹⁹⁵ In 2001 there were only 15 distribution zones serving around 2 percent of total inhabitants.

2003. A ministerial decision mandates CFE to secure the supply of IPPs through the equivalent of tolling agreements. The ministerial decision is a response to IPPs growing impatience about the reliability of supply from Pemex. The decision only gets halfway through implementation.

Searching for alternate sources of natural gas, CFE launches a bidding process for the Gulf of Mexico LNG import terminal (Altamira).

¹⁹⁵ Dow Jones International News, October 3, 2002, “No Bids Made For Gas Distribution In Mexico's Veracruz”, available from Factiva.

2004. Domestic production of oil reaches its historical peak (3.8 MMBD).

Pemex starts using Multiple Service Contracts (Contratos de Servicios Múltiples) to produce non-associated gas in the, on-shore, Burgos basin.

2006. Start of the term of Felipe Calderón (PAN, center-right), a former energy minister and congressman who promoted the private participation in the production of electricity and hydrocarbons.

Natural gas prices in North America reach historical peak at USD 8 per MMBTU.

Altamira LNG import facility goes on stream, fully operated by Shell, importing natural gas from Nigeria at prices indexed to Henry Hub and supplying CFE and IPPs power generators.

2007. A terrorist attack against the facilities of Pemex in the central region of the country creates a first shortage crisis. Strains in the transportation system will continue to afflict the sector for half a decade, at least.

2008. Congress gives the CRE faculties to integrate systems of transportation in *rolled-in* tariff schemes. The creation of an independent system operator was discussed, but not proposed.

Ensenada LNG terminal goes on stream (owned by Semptra) and supplying Baja California, with connections to the electricity system north of the border with the U.S.

2009. Although still below other international references, prices in North America hover around their historical peak (8.8 US/MMBTU between 2005 and 2006). The relative success of Multiple Services Contracts and the high prices of natural gas and oil nourish expectations that Mexico could become a net exporter of natural gas.

CFE's strategy of expansion of power generation inclines towards hydro, renewables and nuclear, plus more LNG imports.

By the end of 2009 abundant shale gas and the economic downturn in the U.S. bring prices to around 4 USD/MBTU.

Following a confrontation with the workers' union of the CLyFC, the National Executive merges the two electricity SOEs leaving CFE in charge and dissolving the union of the CLyFC.

CRE moves for a tactical change: favouring the expansion of demand (and supply) of natural gas through smarter siting of electric producing facilities that use natural gas and that anchor the development of the pipeline system and of networks of distribution.

2010.- The CRE creates the National System of Integrated Transportation (Sistema Nacional de Transporte Integrado. STNI) by merging the privately owned system of Gasoductos de Tamaulipas with the National Pipeline System (Sistema Nacional de Gasoductos, or SNG). Pemex operates the system. This will also be a precedent of the scheme of Independent Pipeline System Operator created in 2014.

2011. New hike of international prices driven by Asian demand, due to Chinese economic growth and Japan's turn-away from nuclear, after the disaster in the nuclear plant of Fukushima.

CRE tenders a new package of distribution zones after a 10-year hiatus. Fifteen years after the partial reform started, there were only 21 distribution zones in Mexico.

Due to increased imports and decreased production in the southern fields (associated gas), Pemex requests that the point of arbitrage that serves to calculate domestic prices be moved south, from Los Ramones to Cempoala.

2012. Manzanillo LNG import facility goes on stream.

Amidst recurrent episodes of regional shortage of natural gas, the national government, Pemex and CFE plan to deploy large new connections to bring land-imports from the U.S. CFE auctions the projects but Pemex decides to build one major pipeline (Ramones) in a joint venture with a private operator.¹⁹⁶

The projects where CFE is the main client are valued in more than USD 14bn and seek to bring gas for the first time to the Pacific Coast and, in the medium term, to propitiate forming hubs across the territory.

New presidential cycle starts in December: Enrique Peña (PRI).

2013. A constitutional reform re-opens exploration and production of petroleum to private and foreign participation. A robust but expedient process to pass secondary legislation ensues the constitutional reform in 2014.

