

MEXICO'S PETROLEUM AND U.S. POLICY: IMPLICATIONS FOR THE 1980s

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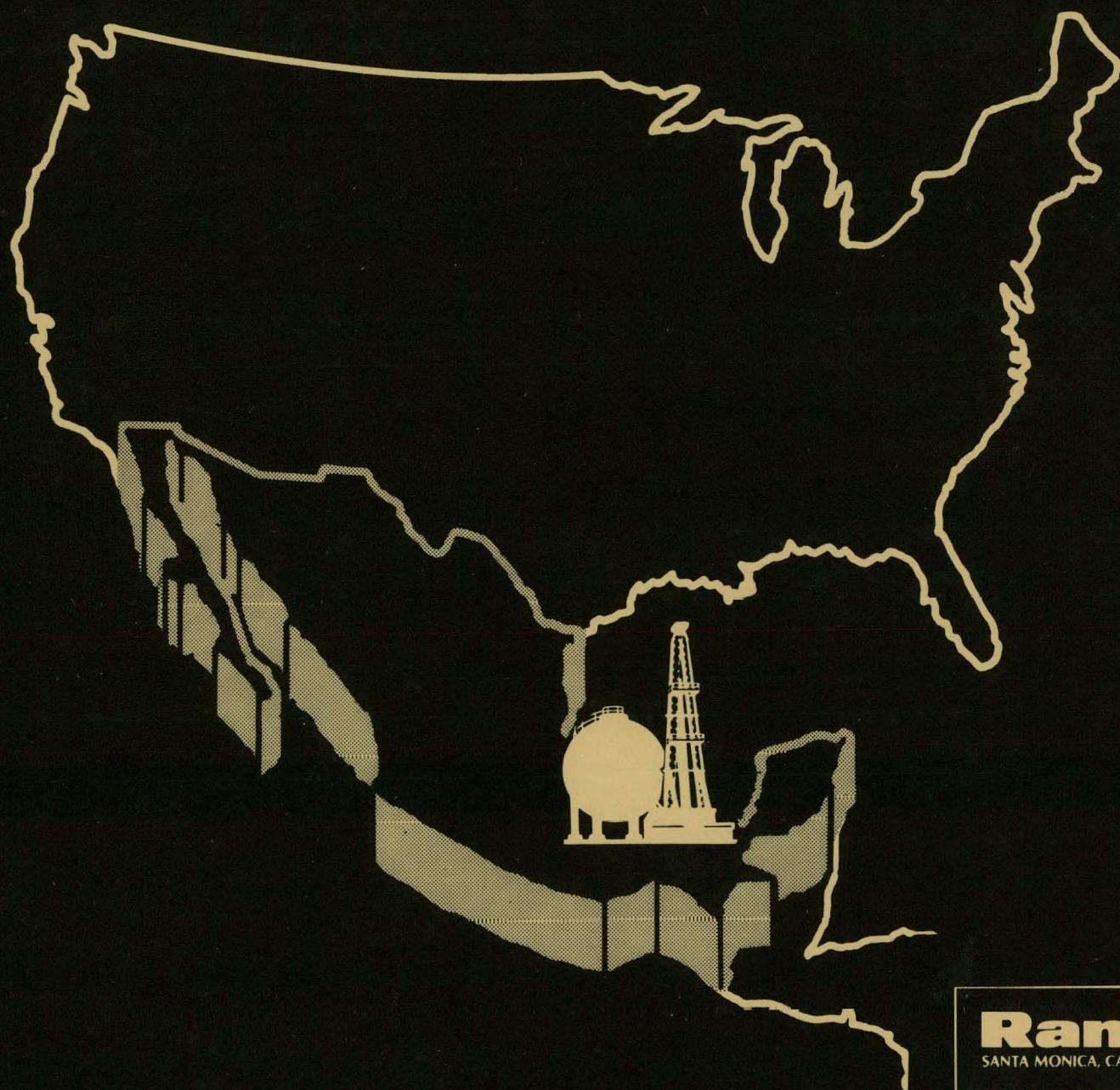
PREPARED FOR THE U.S. DEPARTMENT OF ENERGY

DAVID RONFELDT, RICHARD NEHRING, ARTURO GÁNDARA

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PREFACE

This report explores the implications of major Mexican petroleum reserves for U.S. policy in the 1980s. Mexico's petroleum development has prompted intense interest and evident confusion in U.S. public policy discussions. The present project was undertaken (1) to clarify key factors that will influence Mexico's future petroleum policies, (2) to project expected policy outcomes, and (3) to analyze the implications of these policies for U.S. interests and objectives. The project began at a time when bilateral gas export negotiations were arousing public controversy, which sometimes complicated the field research efforts. Although this report considers aspects of those negotiations, the major research objective was directed beyond the immediate political issues to analyze the factors, trends, and opportunities that will emerge in the coming decade. The authors' work in this area is motivated partly by their belief that U.S.-Mexican relations have entered a new era of increasing importance, complexity, and uncertainty, which may have profound consequences for a range of U.S. domestic and foreign policies. To manage the challenges of this new era in U.S.-Mexican relations, it will be necessary for both nations and their governments to raise their level of mutual understanding, insofar as better understanding will serve to improve the prospects for better cooperation.

The research project is part of Rand's program of policy studies funded by the U.S. Department of Energy under Contract No. DE-AC01-79-PE70078. This report was prepared for the former Office of International and Security Policy under the Assistant Secretary for Policy and Evaluation of the Department of Energy.

In view of the urgency of U.S. and world energy problems, the report should be of interest to members of the government, as well as to industrial managers and economic and political analysts. An executive summary (R-2510/1-DOE) of the report is available that focuses on the most policy-relevant features of the study.

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SUMMARY

This report examines selected factors affecting Mexico's future petroleum policies, and then assesses various implications of Mexico's petroleum for U.S. interests and policies. After a brief introduction, the report is divided into three sections. The first offers a detailed analysis of Mexico's petroleum resources and production possibilities. The second considers petroleum as a symbolic issue of profound significance for Mexican nationalism. The final section provides an assessment of these and other factors for U.S. interests, objectives, and policy options during the 1980s.

RESERVES, RESOURCES, AND PRODUCTION POSSIBILITIES

Despite great public confusion and wild speculations about Mexico's petroleum potential, sufficient knowledge is available to provide a well-documented, reasoned assessment of Mexico's petroleum resources and production possibilities, and to specify the key areas of present and future uncertainty.

Our resource assessment consists of a region-by-region evaluation of Mexico's petroleum possibilities, considering both the results of exploration and development and the identified and potential prospects of areas yet to be explored and developed. Our evaluation emphasizes the areas with the greatest potential: the Reforma area, offshore Campeche, Chicontepec, the offshore area of the Tampico-Misantla Basin, and the northeastern basins. In evaluating each major area, we summarize the basic geology, present significance, and the results of exploration and development activity to date. In considering potential, we include both possible future discoveries and the prospects for additional recovery. We summarize the national and regional assessments by means of subjective cumulative probability distributions. These distributions convey our estimated range of possibilities, based on existing information.

We estimate that Mexico has produced 8 billion barrels of petroleum liquids (crude oil and natural gas liquids) by the end of 1979, and that it has proved reserves of 22 billion barrels and probable reserves of at least 19 billion barrels, for a total known recoverable resource of 49 billion barrels. Our estimate of *proved* reserves of petroleum liquids is less than the 33.6 billion barrels reported by Pemex (Mexico's national oil company) because we consider it premature to include more than minimal amounts from Chicontepec as a proved reserve. Our estimate of *probable* reserves is also less than that published by Pemex, because our lack of information on the regional composition of Pemex's estimate precluded verifying its content. We estimate that there is a 90% probability that Mexico will ultimately produce more than 70 billion barrels, a 50% probability that it will produce more than 90 billion barrels, and a 10% probability that it will produce more than 120 billion barrels.

We also estimate that Mexico has produced 14 trillion cubic feet of natural gas, has proved reserves of 35 trillion cubic feet (again excluding nearly all of Chicontepec), and has probable reserves of at least 25 trillion cubic feet, for a total known recoverable resource of 73 trillion cubic feet. We estimate that there is a 90%

probability that Mexico will ultimately produce more than 130 trillion cubic feet, a 50% probability that it will produce more than 170 trillion cubic feet, and a 10% probability that it will produce more than 210 trillion cubic feet.

The potential is concentrated in a small number of highly productive areas. We estimate that nearly half of Mexico's oil potential is concentrated in the Campeche area offshore southeastern Mexico. This area is very promising because of the immense productive thicknesses encountered in some of the exploratory wells drilled to date. The next most important area is the Reforma area, where the first major discoveries setting off Mexico's oil boom were made. The Reforma-Campeche area, which constitutes one petroleum province, is likely to become the second most important oil-producing province in the world, trailing only the Arabian-Iranian Basin (the Middle East). However, it will probably be no more than 10% of the ultimate size of the Middle East. The other potentially major new oil-producing area is the Chicantepec area. Because this area has poor producing characteristics, potential recovery from its immense known resources of oil-in-place is highly uncertain. No single area is likely to predominate as a source of natural gas. The Reforma and Campeche areas and the Sabinas Basin in northeastern Mexico all promise to be significant.

Our assessment indicates that Mexico will be one of the world's major sources of petroleum. As a source of conventional petroleum (oil and natural gas), we estimate that Mexico will rank fifth to seventh, trailing only the United States, the Soviet Union, Saudi Arabia, Iran, and possibly Iraq and Kuwait. Proportionately, it is likely to be more important as a source for oil than as a source for natural gas.

The future of Mexico's oil production is dominated by two major uncertainties —what its ultimate oil resources will be and what its production policy will be. To illustrate the effects of these two uncertainties, we developed three sets of production profiles for Mexico. Each of the three sets is associated with a different level of ultimate recoverable resources of petroleum liquids: 70, 90, and 120 billion barrels, respectively, approximating the median and near extremes of our resource assessment. Each set illustrates three production policy alternatives: low, moderate, and high peak production. In the three low cases, production peaks at 2.5, 3.0, and 3.5 million barrels per day; in the three moderate cases, production peaks at 3.5, 4.5, and 5.5 million barrels per day; and in the three high cases, production peaks at 5.0, 6.0, and 7.5 million barrels per day.

Because these profiles encompass the range of realistic possibilities, they provide a firm basis for making several key points about the future of Mexico's oil production. First, in view of the probable range of its resource base, Mexico is destined to become one of the world's leading oil-producing nations. Second, because of the characteristics of its oil resources and the practices required to maximize recovery, Mexico will never reach rates of production as high as 10 million barrels per day or more. Third, if Mexico decides to become a major producer and thus a major exporter, it will be choosing a role that its resource base can sustain for only a few decades. Fourth, if Mexico chooses the low or moderate oil production policy alternatives, it should be able to use the associated natural gas production without large-scale flaring. Finally, even though Mexico has major amounts of oil, this does not relieve it for long of the necessity to promote more efficient energy use and to develop alternative energy sources.

SYMBOLIC CHALLENGES AND CONSTRAINTS

As a result of the unique nationalization-expropriation acts of 1938, Pemex was created by transforming foreign private companies, who were interested in maximizing exports for their own profits, into a state enterprise dedicated to meeting Mexico's domestic energy and developmental needs. Pemex was directed to emphasize the public welfare, not profits.

From 1938 through 1976, Pemex's main operational goals were to provide energy self-sufficiency for Mexico and to promote industrial development through subsidized, even sub-cost, energy prices. Petroleum exports and imports were to be minimized.

Since 1976, the discovery of gigantic petroleum fields and Pemex's impressive technical achievements have presented new options for a radical expansion of its traditional goals. Besides producing petroleum for domestic self-sufficiency, Pemex could become a major exporter. And besides promoting domestic economic development through subsidized energy prices, Pemex could earn vast export revenues.

This operational expansion poses great symbolic challenges for Mexican nationalism because of the traditional ideals associated with petroleum and Pemex. Indeed, if Pemex is to become a major exporter, overcoming the symbolic challenges and constraints may prove more difficult than coping with the practical tasks of exploration, development, and production.

Through Mexican eyes, petroleum and Pemex represent "symbolic realities" of extraordinary, almost mystical significance for Mexican nationalism. Since 1938, petroleum and Pemex have symbolized the essences of nationalism: national dignity, economic independence, and state sovereignty. Pemex is a symbol of national dignity and pride because its achievements prove that Mexico can succeed despite obstacles and expectations of failure. Pemex is regarded as a standard-bearer of Mexico's struggles for economic independence. Its creation as a major institution of the Revolution is closely linked to the establishment of respect for state sovereignty within Mexico.

Thus, what happens to petroleum and Pemex goes to the core of what being Mexican means—or is supposed to mean—for Mexico's leaders as well as the man in the street. No other post-Revolutionary institution is endowed, and encumbered, with such a sensitive symbolic load. In domestic politics, this symbolism often embellishes public rhetoric—even though many Mexicans view Pemex as a symbol of corruption and inefficiency. But when petroleum becomes a foreign policy issue, the traditional nationalist ideals become a compelling force.

The three nationalist concepts—national dignity, economic independence, and state sovereignty—constitute a powerful and fateful triad that often constrains the formulation of policy choices. What may appear to be narrow technical matters to Americans, such as the price of a product or other terms of a contract, may be viewed among Mexicans as sensitive political issues having profound implications for their country's future. Mexico's political leaders and policy intellectuals are particularly sensitive to matters affecting state sovereignty. They believe that the state is still not strong enough, that it stands at a critical stage of its development, and that it represents the only real bulwark against pressures from the United States. Issues involving the United States are frequently interpreted more in terms of the risks for Mexico's sovereignty and freedom of action than in terms of the possible benefits for Mexico's economic growth—which is where Americans normal-

ly put the emphasis. This has been evident in past negotiating episodes (e.g., a possible Export-Import Bank loan to Pemex in 1948-1949, and Pemex's first gas export deal with a U.S. company in the mid-1950s). The symbolic triad was a major factor influencing the course of recent gas export negotiations and the prospects for increased crude oil exports in the 1980s.

Mexico's leaders have justified crude export growth since 1976 both as a short-term necessity to resolve acute but temporary economic problems and as the introduction of an important long-term element in Mexico's policies. The short-term justification has been widely accepted. However, this justification is viable only into 1980.

Controversies about long-term issues, which remain far from resolved, may become heated during 1980-1982 because of four concurrent developments. First, Pemex will attain the latest production target during 1980, which will require difficult decisions about whether and how to increase production and exports. Second, petroleum export revenues, which until now have largely financed development within the petroleum sector, will begin to accumulate for major investments elsewhere. Third, the government's long-range planning efforts, which have been represented mainly by the National Industrial Plan and the Global Development Plan, will need to focus on defining and implementing specific large projects. Fourth, the approaching presidential succession will begin to influence high-level decisionmaking. With these developments occurring simultaneously, 1980-1982 might well bring a "crisis of success" for Mexican nationalism, as policymakers try to adapt their traditions to cope with the new opportunities and capabilities confronting them at home and abroad.

The terms of the emerging debate make it clear that the ultimate stakes include the fundamental principles of Mexican nationalism: dignity, independence, and sovereignty. This is evident not only in petroleum export issues but also in such concerns as food production, border development, and trade relations. The strain of dealing with the symbolic challenges will be most evident in Mexico's negotiations with the United States, because the traditional principles discourage acceptance of ideas of interdependence, partnership, and community with its neighbor.

Fortunately, Mexican nationalism is not written in stone and does not prescribe how Mexico's leaders will respond to new situations. Although the traditional ideals bespeak a close-minded and intolerant attitude toward U.S.-Mexican relations, in practice they can be adapted to flexible, pragmatic, and innovative interpretations. But the process of symbolic transformation will take time.

U.S. INTERESTS, OBJECTIVES, AND OPTIONS

Recent public policy discussions in the United States on Mexico's petroleum have focused on three interrelated assumptions: (1) Mexico's petroleum is vital to meeting United States energy needs; (2) Mexico's petroleum should be the keystone of U.S.-Mexican relations; and (3) the United States can strongly influence Mexico's petroleum policies. These assumptions lead some to conclude that the United States should exert special pressures or make concessions to encourage Mexico to produce and export as much petroleum as possible. Although these assumptions are much more common outside than inside the U.S. government, they have shaped expecta-

tions on what U.S. policy toward Mexico should attempt to accomplish. Public discussions in Mexico thrive on similar perceptions of U.S. interests and objectives.

Our research leads us to doubt the validity and adequacy of many aspects of the "conventional wisdom" prevailing in both countries. Promoting Mexican oil as a cheap solution to U.S. energy problems could prove very costly. Our policy toward Mexico and its petroleum needs to consider not only U.S. energy security but also U.S.-Mexican relations in general.

U.S. Interests

Mexico's petroleum resources and policies are of vital interest to the United States in two major areas: U.S. energy security and U.S.-Mexican relations. The first involves not only resolving the problems of oil import dependence during the coming decade but also the transformation of the world energy economy from conventional petroleum resources over the next several decades. The second concerns currently sensitive issues such as immigration, trade, and border relations, and poses critical questions for the long-term evolution of the U.S. economy and society.

Mexico offers the only demonstrated potential for large increases in oil exports from a non-OPEC country during the 1980s. Thus, major increases in Mexico's oil production will affect any program for restraining world oil prices and fostering a more orderly transition to new energy sources during the 1980s and 1990s. Moreover, Mexico promises to be a relatively secure and reliable source of foreign oil, particularly for the United States, which would have the immediate benefit of reducing imports from insecure sources. Nonetheless, Mexico's unique importance to U.S. energy security can easily be overstated, and U.S. energy security interests in Mexico should serve broader, long-term goals. For example, U.S. interests must recognize the potential consequences of petroleum development for Mexico's own energy future. Because Mexico has few immediate alternatives to oil and gas, its transition from conventional petroleum sources to other energy sources will probably begin later and take longer than that in many other countries. Another important consideration is the effect of petroleum development on Mexico's political and economic evolution. Too rapid development could quickly change Mexico from a secure to an insecure source of petroleum.

United States-Mexican relations, for years a subject of minor or parochial interest, have become increasingly essential to the overall progress and security of the United States. Mexico's new importance promises to extend well into the 1980s, broadly influencing U.S. domestic and foreign policies. The stakes include much more than energy, and extend to affecting who Americans are, how they treat each other, and what kinds of work they do. Petroleum is a significant but not predominant interest area within an increasingly complex and multidimensional relationship. The ultimate objective of U.S. policy should be to have a stable, friendly, and progressive Mexico as a neighbor.

United States-Mexican relations are becoming both important and more complex for several reasons. Mexico is now at a critical stage in its domestic development. Massive economic, social, and cultural interconnections are growing throughout the U.S. borderlands and extending deeper into both countries. Mexico is emerging as an important medium power within the frameworks of U.S. global interests. Thus, the United States should not view Mexico only in terms of solving

its energy problems—just as we do not expect Mexico to treat the United States as an easy solution to its population and employment problems.

Neither interest area—U.S. energy security or U.S.-Mexican interdependence—appears to merit clear priority over the other. Both merit roughly equal weight, entailing similar preferences regarding the possible outcomes of Mexico's future petroleum policies. Mexico is not just another oil-producing country. It would still be very important to the United States even if it had no petroleum resources. The fact that it does have major petroleum resources does not diminish the other reasons for its importance.

Key Issues and Preferred Objectives

Several key issues in Mexico's petroleum development will require decisions during the next several years. We describe these key issues and the basic alternatives, consider the varying implications of the alternatives, and on the basis of our assessment of U.S. interests identify those alternatives that seem preferable. Our research suggests that Mexico's own decisions will probably not be very different from those most desirable to the United States. Thus, a major U.S. policy effort to influence Mexico's petroleum policies is unlikely to be necessary.

Production/Export Level and Development Rate. The central issue in Mexico's petroleum development—and the issue of most interest to the United States—is Mexico's choice of oil production levels. This choice will affect the level of Mexico's oil exports and thus its effect on the world oil market, and will determine Mexico's export revenues and its domestic energy future. Although a variety of production paths are theoretically possible, Mexico's basic alternatives can be usefully simplified to low, moderate, or high production levels.

We conclude that the choice of a moderate production and export level by Mexico would provide the best balance of potentially conflicting U.S. interests. This would mean a peak production level of 3.5 to 5.5 million barrels per day, depending on the ultimate size of the resource base, with exports ranging between 1.0 and 2.5 million barrels per day during the 1980s and 1990s. This level, if coupled with efforts to limit and transform oil consumption in the United States and other petroleum-importing countries, would help stabilize the world petroleum market and enhance U.S. energy security. Simultaneously, it should enable Mexico to promote national development without major risks of destabilization and provide the country with ample time for the necessary transition to other sources of energy. In contrast, the choice of a low production level (2.5 to 3.5 million barrels per day) would do little for U.S. energy security, while the choice of a high level (5.0 to 7.5 million barrels per day) could be economically and politically disruptive inside Mexico.

It is too early to forecast what Mexico's eventual choice will be. The production ceiling of 2.5 million barrels per day will be reached in 1980. Potential coalitions in Mexico apparently favor either increasing production very slowly from the original ceiling, thereby committing Mexico to a low production level, or increasing production more rapidly to a moderate level. Although many U.S. analysts have recommended a major U.S. policy effort to stimulate increases in Mexico's petroleum production and exports, we foresee that Mexico's evolving definition of its own interests and needs probably will result in the gradual choice of a moderate production/export profile, a choice that is congruent with U.S. interests. Thus,

there appears to be no real need for special U.S. policy efforts to stimulate Mexico to produce and export more petroleum.

Mexico, it has been said, lacks sufficient capabilities to develop its petroleum resources rapidly enough; therefore, the United States should provide technical assistance to enable it to do so. However, the characteristics of the major new discoveries make this irrelevant. Because the major oil fields of Southeast Mexico require a relatively small number of wells for full development, Pemex is clearly capable of increasing production rapidly with no more need of external services than in industry elsewhere. United States efforts to accelerate the rate of development are therefore unnecessary and inadvisable.

Increased gas supplies are as important as oil supplies for U.S. energy security. The key issues for the United States with respect to gas exports are the level of gas production and the duration of export commitments. If Mexico proves to have large gas resources, the United States could seek additional gas imports. One way of doing so in a manner that could safeguard Mexico's interests and sovereignty would be to institutionalize any future natural gas trade agreements according to existing North American precedents. Procedures used earlier by Canada and Mexico to regulate gas exports to the United States may provide standards whereby gas reserves are dedicated to long-term export only if they are considered surplus to those needed for future national requirements.

Emergency Production Capacity. It would be in U.S. interests for Mexico to have excess oil production capacity that could be used to raise exports rapidly during a sudden international supply shortfall. Mexico could have significant excess production capacity by the mid-1980s if it decides to keep oil production at low levels or if it moves to moderate production levels at slow rates. It may also decide to install excess capacity to give its government the flexibility to increase production rapidly for domestic or international reasons.

If Mexico's government should decide to develop a policy for the emergency use of excess capacity, it would probably do so only within a multilateral context that protected Mexico's sovereignty while providing for responsible international cooperation in coping with an international emergency. One possibility to explore might be an arrangement between Mexico and the International Energy Agency (IEA). Under such an arrangement, safeguards could be developed specifying that Mexico would not be requested to use its excess capacity unless and until all IEA member states (including the United States) had implemented emergency procedures to restrict demand and share supplies.

A multilateral framework that incorporated varied exporting as well as importing nations might be more interesting to Mexico. In this regard, Mexico may consider building upon the proposals for global energy cooperation that were presented by President José López Portillo to the United Nations in September 1979. Because arranging a global approach presents so many difficulties, however, an alternative might be a regional approach for Latin America or the Western Hemisphere, whereby Mexico, Venezuela, and possibly other suppliers would agree to develop and use excess capacity for meeting specified emergency requirements within the region.

Bilateral arrangements for emergency gas supplies could also be important for U.S. energy interests. One approach would be to incorporate emergency supply arrangements within the framework of a long-term contract for a fixed amount of

total gas exports, if one can be reached eventually. In such an approach, emergency increases above contracted rates would be permitted for a specified period, as long as these were balanced by subsequent decreases in off-peak seasons or by reductions in the duration of the contract.

Export Destination and Composition. Mexico currently intends to diversify its oil export destinations, reducing the U.S. proportion from a current 75% to as low as 60% as total oil exports increase. Preliminary agreements to this end have been signed with Japan, France, Canada, and other countries. That a high share of Mexico's exports go to the United States does have marginal advantages for the United States, but not so great as to justify major policy efforts. Moreover, as the export volume expands, Mexico's current unwillingness to offer price discounts to distant nations may increasingly limit Mexico's opportunities to lower the U.S. proportion.

The United States might seek to influence the destination of Mexico's oil exports by making the U.S. energy market as attractive as possible to Mexico. One unilateral step could be to remove all price controls affecting refinery investment. Future increases in Mexico's oil exports will probably consist of heavier crudes from the offshore fields. If U.S. refineries on the Gulf and East coasts are to use heavy Mexican crude to produce the traditional mix of U.S. products, they will have to make substantial investments in downstream refinery capacity—investments that will be less likely if the return on investment is insufficient or uncertain because of controls.

Mexico may consider the export of refined products instead of crude oil. However, this possibility appears to be neither in the interests of Mexico nor the United States. Because refineries are optimally designed for specific markets, such a step would reduce Mexico's flexibility. And because a glut of basic refinery capacity already exists, such a step would represent a poor use of Mexico's investment resources.

Petroleum Revenues and Trade Diversification. One issue that is related to the direction of Mexico's petroleum exports is the disposition of its foreign expenditures of petroleum export revenues. It may be more important for U.S. economic interests that a high proportion of these revenues go to purchase U.S. goods and services than that a high proportion of the oil exports go directly to the United States. More is at stake than just recycling oil revenues for balance-of-payments benefits. Unlike other major oil-exporting countries, Mexico ranks as the fourth—and may become the second—most important U.S. partner in trade and investment. Continued development of economic relations may affect future incentives for Mexican worker migrations and opportunities for expanded production-sharing in agriculture and industry in the North American area.

Mexico seems determined to use its oil revenues for the nationalist purposes of diversifying trade, investment, and technology relations away from excessive dependence on the U.S. economy, while simultaneously seeking improved access to U.S. markets for varied Mexican exports. Its abilities to promote diversification within its total trade pattern would probably be maximized at moderate petroleum export levels. Important structural factors (e.g., the proximity, scale, and diversity of U.S. markets and products) should constrain Mexico from carrying diversification to an extreme. Its opportunities for diversification would appear greatest in the years immediately ahead. However, its interests and needs for renewed emphasis

on U.S. commercial relations should return to the fore in the mid- and late 1980s, as it succeeds in developing new export industries in need of foreign markets. Trade issues, and the linkages to energy issues, may thus become more urgent and controversial in the future.

Energy Use and Petroleum Substitution in Mexico. A major issue and potential dilemma for Mexico is the future rapid growth in the domestic demand for energy, particularly for petroleum. Although Mexico currently consumes little more than a million barrels a day in oil and gas (in oil equivalents), demand has been growing in recent decades by more than 7% per year, a rate that produces a doubling of consumption every decade. The new Industrial Development Plan, which stresses the development of energy-intensive industries, projects future growth as high as 10% a year. Growth rates have been high in part because Mexico's government has heavily subsidized domestic energy consumption. For example, natural gas and residual fuel oil cost Mexico's industries less than 10% of the world price.

If Mexico is to avoid substantial problems in accomplishing the energy transition that will be necessary in the decades ahead, it will have to begin restraining its growth rate in energy demand and developing petroleum substitutes during the 1980s. Mexico's immediate efforts should focus on energy conservation, primarily by reducing the gap between domestic and world petroleum prices, and secondarily by encouraging investment in energy-efficient technologies. Mexico also may need to begin developing supply alternatives, especially for electricity generation. Here the choices are limited; the main alternatives may be nuclear power, using Mexico's potentially abundant uranium ore reserves, and solar power, if the necessary economic and technological breakthroughs occur.

It is in the interests of the United States that Mexico move toward energy conservation and petroleum substitution. However, the role for U.S. policies in these areas appears to be limited. Pressures on Mexico to reduce the growth rate in energy demand, or to develop alternative sources of supply, would be perceived as interference in Mexico's domestic affairs. The U.S. role may be restricted to technical assistance, as requested by Mexico. Nonetheless, policy trends in Mexico indicate a growing awareness of the need to take steps in all these areas.

