
The author provides a discussion of Mexico's current petroleum policy, highlighting the changes that have occurred in the operations of Pemex, Mexico's national oil company. Pemex has instituted a scheme for making decisions in a way that is more open to international markets. This has enabled it to attract capital that would otherwise have probably not been available. The author suggests that further extensions of this model in Mexico's hydrocarbon sector are desirable.

L'auteur discute de la politique actuelle du Mexique en matière de pétrole et met en lumière les changements qui ont été opérés dans les opérations de Pemex, la compagnie nationale de pétrole mexicaine. Pemex a conçu un schéma décisionnel plus ouvert aux marchés internationaux. Ceci a permis à la compagnie d'attirer des capitaux qui n'auraient sans doute pas été disponibles autrement. L'auteur suggère que des transpositions de ce modèle au secteur de l'hydrocarbure mexicain sont désirables.

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Applying a Virtual Economy Model in Mexico's Oil Sector

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Introduction

This article addresses two main questions: (1) What progress has been made as a result of the modernization programs applied to Pemex, the government's petroleum supply agency, in the period 1988-94 and what were their limitations? (2) How might the post-Salinas government of the period 1994-2000 visualize innovation in petroleum policy, particularly in the area of natural gas? It also touches on the larger question of how sectors of the economy controlled directly by government can be transformed in a way that makes them more sensitive to market forces and therefore more efficient.

These questions are approached within the context of the evolution of economies around the world. Since 1989 the command economies of Eastern Europe and the Former USSR have been evolving, on a sector-by-sector basis, toward either market economies or mixed economies. In perhaps less dramatic, but nevertheless important, ways these trends have been occurring in many developing countries (Figure 1). Of course, all market-based economies are 'mixed' in the sense that government plays a role in determining what happens in private markets. In this discussion, however, these terms are used in a special sense: a 'market economy' is one in which the role of government in the economy is primarily as a regulator of how markets function; and a 'mixed economy' is one in which government also has an important, but

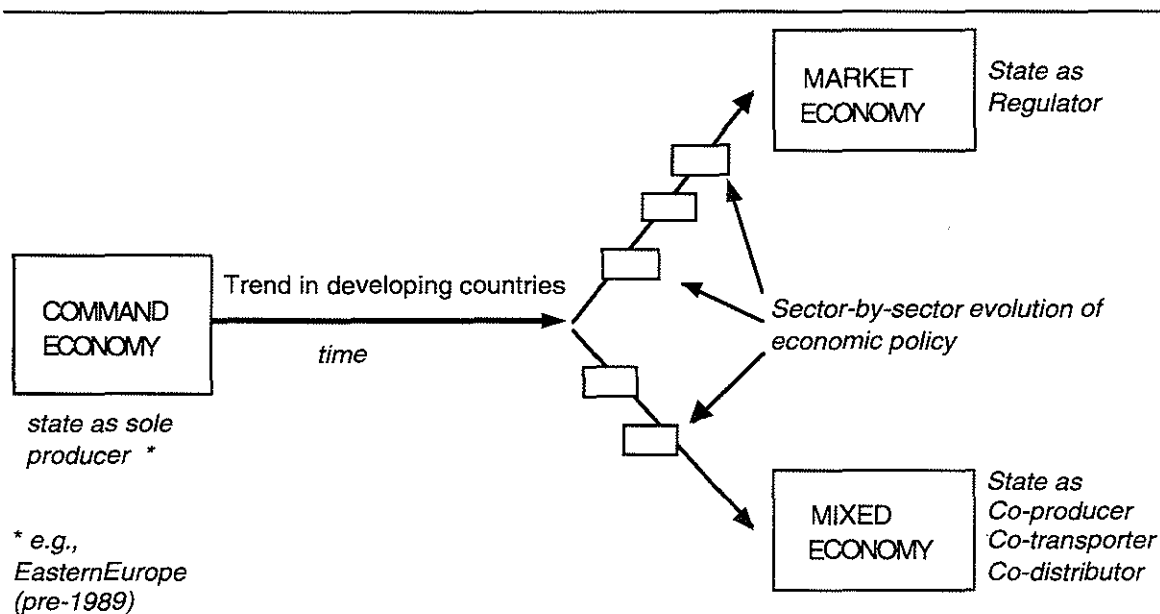


Figure 1: Evolutionary trend toward market or mixed economies in developing countries

not exclusive, role as a producer and distributor of goods and services. The state is both a regulator and a co-producer with private investors. In a 'command economy' the state is the sole producer.