2014. Congress passes a whole new regulatory framework for energy. The design of the new sector is highly liberalised because it is based on private production of hydrocarbons and electricity, although with the NOC and SOEs (CFE, CENAGAS) at the centre.

¹⁹⁶ Business Monitor International, 2015, Company Profile. Petróleos Mexicanos (Pemex). Q1 2015. 31 October 2014. Accessed via Factiva.

The new legal framework recentralizes control and planning of the system of transportation under the control of Pemex. Other privately-owned systems, including those sponsored by CFE, are left with the option to *opt-into* the system operated by the IPSO.

The CRE gets the highest degree of autonomy possible for a regulatory agency (Órgano Regulador Coordinado), only short of constitutionally autonomous organs, like the Human Rights Ombudsman and the National Elections Institute.

New legislation allows CFE to sell gas. By 2015 CFE started to commercialize natural gas for all users, which it had been previously importing for its own use and those of the IPPs without the capacity to resell.

2017. CRE implements the first step of the program of capacity release, to take away 70 percent of the market share of Pemex within three years. Although independent traders start to emerge in the ensuing years, all will be buying gas from Pemex or CFE.

The CRE abolishes pricing rules, formally opening upstream competition. Industrials grouped in CONCAMIN raise their voice against liberalisation, claiming that material access to third options of supply are inexistent.

CRE publishes its first index of prices in five regions in Mexico. The index is only an information resource to carry out natural gas transactions, not a bidding reference.

BP's natural gas marketing and trading arm in Mexico, starts to deliver approximately 195 MMCFD to industrial users, local distribution companies and independent power producers in eight states in Mexico.

2018. (December) A new federal government takes over. Touting his coalition as a left-wing movement, Andrés Manuel López Obrador, embraces a nationalist and populist style that seeks to recentralize decision-making and strengthen Pemex and CFE.

Appendix 2. Main infrastructure additions since 2015

This appendix presents a description of the most important links that have gone on stream in recent years and that have made it possible to attain an open and integrated system of pipelines. A regional look at the development of natural gas projects can better illustrate how national hubs might emerge—as should be expected from policy implementation after 2014. Pipelines have also been going on stream in the United States. (Numbers inside the parentheses identify the links in the map).

Projects in the North

Los Ramones (1)

The rationality of projects coming from the border with the U.S. is simple: securing more supply and bringing it southwards and westwards. The Los Ramones pipeline has been one of the most ambitious projects of this category (114 kms, USD 688m, 2BCFD). The pipeline system, promoted by Pemex, was touted since 2012 as the pillar solution to the problems of supply that were stressing industry and power generation since the late 2000s. It was originally planned to consist of two phases, which later became three.

The whole system carries supply from Texas to the states of Nuevo León and Tamaulipas. The first phase runs from the U.S. border in the state of Tamaulipas at a point close to Ciudad Camargo and runs to the state of Nuevo León, in the site Los Ramones (1). Phase I went on stream in 2016 and connects with three systems: the existing pipeline, formerly property of Pemex (now operated by CENAGAS); an existing pipeline between Reynosa and Monterrey (also part of the system run by CENAGAS); and the second phase of the same project, which has been completed in one first part running to Central Mexico (2). A plan to build a third phase running southwards to the Gulf was cancelled in 2016, considering that the potential availability of supply through a large submarine pipeline – which went on stream in 2019 (see below).¹⁹⁷

Supply in the Pacific Coast and in the industrial regions of the centre

The expansion of the network of transportation in the Pacific is the most important move towards integrating a system with supply sources other than the producing areas in the Gulf and the land imports from the United States. CFE started this process with the LNG import terminal in Manzanillo (which added to one, of local importance, in Baja California). The construction of transportation systems and the creation of distribution zones has made natural gas accessible in a very large area of the nation that had historically utilized other fuels for power generation (Sonora,

¹⁹⁷ See CENAGAS (2016:12).

Sinaloa, and Chihuahua) while also increasing the volume and alternatives for consumers and power generators in the industrial regions of the centre and the Guadalajara metropolitan region.