Alternative Long-Range Directions for U.S. Policy

Several new concepts have emerged recently regarding the overall direction of U.S.-Mexican energy relations during the 1980s and 1990s. One set of concepts derives from a strong concern to promote U.S. energy security around a comprehensive geographic framework. The alternatives are a special energy agreement between the United States and Mexico, a North American energy common market including Canada, Mexico, and the United States, and a Western Hemisphere approach incorporating Venezuela and the Caribbean refinery nations along with the other nations.

Growing recognition of Mexico's general importance for U.S. interests has prompted the formulation of two alternative long-range concepts for directing U.S.-Mexican relations. One such concept would emphasize internationalism, treating Mexico much like any other leading developing country and emerging medium power. The other alternative would emphasize community, treating Mexico as a special and important partner.

All these long-range concepts are tentative. They appear to be most useful as guideposts, emphases, and organizing ideas. As such, all merit further exploration and discussion. Because interdependence is growing inevitably, the most promising direction would be to build a sense of community and partnership in energy and other issue areas among the United States, Mexico, and Canada. However, moving in this direction will pose stiff challenges and great difficulties, and can only be achieved through step-by-step negotiations on specific issues.

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Of course, responsibility for the interpretations and conclusions presented in this report remain ours alone.

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I. INTRODUCTION

This report considers the future implications of Mexico's petroleum for U.S. policies. The recent discovery and development of major petroleum fields in southeastern Mexico have aroused great interest and imaginative speculation that Mexico could, and perhaps should, help to resolve U.S. energy security problems, and, accordingly, that the two neighbors should enter into a new era of broad economic cooperation.

Yet the most fundamental questions remain unanswered. How much petroleum does Mexico have? Estimates range from tens to hundreds of billions of barrels. How much will Mexico produce? Some analysts assert that Mexico could produce as much as 10 million barrels per day by 1990, if not sooner; others say that Mexico is unlikely ever to become a major petroleum exporter.

How these questions may be answered affects other important questions. What will Mexico do with its petroleum export revenues? How do Mexico's policies affect U.S. interests? What can and should the United States do to influence Mexico's petroleum policies? The answers to these questions are as diverse and controversial as are the common answers to the fundamental questions. Rarely has so much seemed to be at stake and been accompanied by such great uncertainty in any U.S. public policy discussions as are those on future U.S.-Mexican energy relations.

In our research, we developed new information and insights to cope with these and other major questions. In so doing, we have sought to clarify the stakes and to narrow the range of uncertainty, both by identifying and examining some key factors that will influence the determination of Mexico's future petroleum policies, and by illuminating some important considerations for U.S. policy that until now have received insufficient attention.

Our analysis is based on extensive interviewing and data collection in Mexico. We examined a variety of public sources, generally overlooked in the literature, including professional publications in the petroleum sector: *Revista del Petróleo Mexicano*, *Revista del Instituto del Petróleo Mexicano*, *Ingeniería Petrolera*, and others. We also conducted interviews with officials and professionals working in Petróleos Mexicanos (Pemex), the Mexican Institute for Petroleum (IMP), the National Energy Commission, the Office of Advisers to the President of the Republic, the Ministry of Patrimony and Industrial Development, the National Council of Science and Technology, and with researchers at several academic institutions. This field work has enabled us to accumulate a large body of new research information.

The purposes of this report are to examine selected factors affecting Mexico's future petroleum policies and to assess the implications of Mexico's petroleum for U.S. policy interests, objectives, and options. The report is organized as follows:

Section II offers a detailed analysis of Mexico's petroleum resources and production possibilities. The assessment proceeds region by region, considering the potential for both future discoveries and further development of known fields. We summarize these regional assessments in an overall evaluation. We then use the resource assessment as a basis for developing and discussing the implications of several potential oil production profiles that Mexico might choose.

Whereas Sec. II deals with what is in the "ground," Sec. III discusses what may be found in the "sky"—petroleum as a symbolic concern profoundly affecting Mexican nationalism. We emphasize the idealized traditions of petroleum nationalism, how these traditions may constrain the policy choices open to Mexico's leaders, and what bearing they have on energy negotiations with the United States.

In Sec. IV we coordinate our conclusions and draw on preliminary findings from as yet unpublished research on institutional and other factors affecting Mexico's petroleum policymaking to provide an overall assessment of the implications for U.S. interests, objectives, and policy options for the 1980s. Our approach emphasizes two areas of long-range concern: U.S. energy security and U.S.-Mexican interdependence. We identify what policy outcomes seem preferable for advancing U.S. interests and discuss the likelihood of realizing these preferred outcomes.

II. RESERVES, RESOURCES, AND PRODUCTION POSSIBILITIES

During the past several years, the size of Mexico's oil reserves has become the subject of intense speculation. As the level of interest in Mexico's oil potential has increased, estimates of that potential have soared, unconstrained by such mundane considerations as exploratory results and the fundamentals of petroleum geology. Mexico has been hailed as another Saudi Arabia, with 200 billion barrels of oil, or even as another Middle East, with up to 700 billion barrels. The recent Mexican discoveries are asserted to have toppled the conventional wisdom that the Middle East is a unique occurrence, that few major oil fields remain to be discovered, and that we are facing a world of increasing scarcity of oil. Mexico's production potential is asserted to be 10 million barrels per day or more by 1990, a level similar to the highest levels of production ever attained in Saudi Arabia, the Soviet Union, and the United States—the three leading oil-producing countries.¹

These optimistic estimates have been countered by more cautious claims, creating considerable confusion on what Mexico actually does have. To clarify the picture, we provide an independent assessment of Mexico's petroleum potential and an evaluation of its production possibilities. We also present a reasoned basis for our estimates, indicating both the state of existing knowledge and the key areas of uncertainty.

The first step in evaluating Mexico's petroleum potential is to specify the appropriate terminology. Public discussion of Mexico's petroleum potential is plagued by conceptual confusions as well as by wildly conflicting estimates. Two misunderstandings have been particularly evident: (1) the failure to distinguish between *hydrocarbon* reserves and *crude oil* reserves, and (2) the failure to distinguish carefully among *proved*, *probable*, and *potential* reserves.

Petróleos Mexicanos (Pemex), Mexico's national oil company, often uses estimates of hydrocarbon reserves or resources in speaking of petroleum possibilities. This approach, which combines reserves or resources of both petroleum liquids (crude oil and natural gas liquids) and natural gas (expressed in terms of oil equivalents) into a single category, is an entirely legitimate means of describing total petroleum resources. The confusion occurs when an estimate of total hydrocarbon resources is assumed to represent only crude oil resources. As Pemex's own numbers clearly indicate, the two are not the same. For example, Pemex has estimated that proved Mexican hydrocarbon reserves were 45.8 billion barrels as of the end of 1979. However, of the total, only 30.6 billion barrels (66.8%) were reserves of crude oil. Pemex has also estimated that the total hydrocarbon potential of Mexico was 200 billion barrels, an estimate that frequently has been used to compare Mexico with Saudi Arabia. (Saudi Arabia, with 37.1 billion barrels' cumulative production and 177.9 billion barrels' proved and probable reserves at the end of

¹ See, for example, B. Netschert, *Mexico: Potential Petroleum Giant*, National Economic Research Associates, September 15, 1978; W. D. Metz, "Mexico: The Premier Oil Discovery in the Western Hemisphere," *Science*, Vol. 202, December 28, 1978, pp. 1261-1265; R. B. Mancke, *Mexican Oil and Natural Gas*, Frederick A. Praeger Inc., New York, 1979; and Resource Planning Associates, *Forecasts of Mexican Oil Production, 1980-1990*, Washington, D.C., May 15, 1979.

1979, has a known recovery of 215.0 billion barrels, the most of any country.) However, if only 70% of Mexico's estimated hydrocarbon potential is crude oil, its crude oil potential is only 140 billion barrels.

The second major misunderstanding has been the failure to distinguish among proved reserves, probable reserves, and potential resources. *Proved reserves* generally refer to known recoverable developed resources, more specifically to amounts that are estimated to be recoverable from wells that have already been drilled and from additional recovery projects that have already proved to be successful. *Probable reserves* refer to estimated recoverable resources from known productive fields that have not yet been developed, including new discoveries lacking development wells and estimated additional reserves from planned secondary recovery projects that are being installed or are yet to be installed. *Potential resources*, as used by Pemex, refer to all ultimately recoverable resources, including cumulative production, proved and probable reserves, additional recovery from known fields, and undiscovered resources. Some of the recent confusion has occurred because the boundary between proved and probable reserves has not been fixed. In recent years there has been a tendency to place reserves that previously would have been classified as probable into the proved category, including reserves from fields that are being developed and reserves from secondary recovery projects that are being installed. This was first done in the United States with the *Prudhoe Bay* field. It appears that Pemex adopted a similar practice in 1978, with the result that this definitional change made a one-time accelerated booking of proved reserves.

During the past four years, estimates of Mexico's proved reserves have increased substantially. Tables 2.1, 2.2, and 2.3 provide Pemex's estimates of proved reserves of crude oil, natural gas liquids, and natural gas by region from the end of 1970 to the end of 1979. Pemex estimates that Mexico's proved reserves at the end of 1979 were 30.6 billion barrels of crude oil, 2.9 billion barrels of natural gas liquids, and 61.2 trillion cubic feet of gas. At the standard conversion rate of 6000 cubic feet per barrel, Mexico's proved hydrocarbon reserves thus total 43.8 billion barrels. At Pemex's conversion rate of 5000 cubic feet per barrel, proved hydrocarbon reserves total 45.8 billion barrels of oil and gas in oil equivalents. Probable hydrocarbon reserves are estimated by Pemex to be another 45.0 billion barrels of oil and gas in oil equivalents. (No details of the composition of probable reserves by type or by region are available. Inferences from available information suggest that roughly half of the probable reserves are crude oil in the recently discovered offshore fields.)

As the regional composition of reserves indicates, estimated proved crude oil reserves are concentrated in the Southern Zone (57.7%), the area where the recent major discoveries began in 1972, and in the Chicontepec area (35.7%). Reserves in the Poza Rica area, historically the primary source of Mexican oil, have declined since 1970. Estimated proved reserves of natural gas liquids are concentrated in the Chicontepec area (44.9%) and the Southern Zone (39.8%). Estimated proved reserves of natural gas are concentrated in Chicontepec (43.7%), the Southern Zone (29.8%), and the Northern Zone (20.7%).

The timing of major year-to-year changes in the estimates of proved reserves from 1970 to 1979 appears to have been determined more by internal political considerations than by the pace of exploration and development. Proved reserves of crude oil inched up between 1971 and 1975, despite the major discoveries and the substantial increase in production that occurred during that period. Beginning

Table 2.1

PROVED RESERVES OF CRUDE OIL IN MEXICO BY REGION, 1970-1978
(In millions of barrels as of December 31)

Area	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
Northern Zone	407	389	375	330	304	305	540	543	478	427
Chicontepec	—	—	—	—	—	—	—	—	10,960	10,938
Poza Rica	1,709	1,689	1,639	1,592	1,556	1,579	1,652	1,609	1,530	1,570
Angostura	2	2	1	1	5	22	63	101	97	
Southern Zone	762	758	818	924	1,222	1,524	4,181	6,833	12,549	17,681
Total ^a	2,880	2,837	2,833	2,847	3,087	3,431	6,436	9,086	25,615	30,616

SOURCE: Petróleos Mexicanos, *Memoria de Labores*, Mexico City (annual).^aTotals may not add up exactly because of rounding.

Table 2.2

PROVED RESERVES OF NATURAL GAS LIQUIDS IN MEXICO BY REGION, 1970-1978
(In millions of barrels as of December 31)

Area	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
Northern Zone	80	78	94	107	115	126	228	278	323	263
Chicontepec	—	—	—	—	—	—	—	—	1,325	1,323
Poza Rica	137	134	133	129	127	129	135	132	128	188
Angostura	—	—	—	*	*	19	41	45	57	
Southern Zone	193	185	179	186	207	248	440	888	960	1,171
Total ^a	409	397	405	423	450	522	843	1,342	2,792	2,944

SOURCE: Petróleos Mexicanos, *Memoria de Labores*, Mexico City (annual).

NOTE: An asterisk indicates less than 0.5 million barrels.

^aTotals may not add up exactly because of rounding.

Table 2.3

PROVED RESERVES OF NATURAL GAS IN MEXICO BY REGION, 1970-1978
(In billions of cubic feet as of December 31)

Area	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
Northern Zone	3,448	3,526	3,509	3,590	3,775	3,889	7,924	11,260	13,519	12,461
Chicontepec	—	—	—	—	—	—	—	—	26,775	26,738
Poza Rica	2,956	2,903	2,847	2,786	2,744	2,791	2,861	2,833	2,761	3,756
Angostura	120	115	104	109	106	390	758	814	979	
Southern Zone	4,871	4,425	4,292	4,327	4,560	4,854	7,866	12,960	14,901	18,261
Total ^a	11,396	10,969	10,752	10,812	11,185	11,924	19,410	27,868	58,935	61,217

SOURCE: Petróleos Mexicanos, *Memoria de Labores*, Mexico City (annual).^aTotals may not add up exactly because of rounding.

with 1976, reserve estimates were increased sharply for all areas of new discoveries and development. (Because of the transition from President Echeverria to President López Portillo and the associated reevaluation of policy, the estimates of reserves as of the end of 1976 were not published until 1978.) Definitional changes appear to be the major cause of the sharp increase from 1977 to 1978. The Chicontepec area is still largely undeveloped, and water flooding in the *A. J. Bermudéz* field, a major source of the near doubling of crude oil reserves in the Southern Zone, was just being installed at that time. The increases from 1978 to 1979 are found entirely in the Southern Zone and are primarily attributable to the development of the offshore Campeche fields.

Both the rapid changes and the composition of the changes in reserve estimates in the past four years suggest that estimates of current reserves are not necessarily a good indicator of Mexico's ultimate petroleum potential, and that a careful evaluation of the geological, engineering, and political factors behind the increases is essential. The following review of Mexico's petroleum potential assesses what the ultimate amounts may be in the light of what can be known and inferred from the characteristics of recent discoveries and development. We conclude that Mexico's ultimate recoverable resources of petroleum liquids are very likely to be between 69 and 121 billion barrels, and that its ultimate recoverable resources of natural gas will most probably be between 131 and 215 trillion cubic feet. If Mexico chooses to become a major oil exporter, this oil resource potential, in view of its characteristics and composition, could support a peak oil production of 5.0 to 7.5 million barrels per day. However, if Mexico emphasizes longer-term self-sufficiency, its oil production is unlikely to rise beyond 2.5 to 3.5 million barrels per day.

MEXICO'S OIL AND GAS RESOURCES

Mexico's future role in the world oil market depends in part on its ultimate oil and gas resources. Although geological endowment is not the only constraint on the choices Mexico may make, it limits the range of possible choices. As a prelude to our analysis of Mexico's possible petroleum policies, this section provides an assessment of Mexico's oil and natural gas resources by addressing the following questions:

1. How much oil and natural gas is likely to exist in Mexico?
2. What is the geographic and geologic distribution of these resources?
3. What is the likely distribution of the reservoir and fluid characteristics of these resources?
4. What are the probable costs of finding, developing, and producing these resources?
5. What are the major uncertainties in these estimates?

Our assessment consists of a region-by-region evaluation of Mexico's petroleum possibilities, considering both the results of exploration and development and the identified and potential prospects of areas yet to be explored and developed. We organize the evaluation into nine regions, consolidated into three areas, including the Southern Zone (the Reforma area, offshore Campeche and adjacent areas, and

the Tertiary basins), the central Gulf Coast basins (Tampico-Misantla Basin, including Chicantepec and similar areas, the Western Gulf of Mexico offshore area, and the Veracruz Basin), and the northeastern basins (Burgos and Sabinas basins) and other potentially productive areas (the interior basins and Pacific Coast basins). (See Fig. 2.1 for the known and prospective petroleum regions of Mexico.) We emphasize those areas with the greatest potential: the Reforma area, offshore Campeche, Chicantepec, the offshore area of the Tampico-Misantla Basin, and the northeastern basins. We summarize the regional assessments in an overall evaluation. As part of the summary, we compare Mexico with other leading petroleum-producing nations and briefly analyze Mexico's potential contributions to world oil resources.

In evaluating each major area, we summarize the basic geology, present significance, and the results of exploration and development activity to date. In these descriptions, we pay particular attention to the field size distribution of known resources, the reservoir characteristics of major fields, and current stages of field development, because of their importance for accurate resource assessment. In considering potential, we include both possible future discoveries and prospects for additional recovery from known fields.

To the extent that available information permits, our assessment covers explicitly the fundamentals of petroleum occurrence—generation, migration, accumulation, and preservation. If petroleum is to occur, all of these conditions must have existed in an appropriate spatial and temporal relationship to each other. Sufficient organic material must be produced, deposited in sediments, and preserved from oxidation. Through burial at sufficient depths, these source materials are subjected to higher temperatures to generate petroleum. Permeable carrier rocks must exist adjacent to the source rocks in order to receive petroleum as it is generated and expelled. The migrating petroleum accumulates in the permeable and porous reservoir rocks. These reservoir rocks are capped by impermeable rocks capable of preventing further migration. Finally, these accumulations or traps must be preserved intact through geologic time.²

Besides the usual number of major uncertainties associated with any resource assessment, we had to wrestle with several unique aspects of the new developments in Mexico to which no analogies exist elsewhere in the world. The end result is clearly a matter of judgment. The judgments are based, where possible, on an extensive use of geological and engineering data, such as counts of potentially productive structures and estimates of potential reservoir volumes. But we necessarily had to go beyond such information, both to infer and to limit the possibilities. The prevailing uncertainty makes any single point estimate of Mexico's potential nearly meaningless. Consequently, we summarize the national and regional assessments by means of subjective cumulative probability distributions. These distributions convey our estimated range of possibilities, based on existing information. As more information is obtained from additional exploration and development, the distributions shown here will have to be altered accordingly, changing in shape and being reduced in range as the currently prevailing uncertainties are gradually reduced.

² For a detailed discussion of these factors, see G. D. Hobson and E. N. Tiraftsoo, *Introduction to Petroleum Geology*, Scientific Press, Ltd., Beaconsfield, England, 1975; and B. P. Tissot and D. H. Welte, *Petroleum Formation and Occurrence*, Springer-Verlag Inc., New York, 1978.

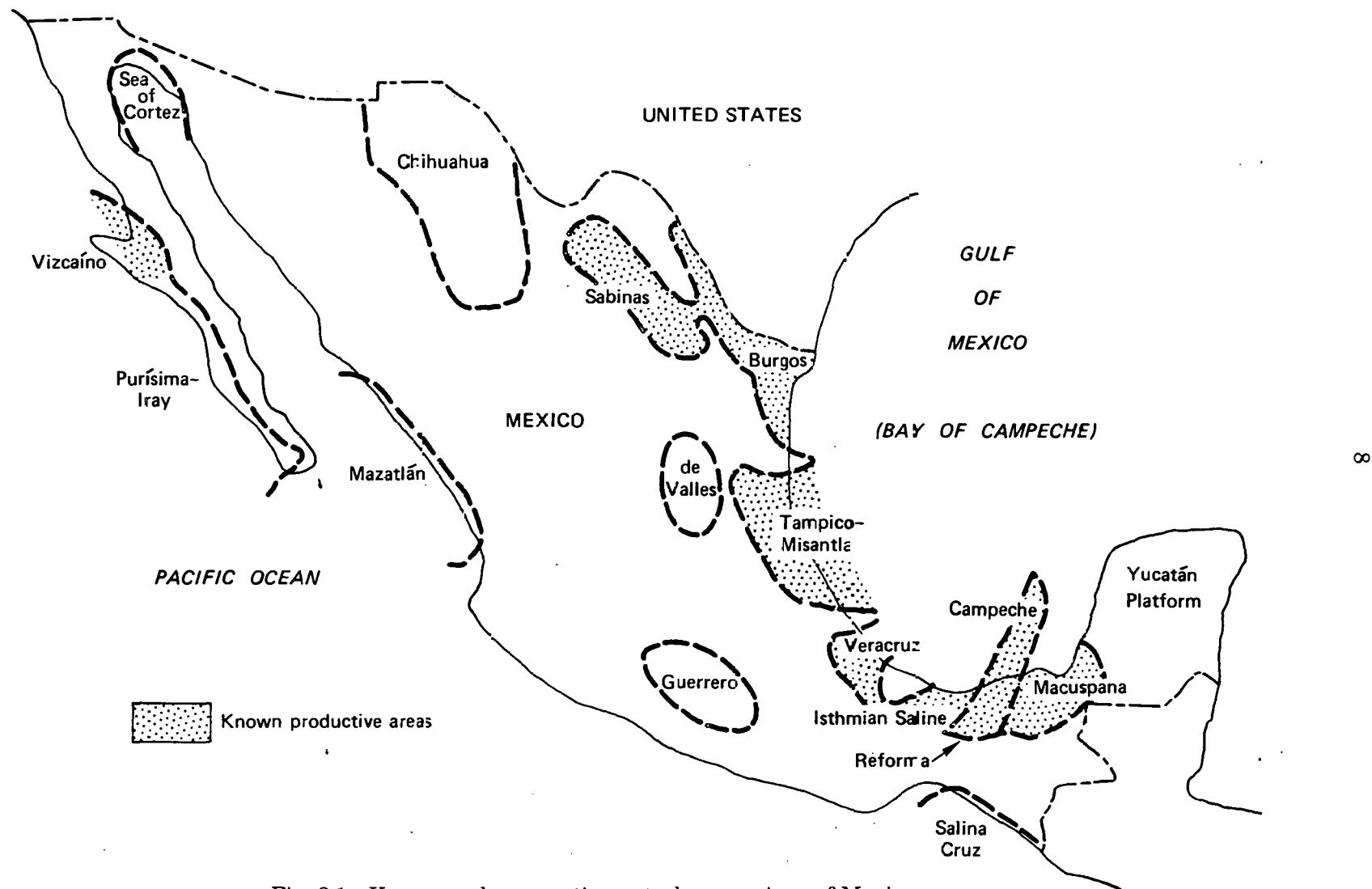


Fig. 2.1—Known and prospective petroleum regions of Mexico

Southern Zone³

With the discoveries beginning in 1972, the Southern Zone has become the most important source of crude oil for Mexico. For purposes of this assessment, we will divide this zone into three parts: (1) the Reforma area (the onshore Mesozoic fields); (2) the Campeche area and other Mesozoic offshore possibilities; and (3) the largely onshore Tertiary basins, including the Isthmian Saline Basin, Tabasco Basin, and the Macuspana-Campeche Basin, and the Sierra Madre de Chiapas.

Reforma.⁴ The Reforma area covers nearly 1950 square miles (5000 km²) in the states of Tabasco and Chiapas between 17°30' and 18°13' north latitude and

³ Because of the many sources we used in making this assessment and because of our need to evaluate and reconcile the various claims made in these sources, we will not document individual statements within the assessment. Instead, we will list the sources used in each section at the beginning of that section. General sources used throughout this assessment include E. J. Guzmán, R. Suárez, and E. L. Ramos, "Outline of the Petroleum Geology of Mexico," in F. M. Bullard (ed.), *Proceedings of the Conference on Latin American Geology, March 29-30, 1954*, University of Texas, Austin, 1955; A. G. Rojas, "Exploration Work in Mexico," in P. L. Lyons (ed.), *Geophysical Case Histories*, Vol. 2, Society of Exploration Geophysicists, Menasha, Wisc., 1956; F. J. Bullard, *Mexico's Natural Gas: The Beginning of an Industry*, University of Texas, Austin, 1968; B. W. Beebe, "Occurrence of Natural Gas in Mexico," in B. W. Beebe (ed.), *Natural Gases of North America*, Vol. 1, American Association of Petroleum Geologists, Tulsa, Okla., 1968; Gerencia de Explotación, Petróleos Mexicanos, *Potencial actual y futuro de la industria petrolera en México*, Mexico City, March 1978; T. Wett and S. L. Matheny, Jr., "Pemex Driving Hard toward Ambitious 6-Year-Plan Goals," *Oil and Gas Journal*, August 20, 1979, pp. 73-81; F. Viniegra O., "La exploración petrolera en México de 1938 a la época actual," *Boletín de la Asociación Mexicana de Geólogos Petroleros*, n.d., pp. 290-317; the annual reviews of petroleum developments in Mexico published in the review of international developments in the *Bulletin of the American Association of Petroleum Geologists*; the annual reports of the Director General of Pemex; and the annual *Memoria de Labores* of Pemex. Interviews with ranking Pemex managers and the use of internal Pemex reports that are publicly available in the Pemex Library in Mexico City were of great importance on numerous specifics.

⁴ For articles of general interest on the Reforma area, see A. A. Meyerhoff, "Petroleum Geology of the Reforma-Campeche Shelf Trend, South Mexico," *Bulletin of the Corpus Christi Geological Society*, December 1979, pp. 12-21; T. J. Stewart-Gordon, "Mexico's Oil: Myth, Fact, and Future," *World Oil*, February 1979, pp. 35-41; "Reforma: A Look at Mexico's Greatest Petroleum Discovery," *World Oil*, September 1978, pp. 57-60, 76; "Intensifican exploración en tres áreas," *Petróleo Internacional*, January 1978, pp. 41-44; A. Franco, "Méjico: El gigante se agiganta," *Petróleo Internacional*, November 1977, pp. 25-32, 41-46; idem, "Giant New Trend Balloons SE Mexico's Oil Potential," *Oil and Gas Journal*, September 19, 1977, pp. 81-85; idem, "Southeast Mexico Ranked Hottest Action Area in Latin America," *Oil and Gas Journal*, February 21, 1977, pp. 102-103; idem, "New Reforma Finds Push Mexico to New Oil Heights," *Oil and Gas Journal*, May 17, 1976, pp. 71-74; idem, "Recent Discoveries Vault Mexico into New Position," *Oil and Gas Journal*, October 21, 1974, pp. 73-76; and idem, "Mexico's Oil Self-Sufficiency Seems Assured," *Oil and Gas Journal*, July 23, 1973, pp. 74-76.

For sources on the geology and exploration process, see O. Gómez Rivero and V. M. Tovar Cruz, "Estudio petrofísico de yacimientos de baja porosidad y su aplicación en el análisis de registros de pozos," *Ingeniería Petrolera*, July 1979, pp. 21-26; M. Nava G., "Registros geofísicos en Tabasco-Chiapas y Campeche-Yucatán," *Petróleo Internacional*, November 1978, pp. 35-40; E. J. and A. E. Guzmán, "Petroleum Geology of the Reforma Area, S.E. Mexico, and References to Exploratory Effort in Baja California," paper presented at the 1978 Circum-Pacific Conference in Honolulu; M. Nava G., "En la nueva y avanzada tecnología, se apoya la productividad de petróleos Mexicanos," *Revista Mexicana del Petróleo*, Vol. 15, No. 259, April-May 1978, pp. 22-41; O.-L. Calzada Tovar, "La exploración geofísica en el área Villahermoso del sureste de México y su importancia en el descubrimiento de estructuras productoras de hidrocarburos," *Ingeniería Petrolera*, June 1977, pp. 21-38 (condensed in *Petróleo Internacional*, November 1977, pp. 78-80, 85-88); A. Flores Vargas, "Paleosedimentología y diagenesis de las rocas carbonatadas productoras en el área Sitio Grande-Sabancúy," *Ingeniería Petrolera*, March-April-May 1977, pp. 5-19 (condensed in *Petróleo Internacional*, November 1978, pp. 44-48); G. Gonzales P., "Estudio geológico estructural del Campo Sitio Grande," *Ingeniería Petrolera*, August 1976, pp. 321-340; F. Viniegra O., "Los nuevos descubrimientos de Chiapas y Tabasco," *Revista Mexicana del Petróleo*, Vol. 13, No. 247, November-December 1975, pp. 10-14; idem, "New Oil Discoveries in Southeastern Mexico," *Proceedings, Ninth World Petroleum Congress*, Vol. 3, London, 1975, pp. 193-194; and idem, "Tectónica de Chiapas-Tabasco-Campeche," *Boletín de la Asociación Mexicana de Geofísicos de Exploración*, Vol. 19, No. 4, October-November-December 1978, pp. 87-97.