In economies that are currently evolving in regard to these fundamental issues, changes in the assumptions underlying government policy and in the legal framework have typically been on a sector-by-sector basis. Even within the hydrocarbon sector, different countries opt for different models in different activities: in some countries the participation of private capital in exploration and production is authorized, while involvement in refining, retail distribution and pipeline transmission is restricted.

In countries in which governments had managed particular sectors of the economy by way of the 'command model,' these sectors have now been transformed into market or mixed sectors. In Mexico, which had a tightly closed economy in the 1960s, '70s and early '80s, substantial parts of the economy began, in 1985, to move toward the market model. Mexico's entry into GATT in 1985, NAFTA in 1993 and the OECD in 1994, are symbolic and real steps in this progressive

commitment toward a market economy. Pemex, however, has insisted on the continuation of the basic command model for the hydrocarbon sector.

There have been only minimal changes in the legal underpinnings of the command model that has been in force in the downstream hydrocarbon sector since 1938 and upstream since 1958. There have, however, been operational changes, in particular a new exposure of the sector to international market forces. A new version of the market economy model is being applied in Mexico's hydrocarbon sector; recognition of this helps one to grasp the current direction of Mexican petroleum policy.

A Search for International Benchmarks

The hallmark of the presidency of Carlos Salinas (1988-94) was modernization of the administration of the public sector. In the energy sector, but mainly in Pemex, the goal of modernization has been the achievement of international competitiveness. As former CEO Francisco Rojas put it, Pemex "is rooting itself as a highly efficient firm, capable of

competing on an equal footing with the largest of international consortia and acting as a pole of attraction in industrial development."

While Pemex prefers to maintain centralized control, there have been exceptions to this policy. In petrochemicals, Pemex and the government agreed to increase the degree to which there would be a mixed approach: both Pemex and private capital would have access to raw materials and markets for 'secondary' petrochemicals. In electricity generation, in late 1992, Pemex, the Federal Power Utility (CFE) and the Commerce Ministry agreed that henceforth electricity would operate according to the mixed model: a new law and a new set of regulations now permit the private generation of electricity in cogeneration plants or by independent power producers (IPPs). In the core energy businesses of Pemex, however, there was no interest whatsoever in either market or mixed approaches (Figure 2).

At the same time, a few visionary hydrocarbon-sector planners developed a new model for growth. This goes back to 1989 when Pemex began to seek international standards and benchmarks for its operations, both upstream and downstream.

Starting in January of that year, the government took draconian measures to reduce the size and influence of the Oil Union, the cost of which, by our estimates, was equivalent to as much as \$2-3/bbl of oil production. At the beginning of 1989, Pemex had roughly 215,000 employees; by the end of 1994, Pemex had cut roughly 100,000 jobs from the payroll.

Several respected international consulting firms, such as McKinsey & Company, SRI International and Arthur D. Little, Inc., were hired by Pemex to assess the international competitiveness of its operations. McKinsey recommended its standard formula: cut staff, reorganize into core business units, and regulate the relationships between business units by means of transfer prices for goods and services. The McKinsey formula, which is designed to help companies become more competitive in market economies, took on an unexpected meaning in the context of a state

monopoly. In Mexico, supply decisions and demand assessments in the domestic market are not taken on the basis of an assessment of competitive forces, and, for this reason, there has been no true market mechanism functioning in the Mexican hydrocarbon sector.

In environmental policy, planners decided that the old Azcapotzalco refinery could not be operated within environmental norms. Abruptly, on March 18, 1991, President Carlos Salinas announced the refinery would be closed immediately. In subsequent years Pemex upgraded the quality of its refined products, introducing unleaded gasoline and low-sulfur diesel and fuel oil. In addition, a major study of air quality in Mexico City was carried out jointly by Pemex, the Petroleum Institute (IMP) and the Los Alamos Laboratory of the US Department of Energy (the final report of which was completed in mid-1994).

In the areas of natural gas transmission and distribution, Pemex retained Gaz de France as a consultant in 1993. Pemex reasoned that France's experience with a mixed economy in the natural gas industry might lead to new insights about gas transmission and distribution.¹ In the area of public safety and environmental policy, Pemex established a high-level office that reports directly to the general manager of the company.²

1/ Such insights, however, are not likely to square with the practices of Mexico's NAFTA partners. In France the concept of open-access in gas transmission is viewed negatively, while in Canada and the United States the concept is credited with stimulating demand and lowering costs to the consumer.