The Northwest system, sponsored by CFE, is the most important piece of this strategy. It comprises four sections that will interconnect to the central industrial region and the Pacific coast south of the Peninsula of Baja California.¹⁹⁸ This gas comes from the Permian Basin, and also from the Eagle-Ford shale play.

Sásabe-Guaymas- El Oro- Mazatlán (3)

IEEnova (Sempra) owns and operates this large 36-inch pipeline (496 kms, 770 MMCFD and USD 470m) that runs from the interconnection in Tucson (U.S. side) and Sásabe (Mexican side) to Puerto Libertad and Guaymas, in the Pacific Coast of Sonora. This section entered in operation in 2015.¹⁹⁹ CFE converted a fuel oil power plant in that location. Two other combined cycle facilities just started operations in the same place (Empalme I and Empalme II).²⁰⁰ A second segment, also owned by Sempra, runs 200 miles from Guaymas to El Oro, both along the Pacific Coast opposite to the Baja California peninsula (Sea of Cortés).²⁰¹ TransCanada owns and operates this section which went on line in 2016. It runs 462 kms along the Pacific coast to supply power generators in Mazatlán, a coastal city.

El Encino-Topolobampo (4)

TransCanada, also owns a pipeline on stream since 2016 that delivers to the port of Topolobampo in the Pacific coast. The 30-inch diameter pipeline has a capacity of 665 MCFD and connects to El Encino, in the centre of Chihuahua -supplied by the CENAGAS-operated systems. There are two new and converted combined cycle power stations at that location.²⁰² CFE, which awarded the 25-year service contract to TransCanada in 2012, seeks to use Topolobampo and Puerto Libertad in order to supply, via carrier, three combined cycle power plants in the southern tip of the Peninsula of Baja California.²⁰³ It is worth noting that Puerto Libertad can also be used as a point of international exports. El Encino can also develop as a regional hub. Currently, the CRE tracks operations at this point to produce its price index for one of five regions in the country.²⁰⁴

Samalayuca- Sásabe (5)

¹⁹⁸ SHCP, 2015, *Programa Nacional de Infraestructura*, available at www.shcp.gob.mx Page 50.

¹⁹⁹ Comisión Federal de Electricidad, 2016, *Informe Anual 2015*, p. 21.

²⁰⁰ CFE, 2016, p. 22.

²⁰¹ CFE, 2016, p. 22.

²⁰² Announcements of TransCanada. Accessed from www.transcanada.com/6132

²⁰³ CFE, 2012, p. 73.

²⁰⁴ NGI, May 21, 2019, “Mexico Natural Gas Prices Hit Record Low For Second-Straight Month”, accessed via Factiva on April 24, 2020.

At the moment this research concluded (December 2020) the inauguration of this pipeline had been put on hold, fraught by the legal opposition of one of the Indigenous peoples of the region (Yaqui).²⁰⁵ This pipeline, also anchored by CFE, is to have a length of 650 kms and 36 inches of diameter. It will connect the gas flowing from Waha via El Paso/San Isidro in the state of Chihuahua to the western point of injection also on the U.S. border (Tucson/Sasabe), and it will supply a number of combined cycle facilities along the way. This pipeline is one of the new ventures of Carlos Slim's (Carso Electric) into natural gas infrastructure and electricity. Through its link with the Sasabe-Guaymas pipeline this project will bring together natural gas from West Texas and Arizona to two consuming regions that have been hitherto disconnected –while connecting gas from Arizona and Texas south of the border. The pipeline is also seen, in the U.S., as instrumental to take away part of the abundant production of the Permian basin. The so-called *Wahalajara* system, comprising a handful of new pipelines (see below) can increase imports by almost 0.89 BCFD.²⁰⁶

Ojinaga- El Encino- La Laguna (6)