For various aspects of development, see J. O. Romero López and J. Rosete Téllez, "Explotación por inyección de agua en yacimientos altamente fracturados y de gran espesor—Aplicación al Campo Sitio Grande," *Ingeniería Petrolera*, December 1978, pp. 5-18; "Massive Waterflood Set for Reforma," *Oil and Gas Journal*, June 5, 1978, pp. 96, 101-102; F. Garaicochea and A. Acuña R., "Alternativas de explotación

92°45' and 93°30' west longitude. The area is bounded on the west and northwest by the Comalcalco Fault, on the south by the mountains of the Sierra Madre de Chiapas, and on the east by the Frontera Fault. The promising area extends offshore to the northeast into the Bay of Campeche (see Fig. 2.2). Although there are some productive Tertiary fields in this geographic area, the "Reforma area" is generally taken to refer only to the Mesozoic fields.

The fields discovered in the Reforma area to date have been found in highly faulted, anticlinal, or domal blocks in several northwest-southeast parallel trends. These structural trends are the result of overthrusting toward the northeast of Jurassic and Cretaceous carbonates and possibly Eocene sediments as well, accompanied by upward movements in the underlying salt. Petroleum has been found primarily in Middle Cretaceous limestones and dolomites. Productive Upper Jurassic dolomites have also been encountered in some fields. The reservoir rocks are the perimeter of the carbonate platform that forms the Yucatan Peninsula. Good reservoir conditions exist only where uplifting and the consequent intense fracturing has occurred. The seals for the reservoir rocks are Upper Cretaceous shales and marls and Eocene and Paleocene shales. The petroleum in the Reforma accumulations is believed to have originated in Upper Jurassic shales and carbonates and Lower Cretaceous carbonates.

As of the end of 1979, approximately 12.4 billion barrels of petroleum liquids and 13.8 trillion cubic feet of natural gas had been proved in the Reforma fields of which 1.4 billion barrels and 1.9 trillion cubic feet had already been produced. Although some of the discoveries are not yet fully developed, the Reforma area has at least 5 billion barrels of probable hydrocarbon resources. Nineteen Mesozoic fields had been discovered in the Reforma area as of mid-1979: *Acuyo, Agave, Artesa* (or *Artega*), *A. J. Bermudéz* (including the *Crisol, Cunduacan, Iride, Jobillo, Ojiaque, Platanal, Pueblo Nuevo, Roatan, Samaria, Tierra Colorado*, and *Tres Pueblos* structures), *Cacho López* (including the *Juspi* extension completed in 1979), *Cactus-Nispero* (including the *Ajenjo, Lino, Lupulo, and Orozus* structures), *Comoapa, Copano, Iris-Giraldas, Lombarda, Mundo Nuevo, Paredon, Rio Nuevo, Sabancúy, Sitio Grande, Sunuapa, Tepate, Topen, and Zarza* (all shown on Fig. 2.2). *A. J. Bermudéz*, the first super-giant (5 billion barrels or more) discovery worldwide since 1970, is clearly the largest of these discoveries, with a currently estimated 6.5 billion barrels of recoverable oil resources (including reserves from secondary recovery). *Cactus-Nispero*, the next largest, has about 1.25 to 1.50 billion barrels of

de los yacimientos del área Reforma," *Revista del Instituto Mexicano del Petróleo*, Vol. 10, No. 1, January 1978, pp. 19-30 (condensed in *Petróleo Internacional*, November 1977, pp. 178-184); "Inician obras de inyección de agua en Campos de Reforma," *Petróleo Internacional*, November 1977, pp. 55-56, 73-74; Gerencia de Explotación, *Petróleo Mexicanos*, "Plan integral para el desarrollo y explotación del Campo Agave," *Ingeniería Petrolera*, December 1976/January-February 1977, pp. 13-20 (condensed in *Petróleo Internacional*, November 1977, pp. 88-90); M. Nava G., H. Ramos, and M. Angel Gonzalez, "Análisis de las terminaciones de los pozos del área Cretacia Tabasco-Chiapas," *Ingeniería Petrolera*, February 1976, pp. 37-66 (condensed in *Petróleo Internacional*, December 1976, pp. 52-54); F. J. del Orbe V., "Mejoran y aceleran perforación en campos cretacicos de Reforma," *Petróleo Internacional*, November 1976, pp. 49-52; idem, "Drilling/Completion of Deep Reforma Wells," *Petroleum Engineer*, December 1975, pp. 26-30, 32, 34, 42; G. Ives, "Development of Reforma Area Oil Fields," *Petroleum Engineer*, December 1975, pp. 46-54; O. R. Delgado and E. G. Loreto, "Reforma's Cretaceous Reservoirs: An Engineering Challenge," *Petroleum Engineer*, December 1975, pp. 56-66; A. Galán C. and A. Olán Barcia, "Qué saben del subsuelo de Reforma," *Petróleo Internacional*, November 1975, pp. 46, 50, 55-60; E. de la Torre Aldape and E. Noguera Farfán, "Técnicas de perforación en el área de Reforma Chis.," *Ingeniería Petrolera*, December 1974, pp. 489-490; and H. Gallegos Bravo and R. Prian Caleti, "Interpretación geológica preliminar y modificación a los programas de perforación de los pozos en los Campos Cactus-Sitio Grande de la Zona Sur," *Ingeniería Petrolera*, December 1973, pp. 535-550.

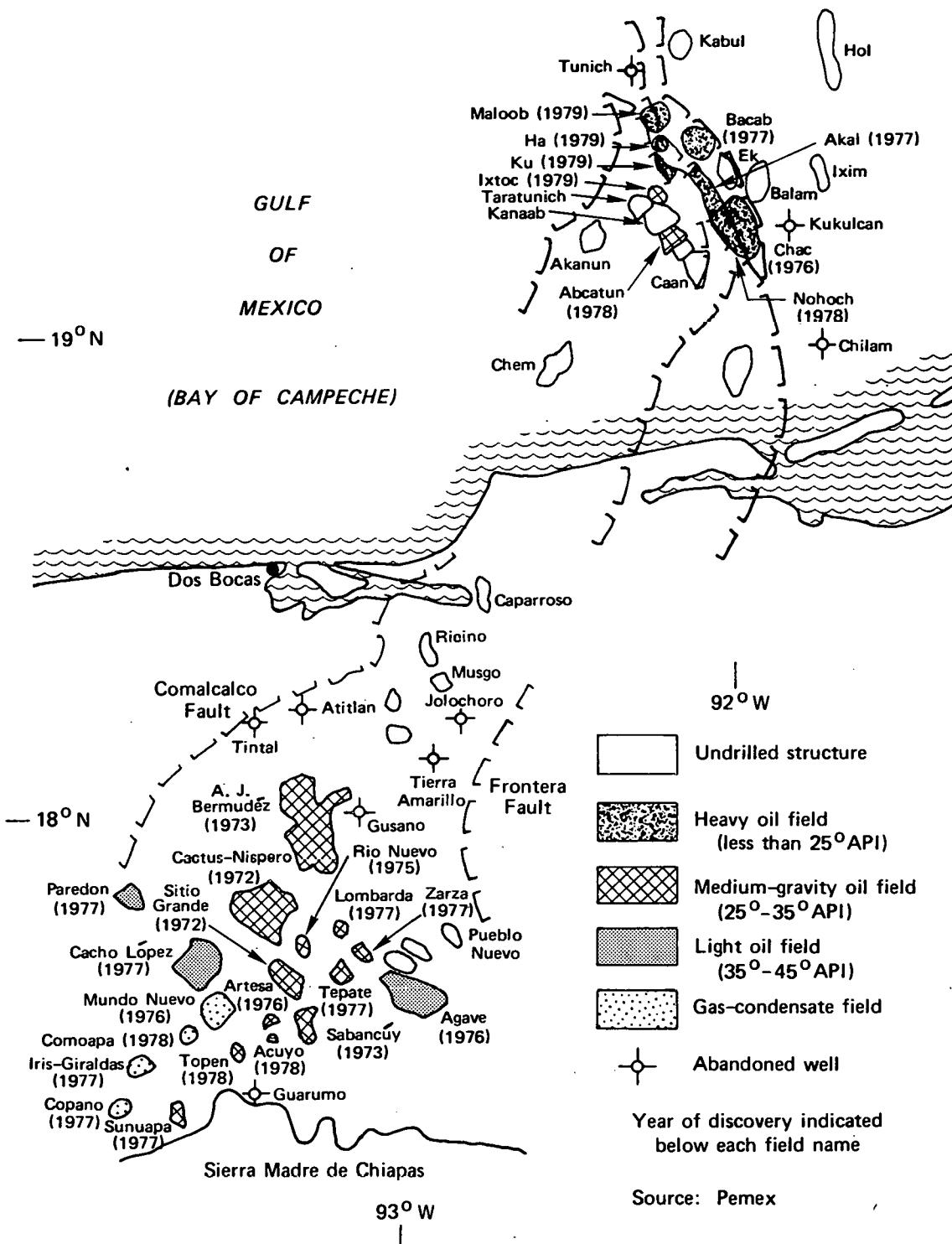


Fig. 2.2—Recent discoveries in southeastern Mexico

crude oil. *Iris-Giraldas* appears to be similar in size to *Cactus-Nispero*. The other known giant fields (at least 500 million barrels of oil or oil-equivalent resources) are *Agave*, with 600 to 800 million barrels of oil and approximately 3 trillion cubic feet of gas, and *Sitio Grande*, with 400 to 450 million barrels of oil and 600 billion cubic feet of gas. Most of the other discoveries appear to be large fields (50 to 500 million barrels or 300 to 3000 billion cubic feet), although a few, particularly *Cacho López-Juspi* and *Mundo Nuevo*, could prove to be giant fields when fully developed.

The productive reservoirs in the Reforma area are unique in two ways. There are no other giant oil fields in the world with major productive reservoirs below 12,500 feet (3800 m) as is commonly found in the Reforma fields. The reservoirs are also unusually thick, with average net productive thicknesses ranging from 700 feet (210 m) to 1600 feet (485 m). The Asmari limestone reservoirs in Southwest Iran are the only other ones in the world that approach the maximum thicknesses found in the Reforma fields. These unusual thicknesses are the primary reason for the size of the Reforma fields. Their areal extent is small for their size, with *A. J. Bermudéz*, the largest in size and area, covering 60 square miles (150 km²), the least area of any super-giant field. Porosity is low, the sum of matrix and fracture porosity ranging between 6% and 11%. With water saturation ranging from 12% to 20% and formation volume factors in the major fields being between 1.7 and 2.3, original oil-in-place is only between 200 to 350 barrels per acre foot. However, because of the intense fracturing of the reservoir rock, permeabilities are excellent. Consequently, per well production is high, averaging 6400 barrels per day in the first half of 1979. Production per well in the *A. J. Bermudéz* field approaches that of the better fields in the Middle East, averaging about 8400 barrels per day.

The hydrocarbon type in the Reforma area varies by groups of field according to their location within the overall productive trends (see Fig. 2.2). The central group of fields has medium gravity (25° to 35° API) crude oil and gas-oil ratios about 1000 to 1500:1 (cubic feet per barrel). Fields on the east and west flanks have light crude oil (35° to 45° API) and gas-oil ratios about 2000 to 4000:1. The fields in the southwest of the known producing trend are gas-condensate fields. Three of the deeper fields in the central group—*Lombarda*, *Sabancúy*, and *Zarza*—have only thin oil columns, their reservoirs being largely water-invaded. (The central group appears to have a similar oil-water contact.) The distribution of hydrocarbon type among the different groups of fields, combined with the sketchy available information on depth of spill point by field, appears to be the result of both greater maturation in the deeper fields on the flanks of the trend and differential entrapment, the oil and gas having migrated updip from both east and west, with the migrating gas gradually displacing oil from the downdip structures in the migration path.⁵

A natural water drive exists in the Reforma fields. In the *A. J. Bermudéz* and *Sitio Grande* fields, it is being supplemented by water injection of 1 million and 150,000 barrels of water per day, respectively. Water injection will eventually probably be used in all the medium-gravity fields. Gas injection is likely to be used in the lighter-gravity fields. Implementation of pressure maintenance and secondary recovery operations is expected to more than double recovery of the oil-in-place, increasing it from 15% to 20% to at least 40%.

⁵ Differential entrapment is described in W. C. Gussow, "Differential Entrapment of Oil and Gas: A Fundamental Principle," *Bulletin of the American Association of Petroleum Geologists*, Vol. 38, No. 5, May 1954, pp. 816-853.

The resource costs of finding and producing Reforma crude oil appear to be low, approaching costs in the Middle East (the lowest in the world). Because of the great depth of the wells (4000 to 5000 m for oil wells) and the need for stimulation operations, total costs per well are high, probably now on the order of \$1.25 to \$2.50 million (in 1980 U.S. \$). However, because of the wide spacing (1 km²) used in development, the substantial reservoir thickness and hence the large drainage volume per well, and the high daily production per well, ultimate production per well (including injection, observation, and dry extension wells) is expected to range between 10 and 50 million barrels. The comparatively small area of the fields and the high production of the wells keeps the gathering costs per barrel low. Because the major fields are close to each other and are quite large, centralized, large-scale surface separation and treatment facilities can be used. The fields are also close to the ocean, minimizing transportation costs. On the basis of these considerations, the discounted resource costs (in 1980 U.S. \$) of Reforma crude oil delivered to Dos Bocas (see Fig. 2.2) are only \$0.50 to \$2 per barrel. If infill drilling is eventually necessary to maximize ultimate recovery, the low ultimate production of infill wells (1 to 5 million barrels per well) will entail marginal resource costs between \$2 and \$4 per barrel.

At its current stage of exploration and development, the Reforma area is already among the 15 largest petroleum provinces of the world. Further exploration and development should consolidate that position. The success rates of exploratory wells within the reef trend have been very high. Only one structure (*Gusano*) within the main trend proved to be dry, as it lacked porosity in the potential reservoirs. Some extension wells into structures tangential to known fields have also proved to be unproductive, their potential reservoirs being below the oil-water contact. These are only minor blemishes on the remarkable record of overall success. There are still several dozen structures in which tests have yet to be completed, particularly northeast of *A. J. Bermudéz* and west of *Paredon-Mundo Nuevo-Copano* (only a few of which are indicated on Fig. 2.2). Significant extensions resulting from drilling in structures tangential to known fields, particularly *A. J. Bermudéz*, are still possible. With an extensive, early use of pressure maintenance and a cautious production policy extending productive lives to at least 30 to 40 years, high rates of recovery (50% to 60%) may be attained. However, actual attainable rates will probably not become clear until the 1990s.

The potential of the Reforma area is, however, limited because the promising area appears to be confined to the uplifted, fractured perimeter of the carbonate platform. Exploratory wells into the Cretaceous at *Tintal*, *Atitlan*, *Jolochoro*, and *Tierra Amarillo* (structures on the flanks of the productive trend) were dry because of a lack of porosity in the potential reservoir rocks. Development in the trend to the southwest will probably be limited by a total lack of potential reservoir rock, the Cretaceous having been extensively eroded. Structural location within the overall trend, the depth of reservoirs and spill points, and postulated migration patterns limit both the number of potentially productive structures within the trend and the number that will be productive of crude oil. Discovery patterns by field size within the Reforma area also correlate closely with the policy of Pemex's exploration group to drill the potentially largest structures first. It appears that the largest fields have already been discovered and that future discoveries will be smaller (unless several of the structures can be consolidated into a single field). Because of the thick reservoir rock, most future discoveries are still likely to be

large fields (50 to 500 million barrels of oil or gas in oil equivalents). In view of the number of locations, the exploratory wells now being drilled, and current drilling rates, nearly all of the potentially productive structures should be tested by the end of 1982.

Considering these factors, both positive and negative, we conclude that there is a 90% probability that the Reforma area has at least 16.5 billion barrels of recoverable petroleum liquids (crude oil and natural gas liquids) and 31 trillion cubic feet of natural gas. There is a 50% probability that the Reforma area has at least 21.2 billion barrels of recoverable petroleum liquids and 52 trillion cubic feet of natural gas. Because of the geological limits of the productive trend, the current extent of exploration and development, and potential recovery rates, we conclude that there is only a 10% probability that total recovery in the area could ever exceed 28.4 billion barrels of petroleum liquids and 82 trillion cubic feet of natural gas.

Campeche and Adjacent Areas.⁶ The potentially productive area in the Bay of Campeche covers more than 3100 square miles (8000 km²) in the southern part of the Gulf of Mexico between 18°15' and 20° north latitude and 91°30' and 92°45' west longitude (see Fig. 2.2). It is a continuation of the same productive trend found onshore immediately to the southwest in the Reforma area. The buried platform edge in which the trend is found continues to the north and northeast around the Yucatan Peninsula. However, prospects in the trend north and northwest of Yucatan are separated from the Campeche area by an erosion channel through the potential reservoirs. The area is limited on the west by the Campeche Scarp, across which water depths increase dramatically from less than 100 m over the Campeche Bank to more than 3000 m in the central Gulf of Mexico.

The fields discovered in the Bay of Campeche have all been found in highly faulted anticlinal or domal blocks. These structures are arrayed in several parallel trends, beginning with a northwest-southeast alignment in the southern part (continuing the structural trends found onshore in the Reforma area reflecting onshore folding and overthrusting) and moving northward gradually to become a north-south alignment, predominantly formed by movement of the underlying salt. The reservoir rocks, like those in the Reforma area, are formed from the uplifted,

⁶ V. Miguel Lozano, "El accidente del Ixtoc: Causas y posibles soluciones," *Información Científica y Tecnológica*, Vol. 1, No. 1, July 15, 1979, pp. 4-7; J. Reyes Núñez, "Interpretación de datos sísmicos en la estructura Akal-Nohoch del Golfo de Campeche," *Ingeniería Petrolera*, June 1979, pp. 5-20; L. Le Blanc, "The Rising of an Oil Powerhouse," *Offshore*, Vol. 39, No. 5, May 1979, pp. 135-146; *idem*, "Technology, Funds Pace Offshore Growth," *Offshore*, Vol. 39, No. 5, May 1979, pp. 149-152; *idem*, "Cantarel Expands to 23 Drilling Units," *Offshore*, Vol. 39, No. 5, May 1979, pp. 154-157; "Bay of Campeche Nohoch and Akal Being Rapidly Developed," *Oil and Gas Journal*, March 26, 1979, p. 163; A. A. Meyerhoff and W. D. Metz, "Mexican Oil Reserves," *Science*, Vol. 203, February 16, 1979, pp. 603-605; B. Sanchez Ortiz and C. Puerto Zapata, "Actividad geofísica exploratoria en el área marina de Campeche," *Ingeniería Petrolera*, January 1979, pp. 15-23; J. L. Worzel and C. A. Burk, "Margins of Gulf of Mexico," *American Association of Petroleum Geologists Bulletin*, Vol. 62, No. 11, November 1978, pp. 2290-2307; "Campeche Rumors Fly amid Pemex's Silence," *Offshore*, September 1978, pp. 67-70; Gerencia de Exploración, *Petróleos Mexicanos, Actividades petroleras marinas en México*, Mexico City, July 1978; A. Franco, "Bay of Campeche May Rival Reforma Area," *Offshore*, Vol. 38, No. 1, January 1978, pp. 43-48, 53; "Campeche Drilling Complicated by Gas Pockets, Logistics, Operating Costs," *Offshore*, Vol. 38, No. 1, January 1978, pp. 46-48, 53; "Descubren otro tren estructural," *Petróleo Internacional*, November 1977, pp. 139-143; W. R. Bryant et al., "Escarpments, Reef Trends, and Diapiric Structures, Eastern Gulf of Mexico," *American Association of Petroleum Geologists Bulletin*, Vol. 53, No. 12, December 1969, pp. 2506-2542; J. W. Antoine and W. R. Bryant, "Distribution of Salt and Salt Structures in Gulf of Mexico," *American Association of Petroleum Geologists Bulletin*, Vol. 53, No. 17, December 1969, pp. 2543-2550; and W. R. Bryant et al., "Structure of Mexican Continental Shelf and Slope, Gulf of Mexico," *American Association of Petroleum Geologists Bulletin*, Vol. 52, No. 7, July 1968, pp. 1204-1228.

fractured perimeter of the Yucatan Platform. The age of the reservoir rocks varies among fields. Some have reservoirs that are a combination of Paleocene and Cretaceous carbonates. In others, the reservoir rocks are solely Cretaceous limestones, similar to many in the Reforma area. Pemex believes that Upper Jurassic reservoirs may be encountered as well. Sources for the Campeche accumulations vary, ranging from the Tertiary in the uplifted *Cantarel* (*Akal-Nohoch-Chac*) block to the Cretaceous and Jurassic in *Abcatun* and *Ixtoc*.

As of the end of 1979, at least 7.0 billion barrels of petroleum liquids and 3.2 trillion cubic feet of natural gas were considered proved reserves in the Campeche area. Probable hydrocarbon reserves in the area exceeded 13 billion barrels, over 90% of which was crude oil. Production from the *Cantarel* fields began in mid-1979. As of that date, discoveries had been made in the *Abcatun*, *Akal*, *Bacab*, *Chac*, *Ha*, *Ixtoc*, *Ku*, *Maloob*, and *Nohoch* structures (see Fig. 2.2). (*Ek* and *Kukulcan* were reported by sources other than Pemex to be discoveries. Our sources indicate that *Kukulcan* was either suspended or abandoned, and the *Ek* is undrilled or was suspended before completion.) Because exploratory drilling is still in an early stage and production facilities are only now being emplaced, any reasonably precise determinations of field size are impossible. However, the *Cantarel* complex is almost certain to be a super-giant field, exceeding 5 billion barrels. In view of the potential area and thickness of *Cantarel*, there is a reasonable probability that it will exceed 10 and possibly even 20 billion barrels. If *Ixtoc*, *Taratunich*, *Kanaab*, *Abcatun*, and *Caan* also prove to be a single continuously productive complex, they could form another super-giant field.

Unlike those in the major fields of the Reforma area, the productive reservoirs offshore Campeche have been found at more conventional depths. The depths to the tops of the reservoir rock on the structures tested to date range from 3500 to 12,000 feet. In most cases, net reservoir thicknesses have yet to be determined. Drilling in the thicker structures has still to encounter an oil-water contact. Current speculation is that *Akal-Nohoch* and *Chac* may have a common oil-water contact at 12,000 feet subsea (3650 m), giving the *Akal* 2 structure a gross productive oil column of 8400 feet (2550 m). Even if this is not the case, net thicknesses in the *Akal* blocks could be double those encountered in the Reforma area. In view of the staggering implications of the possibilities, net thickness is the primary uncertainty in determining the potential resources of the Campeche structures.

Total porosity in the Campeche fields is slightly better than that in the Reforma fields, averaging between 10% and 12%. Primary porosity is slightly worse, but secondary porosity is substantially better, the reservoirs being not only intensely fractured but also highly vuggy, even cavernous. With more conventional formation volume factors because of the shallower depths and heavier crudes, original oil-in-place is likely to be between 400 and 700 barrels per acre foot, roughly twice that in the Reforma area. The nearly infinite permeabilities, the better porosity, and the high buoyancy resulting from oil columns of potentially immense thicknesses create conditions favorable to productivity per well of 25,000 to 50,000 barrels per day, levels greater than even the most productive oil fields in the Middle East. Initial production from the first development wells has averaged 40,000 barrels per day. A conservative approach to production, because of the unprecedented potential thicknesses of the reservoirs and the consequent lack of oil industry experience with extremely thick reservoirs, may, however, result in production

being reduced to 10,000 to 20,000 barrels per day per well as more wells are placed in production.

As is true in the Reforma area, the characteristics of the hydrocarbons discovered to date in the Campeche area vary by field according to the location of the field within the overall structural trend (see Fig. 2.2). *Akal*, *Bacab*, *Chac*, *Ha*, *Ku*, *Malob*, and *Nohoch* contain low-gravity (20° to 25° API), high-viscosity crude oil with low gas-oil ratios (between 250 and 500 cubic feet per barrel). *Abcatun* and *Ixtoc* have medium-gravity (30° to 35° API) crude oil and gas-oil ratios between 750 and 1250 cubic feet per barrel. The heavier oil is believed to have originated in Tertiary sources, the medium-gravity oil from Jurassic and Cretaceous sources.

The resource costs of finding and producing Campeche crude oil will probably be as low as those in any offshore area of the world. Assuming that the development wells will be 8000 to 12,000 feet deep and that Pemex's costs will be similar to drilling costs in the U.S. portion of the Gulf of Mexico, costs per well will probably be between \$1.5 and \$2.5 million (in 1980 U.S. \$). The cost of drilling, production, injection, and accommodation platforms, averaged over the cost of each well, should be similar to or slightly below this amount. (The shallow water depths—80 to 200 feet—and the relatively good weather of the area keep platform tonnage and hence costs low.) Ultimate production per well will probably be 20 to 100 million barrels, if not higher in the thickest fields, given likely production rates. If, as is indicated by activity to date, production is concentrated in a few very large fields in shallow water depths, platforms can be almost mass-produced, operations can be centralized, and the transportation system to Dos Bocas (100 miles away) can be simplified, permitting substantial cost savings. The discounted resource costs of Campeche crude delivered to Dos Bocas could thus be as low as \$0.50 per barrel (in 1980 U.S. \$) from some fields and will probably not exceed \$2 per barrel from any field. Because secondary recovery prospects are completely unknown at this time, we cannot estimate costs beyond primary recovery. However, because secondary recovery operations are likely to be able to use facilities emplaced for primary recovery, their marginal costs may not exceed those of primary recovery.

Although the offshore Campeche area is in an early stage of exploration and development, it would appear that it may be even more important than the Reforma area. If both areas form a single province, as is indicated by the geologic continuity established to date, they may prove to have more crude oil than any other province in the world other than the Middle East. However, because exploration and development have just begun, the potential of the offshore area is subject to a wide range of uncertainty.

The productive limits of the trend, particularly north and south, are unknown. A lack of reservoir rock to the west and a lack of fracturing to the east is apt to limit potential production to a trend no more than 40 miles wide. Pemex has not yet established whether production will be developed in a continuous trend from the central Reforma fields to the central Campeche area. Offshore prospects northwest and north of Yucatan are even more risky. Although some reports indicate that oil was discovered in 1978 on the *Ixchel* structure northwest of Yucatan, Pemex did not include it in its list of 1978 discoveries. Other sources report that not only was the well never drilled, but also that the seismic work performed in the area in 1978 revealed that the prospect lacked structural closure, which is the reason *Ixchel* was deleted from Pemex's list of drilling locations. The absence of closure may be a general condition on the northern and eastern perimeters of the Yucatan

Platform because these areas lack the overthrusting and salt movement found in the Reforma and Campeche areas. As a result, potential reservoirs are likely to be very poor, lacking the intense fracturing of the Reforma and Campeche areas. In addition to a potential absence of reservoir rock and traps, the northern and eastern perimeters of the Yucatan Platform appear to lack adequate source rocks for very large accumulations.

The distribution of hydrocarbons by type is also uncertain. The offshore discoveries to date are all heavy- and medium-gravity crude oil fields, possibly reflecting Pemex's exploratory objective to drill the potentially largest oil fields first. Undrilled structures in the same vicinity as the known productive ones are likely to contain heavy- and medium-gravity crude oil, assuming similar sources and depths of burial. When Pemex tests the deeper structures nearer shore, south of the known productive ones, it will probably encounter lighter crude oils, condensates, and natural gas. The nature of the hydrocarbons that may be found north of current discoveries is totally speculative.

Although it appears that offshore discoveries will be concentrated in a number of giant fields and even a few super-giant fields, field size distributions are uncertain. Most structures in the area are relatively small, covering 1000 to 10,000 acres. However, several adjacent structures could be consolidated to form single fields with areas of 50 to 100 square miles (approximately 125 to 250 km²). If these consolidations do occur, the combined Campeche-Reforma area will be the only petroleum province outside of the Middle East with more than one super-giant oil field. With or without them, the Campeche-Reforma area will probably have more giant oil and gas fields than any area in the world other than the Middle East, Western Siberia, the North Sea, and the Permian Basin. Field sizes will depend primarily on the net productive reservoir thicknesses encountered in each structure. As indicated earlier, immense potential thicknesses have been reported for some structures, exceeding thicknesses found anywhere else in the world. The thickness that is actually productive has yet to be determined, making this factor the major uncertainty in assessing Campeche resource potential.