2/ Both the environment and public safety have been at risk due to the operations of the state oil and electric-power agencies in Mexico. During the administration of Miguel de la Madrid there was an explosion of an LPG plant in a Mexico City lower-income suburb in 1984. During the Salinas administration, on April 22nd 1992, there was an explosion of gasoline-filled sewer lines in a lower-income neighbourhood in Guadalajara. In each instance, hundreds of lives were believed to have been lost.

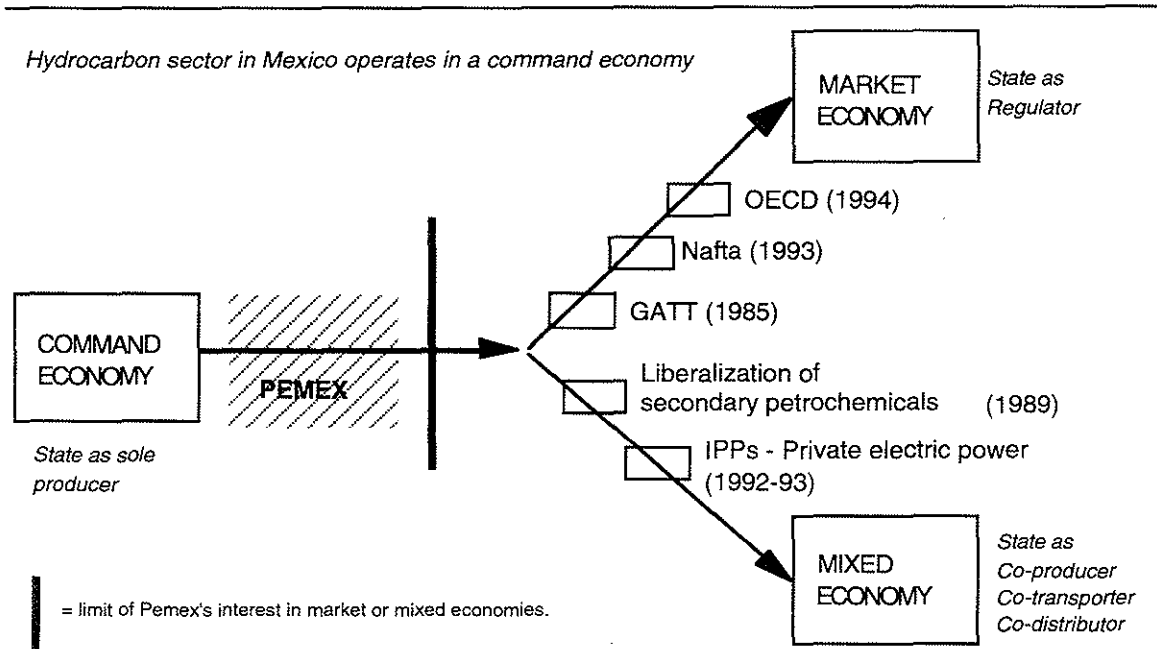


Figure 2: Sectors of the Mexican economy move toward market and mixed economies

The Concept of a Virtual Economy

In this context, Pemex planners, recognizing the limitations of a centralized command economy in the hydrocarbon sector, devised a new conceptual framework, here called the 'virtual market economy' (Figure 3). The idea is to achieve the efficiencies of a market economy while still remaining within the legal framework of a state monopoly. In the new vision, a virtual market economy, one would stimulate intra-company competitiveness and excellence by simulating market conditions. Pemex operating units would be held accountable for international reference prices and performance benchmarks. Achieving such standards would be tantamount to achieving market competitiveness. This goal was at the heart of the Pemex modernization programs of 1989-94.