The Ojinaga- El Encino section has 254km of length and capacity for 1.3BCFD. The project was awarded to Sempra in 2014 and started delivering gas in 2017. The new connections bring together gas imported from South and Western Texas. One of these new connections, auctioned by CFE (Encino-La Laguna, operated by Mexican firm Fermaca) runs parallel to a system operated by CENAGAS.²⁰⁷ Fermaca also owns the continuation of this system to the industrial region of La Laguna (423 kms southwards).²⁰⁸ CFE also awarded this project through a 25-year concession that will supply the fuel to CFE owned and IPP- facilities.²⁰⁹ There is also industrial and residential potential for consumption of natural gas in the region known as La Laguna.²¹⁰ Importantly, La Laguna has the potential to become a hub, because it will connect flows from Chihuahua with imports to Nuevo León.

²⁰⁵ NGL, March 3, 2020.

²⁰⁶ EIA, 2020, "U.S. Natural gas exports to Mexico set to rise with completion of Wahalajara", accessed on July 8, 2020 from <https://www.eia.gov/todayinenergy/detail.php?id=44278#>

²⁰⁷ FD Disclosure, Q4 2016 Infraestructura Energetica Nova SAB de CV Earnings Call – Final. (22 February 2017). Accessed from Factiva at the University of Ottawa. April 7 2017.

²⁰⁸ Technical details of the Ojinaga-El Encino Pipeline are available in <http://www.cfe.gob.mx/Licitaciones/Licitaciones/Documents/OjinagaElEncinoIN1003.pdf>

²⁰⁹ https://www.proyectosmexico.gob.mx/proyecto_inversion/763-cfe-gasoducto-el-encino-la-laguna/

²¹⁰ "Mexico: Fermaca readies gas pipeline El Encino-La Laguna", *El Economista*, 27 January 2017. Accessed via Factiva and Angela Neville, "\$820m Mexican Pipeline to Move Gas from Texas", *Texas Lawyer*, 3 August 2015. Accessed via Factiva.

Interconnections in the centre and Gulf

Several sections are in the process of construction or planning and will link producing and importing areas farther. Some of these are essential to interconnect the system of transportation and transform the nature of the industry.

Villa de Reyes-Aguascalientes-Guadalajara (7)

In 2016 CFE awarded a USD 372 m contract to Fermaca to build, operate and maintain a pipeline (380 kms, 36 inches) Villa de Reyes–Aguascalientes–Guadalajara. The pipeline has a capacity of 1.3 BCFD and went on stream in mid-2020.²¹¹ Along with the Tamazunchale project, these two systems give Fermaca, a Mexican firm, a regional presence as supplier. The Villa de Reyes-Aguascalientes-Guadalajara pipeline is the southernmost (and last) piece of the so-called *Wahalajara* system. The other part of the *Wahalajara* system is the La Laguna-Aguascalientes (1.3 BCFD and 453 km) pipeline, on stream since December 2019.²¹²

Connecting with the Villa de Reyes-Guadalajara line will be the Tula–Villa de Reyes (278 kms), that will supply natural gas to CFE's power generation plants located in Hidalgo and San Luis Potosí. TransCanada is the operator of this link, sponsored by CFE. When complete (probably in 2021), this system will also connect to the pipelines operated by CENAGAS.²¹³

(Underwater) South Texas / Tuxpan pipeline (8)

Auctioned in 2016 by CFE, this joint venture of TransCanada and IENova, the Sempra Energy presence in Mexico, went on stream in 2019.²¹⁴ The pipeline (800 kms, 2bn USD, 2.6 BCFD) runs from Texas to the port of Tuxpan, in the Gulf of Mexico. The pipeline brings natural gas to CFE's power plants in Tamaulipas and Veracruz, on the Gulf of Mexico.