Because production just began in 1979, the potential recovery factors from the offshore fields are also unknown. However, indications that the reservoir characteristics of the Campeche fields are better than those in the Reforma area suggest that recovery of oil-in-place may be quite high, particularly if there is a natural water drive that can be supplemented by water injection. The offshore fields have been compared to the Golden Lane fields, in which primary recovery reached as high as 60%, even though many of these fields have heavy, high-viscosity crude oil similar to that found in *Cantarel*.

In view of the exploratory results to date and the potential for further development, we conclude that there is a 90% probability that the Campeche area, together with the entire offshore perimeter of the Yucatan Platform, has at least 21 billion barrels of recoverable petroleum liquids and 12.3 trillion cubic feet of natural gas. We estimate a 50% probability that the Campeche area has at least 38 billion barrels of petroleum liquids and 26 trillion cubic feet of natural gas. We estimate a 10% probability that the area has at least 63 billion barrels of petroleum liquids and 52 trillion cubic feet of natural gas. Most of this potential will be concentrated in the structures in the general vicinity of *Cantarel* and between *Cantarel* and the coast to the south-southwest.

Tertiary Basins.⁷ Even before the recent discoveries in the Reforma area, the Southern Zone was becoming the leading source of Mexican crude oil and natural gas production. This production came from two Tertiary basins: the Isthmian Saline Basin immediately west of the Reforma area in the states of Tabasco and Veracruz and the Macuspana-Campeche Basin immediately east of the Reforma area in the states of Campeche and Tabasco (see Fig. 2.1). Most of the major fields discovered in the Isthmian Saline Basin, which is similar to the Louisiana Gulf Coast, have been found in highly faulted domal or anticlinal structures formed by intruding Jurassic salt. Structures in the Macuspana-Campeche Basin are more anticlinal with less evidence of underlying salt movement. Reservoir rocks in both basins are predominantly Miocene sandstones at depths of 2000 to 10,000 feet.

As of the end of 1979, approximately 2.4 billion barrels of petroleum liquids and 8.0 trillion cubic feet of natural gas had been proved in the two basins, of which approximately 1.5 billion barrels and 4.8 trillion cubic feet had been produced. The Isthmian Saline Basin contains nearly all of the oil discovered to date; the Macuspana Campeche Basin is predominantly a source of natural gas. Most of the oil and gas found in the two basins have been found in fields between 50 and 250 million barrels' ultimate recovery (oil and oil equivalent). The two largest fields, *Cinco Presidentes* (with 325 million barrels) and *José Colomo-Chilapilla* (2.5 to 2.75 trillion cubic feet), approach giant size.

Because of the extent of exploration of known structures in the two basins and the field sizes found to date, most of the petroleum liquids and natural gas that will ultimately be produced from the two basins have probably already been discovered. But some sizable discoveries may still occur, particularly in the offshore part of the Isthmian Saline Basin and the deeper parts of the Macuspana-Campeche Basin. There are also some secondary recovery possibilities that could be exploited.

Other Areas.⁸ There are two other areas in the Southeast that Pemex is now exploring: the Yucatan Peninsula and the Sierra Madre de Chiapas (see Fig. 2.2). Neither is apt to be a significant producing area. The Yucatan Peninsula appears to lack adequate reservoir rocks and may be lacking in source rocks as well. Although the Sierra Madre de Chiapas has numerous oil seepages, these are more likely to indicate an absence of reservoir seals than the presence of commercial accumulations of petroleum. Some accumulations may be found, but they will probably be highly degraded heavy oils of dubious commercial value. For the Tertiary basins and the Sierra Madre de Chiapas taken together, we estimate a

⁷ J. Reyes Núñez and B. Sánchez Ortiz, "Etapas de la exploración geofísica en el descubrimiento de yacimientos petrolíferos en el área la central del Sureste de México," *Ingeniería Petrolera*, February 1978, pp. 5-17; "Aspecto sismológico de las estructuras salinas del istmo," *Boletín de la Asociación Mexicana de Geofísicos de Exploración*, Vol. 16, No. 2, April-May-June 1975, pp. 33-62; "Domos arcillosos," *Boletín de la Asociación Mexicana de Geofísicos de Exploración*, Vol. 16, No. 1, January-February-March 1975, pp. 1-31; F. Viniegra O., "Age and Evolution of Salt Basins of Southeastern Mexico," *American Association of Petroleum Geologists Bulletin*, Vol. 55, No. 3, March 1971, pp. 478-494; and A. Baro Santon, "Consideraciones generales sobre la geología del Distrito de Agua Dulce, Veracruz," *Ingeniería Petrolera*, January 1971, pp. 5-17.

⁸ A. E. Weidie, "Regional Geology of the Yucatan Platform," in A. E. Weidie and W. C. Ward (eds.), *Carbonate Rocks and Hydrogeology of the Yucatan Peninsula, Mexico*, New Orleans Geological Society, New Orleans, 1976, pp. 2-17; R. H. Marshall, W. C. Ward, and A. E. Weidie, "Stratigraphy and Depositional History of Subsurface Mesozoic Strata of the Yucatan Peninsula," in Weidie and Ward, pp. 18-31; R. López-Ortiz, "Complicación de las manifestaciones de hidrocarburos y su importancia en la Zona Sur de Petróleos Mexicanos," *Boletín de la Asociación Mexicana de Geólogos Petroleros*, Vol. XXII, Nos. 5-12, May-December 1970, pp. 71-98; and F. Mina U., "Petroleum Developments in Mexico in 1966," *American Association of Petroleum Geologists Bulletin*, Vol. 51, No. 8, August 1967, pp. 1435-1444.

90% probability of at least 2.8 billion barrels and 9.0 trillion cubic feet, a 50% probability of at least 3.5 billion barrels and 11.0 trillion cubic feet, and a 10% probability of at least 4.6 billion barrels and 14 trillion cubic feet.

Central Gulf Coast Basins

Until the recent discoveries in the Southern Zone, the fields in the Tampico-Misantla Basin along the central Gulf Coast of Mexico had been the center of Mexican oil production since it began in 1901. The decision to develop the petroleum resources of the Chicontepec area means that this region will maintain a prominent role in Mexican petroleum production for decades to come. Our assessment will cover three areas within the central Gulf Coast region: (1) Chicontepec and similar areas in the Tampico-Misantla Basin; (2) the Tampico-Misantla Basin, including the Western Gulf of Mexico but excluding Chicontepec-type resources; and (3) the Veracruz Basin (see Fig. 2.1).

Chicontepec.⁹ The Chicontepec area covers 1280 square miles (3300 km²) in the states of Puebla and Veracruz between 20° and 21°15' north latitude and 97° and 98° west longitude. The area is in the western part of the greater Tampico-Misantla Basin, being bounded on the west by the Sierra Madre Oriental and on the east by the Golden Lane Platform (Fig. 2.3). There are also two similar areas in the Tampico-Misantla Basin, the Bejucos-LaLaja area, northeast of Chicontepec and north of the Golden Lane Platform, extending offshore with a total area of 930 square miles (2400 km²), and the Nautla-Ayotocoxo area southeast of Chicontepec and south of the Golden Lane Platform, covering 580 square miles (1500 km²). Evaluation of these two areas is just beginning, and there is little information available about them other than that they are similar to Chicontepec.

The petroleum accumulations of the Chicontepec area occur in sandstone lenses or beds interspersed among shale and silty shale beds. These sediments are the result of deposition during the Eocene in a large eroded trough formed in Jurassic, Cretaceous, and Paleocene sediments. Although individual accumulations do not appear to be continuous throughout the area, the overlapping reservoir sands probably form a continuous potentially productive area. This unique aspect of the Chicontepec accumulation means that its development does not have to face the usual risks of exploration.

Pemex currently claims that Chicontepec is the second most important source of Mexico's proved hydrocarbon reserves. As of the end of 1979, the estimated proved reserves of Chicontepec were 10.9 billion barrels of crude oil, 1.3 billion barrels of natural gas liquids, and 26.7 trillion cubic feet of natural gas. Crude oil reserves are thus stated to be slightly more than 10% of the estimated 106 billion barrels of oil-in-place in Chicontepec.

⁹ S. L. Matheny, Jr., "Giant Chicontepec Given 42% of Mexican Oil Reserves," *Oil and Gas Journal*, August 20, 1979, pp. 82-85; Petróleos Mexicanos, *Chicontepec: A Challenge—An Opportunity*, Mexico City, March 18, 1979; D. A. Busch and A. Góvela S., "Stratigraphy and Structure of Chicontepec Turbidites, Southeastern Tampico-Misantla Basin, Mexico," *American Association of Petroleum Geologists Bulletin*, Vol. 62, No. 2, February 1978, pp. 235-246; J. R. Gómez Bazán, "Cuenca Chicontepec estudio sobre terminación de pozos," *Ingeniería Petrolera*, December 1977, pp. 5-16; S. Rentería Curiel, "El Chicontepec—Un reto a la Ingeniería," *Revista Mexicana del Petróleo*, Vol. 15, No. 257, November-December 1977, pp. 47-56; A. Ramón Geic, F. Cuevas Sánchez, and A. Aseff Martínez, "Modelo sedimentario de la gresicas del eocene inferior paleoceno en el área Presidente Alemán Hallazgo," *Ingeniería Petrolera*, November 1976, pp. 467-477; and J. L. Reyes Rodríguez, "Posibilidades de producción de la formación Chicontepec en el Distrito Sur Z.N.," *Ingeniería Petrolera*, September 1974, pp. 373-389.

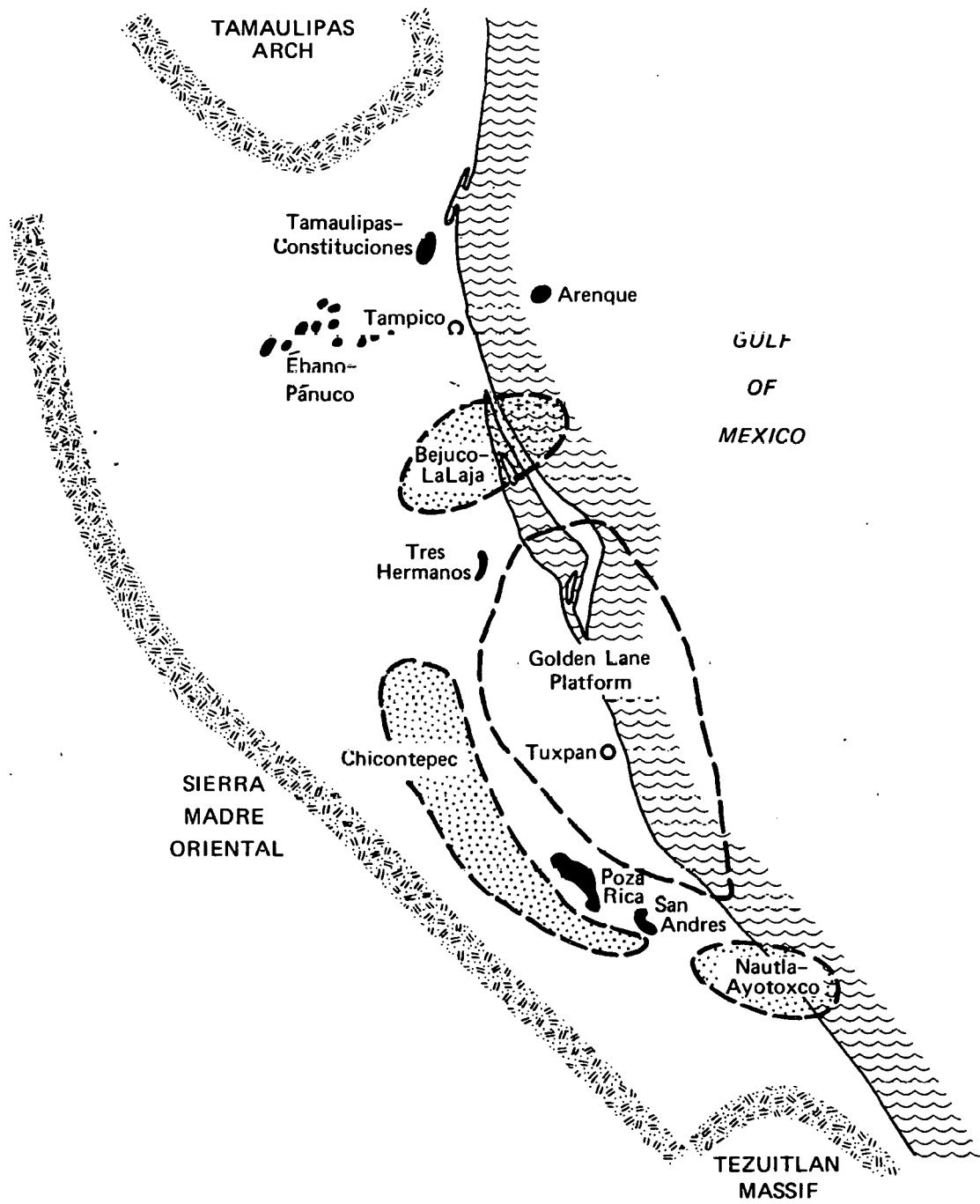


Fig. 2.3—Oil fields of the Tampico-Misantla Basin

As estimates of *proved* reserves, these numbers are clearly premature. The number of wells required to recover the amounts claimed by Pemex may not all be drilled until several decades into the next century. Moreover, the current extent of drilling across the Chicantepec area is too uneven to determine with confidence the distribution and mean of reservoir characteristics. There are also too few production histories of any length to provide reliable indicators of mean ultimate recovery per well.

The current estimates of proved reserves may even prove to be overly optimistic as estimates of ultimate recovery. The reservoir characteristics of the Chicantepec sandstone are very poor. As a result, the area was left undeveloped for decades even though the presence of hydrocarbons was known. Average porosity is stated to be about 7%; average water saturation is 44%; and average permeability is less than 1 millidarcy. These averages tell only part of the story, for there is also substantial reservoir heterogeneity. Reservoir characteristics vary widely even from one well to the next. Initial production per well is low, ranging from 5 to 150 barrels per day, with indications of rapid declines. Ultimate production per well may also be low, averaging only 100,000 to 200,000 barrels. However, if production can be obtained regularly from a half-dozen or more productive zones within a single well, a series of successive cycles of production from different zones could increase ultimate production in the thickest areas to more than 500,000 barrels per well. Formation fracturing is required for successful well completions to improve the very low permeability. Because fine clay is present in the reservoir sands, the fracturing medium is crude oil rather than water, in order to avoid loss of permeability. Recovering the 2500 barrels (400 m³) typically used in a fracturing operation take the first two to twenty weeks of production, depending on the initial rate of production.

The estimates of natural gas reserves for Chicantepec appear to be highly overstated. They imply either (1) distinct gas caps in the productive lenses, (2) nonassociated gas pools, or (3) solution gas-oil ratios of nearly 2500:1. The published articles on the Chicantepec area contain no indications of the first two possibilities. The density of Chicantepec crude (20° to 36° API, varying with depth) suggests that the third possibility is highly improbable.

Chicantepec oil will cost more to produce than the other sources of crude oil in Mexico. Because the producing wells will be only of medium depths (5000 to 8000 feet), and drilled on a standardized basis, their costs will be low, not exceeding \$300,000 per well (in 1980 U.S. \$). Other investment costs for production facilities, pipelines, and the road network, averaged over all the wells, are likely to add a similar amount on a per-well basis. (Pemex estimated in 1979 that drilling 16,000 wells and installing the associated facilities will cost \$8.7 billion.) If workover operations are required on a regular basis, operating costs would become substantial. Discounted resource costs per barrel of production will probably be no less than \$5 per barrel and could easily average \$8 to \$12 per barrel.

These negative factors do not justify disregarding Chicantepec. Rather, we suggest that the potential of Chicantepec be regarded cautiously. Even if current estimates of 106 billion barrels of oil-in-place are subject to margins of error up to 25%, Chicantepec does have an immense volume of oil-saturated reservoir rock. Moreover, recovery of some proportion of that oil-in-place and the dissolved gas is known to be possible at costs well below current world oil prices. The only major uncertainty is how much can be recovered.

Recoverable reserves from the relatively small number of wells drilled to date cannot be much greater than 200 million barrels. Probable primary reserves from the 16,000 wells that Pemex plans to drill could be as much as 4 billion barrels. Because of the poor reservoir characteristics and extreme reservoir heterogeneity, secondary and tertiary recovery methods will be difficult to apply. However, additional recovery could come from developments in the fracturing and acidizing techniques used in the area. Infill drilling, reducing the currently planned spacing of 50 to 10 acres per well, could also boost recovery. Evaluation of the Bejucos-LaLaja and Naulta-Ayotoxco areas could more than double the estimated oil-in-place in Chicantepec-type deposits in the Tampico-Misantla Basin. In view of the reservoir characteristics and the technological possibilities, we estimate a 90% probability that total recovery of petroleum liquids from these three areas will exceed 5.0 billion barrels, a 50% probability that it will exceed 15.0 billion barrels, and a 10% probability that it will exceed 27 billion barrels. Because of the lack of evidence of gas caps and nonassociated gas lenses and indications that most Chicantepec crude is of 20° to 30° API gravity, we estimate a 90% probability that recoverable gas resources exceed 3.0 trillion cubic feet, a 50% probability that they exceed 9.0 trillion cubic feet, and a 10% probability that they exceed 24.3 trillion cubic feet. Because of the low productivity of individual wells and the immense number of wells required for full development, achieving these levels of recovery, if indeed they are possible, will take 50 to 100 years.

Tampico-Misantla Basin.¹⁰ The Tampico-Misantla Basin extends from 20° to 22°30' north latitude along the Gulf Coast of Mexico (see Fig. 2.1). Covering almost the entire northern half of the state of Veracruz, it also extends into small portions of the states of Hidalgo, Puebla, San Luis Potosi, and Tamaulipas. Geologically, this basin is bounded to the west by the Sierra Madre Oriental, to the north by the Tamaulipas Platform, and to the south by the Tezuitlan Massif (Fig. 2.3). Excluding Chicantepec-type areas, the petroleum resources discovered in the Tampico-Misantla Basin are predominantly petroleum liquids. As of the end of 1979, approximately 6.6 billion barrels of petroleum liquids and 5.9 trillion cubic feet of natural gas (nearly all of which is associated with oil) have been made recoverable in the basin. Approximately 4.6 billion barrels of the liquids and 2.8 trillion cubic feet of the gas have been produced.

¹⁰ Besides the general sources on Mexican petroleum geology mentioned earlier, see J. L. Worzel and C. A. Burk, "Margins of the Gulf of Mexico," *American Association of Petroleum Geologists Bulletin*, Vol. 62, No. 11, November 1978, pp. 2290-2307; S. R. Ayala Nieto and A. Gallardo Meléndez, "Análisis económico de la recuperación secundaria en Poza Rica," *Ingeniería Petrolera*, January 1979, pp. 25-29; I. Castro G. and J. Chavez P., "Futuro del Campo 3 Hermanos Distrito Sur," *Ingeniería Petrolera*, April 1978, pp. 17-23; P. Gómez B. and J. J. Gaytán R., "Estudio de un yacimiento marino, Campo Arenque," *Ingeniería Petrolera*, July 1976, pp. 297-309; M. A. Valladares B., "Recuperación secundaria por inyección de agua de Campo Tamaulipas-Constituciones," *Ingeniería Petrolera*, January 1975, pp. 5-10; E. R. Burelo Lorenzana, "Costos e ingresos de la producción de aceite Distrito de Poza Rica," *Ingeniería Petrolera*, December 1974, pp. 513-530; J. L. Granados G. and S. Renteria C., "Estudio geológico: Petróleo del Campo Atun," *Ingeniería Petrolera*, September 1974, pp. 390-399; S. R. Ayala Nieto and A. Pérez Matus, "Proyecto para incrementar la producción de aceite: Yacimiento Tamabra-Campo Poza Rica," *Ingeniería Petrolera*, May 1974, pp. 195-202; A. H. Coogan, D. G. Bebout, and C. Maggio, "Depositional Environments and Geologic History of Golden Lane and Poza Rica Trend, Mexico: An Alternative View," *American Association of Petroleum Geologists Bulletin*, Vol. 56, No. 8, August 1972, pp. 1419-1447; F. Vinicgra O. and C. Castillo-Tejero, "Golden Lane Fields, Veracruz, Mexico," in M. T. Halbouty (ed.), *Geology of Giant Petroleum Fields*, American Association of Petroleum Geologists, Tulsa, Okla., 1970, pp. 309-325; E. J. Guzmán, "Reef Type Stratigraphic Traps in Mexico," in *Proceedings, Seventh World Petroleum Congress*, Vol. 2, Mexico City, 1967, pp. 461-470; and F. Garaicochea P., C. Pérez Rosales, and M. J. Ortiz de María, "An Example of an Extremely Undersaturated and Low Permeability Oil Reservoir," in *Proceedings, Sixth World Petroleum Congress*, Vol. II, Frankfurt/Main, 1963, pp. 117-128.

The hydrocarbon resources of the basin are heavily concentrated in three productive areas, each producing from a different Middle Cretaceous limestone. The earliest to be discovered but the least important are the *Ebano-Panuco* group of fields in the north end of the basin with approximately 1 billion barrels' total recovery of petroleum liquids. The fields on the perimeter of the Golden Lane Platform, the location of Mexico's first oil boom, contained approximately 2 billion barrels of petroleum liquids. The fields of the Poza Rica trend, the mainstay of Pemex's oil production until the 1970s, constitute the third and most important group of fields with approximately 3 billion barrels' estimated total recovery of petroleum liquids.

Despite its historic importance in the Mexican petroleum industry, the onshore part of the Tampico-Misantla Basin (excluding Chicontepec-type areas) does not hold much potential for future major discoveries. The basin is a mature region, having been thoroughly explored during the past 80 years. Except for the offshore discoveries of *Arenque* and of the fields of the marine Golden Lane, there have been no major discoveries in the basin since 1960. Some good nearshore possibilities are yet to be probed. Any future discoveries onshore, however, are likely to be quite small. Moreover, additional recovery possibilities are limited, considering that high primary recoveries have been achieved in many of the Golden Lane fields and that water injection is already in use in *Poza Rica*, *San Andres*, and *Tamaulipas-Constituciones*.

The possibilities further offshore in the Western Gulf of Mexico appear to be substantially more promising, albeit very risky. Seismic work has indicated large anticlines parallel to the coast. There is a high probability that rich, mature source rocks of Jurassic, Cretaceous, and Tertiary ages exist in this area. The anticlines are also likely to have good reservoir seals. Unfortunately, there are no obvious sources of good reservoir rocks in the area. If reservoir rocks do exist, they will probably be thin, discontinuous lenses rather than thick blanket sands with good producing characteristics. Because the anticlines are located in water that is more than 1000 m deep, the costs of development and production are likely to be prohibitive if only poor reservoirs are found. However, the large potential volume in competent traps adjacent to rich source materials indicates that this area should not be overlooked.

Overall, we estimate that the Tampico-Misantla Basin, excluding the Chicontepec-type areas, has a 90% probability of having at least 7.2 billion barrels of recoverable petroleum liquids and 6.6 trillion cubic feet of natural gas, a 50% probability of at least 8.5 billion barrels and 8.0 trillion cubic feet of natural gas, and a 10% probability of at least 11.0 billion barrels and 10.6 trillion cubic feet of natural gas. Because of the uncertainty about potential reservoir rocks in the deep offshore, the potential for high amounts from this area has a very low probability.

Veracruz Basin.¹¹ The Veracruz Basin, also known as the Papaloapan Basin, encompasses the south-central part of the state of Veracruz between 18° and 19°30' north latitude and 95° to 96°30' west longitude (see Fig. 2.1). The basin is bounded by the Tezuitlan Massif on the north and by the mountains of the Sierra Madre Oriental on the west and southwest, and is separated less definitively from the Isthmian Saline Basin by the San Andres Massif to the east. Until the last few

¹¹ R. W. Mossman and F. Viniegra O., "Complex Fault Structures in Veracruz Province of Mexico," *American Association of Petroleum Geologists Bulletin*, Vol. 60, No. 3, March 1976, p. 379-388.

years, the Veracruz Basin contributed very little to Mexico's petroleum resources. A small number of recent discoveries have given it a more respectable role, with 0.2 billion barrels of petroleum liquids and 1.1 trillion cubic feet of natural gas now having been proved in the basin. These discoveries were made at depths of 8000 to 12,000 feet in Middle Cretaceous limestones. The reservoir rocks are believed to be similar to those in the Reforma and Campeche areas, formed from a westward-extending finger of the same reef trend. Structural conditions in the basin are highly complex, the productive area being a region of extensive overthrusting.

Further exploration for Middle Cretaceous reservoirs along the reef trend is expected to yield several more discoveries. However, the potential of the basin is limited by a lack of appropriate traps, and those that do exist are likely to be relatively small, lacking both the area and thickness of the Reforma-size fields. We conclude that there is a 90% probability that ultimate recoverable resources in the basin will exceed 0.4 billion barrels and 1.8 trillion cubic feet, a 50% probability that they will exceed 0.7 billion barrels and 3.0 trillion cubic feet, and a 10% probability that they will exceed 1.2 billion barrels and 5.0 trillion cubic feet.

Northeastern Basins and Other Potentially Productive Areas

The discovery and development of the natural gas fields in the Burgos Basin in the northeastern corner of Mexico marked the beginning of the natural gas industry in Mexico (see Fig. 2.1). Recent discoveries in the western part of the basin and in the Sabinas Basin immediately to the southwest signal the resurgence of this region as a major gas-producing area. We will next evaluate the potential of these two northeastern basins and other potentially productive areas in Mexico, specifically the interior and Pacific Coast basins.

Burgos Basin.¹² The Burgos Basin constitutes the southernmost edge of the Gulf Coast Geosyncline that extends along the coasts of Texas and Louisiana (see Fig. 2.1). It covers the northern part of the state of Tamaulipas as well as the northeastern edge of Nuevo Leon and the northeastern corner of Coahuila. Geologically, this basin is bounded on the south by the Tamaulipas Arch and on the west and southwest by the Tamaulipas Paleopeninsula.

The fields of the Burgos Basin are predominantly in anticlinal or fault traps, although stratigraphic factors are also important in determining the extent of the accumulations. The reservoir rocks are predominantly Oligocene and Eocene sandstones. However, recent discoveries have been made in the Laredo trend in Eocene-Paleocene sandstones, and Pemex's 1976 and 1978 discoveries include some Cretaceous finds in the western part of the basin.

As of the end of 1979, approximately 9.0 trillion cubic feet of natural gas had been proved in the Burgos Basin, of which 4.0 trillion cubic feet had been produced.

¹² Besides the general sources on Mexican petroleum geology given above, see E. Barreda Rodríguez, "Explotación de los yacimientos del noreste del país de 1964 a 1974: Resultados económicos," *Ingeniería Petrolera*, November 1976, pp. 478-485; D. McNabb, "Gas Play along Mexican Border Gains Momentum," *Oil and Gas Journal*, July 28, 1975, pp. 37-40; D. A. Busch, "Influence of Growth Faulting on Sedimentation and Prospect Evaluation," *American Association of Petroleum Geologists Bulletin*, Vol. 59, No. 2, February 1975, pp. 217-230; M. em C. Sergio Cavazos Prado, "Bioestratigrafía y paleoecología del Oligoceno en la Cuenca de Burgos," *Ingeniería Petrolera*, January 1974, pp. 5-16; E. Rodríguez S. and D. A. Busch, "Estratigrafía del Oligoceno de la Cuenca de Burgos—Estudio regional," *Revista del Instituto Mexicano del Petróleo*, Vol. 6, No. 1, January 1974, pp. 16-30; and L. A. Yzaguirre, "Petroleum Geology of the Anahuac and Frio Formations of Northeastern Mexico," in J. Braunstein (ed.), *Transactions—Gulf Coast Association of Geological Societies*, Vol. VII, New Orleans, La., 1957, pp. 191-205.

Roughly one-fourth of this amount has been added to reserves since 1975, presumably from the new discoveries in the Laredo area and elsewhere in the western part of the basin. The Reynosa field, with an estimated 2.5 to 3.0 trillion cubic feet ultimate recovery, provided nearly half of the pre-1975 amounts. Most of the rest was found in another half-dozen fields with ultimate recoveries of 150 to 600 billion cubic feet. The distribution of recent additions by field size is almost totally unknown. The fields of the Burgos Basin are predominantly gas fields with some natural gas liquids. Less than 50 million barrels of crude oil have been made recoverable within the basin, and under 400 million barrels of petroleum liquids have been proved recoverable.