Pemex, which by July 1992, would have a new legal structure that established three operating energy units (plus a petrochemical unit), was to hold itself responsible for meeting international standards of performance in its distinct operating areas. Thus, for exam-

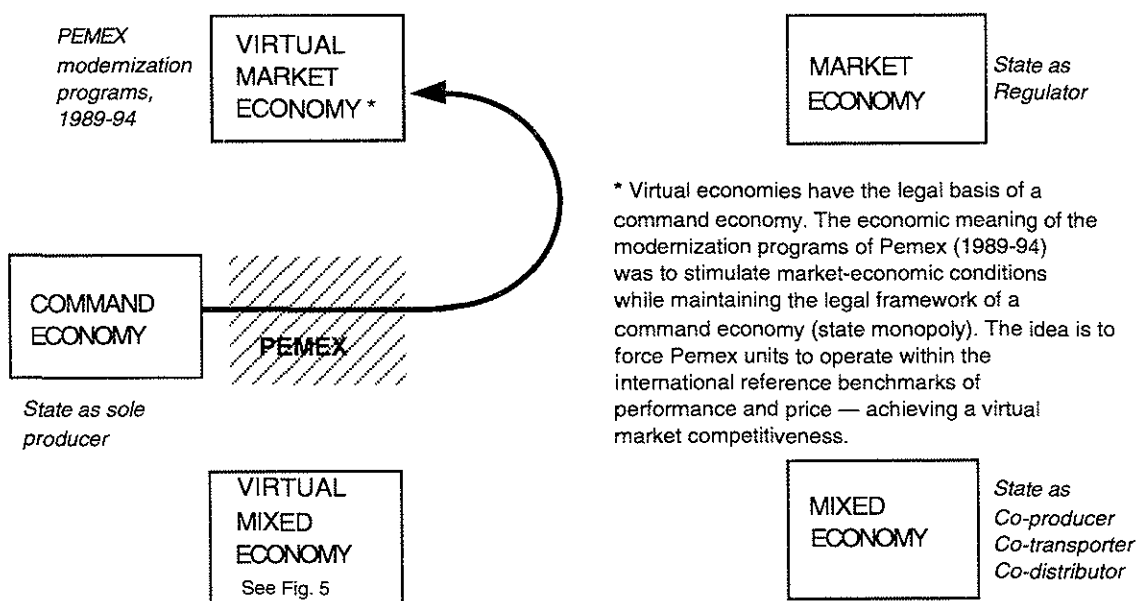
ple, in February 1991 Pemex contracted with Triton International, Inc. of Houston to drill the first turnkey well done under direct contract with an American company in decades. (In the oil boom years 1977-82, drilling contractors like Houston-based Sedco operated in Mexican waters, but as sub-contractors to Mexican contractors like Permargo.)³ The Triton contract showed Pemex that normal drilling time in the Gulf of Campeche should be in the area of 125 days (and possibly under 100 days), not the 265 days that Pemex typically took to complete an offshore well.

In these and other ways, Pemex is attempting to develop its own alternative to the models of economic organization evolving elsewhere. In the virtual market model, Pemex seeks debt-financing⁴ or off-balance-

3/ Ixtoc I, the offshore well that went out of control for over six months in 1978-79 in Campeche, was operated by Sedco, under contract with Permargo.

4/ On November 4, 1990, President George Bush, meeting with his Mexican counterpart in Monterrey, announced US Ex-Im Bank funding in the area of \$6 billion (US) for oil production and the development

Virtual Market Model attracted debt-instrument investors



* Virtual economies have the legal basis of a command economy. The economic meaning of the modernization programs of Pemex (1989-94) was to stimulate market-economic conditions while maintaining the legal framework of a command economy (state monopoly). The idea is to force Pemex units to operate within the international reference benchmarks of performance and price — achieving a virtual market competitiveness.

Figure 3: Hydrocarbon sector in Mexico in 1989-94 developed virtual market economy

sheet financing (via leases and stand-alone project funding)⁵ for programs that meet international standards of performance, output and environmental quality (Figure 3).

In retaining its position as a state monopoly, Pemex is unfazed by the moves of countries like Venezuela, Argentina, Bolivia and

of hydrocarbon reserves. Under the Bush Administration, the US government was very supportive of Pemex's virtual market economy model, as it meant a new source of contracts for US oilfield service and equipment suppliers.

5/ As of mid-1994, the only instance of non-recourse financing in the energy sector in Mexico has been funding for the jointly-ventured refurbishing of a Shell refinery in Houston. Bankers observed that the success of this project hinged on Shell's participation and the Texas location of the refinery assets as much as it did on Pemex's ability to supply crude oil and guarantee 45 kb/d of product off-take. It is inferred that the project would not have been funded on a non-recourse basis without the participation of an international company and had the refinery assets been in Mexico.