Given the size of this project, its strategic importance goes far beyond only supplying power stations in two states. There is a project, currently on hold, to build an interconnection between the submarine pipeline in the Gulf and the systems in the centre of the country: the Tuxpan-Tula

²¹¹ Proyectos Mexico, accessed on July 8th 2020 from https://www.proyectosmexico.gob.mx/proyecto_inversion/769-cfe-gasoducto-villa-de-reyes-aguascalientes-guadalajara/

²¹² Proyectos Mexico, accessed on July 8th 2020 from https://www.proyectosmexico.gob.mx/proyecto_inversion/771-cfe-gasoducto-la-laguna-aguascalientes/

²¹³ The details of the project can be consulted in Proyectos Mexico. Accessed on July 8th 2020 from https://www.proyectosmexico.gob.mx/proyecto_inversion/771-cfe-gasoducto-la-laguna-aguascalientes/

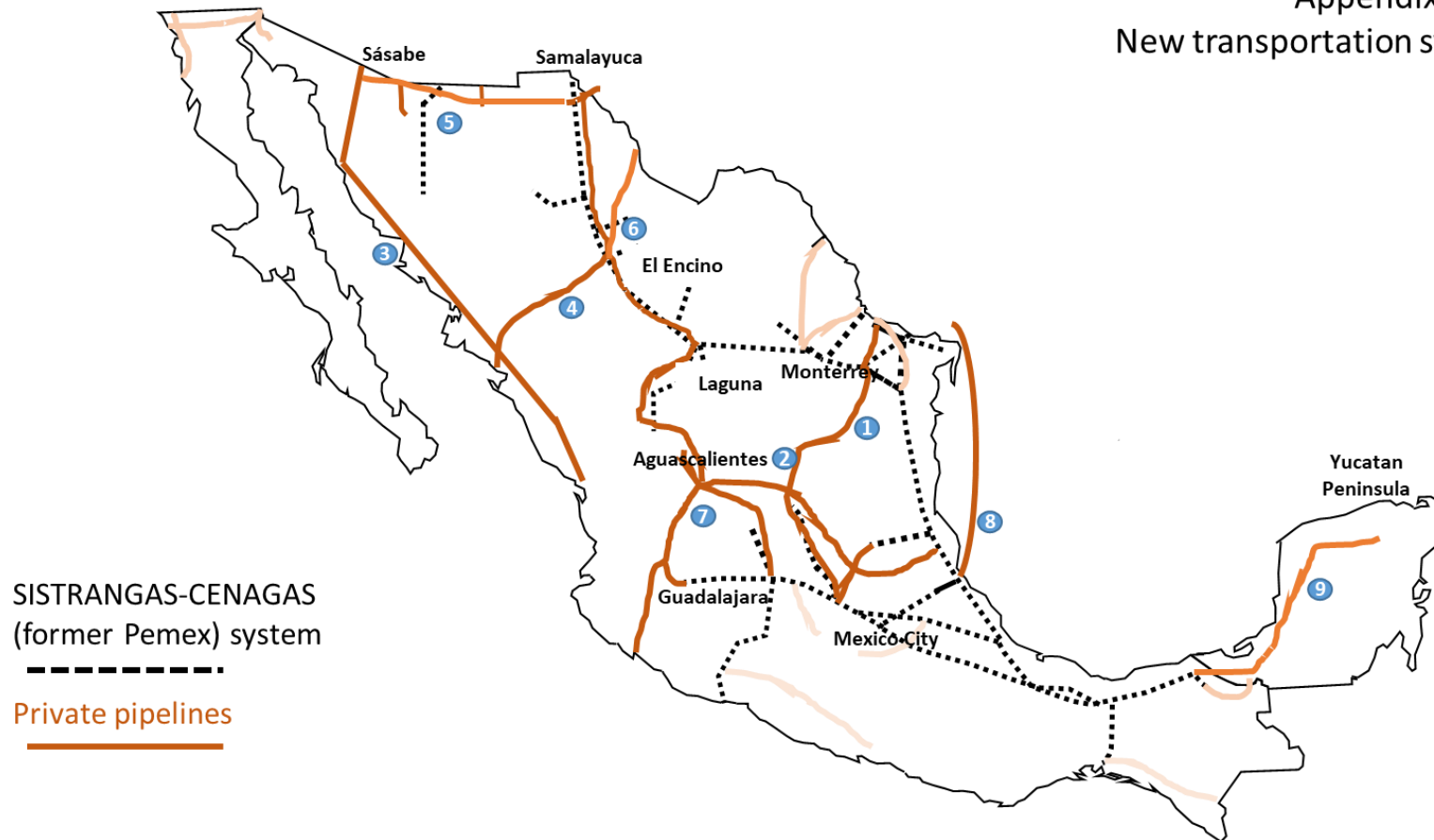
²¹⁴ “Texas-Tuxpan pipeline expected to boost industry and create jobs”, *Business News Americas*, 15th of June 2016. Accessed online at www.uottawa.ca