The large reserve additions of the past four years may have exhausted most of the potential for increases in the known gas resources of the Burgos Basin. The Reynosa area, the traditional source of Burgos Basin production, is a mature area similar to south Texas across the Rio Grande River. Any future discoveries in that area will probably be less than 150 billion cubic feet, with most under 50 billion cubic feet. The offshore part of the Burgos Basin is expected to be at best only minimally productive, just like the south Texas offshore area immediately to the north. Pemex has probably developed 1 to 2 trillion cubic feet of reserves in Tertiary reservoirs in the Laredo area during the past five years. But this play is limited by outcropping to the west and a loss of porosity to the east and may be reaching the limits of development. The best possibilities in the basin appear to be in the Cretaceous west and southwest of Laredo, where the Burgos Basin joins the Sabinas Basin. There are several large anticlines in the area, each with a potential size of 0.5 to 3.0 trillion cubic feet. Overall, we conclude that there is a 90% probability that the Burgos Basin has at least 10.2 trillion cubic feet of natural gas and 0.4 billion barrels of petroleum liquids, a 50% probability of 12.0 trillion cubic feet and 0.6 billion barrels of petroleum liquids, and a 10% probability of 14.5 trillion cubic feet and 0.8 billion barrels of petroleum liquids.

Sabinas Basin.¹³ The Sabinas Basin covers 15,500 square miles (40,000 km²) in northeastern Mexico (see Fig. 2.1). It extends throughout the center of the state of Coahuila into the northwestern part of the state of Nuevo Leon. Geologically, it is bounded on the north by the Tamaulipas Paleopeninsula and on the southwest by the Coahuila Paleopeninsula. To the northeast, it joins a corner of the Burgos Basin.

Natural gas was first discovered in the Sabinas Basin in 1977, making it the newest potentially significant source of hydrocarbons for Mexico. By the end of 1979, approximately 7 trillion cubic feet of dry natural gas had been proved in the basin. Probable reserves are at least another 3 trillion cubic feet. This gas was found in several long narrow anticlines. The reservoir rocks in these discoveries were Lower Cretaceous dolomites and Upper Jurassic sandstones. Production was encountered at depths of 6500 to 8500 feet. The largest field discovered to date—Monclava-Amuleto-Buena Suerte-Ines—is 22 miles long and was stated to have reserves of 1.54 trillion cubic feet as of the end of 1977, an estimate that has

¹³ B. Márquez Domínguez, "Evaluación petrolera de sedimentos carbonatados del cretácico en el Golfo de Sabinas, NE de México," *Inginería Petrolera*, August 1979, pp. 28-36; Gerencia de Explotación, Petróleos Mexicanos, *Cuenca del Golfo Mesozoico de Sabinas*, Mexico City, March 1978; and P. R. Krutak, "Structural Geology of the Sierra de la Gavia, Coahuila, Mexico," *Geological Society of America Bulletin*, Vol. 78, January 1967, pp. 59-76.

probably increased with the successful extension and production wells drilled in the field in 1978 and 1979.

If most of the known prospects of the Sabinas Basin prove to be productive, it would be one of the largest sources of natural gas in North America. Using both surface geology and seismic reconnaissance, Pemex has delineated 65 structures in several parallel northwest-southwest trends. Thirty-three of these structures are each over 19 miles (30 km) long, a size that suggests fields with a potential of 1.0 to 5.0 trillion cubic feet apiece. The major uncertainties about the basin's potential are the extent to which reservoir rocks will be found in these structures, the presence of adequate source rocks throughout the basin, and the extent to which the reservoirs will be filled with methane rather than nonhydrocarbon gases. The current fields are in the same area as and underlie the coal-bearing formations of the Sabinas Basin. The presence of coal, together with a hydrocarbon composition of the gas discovered to date exceeding 99% methane, suggests terrestrial source materials, which are generally only sources for natural gas, not petroleum liquids. Sources in the northwestern half of the basin are, however, obscure. Moreover, reservoirs containing predominantly carbon dioxide have been discovered in the southeastern corner of the basin. In view of the discoveries to date and the high rate of drilling success, we estimate that the Sabinas Basin has a 90% probability of at least 18.0 trillion cubic feet of natural gas, a 50% probability of at least 32.0 trillion cubic feet, and a 10% probability of at least 53.0 trillion cubic feet. We consider the potential for petroleum liquids in the basin to be negligible.

Other Potentially Productive Basins.¹⁴ Except for the Sabinas Basin, all of Mexico's known petroleum potential is confined to the basins that ring Mexico's Gulf Coast. Pemex considers several interior and Pacific Coast basins also to have good petroleum possibilities. The interior basins include the Chihuahua Basin in the eastern two-thirds of the state of Chihuahua, the Valles Platform in the eastern half of the state of San Luis Potosi, and the Guerrero Basin in the northeastern part of the state of Guerrero. The Pacific Coast basins include the Colorado River Delta-Upper Sea of Cortez Vizcaíno and Purísma-Iray basins on the west-central and southwest coast, respectively, of Baja California, the Mazatlán Basin on the coast of the states of Sinaloa and Nayarit, and the Salina Cruz Basin on the coast of Oaxaca and Chiapas (see Fig. 2.1).

Pemex has conducted geological and geophysical work in all of these basins and has drilled exploratory wells in all but the Mazatlán Basin. The only discoveries with commercial potential have been the *Cantina* (1976) and *Bombas* (1977) discoveries in the Vizcaíno Basin, both of which were small traps containing dry natural gas. Although nearly all these basins are known to contain potential source and reservoir rocks and have potential traps, they are not expected to be major contributors to Mexico's petroleum resources. The potential traps in the Pacific Coast basins appear to cover a relatively small area and to have only thin reservoirs, neither of which is conducive to the large accumulations that are necessary for a

¹⁴ In addition to the annual surveys of petroleum developments in Mexico that appear in the *American Association of Petroleum Geologists Bulletin*, see E. J. and A. E. Guzmán, "Petroleum Geology of the Reforma Area, S.E. Mexico and References to Exploratory Effort in Baja California," paper presented at the 1978 Circum-Pacific Conference in Honolulu; E. López-Ramos, "Marine Paleozoic Rocks of Mexico," *American Association of Petroleum Geologists Bulletin*, Vol. 53, No. 12, December 1969, pp. 2399-2417; and G. P. Salas, "Petroleum Evaluation of North-Central Mexico," *American Association of Petroleum Geologists Bulletin*, Vol. 52, No. 4, April 1968, pp. 665-674.

basin of significance. They also appear to be predominantly gas-prone. In these and other respects, the Mexican Pacific Coast basins appear to be analogous to the U.S. Pacific Coast basins north of the central California coast, none of which is more than a minor producer.

Cenozoic volcanic activity in the south-central interior basins may have destroyed any Paleozoic or Mesozoic accumulations that did exist. There could be some deep Paleozoic natural gas possibilities in the Chihuahua Basin; however, the existence of both deep structures and adequate reservoirs has not yet been demonstrated. The interior basins appear to be analogous to the basins of the southern Rocky Mountain region and the basin, range, and plateau provinces of Arizona and Nevada, nearly all of which are nonproductive or insignificant sources of petroleum. Overall, the potential of these basins ranges from a 90% probability of at least 1.0 trillion cubic feet of natural gas and no petroleum liquids, a 50% probability of at least 3.0 trillion cubic feet and 0.1 billion barrels, and a 10% probability of at least 8.0 trillion cubic feet and 0.6 billion barrels.

Summary Assessment

Our estimates of Mexico's ultimate production of petroleum liquids (crude oil and natural gas liquids), of natural gas, and of hydrocarbons are shown in Figs. 2.4, 2.5, and 2.6 and summarized on Table 2.4. We present the estimates in the form of cumulative percent probability distributions. Each curve shows the estimated relationship between the amount of ultimately recoverable resources and the probability of their existing, being discovered, and being produced. The curves express the cumulative probability that resources "greater than" the corresponding graphed value could be produced. The minimum producible resource level (that at 100%) indicates an amount we are certain that Mexico will ultimately produce. The maximum level (that at zero percent) indicates our highest expectation of what Mexico might ultimately produce. The range and shape of the curve reflect the current level of knowledge. As further exploration and development increase this knowledge, the range will be reduced and the curve will become steeper. New discoveries and developments in recovery will move the 100% level to the right. Dry holes on major prospects and disappointments in recovery will move the zero percent level to the left.¹⁵

The estimates of Mexico's petroleum potential are the statistical summations of our regional cumulative probability distributions (which are summarized in the text and in Table 2.4 and shown in Figs. 2.7 and 2.8). Because the estimate for the potential of any one region is independent of the estimates of the potential of the other regions, we used a Monte Carlo technique to develop the overall estimates. A value from each regional cumulative probability distribution was randomly selected and used to produce one possible sum. This process was repeated 5000 times. The cumulative probability distributions for Mexico are the distributions of these 5000 sums.

As of the end of 1979, we estimate that Mexico has produced 7.7 billion barrels of petroleum liquids, has proved reserves of 21.5 billion barrels, and has probable

¹⁵ For an excellent discussion of the methodology of resource assessment, see the work of the Geological Survey of Canada as reported in Energy, Mines, and Resources Canada, *Oil and Natural Gas Resources of Canada, 1976*, EP77-1, Ottawa, 1977.

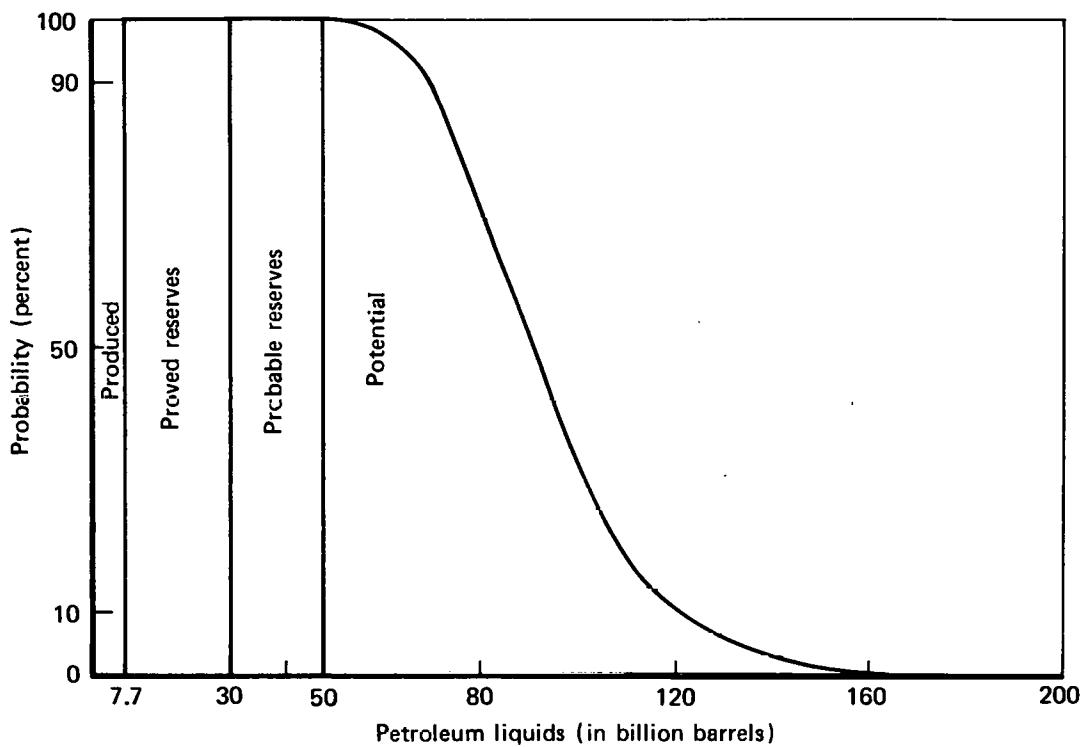


Fig. 2.4—Estimated recoverable resources of petroleum liquids in Mexico
(cumulative percent probability distribution)

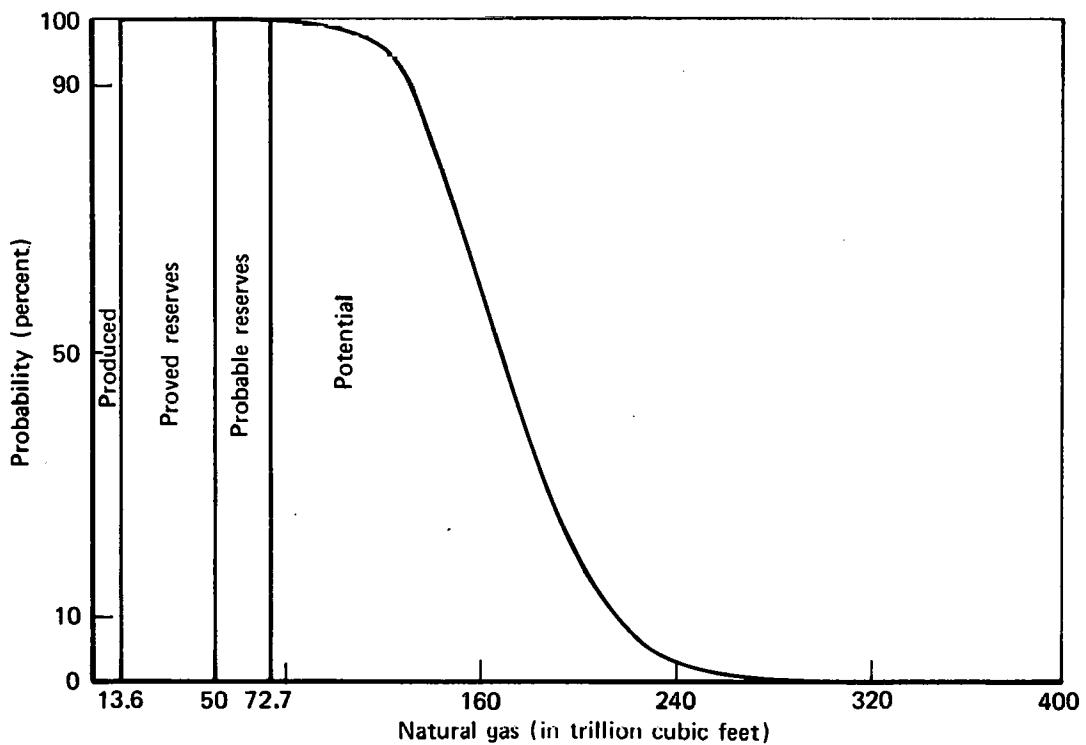


Fig. 2.5—Estimated recoverable resources of natural gas in Mexico
(cumulative percent probability distribution)

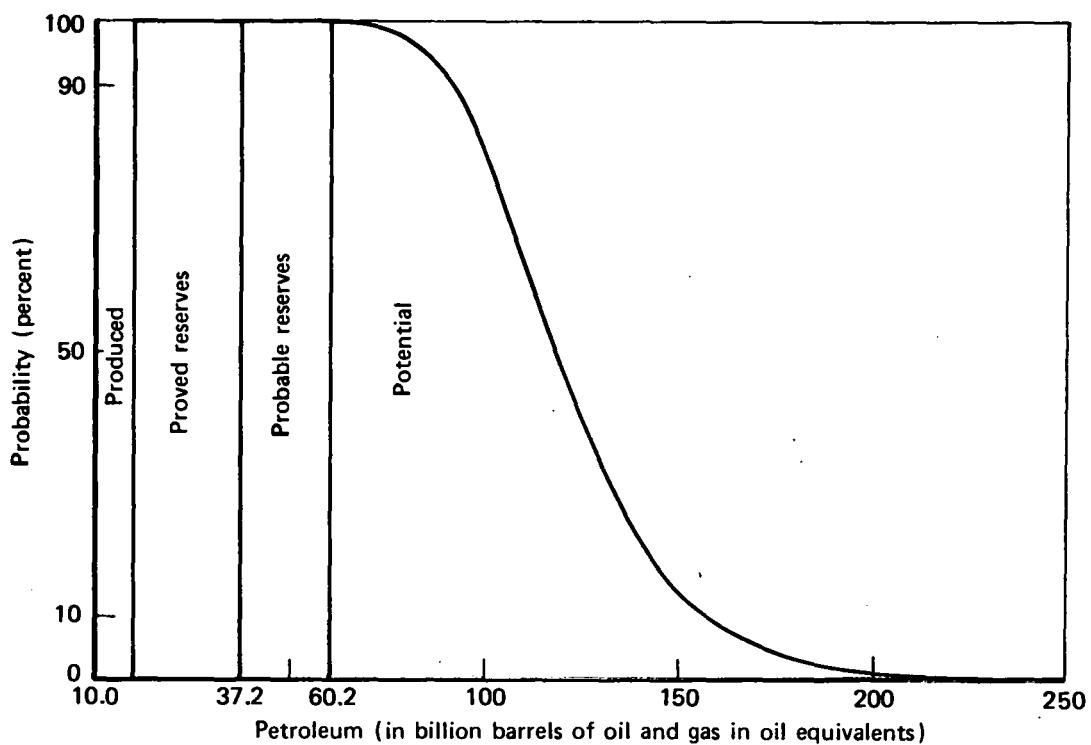


Fig. 2.6—Estimated recoverable resources of petroleum in Mexico (cumulative percent probability distribution)

reserves of at least 18.9 billion barrels for a total known recoverable resource of 48.1 billion barrels (Fig. 2.4). Our estimate of proved reserves is less than that stated by Pemex because we consider it premature to include more than minimal amounts from Chicontepec as a *proved* reserve. Our estimate of probable reserves is less than that published by Pemex because our lack of information on the regional composition of Pemex's estimate precluded verifying its content. We estimate that there is a 90% probability that Mexico will ultimately produce more than 68.7 billion barrels, a 50% probability that it will produce more than 90.8 billion barrels, and a 10% probability that it will produce more than 121.4 billion barrels, and no chance that it will produce more than 200 billion barrels.

We also estimate that Mexico has produced 13.6 trillion cubic feet of natural gas, has proved reserves of 34.6 trillion cubic feet (again excluding nearly all of Chicontepec), and has probable reserves of at least 24.5 trillion cubic feet for a total known recoverable resource of 72.7 trillion cubic feet (Fig. 2.5). We estimate that there is a 90% probability that Mexico will ultimately produce more than 131.3 trillion cubic feet, a 50% probability that it will produce more than 168 trillion cubic feet, and a 10% probability that it will produce more than 214.6 trillion cubic feet, and no chance that it will produce more than 310 trillion cubic feet.

Using a conversion rate of 6000 feet per barrel, we can combine these two estimates into a single estimate of Mexico's hydrocarbon or petroleum potential expressed in barrels of oil and gas in oil equivalents (Fig. 2.6). As of the end of 1979, we estimate that Mexico has produced 10.0 billion barrels of liquid and gaseous

Table 2.4
ESTIMATED PETROLEUM RESOURCES OF MEXICO BY REGION
AS OF DECEMBER 31, 1979

Region	Petroleum Liquids ^a (billions of barrels)			Likelihood of Existence		
	Cumulative Production	Proved Reserves	Probable Reserves	High (90%)	Median (50%)	Low (10%)
Reforma	1.4	11.0 ^b	3.0	16.5	21.2	28.4
Campeche	*	7.0 ^b	12.0	21.0	38.0	63.0
Other Southeast	1.5	0.9	—	2.8	3.5	4.6
Chicontepec	*	0.2	3.9	5.0	15.0	27.0
Other Tampico-Misantla	4.6	2.0	—	7.2	8.5	11.0
Veracruz	*	0.2	—	0.4	0.7	1.2
Burgos	0.1	0.3	—	0.5	0.6	0.8
Sabinas	—	*	—	*	*	0.1
Interior/Pacific	—	—	—	*	0.1	0.6
Total Mexico	7.7	21.5	18.9	68.7	90.8	121.4
Natural Gas (trillions of cubic feet)						
Reforma	1.9	11.9 ^b	12.0	31.0	52.0	82.0
Campeche	*	3.2 ^b	7.2	12.3	26.0	52.0
Other Southeast	4.8	3.2	—	9.0	11.0	14.0
Chicontepec	*	0.1	2.3	3.0	9.0	24.3
Other Tampico-Misantla	2.8	3.1	—	6.6	8.0	10.6
Veracruz	0.1	1.0	—	1.8	8.0	5.0
Burgos	4.0	5.0 ^c	—	10.2	12.0	14.5
Sabinas	*	7.1 ^c	3.0	18.0	32.0	53.0
Interior/Pacific	—	*	—	1.0	3.0	8.0
Total Mexico	13.6	34.6	24.5	131.3	168.0	214.6

NOTES: The estimates for all of Mexico are the statistical summation, not the arithmetic summation, of the regional estimates.

An asterisk indicates less than 0.05 billion barrels or 0.05 trillion cubic feet.

^aCrude oil and natural gas liquids.

^bEstimated division of Southern Zone reserves.

^cEstimated division of Northern Zone reserves.

hydrocarbons, has 27.2 billion barrels of proved hydrocarbon reserves, and has 23.0 billion barrels of probable hydrocarbon reserves. Overall, we estimate that there is a 90% probability that Mexico will produce more than 90.6 billion barrels, a 50% probability that it will produce more than 118.8 billion barrels, and a 10% probability that it will produce more than 157.2 billion barrels. There is some justification for Pemex's current estimate of a total hydrocarbon potential of 200 billion barrels. But the probability is only slightly more than 1% that Mexico's ultimate production will exceed this level of 200 billion barrels.

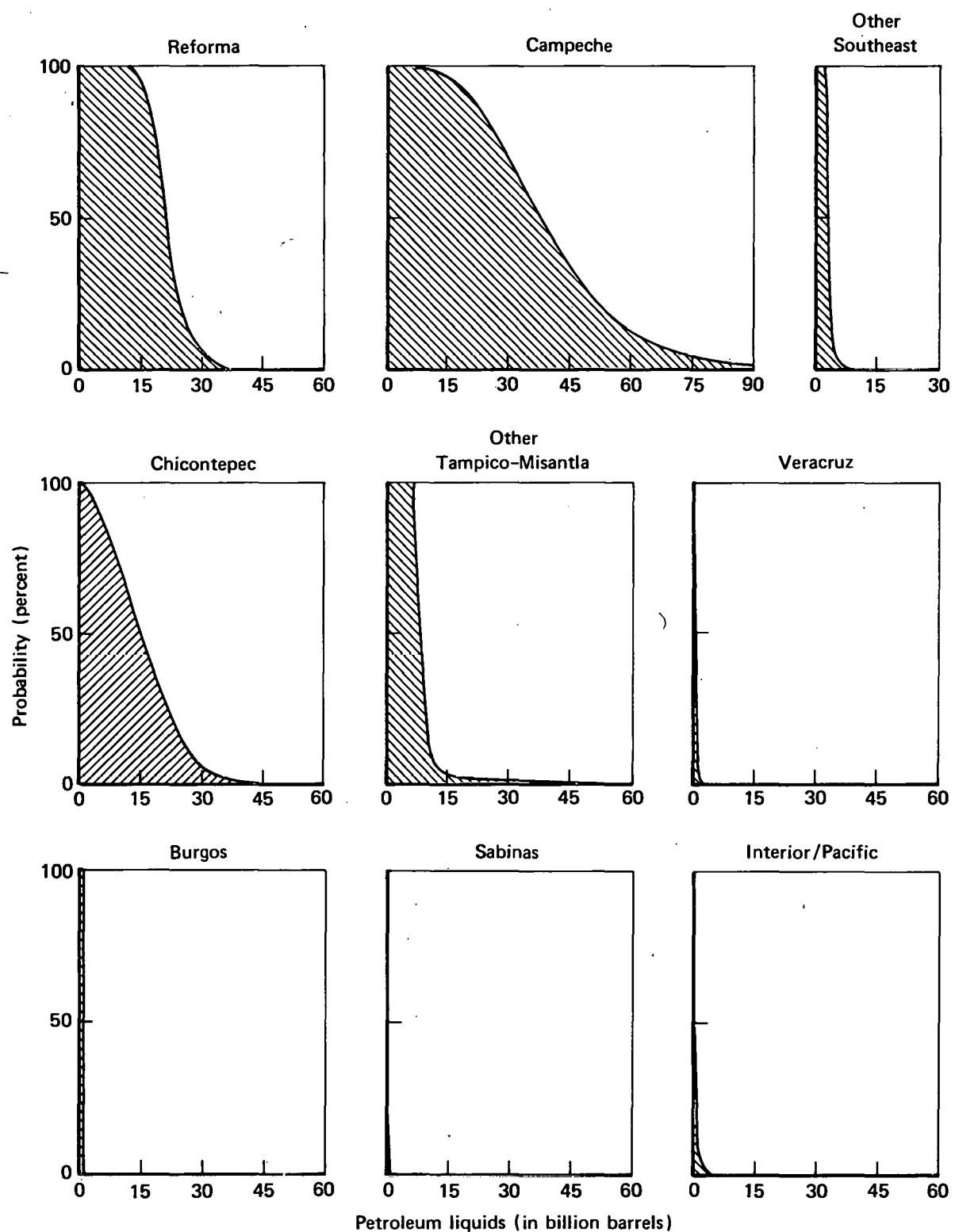


Fig. 2.7—Estimates of the potentially recoverable resources of petroleum liquids in the regions of Mexico (cumulative percent probability distribution)

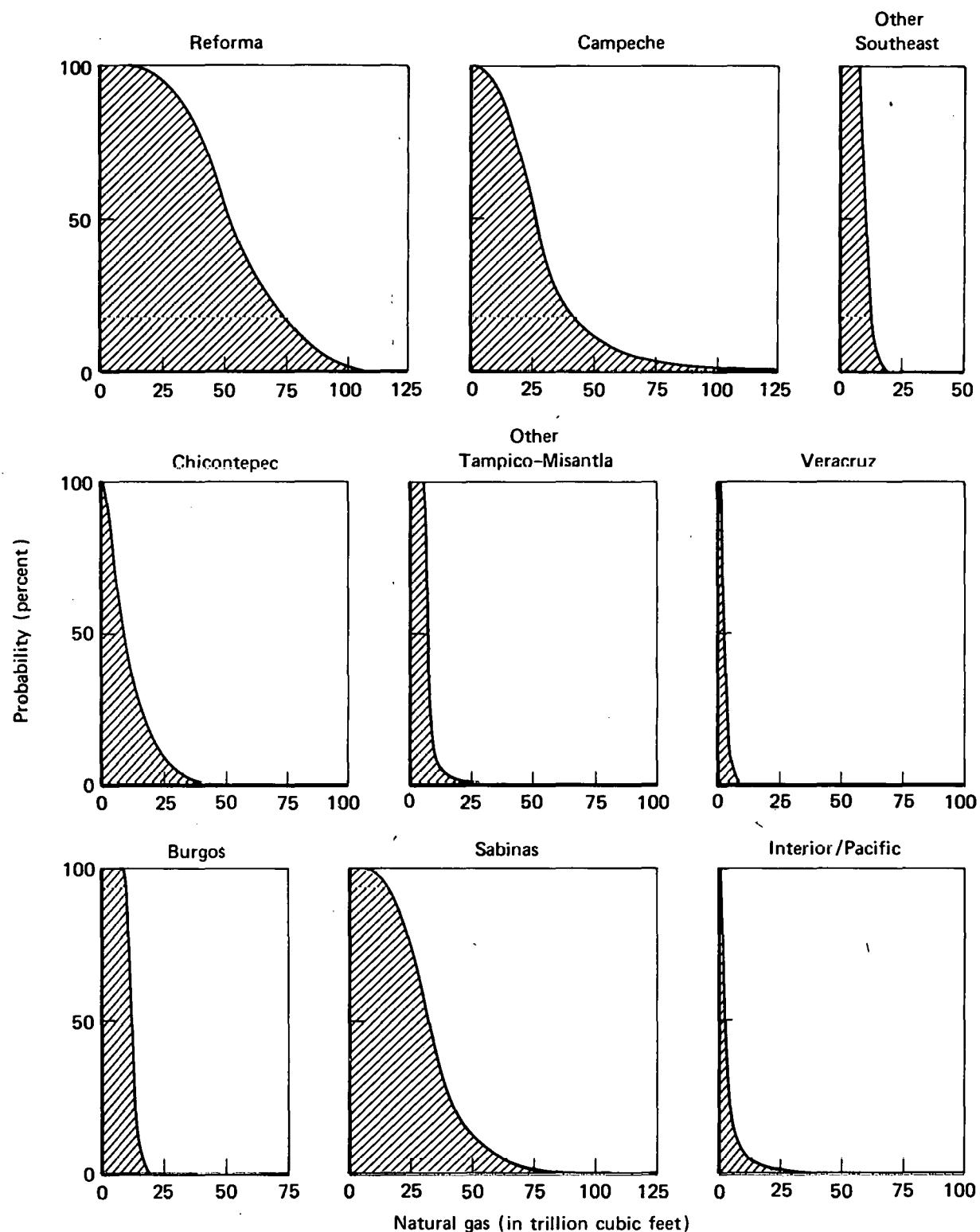


Fig. 2.8—Estimates of the potentially recoverable resources of natural gas in the regions of Mexico (cumulative percent probability distribution)

Other researchers have made higher estimates of Mexico's petroleum. If such estimates are to prove correct, there will have to be major discoveries on the northern and eastern perimeters of the Yucatan Platform, in the interior basins, or in the Pacific Coast basins. As we indicated in the regional evaluations, there are strong geologic reasons for thinking that major accumulations of petroleum could not exist in any of these areas.