Colombia toward a mixed approach in upstream and downstream operations. A closer look at innovations in hydrocarbon policy in other countries (for instance, Venezuela) that have opted in favor of a mixed economy model shows that it is usually the case that not all industrial areas are included in it. Thus, Venezuela permits co-production (an aspect of a mixed economy) in exploration and production, but not in domestic refining or local distribution. In some instances, government policy permits private investment in multiple areas, but builds in some anti-trust precautions. In Argentina, the government adopted a mixed economy model, and wisely separated the market functions of gas transmission from gas distribution, letting investors choose between transmission lines or distribution systems, but not both (Figure 4).

Pemex under the Salinas Administration

Throughout the six-year Salinas presidency

Countries with mixed economies sometimes reserve some activities to the state

Economic policy regarding natural gas

		True (real)	Virtual *		
Type of economic organization	Command model	Pemex monopoly (E&P, GP, T, D)	CFE dependence on Pemex	State as sole producer	
	Market model	US, Canada (E&P, GP, T, D) (E&P, GP, T, D)	Pemex virtual market (via international reference prices & benchmarks)	State as regulator	
	Mixed model	Venezuela (E&P) France (E&P) Argentina (E&P, GP, T, D)	Virtual co-production * Virtual co-transmission **	State as co-producer co-transporter	

Characteristics of economic activity

E&P = Exploration & production
 GP = Gas processing
 T = Gas transportation/transmission
 D = Gas distribution

* via incentive E&P service contracts
 ** via build-operate-transfer (BOT) leases

Figure 4: Legal and policy frameworks and directions for natural gas policy

Pemex maintained oil and gas production steady at about 2.6 MMb/d and 3.5 bcf/d respectively. Oil exports were also steady, at about 1.3 MM b/d.⁶ Pemex's payroll was cut back nearly 50%, and control by the Oil Union on Pemex hiring was broken.

One of the accomplishments of the Salinas Administration was its holding firm during the Nafta negotiations (1991-93) in regard to foreign investment in the petroleum sector. Mexican negotiators turned back every attempt to modify existing practices (codified or not)⁷ in the energy sector.

6/ In the weeks following the Iraqi invasion of Kuwait in August 1990, Mexico announced that it would help cover the world oil supply shortage by increasing exports by 100 kb/d, a symbolic gesture regarded as controversial inside Pemex and the Energy Ministry due to the risk of damaging reservoirs by over-production. (Pemex's safe production margin was in the neighbourhood of 20 kb/d.)

7/ Outside Mexico it was widely believed that there was no legal, constitutional or regulatory restriction that would have prevented the government

A second accomplishment was the dramatic shift in Pemex from volumetric to economic thinking about investment policies. Decisions regarding exploration and production (E&P) now routinely involve evaluations of projects by reference to financial indicators like net present value, internal rate of return and cost-benefit ratios. Such a change in orientation is partly reflected in Pemex's new reporting format for its annual report, the *Memoria de Labores*, issued on March 18th for the previous year. The report for 1993 showed a dramatic reorientation in Pemex's approach to inter-company accountability. An example would be the reporting standards for natural

from authorizing private investment in gasoline retailing. The only constitutional restriction is that title to petroleum products is to remain with the state until sold to the consumer, thereby putting the retailer's earnings on the basis of a volume-indexed commission. Mexican service stations are currently operated by private parties on this basis, and foreign operators (had they been authorized) would have been willing to compete under the same regulations.

gas: where in 1977 Pemex cryptically reported gas production and utilization in only five rows of data, in 1993 it has four tables with several dozen reporting categories.⁸

A third accomplishment was the creation and application of the virtual market model discussed above. This approach succeeded in bringing in perhaps \$20 billion in debt-instrument funding to invest in infrastructure for Pemex. It also brought in an extra billion dollars in non-recourse project financing for Pemex's joint venture with Shell USA in the to-be-refurbished Houston refinery at Deer Park scheduled for a mid-1995 opening.

Yet this model has its limits and its critics. Some critics say that the virtual market model does not bring all of the efficiencies of a genuine market economy, as the 'decision to correct course' is again taken within a command framework, not as a result of the conflict of market forces. They argue in short that simulation of market conditions is a risky way to stimulate market competitiveness.