pipeline. Currently, its temporal suspension has had the important systemic consequence of changing the flows of part of the Wahalajara systems (described above) which will be supplying gas southwards to the West (Guadalajara, via Laguna-Aguascalientes) and to the centre (Aguascalientes-Villa de Reyes). Interestingly, once the Tuxpan-Tula interconnection goes on stream (possibly by 2022), the system might be *too large in that region*, a condition that can compromise reliability. The compression station in Cempoala, also in operation since 2020, intends to give solvency to these complicated dilemmas.

The two peninsulas: Baja California and Yucatan

The Yucatan peninsula has been experiencing serious problems of electricity reliability. It can be solved with a new transmission line, but it can also be solved with more volumes injected directly through the existing systems (Chapter 5. Mayakan system with number 9 in the map). The problem is that the current production of Pemex is not enough to maintain pressure in that system and there are no alternative pipelines to supply.

Appendix 2 New transportation systems (2020)



Appendix 3. Illustration of General Terms and Conditions of Service

Modality of delivery		Modifications	Minimum Consumption	Minimum and a maximum period	Can be combined with other modalities?	Price (2011) ²¹⁵ 1) USD/GJ <i>USD/ gcal</i>
FB Firm Basis (Base Firme)	Same quantity each day	Strict	---	1 Month when delivery point is the processing plant. 12 months otherwise.	Only with one of: IB OB SS	0.0236 <i>0.0987</i>
(OB) Occasional Basis Base Occasional	Same quantity each day	No modifications		At least a day of gas and less than a month	Can contract several OBs. FB IB	0.0236 <i>0.0987</i>
Base Interruptible	Same quantity each day	Can be canceled with 48 hours note.		One day to one month.	Can contract several FB OB	0.0229 <i>0.958</i>
FSS Firm-Flexible Service Servicio Firme Flexible	Different quantities each day.	Quantities are defined in a monthly program that cannot change.	Minimum daily average of 480 Gcal.	Twelve months (that is, 12 monthly programs).	Not on the same delivery point.	0.0369 <i>0.1545</i>
SS Swing Service Servicio Swing	Different quantities at the discretion of the purchaser.	Variation: between cero and the contracted quantity.		12 months at least.	FB	0.1354 <i>0.5669</i>
Tunnel service	Different quantities each day within a pre-arranged range.	The pre-arranged range can be of 10, 20 or 30 percent.		12 months.	No.	0.0543 (10 %) 0.0911 (20 %) 0.1108 (30%) <i>0.2274</i> <i>0.3816</i> <i>0.4637</i>
Volumetric service	Different quantities each day (between cero and the contracted Q)	No restriction.		One month	No.	0.1354 <i>0.5669</i>
According to the General Terms and Conditions of First-Hand Sales of Natural Gas, as approved in December 2011 by the CRE in RES/308/2011.						

²¹⁵ CRE, 2011, “Costos de servicio del Catálogo de Precios y contraprestaciones” (RES/308/2011).

Appendix 4. Interview guide, recruitment form and ethics certificate

Part A. Questions for independent power producers, industries and CFE officials

(Note: the interview will use these questions as a guidance, emphasizing some aspects in accordance to how the research examines the organizations represented by each interviewee)

1. Importance of natural gas for business

- How important is natural gas for your business? Can you substitute other fuel for natural gas in case that reliability in the delivery of natural gas is compromised?
- How do the volatility of prices and the poor reliability of deliveries of NG affect your competitiveness as an industry? What alternatives did you elicit while shortages were more frequent, during the years 2009 to 2012?