We expect that Mexico's ultimate petroleum resources will be predominantly petroleum liquids. Natural gas will comprise a greater proportion of future additions than of known resources, but petroleum liquids will be approximately three times more important on an oil-equivalent basis. Offshore fields in the Bay of Campeche will be the most important source of petroleum liquids. The Reforma fields and the Chicantepec-type areas will probably be the next most important source. The Tampico-Misantla Basin (excluding Chicantepec) will also be an important contributor. Because of relative differences in potential at various probability levels, no single basin predominates as a potential source of natural gas. The Reforma fields, the Campeche area, and the Sabinas Basin all promise to be significant sources. The Burgos Basin and the Chicantepec-type areas will also make noticeable contributions. (The regional assessments for petroleum liquids and natural gas are shown in Figs. 2.7 and 2.8.)

Our assessment suggests that an emphasis on the potential of the total sedimentary area of Mexico is a misguided approach to estimating the country's petroleum resources. The appropriate emphasis is on the small number of areas that have the potential to be very productive. Ultimate petroleum resources in Mexico will be determined predominantly by developments in a few potentially very rich areas. Although a few other areas may be discovered, most of the basins in Mexico will be either nonproductive or of only minor importance.

In this respect, the profile of Mexico's resources resembles that of the rest of the world. Worldwide, oil and natural gas resources are concentrated in a few major basins. Moreover, resources within these major basins are generally located in a few super-giant and giant fields. The ultimate distribution of oil resources in Mexico by field size should not differ significantly from that of other countries. We estimate that roughly half of Mexico's oil will be recovered from super-giant fields such as *A. J. Bermudéz, Cantarel*, and the *Chicantepec* deposit. The majority of the balance will come from other giant fields such as *Poza Rica* and *Cactus-Nispero*. Natural gas resources will probably be less concentrated, but most will be in fields of more than 1 trillion cubic feet each.¹⁶

We estimate that Mexico will be one of the world's major sources of conventional petroleum liquids. At its known level of oil resources, it belongs in the same group with Iraq and Venezuela, and it is reasonable to speculate that it could reach the same level as Kuwait. Mexico could even rank with Iran and the Soviet Union, although this possibility is highly unlikely because of the respective potentials for reserve increases in these two countries and the low probability that Mexico will have more than 125 billion barrels. Only Saudi Arabia and the United States will clearly have greater ultimate production.

¹⁶ For the data supporting this and subsequent international comparisons, see R. Nehring, *Giant Oil Fields and World Oil Resources*, The Rand Corporation, R-2284-CIA, June 1978; *idem*, *The Outlook for Conventional Petroleum Resources*, The Rand Corporation, P-6413, November 1979; and the *International Petroleum Encyclopedia*, Vol. 12, The Petroleum Publishing Company, Tulsa, Okla., 1979.

Mexico will also become a valuable source of natural gas, although proportionately less so than as a source of oil. At its known level of gas resources, it belongs in the same group as The Netherlands and Saudi Arabia, but its level of production could eventually rival that of Algeria. We judge that Canada will have more ultimate natural gas resources than Mexico, and that Iran, the United States, and the Soviet Union will have several times more.

As a source of conventional liquid and gaseous hydrocarbons, we estimate that Mexico will rank fifth to seventh, trailing only the United States, the Soviet Union, Saudi Arabia, Iran, and possibly Iraq and Kuwait. If we include countries that are rich in nonconventional sources of oil, primarily oil sands and oil shale, Mexico would drop at most two places down the list after Canada and Venezuela.

The Reforma-Campeche area could become the second most important oil-producing basin in the world, trailing only the Arabian-Iranian Basin. The West Siberian and Maracaibo basins are the only other oil-producing areas that could rank above the Reforma-Campeche area. However, as a source of oil, the Reforma-Campeche area runs a poor second to the Middle East, as it should be no more than one-tenth of the ultimate size of the Arabian-Iranian Basin. The Tampico-Misantla Basin (including the Chicantepec-type areas) has the potential to rank among the dozen largest oil-producing basins in the world. With these two rich basins, Mexico will be one of the few countries (along with the Soviet Union, the United States, Venezuela, and possibly Canada and China) to have more than one major oil-producing basin.

With the discoveries in the southeast and the potential development of the Chicantepec-type areas, Mexico is emerging as a major source of the world's petroleum. However, its potential contributions do not alter the world oil outlook. During the past several years the consensus of experts has predicted that ultimate conventional world oil resources will be 2 trillion barrels, plus or minus 20%. Mexico's ultimate potential is approximately only 5% of this total. Although such a share is certainly significant, it does not require revising the consensus estimate of world potential. In fact, in view of some of the major exploratory disappointments elsewhere in the world, achieving the potential for Mexico estimated here may even be necessary to attain the lower range of the consensus estimate.

PRODUCTION POSSIBILITIES

No aspect of the Mexican petroleum situation has so fired the popular imagination as the possibility that Mexico will soon become a major oil producer. This excitement over Mexico's production potential is intensified by the pronounced contrast between the promise of Mexico and the many disappointments that have occurred in the other major petroleum-producing countries during the past five years.

Developments since 1974 have deflated the expectations of oil-production optimists. Saudi Arabia, once thought to be capable of easily producing 20 million barrels per day, is now not expected to exceed 12 million barrels per day. The Soviet Union, the largest oil-producing country since 1976, faces an imminent peak and subsequent decline in its oil production. The long-term decline in U.S. oil production, temporarily reversed in 1977 and 1978 by the initiation of production from the North Slope of Alaska, resumed in 1979. Production in Iran has been curtailed

following the recent revolution. Abu Dhabi, Kuwait, Libya, and Nigeria have instituted production limitations. Algeria, Canada, Indonesia, and Venezuela are constrained from increasing production by a lack of reserves. Production in the North Sea will soon peak. The massive new oil discoveries elsewhere in the world that were widely predicted to spring up after the sharp increase in world oil prices in 1973 have yet to make an appearance, if they ever will.

The recent developments in Mexico cast a ray of hope across this gloomy horizon. The Reforma-Campeche area is the only demonstrated major petroleum province to be opened up in the world since 1970. A. J. Bermudéz, *Cantarel*, and possibly *Chicontepec*, if we consider the entire area as constituting a single field, are the only recognized super-giant oil fields that have been discovered worldwide in the past decade.¹⁷ With the current development of the offshore fields, the annual increases in oil production in Mexico have even begun to accelerate. In view of the rapid pace of discoveries, reserve increases, and production capacity expansion, some commentators have projected that by the early 1990s Mexico could produce 10 million barrels per day or more.¹⁸ This level of production would be similar to the highest levels of oil production ever attained in Saudi Arabia, the United States, and the Soviet Union, the world's three largest oil-producing countries.

Such hopeful projections are premature. The future of Mexican oil production is far from clear. Two major uncertainties dominate the future. First, Mexico's ultimate oil resources are yet to be determined. At least another decade of exploration, development, and production must occur before we can narrow the range of possibilities. Second, fundamental decisions about production policy must still be made by the Mexican government. At one extreme, Mexico could become a major oil exporter for a few decades and then face the necessity of undergoing a rapid transition from oil and natural gas to other energy sources. At the other extreme, it could only produce enough to maintain longer-term self-sufficiency.

To illustrate the effects of these two uncertainties on the future of Mexican oil production, we have developed three sets of production profiles. Each set shows three different paths of production, following a different production policy decision. The production paths span the century between 1965 and 2065. This long-time perspective demonstrates the consequences of each production policy decision for the producing lifetime of the total recoverable resource.

Each of the three sets of production profiles is associated with a different level of ultimate recoverable resources of petroleum liquids (crude oil and natural gas liquids). The three levels chosen for analysis were (1) 70 billion barrels (approximately our 90% probability level); (2) 90 billion barrels, an amount approximating our mean expectation of Mexican petroleum liquid resources; and (3) 120 billion barrels (approximately our 10% probability level). These three levels thus encompass nearly all of our estimated range of Mexico's oil potential. As we emphasized

¹⁷ A major petroleum province is a geographically contiguous and geologically similar set of oil and gas fields with a recovery of 10 billion barrels or more. The 20 known major provinces contain 85% of the world's known oil resources. A super-giant oil field contains 5 billion barrels or more. Super-giant oil fields contain over 50% of the world's known oil resources. Three fields discovered in the Middle East during the 1970s may eventually prove to be super-giants (*Abu Ghirab-Dehluran*, *Majnoon*, and *Jawb*). See Nehring, *Giant Oil Fields*.

¹⁸ See B. Netschert, *Mexico: Potential Petroleum Giant*, National Economic Research Associates, September 15, 1978; W. D. Metz, "Mexico: The Premier Oil Discovery in the Western Hemisphere," *Science*, Vol. 202, December 28, 1978, pp. 1261-1265; R. B. Mancke, *Mexican Oil and Natural Gas*, Frederick A. Praeger Inc., New York, 1979; Resource Planning Associates, *Forecasts of Mexican Oil Production, 1980-1990*, Washington, D.C., May 15, 1979.

in the resource assessment, each level chosen here is only one estimated value of *potential* oil resources. None is a proved reserve at this time. Moreover, there are no strong reasons for preferring any one over the other two as the one real level. The actual level of Mexico's oil resources will only become apparent during the next 10 to 20 years as exploration, development, and production proceed.

For each level of ultimate recoverable resources, we display three production profiles corresponding to three basic production policy alternatives facing Mexico. We define each profile primarily by the peak level of production reached and secondarily by the duration of peak production and the subsequent rate of decline. We estimated the potential annual rates of increase in production during the 1980s in each profile, considering the composition and producing characteristics of the oil resource base and potential rates of discovery and development. The three production policy alternatives illustrated by the profiles are as follows:

1. *Low Production*: Mexico sets a production level emphasizing longer-term self-sufficiency. Production increases at a slow rate during the early 1980s as development of both the Reforma-Campeche fields and Chicontepec is constrained by the self-sufficiency policy. Oil exports are kept at minimal levels. Production ceilings for the three resource levels are established at 2.5, 3.0, and 3.5 million barrels per day, respectively.
2. *Moderate Production*: Mexico expands production at a moderate pace during the 1980s. Development of the Reforma-Campeche fields is followed by an extensive development of the Chicontepec-type areas. Crude oil exports reach moderate levels but generally do not exceed domestic oil consumption. Production reaches peak levels of 3.5, 4.5, and 5.5 million barrels per day, respectively, for the three resource levels.
3. *High Production*: Mexico decides to become a leading crude oil exporter by 1990 and expands production as rapidly as the rate of discovery, the producing characteristics of the fields, and Pemex's capabilities permit. Development of the Reforma-Campeche fields and the Chicontepec-type areas is accelerated. Production peaks at 5.0, 6.0, and 7.5 million barrels per day, respectively, for the three resource levels.

The production profiles associated with each resource level are shown in Figs. 2.9, 2.10, and 2.11 as production profiles I, II, and III.

These profiles provide nine different scenarios for the future course of Mexico's oil production. The profiles should be considered as hypothetical constructs. None is an unqualified prediction of what will happen. Each shows what may happen if Mexico proves to have the specified level of resources and chooses a particular production policy. However, because the profiles encompass the range of realistic possibilities, they provide a firm basis for making several key points about the future of Mexico's oil production.

First, in view of the probable range of its resource base, Mexico is destined to become one of the world's leading oil-producing nations. Only three countries—Saudi Arabia, the Soviet Union, and the United States—will clearly have higher peak annual rates of production than that which Mexico can attain irrespective of its resource base. With the higher levels of resources and a decision to become a major exporter, peak Mexican oil production could exceed that of Iran (6.0 million barrels per day). Unless Mexico brings production expansion to a halt in the early

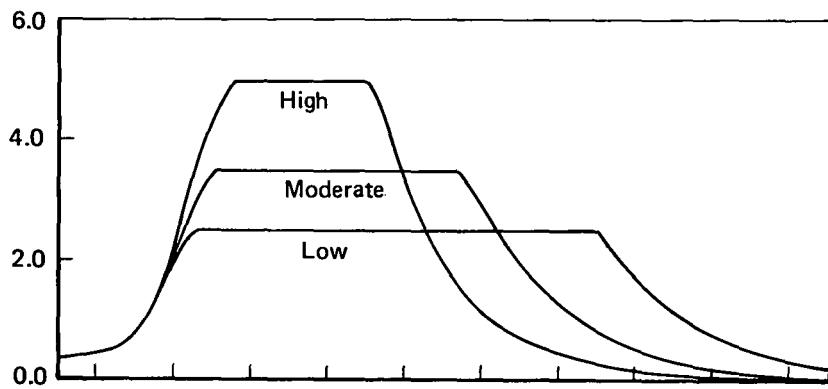


Fig. 2.9—Mexican oil production profiles I, 1965-2065
(70 billion barrels ultimately recoverable)

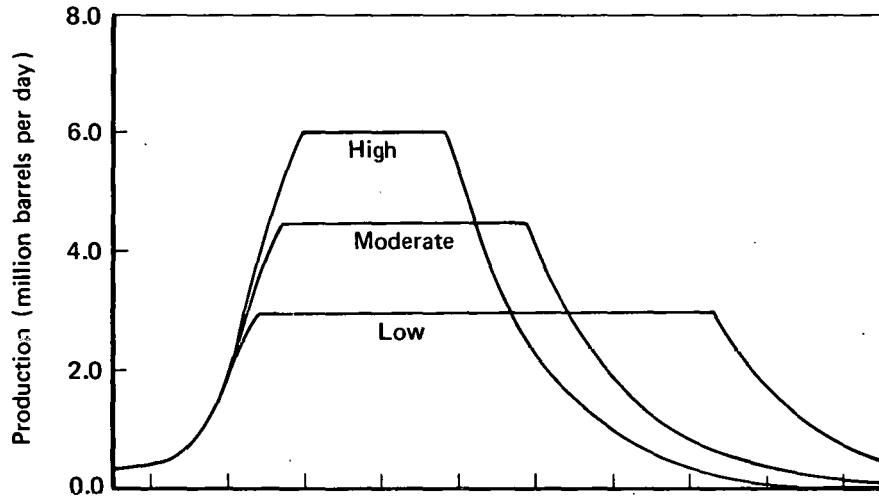


Fig. 2.10—Mexican oil production profiles II, 1965-2065
(90 billion barrels ultimately recoverable)

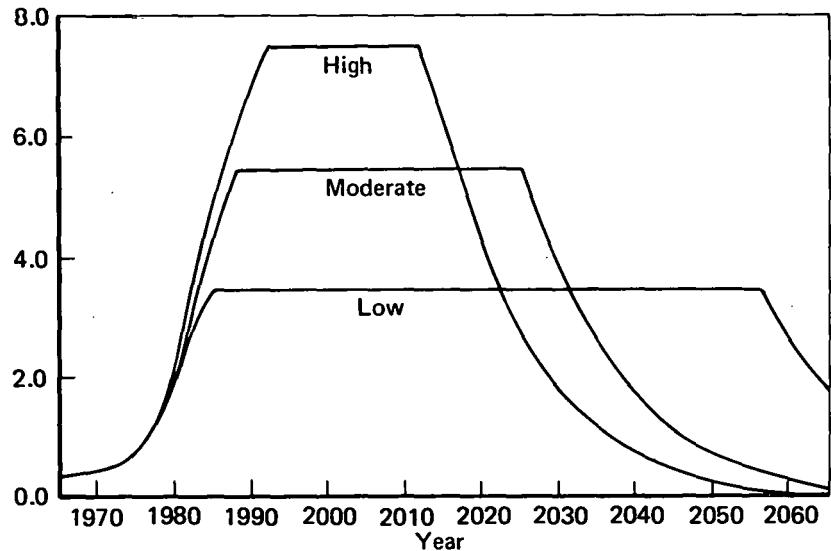


Fig. 2.11—Mexican oil production profiles III, 1965-2065
(120 billion barrels ultimately recoverable)

1980s, its rate of production will surpass the peak annual rates attained by the next leading producing countries—Venezuela (3.7 million barrels per day), Iraq (3.5 million barrels per day), Libya (3.3 million barrels per day), and Kuwait (3.0 million barrels per day).

Second, Mexico will never reach rates of production as high as 10 million barrels per day or more. At the most optimistic resource level used here (120 billion barrels), the high production profile peaks at 7.5 million barrels per day and remains at that plateau for 20 years. The probable composition of Mexico's oil resources suggests that such a high-level plateau is more realistic than a sharp production peak at a higher level of production. If Mexico is to attain high levels of ultimately recoverable oil resources, it can do so only if high recovery rates in the Reforma-Campeche fields are realized. Such high recovery rates can be realized only if the major fields have long productive lives through water injection and other means of supplemental recovery. They cannot be realized if peak rates of production are increased above prudent levels. The current production rate in *A. J. Bermudéz*, the largest of the Reforma fields, implies that Pemex has chosen to produce its largest fields at rates that should maximize ultimate recovery. Moreover, high levels of ultimately recoverable resources implies extensive recovery from Chicantepec and similar nearby areas. Because of the low productivity of individual Chicantepec wells, the large number of wells that will be required to develop the area to its fullest extent, and the intent to make this area a long-term economic development project, Chicantepec oil development with high levels of recovery will probably be a 75- to 100-year endeavor with annual production never exceeding 2.5% of ultimate production from the area.

Third, if Mexico decides to become a major producer and thus a major exporter, it will be choosing a role on the world stage that it can sustain for only a few decades. At all resource levels, the decision to attain high production rates results in a peak that can only be maintained for 15 to 20 years, after which production declines precipitously and irreversibly. The choice of high production rates, as seen within the context of Mexican history, would resemble a choice to repeat on a much grander scale the experience of the development of the Golden Lane, which gave Mexico its first major oil boom. Total Mexican production trebled in three years, increasing from an average of 170 thousand barrels per day in 1918 to 530 thousand barrels per day in 1921—the latter being 23% of total world production for 1921. By 1927, however, production had dropped back to 175 thousand barrels per day.

Fourth, if Mexico chooses the low or moderate oil production policy alternatives, it should be able to use the associated natural gas production without large-scale flaring. Avoiding waste of the natural gas becomes a problem only if production is accelerated rapidly. For any of the low paths of production, Pemex can choose to shift oil production among fields, depending on how much natural gas it will want to produce. Gas production can be kept low by concentrating on the heavy oil fields with low gas-oil ratios. Production can be increased substantially by emphasizing the light oil and gas-condensate fields. Some of this flexibility would still exist at moderate levels of oil production, but flaring probably could only be avoided if some of the associated natural gas production is exported. At any of the high levels of oil production, Pemex would have no production flexibility. These levels could only be achieved if every field were produced at full capacity. High levels of natural gas exports would have to accompany the high levels of crude oil exports to avoid massive flaring.

Fifth, even though Mexico probably has high levels of oil resources, this does not relieve it for long of the necessity to promote more efficient energy use and to develop alternative energy sources. Because of the increasingly pronounced internal subsidy provided by government price controls on internal petroleum product and natural gas sales in Mexico, energy demand has continued to grow at high rates throughout the 1970s. In contrast, energy demand in the industrialized countries was decelerating dramatically as world oil prices rose sharply. If Mexican energy demand continues to grow without interruption at similar high rates into the 1990s, more than doubling every decade, it will not be possible to attain longer-term energy self-sufficiency for the Mexican economy.

Figure 2.12 illustrates this point by showing six scenarios of Mexican oil production, consumption, and exports. The production profiles are the three levels associated with 90 billion barrels' ultimate recovery (from Fig. 2.10). We show two consumption possibilities. In the first, designated as constrained demand, consumption, after some adjustment for the substitution of natural gas for residual fuel oil between 1978 and 1982, is projected to grow at 8% annually until 1985. After that, a gradual move of internal prices toward world levels, increased efficiency in the energy-using stock of capital equipment, and the introduction of other energy sources result in a gradually declining rate of growth until oil consumption stabilizes at 3.0 million barrels per day in 2002. In the second, designated as uncontrolled demand, consumption continues to grow at 8% after 1985.

The differences between the constrained demand and the uncontrolled demand scenarios for Mexico's petroleum self-sufficiency are pronounced. With constrained demand, which still permits a trebling of consumption from current levels and thus substantial economic growth as well as an adjustment period of nearly two decades, Mexico can maintain petroleum self-sufficiency for the next 40 to 60 years. And at the moderate level of production, it could maintain exports of 1.0 to 1.5 million barrels per day for 40 years. With uncontrolled demand, it is difficult for Mexico to maintain self-sufficiency past the end of this century, even with high levels of production. Any export capacity Mexico may have dwindles rapidly during the 1990s. The rapid changes in exports and hence export revenues associated with the uncontrolled demand scenarios only hint at the economic and political dislocations resulting from the continued subsidization of internal energy consumption.

The major uncertainty in this exercise is the future of internal Mexican oil demand. The projection for constrained demand shown here could easily underestimate the actual rate of growth. Gradually eliminating the growth in petroleum consumption will require a major policy effort on the part of the Mexican government. No such effort is yet apparent. Because internal oil and gas prices are frozen at nominal levels, real internal prices of energy are actually decreasing substantially, widening the gap between internal and world prices. There are no major political interests inside Mexico that are strongly advocating reducing the subsidy of consumption and narrowing that gap, even though it is ultimately unavoidable. Moreover, the low resource cost of Reforma and Campeche oil makes it easy for the government to postpone making the hard decision to move internal prices toward world prices. The new industrial development plan assumes a much higher rate of energy growth, particularly from the rapid development of energy-intensive industries such as petrochemicals, fertilizers, steel, and cement. Because of the age-distribution of the population, the labor force will continue to grow rapidly for decades to come, making high economic growth rates mandatory to avoid social

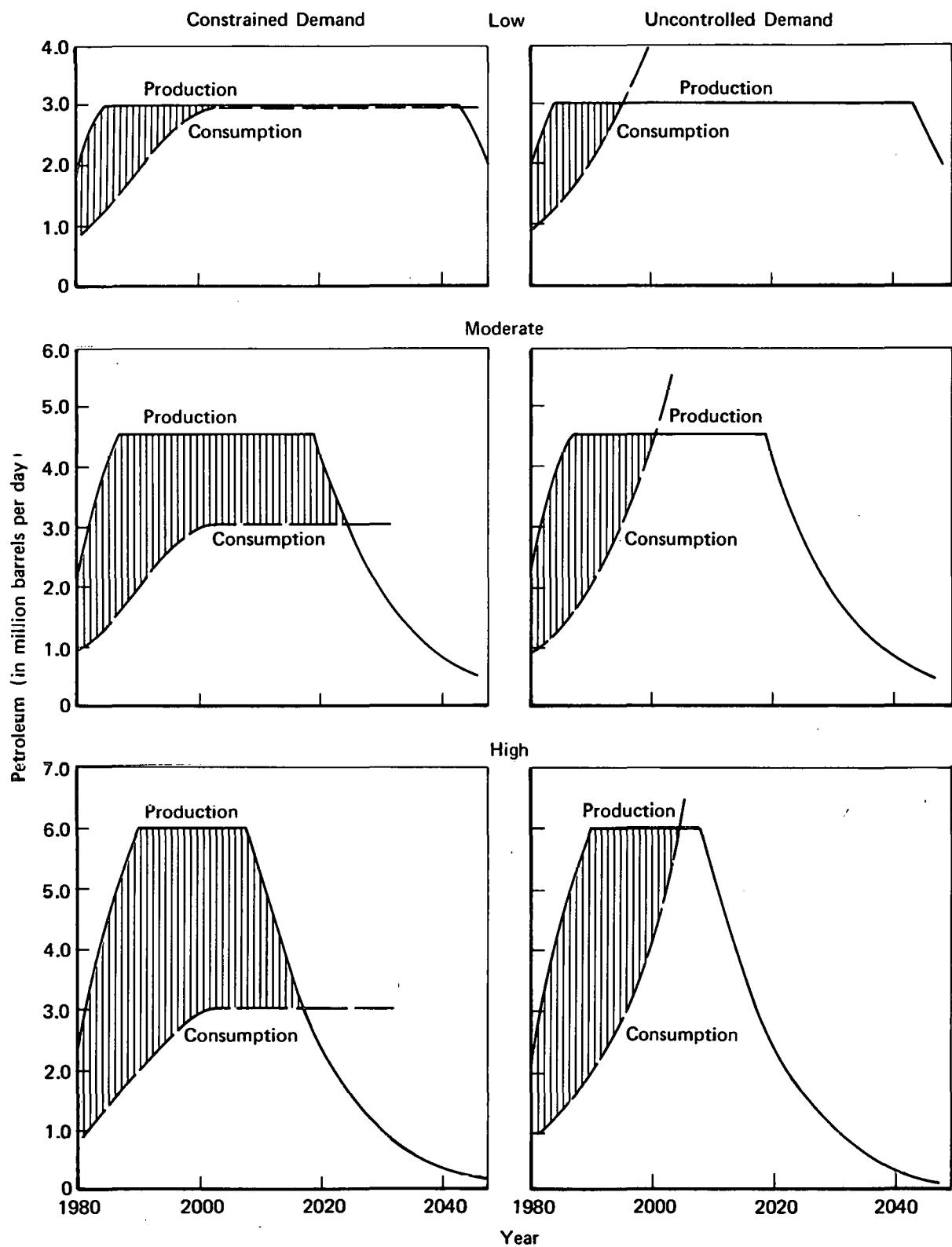


Fig. 2.12—Six scenarios of Mexico's oil production and consumption

unrest. These factors, if permitted to continue unimpeded, could easily result in Mexican oil demand exceeding 4.0 million barrels per day by 2000. Continued rapid rates of growth would limit the period of continued self-sufficiency in Mexico to only 20 to 25 years from now, despite Mexico's emerging status as one of the few great storehouses of oil.

III. PETROLEUM, PEMEX, AND MEXICAN NATIONALISM

What will Mexico do with its petroleum? Pemex could become a major petroleum export industry that could generate enormous financial revenues for the development of the country. To many Americans, this would seem like a natural and positive accomplishment. And many Americans have hastened to speculate that high petroleum export rates would be best not only for the United States but also for Mexico—that is, best according to some typically American presumptions regarding how Mexico should promote its national interests, resolve its domestic socioeconomic problems, and promote its international negotiating capabilities.

Such American assessments of what appear to be the “empirical realities” affecting Mexico’s situation have frequently ignored the fact that, through Mexican eyes, petroleum and Pemex may be said to represent “symbolic realities” of extraordinary, almost mystical significance for Mexican nationalism. These symbolic realities link petroleum and Pemex to broader national concerns, according to an institutionalized tradition that often constrains Mexico’s domestic and foreign policy options. Indeed, for Pemex to become a major petroleum exporter would represent not only a new empirical role but also a radical transformation within traditional nationalist conceptions. For Pemex to become a major exporter in the future, overcoming the symbolic challenges and constraints may prove much more difficult than coping with the practical tasks of exploration and development. The value dimensions of Mexican nationalism strengthen our reasons for projecting that Pemex will pursue a low-to-medium production strategy and will avoid high exports.