Decisions to correct course within the command framework are slow and uncertain, given the culture in Pemex that requires a complex checking up and down a chain of formal and informal command. In June 1981, Pemex's CEO, Jorge Diaz Serrano, tried to 'correct' the export price of Mexican crude (by lowering the price by \$2/b), only to be forced out of office for his failure to get prior approval from the Economic Cabinet. As a result of the ensuing failure to correct prices, Mexico's oil exports, which were about 1.5 million b/d in April, fell precipitously – while bureaucrats argued pricing philosophy – to under 500 kb/d in July. This catastrophic miscalculation precipitated capital flight, then a painful series of devaluations that were only suspended during the Salinas Administration, some 10 years later.

8/ Interpreting data in the Pemex reports, and changes in their presentation, is difficult. The author has examined 10 years of these reports closely and has been able to clarify the meanings of various changes over the years. More information can be supplied by the author on request.

An example of the risks involved in the new policy is in the area of private electric power generation. According to the new law of December 1992 and the operating regulations of May 1993, private capital may invest in electric power generation, but only on the condition that power in excess of internal consumption be sold to the CFE. The virtual market economy model is able to provide reference prices for most, but not all, of the elements needed to make a fundable business: Pemex will be able to quote US Gulf Coast reference prices for wellhead gas and gas transmission, thereby simulating US market conditions, but the CFE is limited in its ability to set consumer prices by considerations of social policy that come from the Commerce, Finance and Energy Ministries. How then will a private IPP be able to invest in a power plant if it knows that only its costs – but not its tariff rates – will be indexed to international prices? The concern is that prospective non-recourse lenders will not be forthcoming for any such power projects in Mexico.

Historically, Pemex has been an organization that responds more to political considerations than to quantitative measures of performance. A case in point is the time warp in relation to the publication of Pemex's operating regulations. While the new 'organic law' of Pemex was issued in July 1992, three years later Pemex's operating regulations (*reglamento*) continue to be those issued in August 1972. The main reason is that Pemex's operating units do not agree among themselves as to the assignment of assets and liabilities that should correspond to each unit. A second point of disagreement concerns the assignment of public trust and responsibility (e.g., public and industrial safety, care of the environment, quality assurance and reliability of supply).

Pemex units are also in disagreement with cabinet ministries, mainly Commerce, Finance and Energy, regarding the role of private investment and the weight that should be given to the demands of prospective lenders. In the view of the ministries, the funding premise of the electric power development plan for the period 1995-2004, namely, that a

significant share of investment capital would come from private lenders who would not ask for a sovereign guarantee, is currently in question, mainly because they fear that funds will not be made available.⁹

Other critics say that the model provides for no market incentive to reduce production costs and that, at the end of the day, it brings in too little money for the development of Mexico's energy infrastructure and the expansion of energy markets. While in the first quarter of 1994 Norway and the United Kingdom together increased oil production by 22% (to 4.9 million b/d from a previous 4.0 million b/d in the first quarter of 1993), Mexican oil production at 2.6 million b/d has been flat for most of a decade. While the North Sea has an aggregate annual capital budget at the level of \$9-10 billion (US), Pemex typically receives from the finance ministry only \$2 billion for investments in E&P in a given year. Scaled to the investment levels of the North Sea, Mexico's E&P efforts are annually under-funded by nearly \$5 billion dollars.

Finally, in relation to economic regulation, the virtual market economy model relies basically on self-regulation by Pemex and the CFE. The setting up of a Regulatory Energy Commission in 1993 to serve as a counterpart to the Federal Energy Regulatory Commission (FERC) in the US is, in theory, a step forward. Creating a Mexican FERC for electricity matters, however, is still a long way from establishing local public utilities commissions (PUCs) whose main responsibility is to serve as quasi-transparent public forums that balance the interests of energy producers and transmission companies (Pemex and the CFE) with those of local distributors and consumers. In the view of outside observers, the

9/ These policymakers point to the stunning failure in October 1993 of private financing for the so-called Carbón II coal-fired electric power plant. The project, led by Mission Energy, a unit of Southern California Edison, needed about \$2 billion in non-recourse financing for a 1.6 GW facility. For additional discussion of financing issues, see Baker (1994a, 1994b and 1995a).

problem of not having the equivalent of PUCs in Mexico seems intractable, given the historic advantage that Pemex and the CFE have been able to wield within the Mexican political system. Not even the creation of a cabinet-level energy ministry in the early 1980s has materially affected the virtual independence with which Pemex and CFE have been able to operate.