2. Knowledge and position towards instruments of policy

- Are you aware of the regulatory changes that took place at the end of the last decade and that restructured the tariffs for transportation of natural gas and centralized the operation of the system of pipelines? How have they affected or favoured you? (reliability, efficiency).
- The "un-bundled" system allows consumers to contract supply separately from transportation of the commodity. (For users that already use the new rules of transaction) what advantages and disadvantages did you find in joining the so called "un-bundled" system of sales of natural gas?/ (Conversely, for consumers that still have not changed) "why have not you joined the "un-bundled" system of sales of natural gas?

3. Position towards other large consumers and the sector regulator

- How have you communicated your interests with regards to policy with other industries in this region of the country, in Mexico or in North America?
- What was your relation to the CRE before the crisis? And afterwards? (exclusively for Independent Power Producers) What about CFE?
- Has your enterprise participated in hearings or consultations organized by the sector regulator? Has your enterprise participated in some organization that advanced an agenda for the regulatory regime of natural gas?

Part B. Questions for public servants, staff of regulatory agencies and staff of state owned enterprises

(Note: the interview will use these questions as a guidance, emphasizing some aspects in accordance to how the research examines the organizations represented by each interviewee)

1. Role of the public agencies in the regulatory reform.
 - What was the role of this (public agency or state owned enterprise) in proposing the new regulatory model that was put in place between 2010 and 2014?
 - How did this agency promote compliance with the un-bundled rules for transacting natural gas in the years before the crises of supply that started in 2009?
2. Rationale for regulatory change in 2014.
 - Considering that regulation helps to strike a balance between the potentially conflictive goals of economic efficiency, security and reliability of supply of fuels and environmental protection, what goals were privileged in the old and new models of regulation?
 - Did the failure in implementing (un-bundled) rules for first hand sales and transportation of natural gas indirectly affect the decision to adopt a centralized system of transportation of natural gas? If so, how?
3. Instruments of regulation before and after the critical years of 2009 to 2012.
 - What instruments of regulation and oversight on PEMEX (Petróleos Mexicanos) decisively proved in need of overhaul in the years running between 2009 and 2012?;
 - What are the expectations on the performance of this agency under the new regulatory framework, in place since 2014?

Recruitment Form

If via telephone: Researcher introduces self (name, title, institution).

If via e-mail or regular mail (if regular mail, will be on letterhead): Dear [name of potential participant],

If participant suggested by prior interviewee: I am contacting you at the suggestion of [name of prior interviewee].

As you might have heard, I am undertaking a research study exploring the regulatory changes that have taken place in the natural gas sector in Mexico. The research focuses on the crises of shortages that occurred between 2009 and 2012.

The recent revision of rules governing sales and transportation of natural gas in Mexico signals a major change in the regulatory model adopted in the 1990, one that can be characterized as an almost full-fledged liberalisation. Understanding the causes of these revisions, and their implications for regulatory authority in Mexico is all the more important now that, since 2014, the production of petroleum has been opened to private participation.

My research explores a range of questions relating to the compliance with the regulatory model that was in place since 1995 and until 2014 and to the design of a new regulatory regime, already in place. These questions include, primarily, the ways in which large consumers of natural gas contributed to the compliance of the, liberalised, regulatory model across this period. The research makes an emphasis on the crises of supply that occurred between 2009 and 2012. It will inquire consumers, marketers of natural gas and operators of transportation services as to how the mentioned shortages affected their business strategies and their relations to the sector regulator. Regulators and other policy makers will be inquired as to how the mentioned crises of supply affected their relations with the regulated; how marketers, consumers and operators of transportation services participated in the design of the new, revised, rules; and key challenges for the regulators in the years to come, with an emphasis on the consequences of the major reform that, in 2014, opened production of natural gas and oil to private participation.

Given the lack of primary material to closely scrutinize the mentioned process of regulatory change, the interviews with individuals who were part of it, both on the side of public service or as part of private firms, are an indispensable component of the study.