ROOTS OLDER THAN 1938

Petroleum was an important issue before the dramatic 1938 nationalization-expropriation of the foreign oil companies and the creation of Pemex, Mexico’s national oil company. A quick review of some earlier history reveals several entrenched traditions that are relevant today. First, public ownership of natural resources was the rule in Mexico long before the 1910 Revolution. Second, as Mexico’s rulers struggled to establish Mexico’s sovereignty and independence after the 1910 Revolution, they skillfully tempered the ideals of their nationalism with pragmatism in order to mold practical policies. At all times, Mexico has shown great ambivalence between inviting foreign influence to assist in economic development and progress and rejecting such foreign influence to assert Mexico’s national sovereignty, independence, and dignity.

“Juices of the Earth”

Mexican perspectives on petroleum were shaped by Latin legal traditions that go much farther back in history than the 1910 Revolution and the 1938 expropriation. In those honored traditions, sovereignty over natural resources pertained to the state and the people. Private ownership of natural resources was an alien

Anglo-Saxon concept, mainly identified with foreign interference in Mexico's affairs.

The traditional law, as codified by King Charles III in the mineral law for New Spain of 1783, specified that the title to mineral substances, including "juices of the earth" or petroleum, lay with the sovereign, who had authority to grant rights and govern the exploitation of subsoil resources. When Mexico achieved its independence from Spain after 1821, the law remained the same but the Mexican state replaced the monarchy as sovereign. Thus, title to mineral resources resided ultimately with the people of Mexico.

The Porfirian Deviation

This tradition was violated by the regime of Porfirio Díaz (1876-1911), who believed fostering private foreign investment was the most effective way to develop Mexico. During his tenure, the Mexican Constitution was amended by four mining laws that permitted foreign ownership and exploitation of subsoil resources, including petroleum. However, petroleum was not a major industry in Mexico until the last of these laws was enacted. The Mining Law of 1884 included a declaration that petroleum was the exclusive property of the owner of the land. The Mining Law of 1892 permitted landowners to freely exploit hydrocarbons without obtaining official concessions. The first law dealing exclusively with petroleum, the Petroleum Law of 1901, gave the federal executive the power to grant concessions to exploit petroleum located on national lands, while continuing to recognize that private owners could freely exploit (and export) petroleum located on their private lands. The Mining Law of 1909 reaffirmed that oil rights were the exclusive property of the owner of the surface soil.

These laws reflected principally Anglo-Saxon concepts of private property and thereby represented a fundamental aberration in the centuries-old legal history of Mexico. In the eyes of Mexico's revolutionaries, the Díaz regime had fraudulently given away the nation's patrimony by authorizing foreign private ownership of Mexican land and subsoil rights.

The Revolutionary Return and Advance

An important goal of the Mexican Revolution was the restoration of the traditional mining law. The Constitution of 1917, which is still in force, included Article 27 to reinstate the old Spanish and Mexican law regarding subsurface resources. Article 27 declares that the nation is the sole owner of all minerals, including petroleum. This ownership is inalienable, and only Mexican citizens can obtain concession rights. Foreign corporations are specifically excluded. However, the nation can grant the same rights to aliens if they accept the jurisdiction of Mexican law and agree not to invoke the protection of their own governments. If they do so, the penalty is forfeiture of the claim.

In sum, the famous Article 27 did not introduce a radical concept regarding the ownership of natural resources. It reaffirmed Mexico's traditional law of state sovereignty over natural resources and in so doing reaffirmed a related tradition of rejecting foreign influences.

Defining and enforcing this law proved an ordeal, and its implementation on passage was not automatic. Instead, the interpretation and application of Article

27 remained subject to an ad hoc set of rulings and negotiations, and implementing legislation was not passed until the introduction of the Petroleum Code in 1925. During the intervening years, the American, British, and Dutch oil companies turned Mexico into the world's leading petroleum exporter, while Mexico's weak government struggled to establish some effective sovereignty and control over their activities. The key issues were whether Article 27 was retroactive and confiscatory, as the foreign companies and their governments feared, and how Mexico's government should exercise jurisdiction to regulate the burgeoning petroleum industries.

The first post-revolutionary governments, those of Venustiano Carranza and Alvaro Obregon, hesitated to apply Article 27 to its full extent and agreed that it was not retroactive under the terms of another constitutional article, Article 14. The American companies, claiming that by law they "owned" their properties, wanted the situation clarified in a formal treaty. Both Carranza and Obregon would only intimate informally that they would not interfere with existing ownership arrangements. However, Mexico's Supreme Court ruled in 1921 that Article 27 would not be applied retroactively; that is, it would not affect ownership and exploitation rights legally acquired before 1917 as long as the owners of the oil lands had performed "positive acts" in the past. In addition, the Bucareli Conferences of 1923 helped to settle disagreements over legal claims and regulations; in effect, the conferences ratified continued foreign rights to explore and exploit subsoil deposits, although they did not settle ownership issues.

The major step toward implementing Article 27 was taken during the administration of Plutarco Elias Calles, which introduced the Revolution's first Petroleum Code in 1925. This legislation required that the oil companies obtain new concessions, limited to 50 years' duration, that would replace the concessions granted for perpetuity before 1917. Although this legislation confirmed the existing rights of the oil companies, these rights were now subject to a time limit. Moreover, the new legislation constituted recognition that subsoil rights were vested in the nation. Following objections from the oil companies and the U.S. government, the 1925 legislation was amended in 1928 by the Calles-Morrow agreement to allow "confirmatory concessions" of unlimited duration for those owners and leaseholders who had acquired such subsoil concessions before May 1917. Nonetheless, the 1925 Petroleum Code had served to reassert the traditional principle that subsoil rights were ultimately vested in the nation.

From 1928 through 1936, no additional legislation of significance was adopted regarding Article 27. Instead, disputes with the foreign oil companies increasingly involved labor issues, based on another important article of the 1917 Constitution, Article 123. The terms of Article 27 returned to the fore, however, in the administration of Lazaro Cárdenas, when a presidential decree in 1936 called upon Mexico's congress to legislate the expropriation for state ownership of all property considered to be in the public interest (*de utilidad pública*)—including oil and gas. This step, moving anew in the nationalist directions implicit in Article 27 and the Petroleum Code of 1925, headed Mexico toward the 1938 acts of expropriation.

Pragmatism despite Nationalism; Nationalism despite Pragmatism

This brief legislative summary cannot begin to convey the complex history leading up to the 1938 expropriation-nationalization of the foreign oil companies

by the Cárdenas government. History shows that despite tense moments and conflicting developments, the foreign oil companies, the Mexican government, and its incipient oil institutions all managed to maintain a symbiotic relationship over a remarkably long period. During this period, Mexico experienced a full cycle of oil exploitation (discovery, development, and decline); at its peak in the early 1920s, Mexico was a major world oil producer. All this occurred during the violence of the Mexican Revolution and World War I, in which two major sources of foreign investment in Mexico—Britain and the United States—were involved. Despite this, and despite the nationalist passions aroused by the Revolution, the oil companies, the U.S. government, and the Mexican government conducted a mutually beneficial relationship in a climate of controlled hostility.¹ As a Mexican historian has observed, "The history of the manner in which federal taxation of the oil companies was regulated is part of the history of the constant accommodation of conflicting interests."²

This coexistence and accommodation of conflicting interests derived in part from the success of Mexico's leaders in balancing nationalism and pragmatism in their attempts to produce practical policies. Their nationalist thrusts generally began at the symbolic level, through decrees, laws, and constitutional changes, but the practical implementation occurred at a relatively slow pace. In this incremental process, the conflicts engendered by petroleum legislation were always resolved by reasonable compromises—and throughout oil production continued. During this period the several Mexican administrations were weak, and the petroleum issue introduced an influential rallying theme when perhaps others were absent. In addition, foreign investment in Mexican oil was threatened at times by the Mexican administrations' attempts to advance various interests, for example, in the Carranza administration, to obtain diplomatic recognition, and in the Calles regime, to gain support for a faltering government. Nonetheless, neither the Mexican government nor the oil companies allowed Mexican claims, or the oil companies' objections, to interrupt petroleum production. While the Mexican side would espouse revolutionary nationalism and then temper it with pragmatism, the foreign oil companies would be sympathetic to nationalist symbolism once they were assured of pragmatic outcomes. The common and most immediate concern was to keep oil

¹ That the possibility of uncontrolled hostility was never absent, however, is illustrated by an anecdote from Bernard Baruch:

Senior Del Rio was fearful of letting Americans have too much economic influence in Mexico. (This was during the Porfiriato in 1904.) As he explained to me, he was afraid that the concessions granted Americans might some day be used as an excuse to seize northern Mexico.

Some years later I recalled his words when some of our oil people proposed doing just what Del Rio feared—and, but for Woodrow Wilson, they might have had their way.

It was shortly after we entered World War I. President Wilson had invited me to a White House discussion of an oil shortage which threatened to disrupt our military plans. One official proposed that we seize the Mexican oil fields in Tampico. Squadrons of marines had already been alerted. The President had only to give the word for them to push off.

President Wilson hardly waited for the finish of the argument. When aroused, he would speak in firm, measured tones, which left no doubt what was in his mind.

"What you are asking me to do is exactly what we protested against when committed by Germany," he reprimanded. "You say this oil in Mexico is necessary for us. That is what the Germans said when they invaded Belgium; 'it was necessary' to get to France. Gentlemen," he concluded, "you will have to fight the war with what oil you have."

Baruch: *My Own Story*, Holt, Rinehart & Winston Inc., New York, 1958, p. 193.

² Lorenzo Meyer, *Méjico y Estados Unidos en el conflicto petrolero (1917-1942)*, El Colegio de México, Mexico City, 1968, p. 30.

production on track—a concern in which the interests of the Mexican government and the foreign oil companies overlapped until the mid-1930s.

The 1938 expropriation of the foreign oil companies did not occur until well after the nadir of Mexican oil production. Some historians maintain that early fears of impending oil expropriation caused a flight of foreign oil investment in the 1920s and that the damage to Mexico's oil development could only be corrected by nationalization. Others, however, believe that expropriation fears were greatest after the adoption of the nationalist and revolutionary Constitution of 1917. These initial fears were assuaged by Mexican assurances to honor Article 14, which prohibited retroactive application of Article 27. This resulted in substantial foreign oil investment between 1918 and 1925, a period that corresponded to the best years of Mexico's oil production. Later, the Petroleum Code of 1925 reduced oil investments from perpetuity to 50 years' duration, a change that concerned foreign companies but did not induce immediate capital flight. The 1928 amendments to the 1925 Code, which allowed confirmatory concessions in perpetuity, reassured the foreign oil companies. The decline in capital investment during the post-1925 period reflected broader factors than expropriation fears. For example, the rate of return on investment in Mexico experienced a rapid decline, and investment in Venezuela became much more profitable. Also affecting foreign investment priorities was the major world depression in the late 1920s and early 1930s. The international investment picture aside, however, it is clear that fears of expropriation were not strongly felt until after the beginning of Cárdenas' administration. Even then, expropriation was not inevitable and was precipitated largely by the intransigence of the oil companies when confronted with a set of demands from organized Mexican labor groups.

Breaking with the old pattern of pragmatism, the Cárdenas administration revived the nationalism inherent in the Revolution. In the words of a U.S. historian,

Political and legal objectives were very important. Mexicans wanted to force powerful foreign economic units to respect and observe Mexican laws and procedures. Those individuals steeped in the revolutionary tradition resented the Bucareli and Morrow-Calles agreements. They wanted to abrogate those portions of the agreements that effectively barred the claim of the nation to ownership of subsoil deposits, as asserted in Article 27 of the Constitution. The Mexicans wanted to establish beyond doubt the political independence and sovereignty of the country by ending the interference of powerful foreign companies in internal political affairs.³

Perhaps there was never a more pragmatic time than 1938 for Mexico's rulers to be so nationalist.

TRADITIONAL MISSIONS AND "SYMBOLIC REALITIES" SINCE 1938

Since the 1938 nationalization-expropriation of the foreign oil companies, petroleum and Pemex have embodied the essence of Mexican nationalism, representing what being Mexican means—or is supposed to mean as a symbolic reality—for

³ J. Richard Powell, *The Mexican Petroleum Industry, 1938-1950*, University of California Press, Berkeley, 1956, p. 32.

Mexico's leaders as well as for the man in the street.⁴ The roles conceived for Pemex have extended well beyond petroleum supply to include very broad societal missions, and these missions are integral to the fulfillment of national missions and to what is now termed the "National Project." What happens to petroleum and Pemex is regarded as central to Mexico's identity, dignity, sovereignty, independence, and development—as a nation, a state, and a people. To quote a former Pemex official, "Not a single enterprise is above the nation, but if anyone comes close, in its ends and goals, to the paramount interest of Mexico, it is the petroleum industry."⁵

No other post-Revolutionary Mexican institution is endowed, and encumbered, with such a heavy symbolic load—a load that arouses great pride, acute sensitivity, and even insecurity among Mexican nationalists. Pemex stands for Mexican nationalism even more than does the Partido Revolucionario Institucional (PRI),⁶ because Pemex was the fruit of an international struggle, whereas the PRI emerged from domestic politics. The symbolic significance of Pemex transcends criticisms that it is corrupt, inefficient, and incompetent. Such criticisms, which can be applied to almost any Mexican institution, do not obviate the popular belief that Pemex's ideals represent the forging of a new destiny for Mexico.

Over the years, however, Pemex has exhibited, often to a high degree, many of the evils and shortcomings of the Mexican political system, and the idealistic nationalist symbolism has served to embellish domestic rhetoric, parochial demagoguery, and bureaucratic maneuvering. Nonetheless, once petroleum issues involve foreign relations, the terms of the dialogue change dramatically, and the idealized conceptions of Pemex's societal missions assume a compelling reality for Mexicans. Thus, to repel U.S. business overtures for offshore development rights in 1955, Antonio J. Bermúdez, Pemex's Director General 1947-1958, declared he did not know which would be more difficult to change—the colors of the Mexican flag or the country's laws that pertain to petroleum.⁷

The Immortality of 1938

The 1938 expropriation-nationalization of the foreign oil companies by President Cárdenas was more influential than any event in Mexico's history in bringing the people together as a nation. In the words of Bermúdez, who was one of Pemex's greatest leaders, "The expropriation . . . profoundly stirred the spirit of the Mexican people. Mexico seemed to have found itself in a collective liberating experience." For a people who "have been profoundly divided on many issues throughout the course of their history," this experience constituted a "unifying factor" and established a "common public interest." As a result, "public opinion is always alert to what occurs in the petroleum industry. . . ."⁸

⁴ For a detailed history of how the 1938 nationalization of the foreign oil companies affected U.S.-Mexican relations at the time, see the eyewitness account by the U.S. Ambassador to Mexico, Josephus Daniels, *Shirt-Sleeve Diplomat*, University of North Carolina Press, Chapel Hill, 1947; and E. David Cronon, *Josephus Daniels in Mexico*, University of Wisconsin Press, Madison, 1960.

⁵ Licenciado Jesús Reyes Heroles, *Report of the Director General, Petróleos Mexicanos*, Mexico City, March 18, 1965, p. 15.

⁶ The PRI is the government-sponsored party that has dominated Mexican politics for decades.

⁷ Bermúdez, *The Mexican National Petroleum Industry: A Case Study in Nationalization*, Institute of Hispanic American and Luso-Brazilian Studies, Stanford University, Stanford, Ca., 1963, p. 35.

⁸ *Ibid.*, pp. 18-19.

Although the symbolism dates from 1938, it survives today as a vital spiritual heritage. Jesús Reyes Heroles, Director General 1965-1970, insisted that Pemex's methods and policies must evolve with changing conditions and observed that "the essential policy of Petróleos Mexicanos is established from its origins, and finds its substance in these same origins—it was born to regain law and impose sovereignty, and with the purpose that the country benefit from its own natural resources."⁹ Antonio Dovalí Jaime, Director General 1971-1976, constantly reminded the Mexican people of Pemex's identity with one of the most "transcendental acts" in the life of modern Mexico—an act that changed the course of Mexico's history and enabled it to forge a new, independent destiny. And according to the current Director General Jorge Díaz Serrano, "Today, like yesterday, petroleum is identified with the country and its men, and represents the sovereign decision, that of Lazaro Cárdenas and that of López Portillo, to manage our destiny as a nation."¹⁰

The profound significance of the 1938 events not only finds expression in the speeches of Pemex's directors but also lives through the writings of Mexico's major policy intellectuals. One of these intellectuals, in commenting on the prospects for U.S.-Mexican energy relations, insists that "Every consideration regarding Mexican petroleum brings up the 1938 expropriation and the fact that, from then on, Mexican nationalism found its best expression in sovereignty over natural resources and the utilization of these for the internal benefit of the nation."¹¹ Another policy intellectual turned government official writes, "[the 1938 events] culminate, moreover, a long process of affirmation of the ideas of the Revolution and mark the initiation of the self-determination of the Government, and in financial matters, affirm the national sovereignty and serve as a symbol of the economic emancipation of the country."¹² In a recent work of a distinguished Mexican novelist, a fictional character identifies March 18, 1938, as a day when "Mexicans had looked one another in the face"—an event of such significance that should Pemex now "associate with transnational oil companies and become a part of enterprises that would in the end divest us of our control over our own resources," the result might well be "the day when we Mexicans might cease to look one another in the face."¹³

National Dignity

Pemex is a symbol of national pride and dignity, demonstrating that Mexico and Mexicans can accomplish goals through their own efforts, that through a process of suffering and struggling they can prove to themselves and to the world, especially to the United States, that they can succeed despite obstacles and expectations of failure. The 1938 expropriation is said to have rescued Mexico's national dignity, along with its economic independence and state sovereignty. For example, Director General Reyes Heroles observed that "The national petroleum industry, in its development, has faced dangers, because it started from a supposition: the incapability of Mexicans to administer it. The people of Mexico have demonstrated

⁹ *Report of the Director General*, p. 5.

¹⁰ *Report of the Director General*, Petróleos Mexicanos, Mexico City, 1979, p. 27.

¹¹ Olga Pellicer, "La política de los Estados Unidos hacia México: La nueva perspectiva," *Foro Internacional* (El Colegio de México), No. 74, October-December 1978, p. 211.

¹² Romeo Flores Caballero, "El petróleo: Una alternativa para el desarrollo de México," *Quid*, Vol. IV, No. 2, February 1979, p. 25.

¹³ Carlos Fuentes, *The Hydra Head*, Farrar, Straus, & Giroux, Inc., New York, 1978, pp. 221-222. This novel seems written to appeal to foreign audiences rather than to impress Mexican readers.

that not only can they administer and make an industry grow, they have set an example of their capability for action and creation.”¹⁴ Mexicans can be proud, according to Director General Dovalí Jaime, because since 1938 “a decision which then was believed to be suicide or, at least, insensate,” has nonetheless proved to be a “victory of law and reason over the powerful material interests of the world petroleum empires.”¹⁵

Economic Independence

Pemex is the standard-bearer of Mexico’s struggle for national economic independence and of its prospects for growth and progress. Thus, Bermúdez observes that the 1938 events expressed the “unified will of the nation to foster its overall economic and social development.”¹⁶ President Lazaro Cárdenas “provided the country with the instrument and the means for its progress and development and for the independent strengthening of its economy.”¹⁷ According to current Director General Díaz Serrano, the 1938 events “produced the first change of importance in all the economic history of Mexico.”¹⁸

Thus, while Pemex became the principal energy producer in Mexico, and while its leading objective became national self-sufficiency, the concept of its economic roles moved far beyond the production of petroleum. Pemex is traditionally hailed in the literature as the motor, the mainstay, the key instrument, the main institution, the spinal column, the basic pivot, the most solid support, and/or the master lever of Mexico’s overall economic independence and development. No other economic or governmental institution in Mexico is identified with such responsibilities. Pemex’s policies are praised for having helped to promote and subsidize the development of both the private and public sectors of Mexico’s mixed economy in recent decades.

State Sovereignty

This view of Pemex as the key to Mexico’s economic independence blends inseparably with its political importance as a major institution of the state and the Revolution. “Much has been said of the contribution that Petróleos Mexicanos has made to national economic development. But less attention has been paid to the role it has played in behalf of the country’s institutions, acting in favor of political stability and Mexico’s progress in every field.”¹⁹ Pemex’s creation in 1938 not only generated international respect for Mexico’s sovereignty as a nation, but it also helped establish state sovereignty within Mexico by making Pemex the guardian, trustee, and administrator of an important part of the national patrimony. Thus, according to Mexico’s leading scholar on petroleum history, “Mexico considered the

¹⁴ *Report of the Director General*, March 18, 1970, pp. 28-29.

¹⁵ *Report of the Director General*, Petróleos Mexicanos, Mexico City, 1971, p. 3.

¹⁶ Bermúdez, 1963, p. 19.

¹⁷ Bermúdez, *La política petrolera Mexicana*, Editorial Joaquín Mortiz, Mexico DF, 1976, p. 13.

¹⁸ “Línea troncal nacional de distribución de gas natural,” speech of the Director General of Petróleos Mexicanos before the House of Representatives, Mexico City, October 26, 1977, p. 5.

¹⁹ Reyes Heroles, *Report of the Director General*, Petróleos Mexicanos, Mexico City, March 18, 1966, pp. 22-23.

expropriation to be necessary in order to preserve unharmed the authority of the state—representative of the national interest—against private interests.”²⁰

Since 1938, Pemex has grown to become the largest state enterprise, as well as the most important industry, public or private, within Mexico’s mixed economy. Thus, Pemex’s creation and its development are claimed to affect not only Mexico’s overall economic independence, but also the institutional autonomy, stability, and vulnerability of the state, both within Mexico and in terms of pressures from abroad.

The Petroleum Mystique

Pemex, its personnel, and the petroleum workers are supposed to represent the patriotic spirit of Mexican nationalism by expressing what is called “la mística petrolera” (the petroleum mystique). This requires “the profound conviction in all those who serve the industry that to serve Petróleos Mexicanos is to serve the fatherland, a conviction founded on knowledge of the objectives of the nationalization and on adhesion to those that motivate and inspire their labors.”²¹ Indeed, according to one set of Pemex guidelines, it was imperative “To think so that the phrase ‘The oil is ours’ substitutes with ‘At the service of the fatherland’ in the conscience of all members of the Enterprise. . . .”²² Pemex’s mission is thus viewed as central to the national mission, with a consciousness of this being essential to work and organizational accomplishment.

This mystique, based on the highest ideals symbolized by Pemex, is supposed to motivate productivity at all levels of the state organization, and especially among the union workers. Moreover, it is supposed to convey a humanistic spirit that would hold together “la familia petrolera.” Widespread corruption, however, is said to have undermined this mystique. Yet it continues to provide an honored standard, implicitly more than explicitly, by which to judge the performance and policies of Pemex leaders, who are expected to exhibit political conscience as well as engineering ability.

In sum, Mexican concepts regarding national dignity, economic independence, state sovereignty, and the petroleum mystique appear to compose the symbolic realm encompassing petroleum and Pemex and fitting them into the broader national context. These concepts provide the standards, or values, by which petroleum policies and Pemex activities must be—and will be—judged and justified among influential traditional/leftist nationalists within Mexico. Even though the concepts represent ideal views, and even though varied nationalist elites may disagree over their full meaning, these concepts place constraints on the policy options available to Mexico. For example, the concepts all require a strong dedication to resource conservation, and they make Pemex’s export policies subject to close scrutiny. Whereas the petroleum mystique mainly affects domestic politics, the other concepts exert strong influence over foreign policy choices.

²⁰ Lorenzo Meyer, “La resistencia al capital privado extranjero: El caso del petróleo, 1938-1950,” in Bernardo Sepúlveda Amor et al., *Las empresas transnacionales en México*, El Colegio de México, Mexico City, 1974, p. 108.

²¹ Bermúdez, 1976, p. 37; see also p. 58.

²² Petróleos Mexicanos, *Objetivos y políticas generales*, Distrito Poza Rica, Veracruz, 1961, pp. 3-4.

PEMEX'S OPERATIONAL ACTIVITIES AND EXPORT QUESTIONS

Pemex's first task was to transform the foreign private oil companies in Mexico, which had been predominantly interested in maximizing exports for profit, into a state enterprise dedicated to meeting Mexico's domestic energy and developmental needs. Pemex was directed to emphasize the public welfare, not profits. From 1938 through 1976, Pemex's essential operational goals were to provide energy self-sufficiency for Mexico, simultaneously promoting industrial development through subsidized, even sub-cost, prices. Petroleum exports as well as imports were to be minimized. Of course, the societal missions, discussed above, served to reinforce and embellish these operational goals.

During these decades Pemex lacked the petroleum resources, technical capabilities, and investment capital to even attempt to become a major exporter. Nonetheless, export questions occasionally reappeared to stir internal debates during the 1940s, 1950s, and 1960s. In these debates the conceptions of Pemex's societal missions aroused special vigilance among leftist nationalists, who resisted the prospect that Pemex might develop into a petroleum exporter or otherwise get entangled with the major oil companies. A quick review of two historical episodes that have received little attention from American researchers will help clarify the nature of these political sensitivities.

1948-1949 Loan Negotiations²³

During 1948-1949 the Mexican government sought a major loan from the U.S. government, potentially as much as \$475 million, to finance a five-year petroleum development plan. The loan request was promoted by Pemex's new Director General, Antonio Bermúdez, with the support of President Miguel Alemán, who was widely regarded as pro-American and pro-capitalist. Pemex was in poor technical and financial shape. The organization had survived the ten years since 1938, despite the fact that the departing foreign oil companies had embargoed equipment sales to Pemex and boycotted purchase of its products abroad. As a result of local labor-union politics in particular, it was widely recognized within Mexico that Pemex was performing poorly, that it was overstaffed, and that corruption, inefficiency, and incompetence were prevalent. Pemex clearly needed a massive injection of both capital and technology to explore for new reserves, develop increased production capabilities, and diversify its product mix to include many refined products still being imported from the United States.

²³ Mexicans have devoted considerable attention to the conduct and outcome of these negotiations, largely because of domestic political ramifications. Mexican sources include José Domingo Lavín, *Petróleo*, Fondo de Cultura Económica, Mexico City, 1976 (reprint), especially pp. 332-366; Bermúdez, 1963, pp. 177-181; Meyer, "La resistencia al capital privado extranjero," pp. 150-152; and Miguel Alemán Valdés, *La verdad del petróleo en México*, Editorial Grijalbo, Mexico City, 1977, pp. 618-669.

The principal U.S. academic source on the negotiations consists of one paragraph in Powell, 1956, p. 49, which contains an erroneous description that is repeated in recent American writing.

For additional information on the negotiations, see "Progress Report of the Committee on Interstate and Foreign Commerce," *Fuel Investigation: Mexican Petroleum*, House Report No. 2470, Washington, D.C., 1949—known as the Wolverton Committee Report. See also declassified State Department documents in *Foreign Relations of the United States*, 1948, Vol. IX, *The Western Hemisphere*, Washington, D.C., 1972, pp. 603-619; and *Foreign Relations of the United States*, 1949, Vol. II, *The Western Hemisphere*, Washington, D.C., 1975, pp. 671-700.

The most logical source for new long-range financing on a scale sufficient for a major development program was the Export-Import Bank of the U.S. government. Relations between the United States and Mexico at that time were uneasy, although there had been cooperation during the World War II years when the United States needed Mexican labor and raw materials, and especially since 1942 when Mexico had agreed to pay compensation for the expropriated U.S. properties. The Export-Import Bank had already agreed to finance one project for Pemex, the building of a refinery to produce aviation gasoline for the war effort (although political delays in obtaining the loan were such that the refinery was built too late to serve its purpose).

In the United States, the loan request was most actively supported by the Congressional Committee on Interstate and Foreign Commerce, the so-called Wolverton Committee. It had been advocating that the U.S. government emphasize developing secure new petroleum sources in the Western Hemisphere, at a time when U.S. and European petroleum demands seemed to be pressing world supplies. The loan request also received support within the Interior Department, the Defense Department, and from some small independent U.S. oil companies. The principal arguments in favor of granting the loan request were cast in terms of U.S. needs for Western Hemisphere solidarity and good-neighborliness, the importance of U.S.-Mexican relations, and the prospects for generating new Mexican oil exports on the world markets.