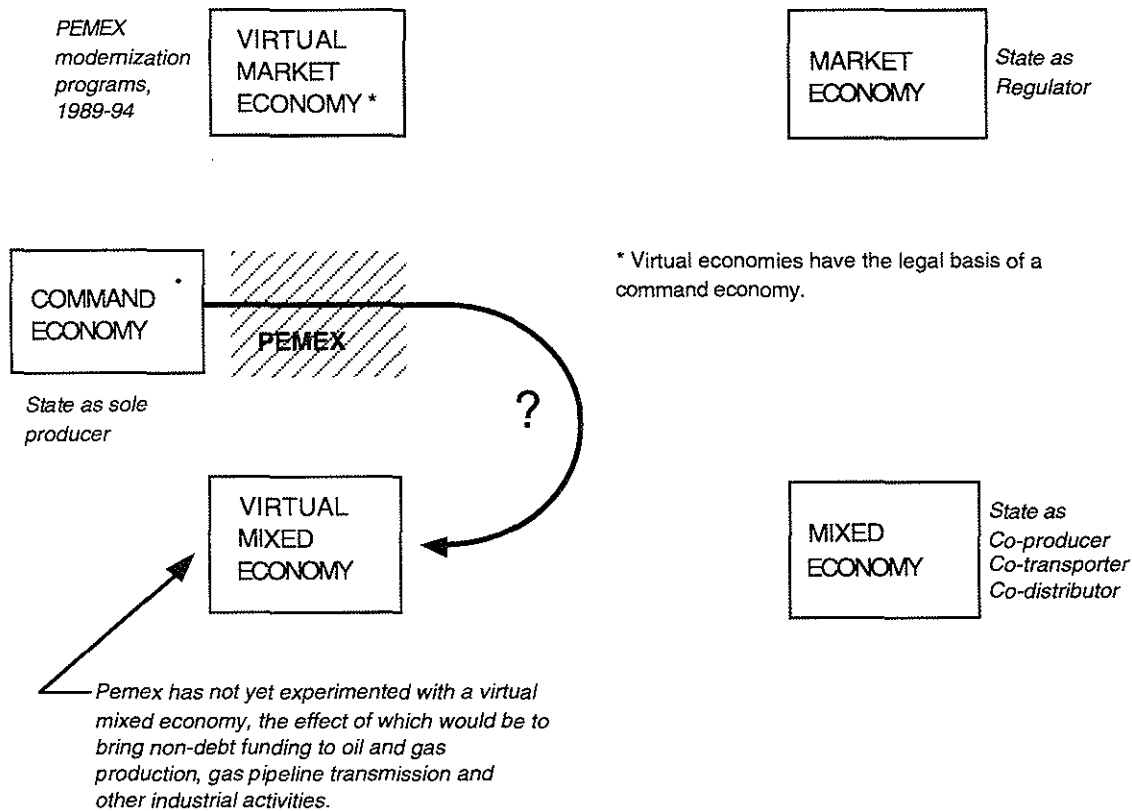
Is a Virtual Mixed Economy a New Option?

It is likely that macroeconomic planners of the new government led by Dr. Ernesto Zedillo will want a continuation of the basic command-model economy for the hydrocarbon sector. The need for major funding for onshore gas production in the North and deep-water oil production in the Bay of Campeche will compete for equally demanding needs for funding for social and economic infrastructure in Chiapas, Oaxaca, Michoacán, Guerrero and other areas suffering from recession and political unrest. This competition for federal funds may lead to a reappraisal of the administration of Pemex by the post-Salinas government.

The programs of the Salinas Administration implicitly point to a new, yet untried, policy option: a virtual *mixed* economy – in which private investment is added to the virtual market model now applied by Pemex – designed to attract funds for both upstream and downstream projects (Figure 5).

Upstream, the new policy would open up two new methods to bring in new production. For projects that involved existing fields where production had fallen and which required workovers, secondary recovery or Enhanced Oil Recovery, oil and gas producers could work as contractors for Pemex and be paid by a compensation mechanism that would index financial reward to the economic efficiency of production (that is, to the profitability of a field). Such contractors would also provide project investment funds. Examples of such models exist in various parts of the world, such as Venezuela and Russia. In Mexico the old Poza Rica fields have all

Virtual Mixed Economy offers an untested policy option



* Virtual economies have the legal basis of a command economy.