As such, I would like to invite you to take part in an interview, in particular to discuss [key topic that participant has knowledge of]. Would it be possible to arrange an interview to this end? It would have a duration of between 1 to 1 ½ hours and it might be conducted in the time and place of your preference.

If you like, our discussion could be undertaken on an anonymous basis (i.e., your name would not appear in connection with the study or its findings).

I hope that this request will meet with a positive reply. Your participation in the study would be invaluable.

If via e-mail or regular mail:

If you wish to inquire for more details, please do not hesitate to reach me, (*contact data below*).

Sincerely,

Rafael A. Aguirre Ponce
PhD Candidate. Public Administration and Policy
School of Political Studies

[Researcher answers any questions posed by participant. If participant accepts to be involved in the study, interview is scheduled and, if recruitment undertaken via telephone, participant is provided with contact information for the researcher. Interviewees will be provided with the choice of meeting at their office, at a public location of their choosing, or, in the case of participants who are retired or have limited mobility, at their residence.]



Université d'Ottawa University of Ottawa

Bureau d'éthique et d'intégrité de la recherche

Office of Research Ethics and Integrity

Ethics Approval Notice Social Sciences and Humanities REB

Principal Investigator / Supervisor / Co-investigator(s) / Student(s)

<u>First Name</u>	<u>Last Name</u>	<u>Affiliation</u>	<u>Role</u>
Monica	Gattinger	Social Sciences / Political Science	Supervisor
Rafael	Armando	Social Sciences / Political Science	Student Researcher

File Number: 06-15-25

Type of Project: PhD Thesis

Title: The liberalization of the midstream natural gas sector in Mexico. An institutionalist view of regulation (1992-2014)

Approval Date (mm/dd/yyyy)	Expiry Date (mm/dd/yyyy)	Approval Type
09/10/2015	09/09/2016	Ia

(Ia: Approval, Ib: Approval for initial stage only)



Université d'Ottawa University of Ottawa

Bureau d'éthique et d'intégrité de la recherche

Office of Research Ethics and Integrity

This is to confirm that the University of Ottawa Research Ethics Board identified above, which operates in accordance with the Tri-Council Policy Statement (2010) and other applicable laws and regulations in Ontario, has examined and approved the ethics application for the above named research project. Ethics approval is valid for the period indicated above and subject to the conditions listed in the section entitled "Special Conditions / Comments".

During the course of the project, the protocol may not be modified without prior written approval from the REB except when necessary to remove participants from immediate endangerment or when the modification(s) pertain to only administrative or logistical components of the project (e.g., change of telephone number). Investigators must also promptly alert the REB of any changes which increase the risk to participant(s), any changes which considerably affect the conduct of the project, all unanticipated and harmful events that occur, and new information that may negatively affect the conduct of the project and safety of the participant(s). Modifications to the project, including consent and recruitment documentation, should be submitted to the Ethics Office for approval using the "Modification to research project" form available at: <http://research.uottawa.ca/ethics/submissions-and-reviews>.

Please submit an annual report to the Ethics Office four weeks before the above-referenced expiry date to request a renewal of this ethics approval. To close the file, a final report must be submitted. These documents can be found at: <http://research.uottawa.ca/ethics/submissions-and-reviews>.

If you have any questions, please do not hesitate to contact the Ethics Office at extension 5387 or by e-mail at: ethics@uOttawa.ca.

Signature:



Université d'Ottawa University of Ottawa

Bureau d'éthique et d'intégrité de la recherche

Office of Research Ethics and Integrity

Ethics Approval Notice Social Sciences and Humanities REB

Principal Investigator / Supervisor / Co-investigator(s) / Student(s)

<u>First Name</u>	<u>Last Name</u>	<u>Affiliation</u>	<u>Role</u>
Monica	Gattinger	Social Sciences / Political Science	Supervisor
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Approval Date (mm/dd/yyyy)	Expiry Date (mm/dd/yyyy)	Approval Type
09/10/2020	09/09/2021	Renewal



Université d'Ottawa University of Ottawa

Bureau d'éthique et d'intégrité de la recherche

Office of Research Ethics and Integrity

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