Figure 5: Hydrocarbon sector in Mexico has not experimented with a virtual mixed economy

but ceased production, and production from the onshore Reforma fields in the southeast has been in decline for ten years. The controversial Chicontepec fields have yet to be brought into serious production. These three areas are mentioned as regions where this type of compensation mechanism could be easily applied.

The general concept of a risk service contract will have to be modified, however, for greenfield projects requiring exploratory drilling. Here, there is exploration risk that must be compensated by a commensurate economic incentive.¹⁰ The developer must be

10/ While Pemex in its public statements minimizes exploration risk, there is a distinction to be made between the risk associated with field extension drilling and the risk associated with greenfield de-

velopment. The later always has substantial risks. paid for bringing a new field into production efficiently. And he must be paid well for bearing the exploration risk, according to international standards. Here, the most straightforward approach is some form of a production sharing agreement (PSA). It is not necessary that the private developer take title to the oil or gas, which, in Mexico's case, is prohibited by law. What is necessary is that the developer be paid in a manner that reimburses his costs and pays a reward indexed to the economic success of the project. Pemex's major crude oil customers, if involved in development projects, could be paid as a discount on future purchases of crude oil. Other developers, such as independent oil and gas companies, would require payments in

cash or its petroleum equivalent, at the option of Pemex.

The important points here are that ownership of the resource base would remain with the State and operational approval would remain with Pemex—thereby maintaining full state sovereignty. This model would entail neither sharing of production nor of profits. The fees paid to developers are for Reservoir Development and Management Services (RDMS). Such developers are part of Pemex's cost structure and are not principals involved in the distribution of its profits.¹¹

In these ways, with little new direct investment of its own, Pemex would gain the benefits of new dry gas production in the north and new reservoir development and management expertise for difficult plays in Campeche.

Downstream the model could be used to fund infrastructure needs, such as the natural gas pipeline to Mexicali (the hometown of President Zedillo) that is 15 years overdue and the nearby Rosarito thermoelectric plant. Another similar project in need of funding is the new gas pipeline that is to extend 600 kilometers from the gas fields of Villahermosa to the electric power facility to be privately built in the Mérida area (known as the Mérida III project).

Short of privatizing pipelines or incurring more public-sector debt to fund upstream development and gas imports, the virtual mixed economy model offers perhaps the only acceptable permutation of Mexico's traditional command model that will permit the needed expansion of both the hydrocarbon and electric-power sectors. The task of implementing that model will be as much a challenge for legal minds as it will be for market planners,

developers, regulators and prospective lenders. The legal issue is crucial and is not about changing the niceties of contractual language. The legal framework of a new virtual mixed economy would have to be built on institutional arrangements that balance the competing interests of Pemex, the Federal Power Utility (CFE), developers, lenders and consumers, as well as taking into account environmental issues and public safety.

Concluding Comments

If Mexico is to gain full benefits from NAFTA, it will not be enough that Pemex is competitive. Mexico's export sector will grow in part because of market pressures in the energy sector that work to reduce the costs and prices of energy inputs. For this to happen, the absence of trust and of expectations of fair treatment that characterized much of the inter-governmental-agency debate around energy policy during the Salinas years will have to be replaced by a new atmosphere, one that will win the support of Pemex and the CFE and that will attract the long-term commitment of a new class of Pemex contractors, electric power developers and lenders. If this new atmosphere does not materialize, Mexico faces the likelihood of little interest in electric power generation from investors and lenders and will not enjoy the environmental and economic benefits inherent in such investments.

As the Mexican economy struggles to recover from the 40% meltdown of the peso that occurred at year-end 1994, there will be an increased urgency to find creative sources of funding for Pemex's production and infrastructure needs. In the wake of the devaluations and the proposals (ill-advised, in our view) to tie Pemex export revenues as collateral for a US-led \$50 billion emergency aid package, it is unlikely that New York underwriters will soon support major Pemex Yankee bond issues. If, through no fault of its own, Pemex comes to experience restricted access to debt markets, project financing in production, refining, and gas transmission may yet be practical in a virtual mixed economy.

11/ Pemex's gross profits would be the gross income less a) lifting costs, b) allocation for capital recovery and c) RDMS fees. The complexity of this issue is increased in the case of natural gas, as the compensation mechanism in Mexico would have to start from an equivalent Gulf Coast market price. The "price equivalency test," in turn, would have to take into account differences in the BTU content of the gas and wellhead-to-grid transportation values.

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