The loan terms, as requested by Mexico, were vigorously opposed by the U.S. Ambassador in Mexico, the State Department, the Navy Department, and the major oil companies. Moreover, the Export-Import Bank itself counseled against providing a loan for petroleum exploration and production development, although it was providing significant loans in other socioeconomic sectors. Opposition to the Mexican request was based on several concerns: Such a loan to Pemex would legitimize nationalization and thus stimulate adverse consequences throughout the hemisphere (especially in Venezuela). Mexico would only use Pemex's further development to improve domestic self-sufficiency, which would not result in major new exports. This was combined with the belief that Mexico had too many domestic socioeconomic problems to persist long with its intransigent political nationalism in petroleum matters. Accordingly, neither U.S. global nor bilateral interests would be served by authorizing the loan on Mexico's terms. Instead, it was suggested that Pemex seek credits from U.S. private enterprises (specifically, the major oil companies seeking to reenter Mexico).

While their loan request was being assailed in Washington, Bermúdez and Alemán also encountered stiff criticism inside Mexico. Nationalist critics claimed that Pemex's loan request, or other concurrent negotiations to sign risk-contracts for exploratory drilling with small U.S. independents, could result in loss of economic independence and state sovereignty for Mexico. Despite Pemex's poor domestic image, once the issues concerned reentry of foreign capital, the domestic dialogue shifted to the primary significance of Pemex as the symbol and substance of state control over Mexico's destiny. The issues inevitably aroused—and confirmed—the influence of various nationalist, leftist, and Cardenista elements to an extent that could not be ignored by Mexico's President or Pemex's Director General. There was no way to limit the discussion of the loan request to diplomatic circles and keep it isolated from public politics. By now, Mexican labor circles had solidified their position that it was far better for Mexico to go slowly and even sacrifice possible

economic benefits than to compromise its fundamental principles of nationalism and risk threats to sovereignty.²⁴

The nature of the public discussion of the loan request in the United States further aroused Mexican nationalism. American press reports about the loan, and the prospect that it might create new roles for the big oil companies, provided fuel for reactive Mexican commentaries. The official visit to Mexico by the Wolverton Committee had unintended negative repercussions. The congressional committee was viewed as representing a democratic, flexible, good-neighbor policy line that, within the U.S. system, was essentially "soft" on Mexico. During their visit, committee members were cooperative and respectful, seeking to negotiate without pressure and within the law. Yet it would later be concluded, albeit by a State Department functionary opposed to the loan request, that their visit innocently served to arouse nationalist sensitivities.

After months of negotiations, visits, proposals, and counterproposals, the U.S. government denied authorization of the loan on terms that would be acceptable to the Mexican government, which thereupon withdrew the loan request.²⁵ During the next few years, Pemex did sign controversial "risk-contracts" for exploratory drilling with some small U.S. independents, although their activities remained very limited and the contracts were terminated in 1968. Moreover, the Export-Import Bank reportedly made about \$150 million available to the Mexican government for developing nonpetroleum sectors, while the Mexican government reallocated internally to Pemex an essentially equivalent amount. Thus, earlier rigidities exhibited in both nations did not prevent eventual adaptation to pragmatic outcomes.

Gas Export Negotiations in the 1950s²⁶

Pemex's first significant negotiations to export gas to the United States in the mid-1950s resemble, although on a lesser scale, the negotiations that took place in the late 1970s. Even in the 1950s Pemex encountered domestic political difficulties in concluding a small contract that seemed economically rational and profitable for Mexico.

In the early 1950s, Pemex found itself with very large gas reserves and underutilized production capabilities in the Reynosa fields, far in excess of current and projected domestic demand in Mexico's Northeast. At the time, Pemex was in financial straits because Mexico's President would not permit the industry to raise the extremely low domestic prices for its products. Thus, it seemed reasonable to export some of the Northeast gas to U.S. markets just across the border.

Pemex Director General Bermúdez determined a fundamental export principle: that only "excess" production should be exported. "Of course, neither oil nor gas should be exported unless there is an actual excess of production and proved reserves over and above the national requirements, not only current but also into

²⁴ See Sanford A. Mosk, *Industrial Revolution in Mexico*, University of California Press, Berkeley, 1954, pp. 103-104.

²⁵ The interactions over this issue provide excellent material for examining the different negotiating methods of the two governments.

²⁶ Data on the gas negotiations of the 1950s are not readily available. Our written sources for this discussion are few in number but include the generally impressive work of Fredda Jean Bullard, *Mexico's Natural Gas: The Beginning of an Industry*, The University of Texas at Austin, 1968, and a copy of the original "Gas Purchase Contract" between Petróleos Mexicanos and Texas Eastern Transmission Corporation, dated September 27, 1955, 42 pp.

the foreseeable future.”²⁷ Once this principle was satisfied, the desirability of exporting gas would depend on a further set of conditions concerning domestic gas-oil substitution and the proviso that if “by not exporting gas, production in the fields would have to stop for lack of access to domestic markets, exception may be made.”²⁸ Bermúdez concluded that the Reynosa gas reserves met all the conditions and decided that “from all points of view, it seemed reasonable to export at least part of the available gas surplus.”²⁹

A decision to export the gas, he claimed, would yield the following benefits. It would benefit Mexico as a nation, because it would increase and diversify Mexico’s exports, opening up a new and profitable market for earning foreign exchange. Gas exports would benefit Pemex by enabling it to acquire income and make productive use of the investments it had made in developing the Reynosa reserves. And an export decision would benefit Mexico’s public gas consumers, because earning income on underutilized reserves would help to stimulate greater gas development and production for the future, as well as help keep domestic prices at a minimum.³⁰

As a consequence, in September 1955 Pemex entered into a contract to export a maximum of 200 million cubic feet per day of natural gas to the Texas Eastern Transmission Corporation, which had made the best contractual offer. The terms were quite favorable to Mexico. It would receive a starting price of 14.2 cents per thousand cubic feet, which was higher than the current price in the adjacent U.S. market; and the price would escalate each year at 0.2 cents per thousand cubic feet. The contract was for 20 years’ duration, until 1975, with prices being renegotiable every five years. Pemex assigned to a U.S. technical service company, DeGolyer and McNaughton, the task of estimating periodically the quantity of economically recoverable gas reserves. Their estimates were to serve Pemex as a basis for determining how much gas might be delivered for export. Although the contract was arranged in 1955, exports did not begin until 1958.³¹

The new policy to export gas reportedly aroused political controversy and resistance within Mexico, despite the evident economic rationality of the export

²⁷ Bermúdez, 1963, p. 79.

²⁸ Ibid. The text reads as follows:

With this fundamental export principle in mind, the desirability or the undesirability of exporting gas depends essentially upon the following conditions:

1. Faced with the disjunctive proposition of either exporting gas or exporting crude oil, gas should be given the general preference since crude oil yields are both more varied and valuable than those of natural gas.
2. If natural gas can replace in domestic consumption a volume of residual fuel oil available for export, the latter (fuel oil) should be given export preference, since under present conditions, residual fuel oil brings higher returns (per B.t.u. equivalent) in the existing export markets.
3. If natural gas is required to replace a volume of fuel oil which must be transformed by cracking processes into light or middle refined products, natural gas should not be exported.
4. If the use of natural gas replaces fuel oil which has no other market, it would then be undesirable to use the gas domestically and it should be exported.
5. It is desirable to export gas only when there is a surplus with respect to the national demand as outlined above and allowing for an ample margin for contingencies. If, however, by not exporting gas, production in the fields would have to stop for lack of access to domestic markets, exception may be made.
6. In any case, only dry gas should be exported, i.e., natural gas from which all valuable liquifiable hydrocarbons have been extracted.

²⁹ Ibid., p. 80.

³⁰ Ibid. See also Bermúdez, *Report of the Director General, Petróleos Mexicanos*, Mexico City, March 18, 1957, p. 15.

³¹ Bermúdez, 1963, p. 80; Bullard, 1968, p. 297; and “Gas Purchase Contract,” September 27, 1955.

decision. The criticisms were very similar to those that would later be made regarding the 1977 negotiations. The squandering of Mexico's national patrimony, as well as the risks for Mexico's economic independence and state sovereignty, were all said to be at stake. And the opposition evidently emanated not only from nationalists (including industrialists) outside Pemex but also from conservationists inside Pemex. Bermúdez found his decision criticized from various directions, although not on a scale that prevented him from concluding the contract.

Besides proving remunerative for Mexico, the contract had a major side benefit. During the early 1960s it enabled Pemex, using the contract as collateral, to qualify for large credits from U.S. and French investors and thereby finance the construction of several important petrochemical and refining plants.

The Tradition Continues

During the 1960s and early 1970s, Pemex was not involved in any new negotiations with U.S. government agencies or foreign oil companies, except for the popular rescission of risk-contracts with a few American independents. Meanwhile, petroleum nationalism remained very alive. Thus, Bermúdez insisted, in his first major publication in 1963, that

It is illusory, and would be harmful, to pretend that petroleum produced and exported in large quantities could become the factotum of Mexico's economy or the panacea for Mexico's economic ills. Mexico does not wish ever to be forced to export such an indispensable energy and chemical resource. Neither does it wish to compete with or join a world oil combine which does not and could not have Mexico's best interests at heart.³²

Writing later in 1976 as a renowned spokesman of Pemex's petroleum traditions, Bermúdez essentially repeated this opposition to large-scale exports. Meanwhile, Directors General Reyes Heroles and Dovalí Jaime also argued against developing major exports. The view prevailed, as expressed in 1976 by a leading Mexican economic planner, that "To produce for export, whether crude or distillates, would signify a change of the greatest proportions in the industry."³³ This view remained intricately tied to larger conceptions of Mexico's domestic and foreign policy needs.

NEW CHALLENGES FOR MEXICAN NATIONALISM

Since 1976, the discovery of gigantic petroleum fields and Pemex's impressive technical achievements to develop them have presented new options for a radical expansion of its objectives.³⁴ Besides producing petroleum for domestic self-sufficiency, Pemex could become a major exporter. And besides promoting domestic

³² Bermúdez, 1963, p. 115.

³³ Leopoldo Solís, "El final de la frontera de recursos naturales," *Trimestre Político*, July-September 1976, p. 99.

³⁴ Some very interesting professional publications that neither U.S. nor Mexican social scientists have consulted and that provide many useful articles for tracing technical, institutional, and policy developments in the petroleum sector are *Revista del Petróleo Mexicano*, bimonthly publication of Pemex; *Revista del Instituto Mexicano del Petróleo*, quarterly publication of the Mexican Institute for Petroleum (IMP); and *Inginería Petrolera*, monthly publication of the Mexican Association of Petroleum Engineers. For example, the discoveries of Sitio Grande and Cactus in May 1972 were immediately reported in these professional publications.

economic development through subsidized energy prices, Pemex could earn vast export revenues. Because Mexicans have endowed petroleum and Pemex with such extraordinary societal significance, these potential innovations in petroleum policies present Mexican nationalism with radical symbolic challenges that have fomented profound controversies about Mexico's future options in almost all domestic and foreign policy areas.

Justifying Crude Exports: Short-Term versus Long-Term Issues

The concern is not simply whether Mexico should export crude. Pemex exported at low levels long before 1975, reaching a high of 38 thousand barrels a day in 1951. As long as crude exports remained at low levels, they could be easily reconciled with Mexico's national interests—for example, to balance the costs of petroleum-related imports, such as petrochemical and refined products not produced in Mexico, or natural gas to supply northern border states. However, present and prospective export levels are so enormous compared with the past that they raise sensitive qualitative questions.

The concern is whether higher levels of exports would be consistent with the traditional principles of Mexican nationalism. Mexico's leaders have justified crude export growth since 1976 both as a short-term necessity to resolve acute but temporary economic troubles and as the introduction of an important new long-term element in Mexico's policies. Thus, President López Portillo has declared that "Now we have to think about two things: how to administer the economic crisis the country is experiencing, and at the same time prepare for the administration of abundance. . . ."³⁵ The justification of exports as a short-term necessity has been widely accepted. However, this justification is viable only into 1980. Controversies about petroleum exports as a long-term policy remain far from resolution. Export growth during 1980 and after will depend primarily on how Mexicans perceive the long-term implications for the continuity and transformation of Mexican nationalism.³⁶

Short-Term Necessity (1976-1980). Mexico's current petroleum policies result largely from acute problems that climaxed during 1970-1976. The petroleum sector experienced a crisis because Mexico's proved reserves diminished, keeping pace with rising domestic demand required large imports, and world petroleum prices trebled. This crisis spurred Pemex to rapidly develop new oil fields discovered in the Southeast during 1972-1975. By 1975, Mexico had recovered to a position of net self-sufficiency in crude petroleum production to meet domestic demand. At the same time, Mexico's economy entered a financial crisis because of declining growth rates, an excessive foreign debt, private capital flight, a tardy peso devaluation, and widespread lack of confidence at home and abroad regarding Mexico's economic and political stability. This deterioration drove Mexico's government to accept a financial rescue operation mounted by the International Monetary Fund and international banks during 1976. Thus, when President López Portillo took office at the end of 1976, an urgent need existed to increase petroleum production

³⁵ Press conference, reported in *Excelsior*, January 29, 1978, p. 16.

³⁶ This theme appears in Centro de Estudios Internacionales, *Las perspectivas del petróleo Mexicano*, El Colegio de México, Mexico City, 1979; see especially the article by Samuel I. del Villar, "El significado del petróleo para la sociedad Mexicana: Perspectiva y síntesis del debate," p. 4.

to generate export revenues and restore international confidence in Mexico's ailing economy.

The exigencies of economic recovery have provided adequate justification for Pemex's exports from 1976 through the present. During 1977, President López Portillo spoke of the need to escape from a "financing trap" that was hindering Mexico's recovery and growth.³⁷ Director General Díaz Serrano maintained that exporting petroleum through Pemex "constitutes the best alternative to get out of this trap."³⁸ The Secretary of Patrimony and Industrial Development José Andres Oteyza added that "we will export oil and gas only as a temporary (*coyuntural*) measure in order to orient ourselves to a new program for medium-and long-term industrialization."³⁹ The leader of the independent National Association of Economists agreed that "present oil exports are justified because they are temporary to overcome the present crisis in the country."⁴⁰

This short-term justification for exports can only serve until 1980. President López Portillo divided his six-year term into three two-year phases: The first was devoted to recovery from the crisis; the current second phase is dedicated to consolidating the economy and getting rid of "bottlenecks" and other "circumstantial problems" in order to prepare for the final phase; and the third phase of new economic growth will begin confronting the "structural problems" of Mexico's economy.⁴¹ The economy is already recovered (and may be overheating). In 1980, the recovery and reconsolidation of the economy and the attainment of financial self-determination should be completed. At that time, it will no longer be possible to treat petroleum exports as a circumstantial deviation made necessary by an exceptional crisis.

Controversy in the Long Term (after 1980). As if to prepare for the transition, Mexico's current administration has advanced reasons for long-term exports simultaneously with the short-term rationale. The main point is that exports can generate financial resources and improve Mexico's negotiating position for the pursuit of long-range development goals. President López Portillo has asserted that Mexico now has its best chance in centuries, and perhaps its last chance, to vault itself toward a high level of socioeconomic development and that it could be considered unpatriotic not to take advantage of the opportunity. Following the President's lead, Díaz Serrano has further emphasized that, despite the risks inherent in development, "it is better to deal with problems generated by wealth than those that always accompany poverty."⁴² In Pemex's view, moreover, it is better for Mexico to export some petroleum now, while good prices and markets are assured, than wait for an uncertain future when petroleum's value may decline.

The new emphasis on long-range objectives in Mexico's export policies intensified during early 1978 when Pemex's technical achievements enabled the President to announce that the official "production platform" of 2.25 million barrels a day would be achieved in 1980 rather than in 1982, as originally targeted. For López Portillo, this achievement meant that "Now it is not just a matter of simply

³⁷ Speech reported in *El Día*, February 11, 1977, p. 7.

³⁸ *Report of the Director General*, Petróleos Mexicanos, Mexico City, March 18, 1977, p. 17.

³⁹ *Excelsior*, November 24, 1977. Pemex falls under the jurisdiction of the Secretariat of Patrimony and Industrial Development (Patrimonio/SEPAFIN).

⁴⁰ *El Sol de México*, March 28, 1978, p. B-1.

⁴¹ Speech reported in *El Día*, January 5, 1979.

⁴² *Report of the Director General*, Petróleos Mexicanos, Mexico City, March 18, 1978, p. 6.

delivering a potentiality to whomever succeeds me, but of determining in this administration what it is that we should accomplish with that resource surplus. And with that I want to assume before you a responsibility that I consider historic."⁴³ Petroleum would thus be used as "the fundamental support, the basic pivot" in the forthcoming efforts to get rid of misery in Mexico. This was necessary, he insisted, "because only by remedying the miseries (*males*) of the parents can we guarantee the security of the children."⁴⁴ Meanwhile, Díaz Serrano made the extraordinary claim that, given the new dimensions of Mexico's petroleum reserves, "the decision to export is not an optional conduct, but a patriotic imperative that should be accomplished for the good of the country."⁴⁵

Despite the apparent economic rationality of such arguments, the leaders' statements show some strain, as well as determination, in moving against the traditional currents of petroleum conservationism and nationalism in Mexico. Thus, according to the President, "There are those who want us to postpone this decision. They are the same ones who, not wanting the petroleum to be exploited now, also do not want us to go into debt. But the economy cannot work miracles. If there are no domestic resources and they do not come from abroad, hopes are dashed, and I do not want a Mexican people with dashed hopes."⁴⁶ And Díaz Serrano reportedly declared that "We either produce oil today, without further delays and puerile fears, using it immediately and to the limits of our strength and intelligence, in order to become truly more self-sufficient and masters of our fate, or we shall bitterly regret not having risen to the historic times through which we are living."⁴⁷

By now the internal debate has become heated over the long-term uses to which petroleum revenues could and should be put. Yet the current level of controversy may only be a warm-up for the debates foreseen for the period 1980-1982 when several critical developments will take place concurrently. During 1980, Pemex is scheduled to attain the latest production platform, which will require a decision to remain at that level or move higher. Petroleum export revenues, which until now have largely financed development within the petroleum sector, will begin to accumulate for investments elsewhere. The long-range economic planning efforts, which have been represented mainly by the National Industrial Plan and the Global Development Plan, will require definition of specific projects. And the approaching presidential succession will begin to influence high-level decisionmaking.

With these simultaneous developments, 1980-1982 might well bring a "crisis of success" for Mexican nationalism, as policymakers try to adapt their traditions to cope with the new opportunities confronting them at home and abroad. The terms of the emerging debate make it clear that the ultimate stakes are the fundamental principles of Mexican nationalism—sovereignty, independence, and dignity—and that any long-range justification for petroleum exports and petroleum-based development must derive somehow from flexible, modernized interpretations of these principles.

⁴³ Speech titled "En petróleo sigue izada la bandera de Cárdenas," March 30, 1978, p. 7 (pamphlet).

⁴⁴ *Ibid.*, p. 10.

⁴⁵ *Report of the Director General*, March 18, 1978, p. 11.

⁴⁶ "En petróleo sigue izada la bandera de Cárdenas," March 30, 1978, p. 10.

⁴⁷ Remarks made during the Report of the Director General, reported in *El Día*, March 19, 1978, pp. 8-10, but not included in the official version published by Petróleos Mexicanos.

The Fateful Triad: Sovereignty, Independence, and Dignity⁴⁸

Whenever petroleum and Pemex become foreign policy issues, as mentioned above, Mexicans manifest extreme sensitivity to questions of state sovereignty, economic independence, and national dignity. These three symbolic concepts constitute a powerful and fateful triad that often constrains the formulation of policy choices—even on such broad issues as economic development and social progress. What may appear to be narrow technical matters to Americans, such as the price of a product or other terms of a contract, may be viewed among Mexicans as sensitive political issues having profound implications for their country's future. Mexico's political leaders and policy intellectuals have been especially alert to matters affecting state sovereignty. They believe that the state is still not strong enough, that it stands at a critical stage of its development, and that it represents the only real bulwark against pressures from the United States. In their public debates, issues involving the United States are frequently interpreted more in terms of the risks for Mexico's sovereignty and freedom of action than in terms of the possible benefits for Mexico's economic growth—which is where Americans normally put the emphasis. For example, during 1973 Mexican leaders rejected direct American participation in developing Mexico's oil-rich Southeast—just as they have on other occasions rejected American economic assistance to develop the northern border economies—because this could compromise sovereignty over those outlying regions.⁴⁹ In this framework, sovereignty must take priority over development. It is better to sacrifice possible short-term economic benefits than compromise state sovereignty.

This does not mean that Mexican nationalists are inherently "irrational" and that they long so idealistically for sovereignty and independence as to disregard practical economics and shun pragmatic choices. Quite the contrary. Economists within Mexico's government have conducted detailed analyses of the effects of Mexico's petroleum development and revenue earnings on very practical issues, such as the inflation rate, excess liquidity, the balance of payments, and the overall "absorptive capacity" of Mexico's economy. There has been widespread concern to promote economic development and social progress throughout Mexico. But these practical issues are ultimately conditioned by the fateful triad of nationalist ideals.

The realities and ideals currently concerning Mexican nationalists are being integrated into an overall concept called the "National Project." The definition of this concept is subject to debate, perhaps an enduring debate. Yet, in whatever detail objectives for economic development and social progress are discussed, they are subordinate to the long-range enhancement of sovereignty, independence, and dignity for Mexico. What is in play is the vision of the future of Mexico. The stakes are highly political, including the outcome of Mexico's "dependency" on the United States, the role of the state within Mexico, and the role of Pemex within Mexico's institutional structure. For many nationalists, these stakes are as crucial as inflation rates and unemployment levels.

⁴⁸ This discussion is limited to Mexico's experiences with petroleum since 1938. A fuller discussion of Mexican nationalism would have to include other experiences, such as the loss of territory to the United States during the 1800s and the U.S. involvement in the Mexican Revolution beginning in 1910.

⁴⁹ On Mexican rejection of U.S. participation in developing Southeast Mexico, see Dovalí Jaime, *Report of the Director General, Petróleos Mexicanos*, Mexico City, 1973, p. 8; and remarks by Secretary of the Presidency Licenciado Hugo Cervantes del Río, reported in *Excelsior*, February 20, 1973.

As to future U.S. relations, the nationalist objectives reveal great ambivalence toward such concepts as interdependence, partnership, and community. They aim to reduce "dependence" and create "independence." The nationalists presume that reducing dependency will diminish Mexico's "vulnerability." They further presume that "interdependence," even though it could profit the economy, would be detrimental to Mexico's political position. It is extremely difficult, if not almost unthinkable, for Mexico's nationalist policy elites to reconcile the triad with interdependence, because of their fear of compromising the role of the state within Mexico.

As to the state, the nationalist objectives envision making it a fundamental force in Mexico's mixed economy, especially now that petroleum provides government elites with a new instrument for fortifying the government's roles in planning, directing, and benefiting from the mixed economy. The strength and stability of the Mexican government have traditionally relied on support from two institutional pillars—first, the PRI party, and second, the military. The government's proposed use of petroleum revenues suggests that growing importance will be given to a third pillar—state enterprises. If so, this could mean a major change in the institutional structure of Mexico's political and economic systems.

As to Pemex, the nationalist objectives aim to ensure that the industry remains a subordinate element within the government bureaucracy. Because of the traditions of petroleum nationalism, Pemex's new roles have aroused suspicions within some Mexican policy circles that the state enterprise is becoming too powerful and too autonomous in the pattern of a private transnational corporation. If so, it cannot be trusted as the guardian, trustee, and administrator of the public patrimony to operate entirely in Mexico's national interests. There is a new risk that U.S. companies could "colonize" an institution that by tradition symbolizes the conquests of Mexican nationalism.⁵⁰ Recent concern that its foreign involvements could embarrass and jeopardize state sovereignty, economic independence, and national dignity has provided traditional/leftist nationalists in particular with vital public issues, for example, the U.S.-Mexican gas negotiations beginning in 1977.

Symbolic Jeopardy: 1977 Gas Negotiations. The unfortunate course of the original gas-export negotiations during 1977, and the consequences during 1978, demonstrate the profound effect of this symbolic triad on Mexican political behavior. During 1977, Pemex laid plans for constructing a large-diameter pipeline to sell massive amounts of natural gas to the United States. At the same time, Patrimonio and Pemex representatives began sales negotiations with U.S. companies and the U.S. government. Pemex viewed the negotiations as a reasonable commercial transaction that would end a serious waste of gas during a period in which the industry pursued its goal of developing oil production. How Patrimonio viewed the negotiations is not clear, but its representatives played active roles in proposing that the U.S. government agree to Mexico's terms.⁵¹ At this time, Patrimonio was trying to establish jurisdiction over Pemex and its policies, as authorized by administrative reforms enacted during 1976.

During August, Pemex obtained the agreement of six U.S. pipeline companies to import the gas according to the terms proposed by Pemex and Patrimonio.

⁵⁰ Laurence Whitehead, "Petróleo y bienestar," *Foro Internacional*, Vol. 72, April-June 1978, p. 660.

⁵¹ As indicated by the chronology of events presented in Elizabeth Moler and James Bruce, *Mexico: The Promise and Problems of Petroleum*, Committee on Energy and Natural Resources, U.S. Senate, Washington, D.C., March 1979, pp. 157-162, and reprinted (translated into Spanish) in *Proceso*, March 19, 1979, pp. 6-8.

However, officials of the U.S. Departments of Energy and State questioned the Mexican terms of the agreement, and in October a U.S. senator introduced legislation to block a related Export-Import Bank loan that Mexico had requested for financing the pipeline project. Meanwhile, inside Mexico, reports of the project aroused so much political controversy that the Chamber of Deputies made an unprecedented decision to have Pemex's Director General testify before the Chamber in October.

Although there was concern with the economic costs and benefits of the project, compared with the alternative of liquefying the gas for export to diversified overseas markets, economic issues were subordinate. The project was attacked because it represented a huge investment and commitment to establish a long-term structural relationship with the U.S. energy market for the first time in Pemex's history. The stakes were clearly Mexico's independence, sovereignty, and dignity, as well as its resource conservation for future generations.

Critics, mainly outside the government, charged that the project would compromise these principles. It would increase Mexico's dependency on the United States, squander a nonrenewable resource, and further weaken Mexico's negotiating capacities. Mexico would become a strategic zone and risk possible military occupation during a crisis. The project would link Mexico's domestic infrastructure directly to the United States, which might treat the pipeline as joint property because of heavy U.S. financial investment and technological participation in its development.

Defendants of the gas export project argued that it would enhance Mexico's independence and sovereignty and that the country should take advantage of its improved negotiating position to conclude a profitable contract. Instead of increasing Mexico's dependency and vulnerability, the project would make the United States dependent on Mexico because of the worsening U.S. energy picture. Military threats were highly unlikely; moreover, Mexico's sovereignty would be protected by the international system.⁵²

While the debate continued within Mexico, Pemex began to construct the pipeline. However, actions taken by the U.S. Department of Energy during December 1977 put an end to the negotiating process.⁵³ Moreover, the DOE actions served to alienate supporters and further aggravate opponents of the gas export project within Mexico. Mexico's President, Pemex, and Patrimonio thus found their options confined both by the U.S. government and by traditional/leftist nationalism within Mexico—as had occurred in the past. The result was a special presidential decision reaffirming the dedication of Mexico's gas resources to domestic consumption, despite the economic opportunity cost. Mexico's President has claimed that the

⁵² The Director General's presentation and the ensuing discussion in the Chamber of Deputies are printed in the new magazine *Económica*, November 16, 1977, pp. 17-69. The views of a leading critic appear in Heberto Castillo and Rius, *Huele a gas: Los misterios del gasoducto*, Editorial Posada, Mexico City, 1977. Views of a major defendant of the original gas export project, who now agrees with the political vision of the critics, are given in Jesús Puente Leyva, "Relaciones México-Estados Unidos: Oportunidad estratégica y desafío político del petróleo," January 1979 (mimeographed). See also the articles by the above critics in *El Economista Mexicano*, March-April 1978, special issue on "Energéticos en México y en el mundo."

Two U.S. academic reviews are Richard E. Fagen and Henry R. Nau, "Mexican Gas: The Northern Connection," in Richard E. Fagen (ed.), *United States Foreign Policy and Latin America*, Stanford University Press, Stanford, Ca., 1978; and George W. Grayson, "Mexico and the United States: The Natural Gas Controversy," *Inter-American Economic Affairs*, Winter 1978, pp. 3-28.

⁵³ By now it is clear that all sides, Mexican as well as American, made some errors, overplayed their hands, and lacked correct information about how the other side's government worked.

affair had weakened his personal sovereignty and dignity before his people, thereby constraining his ability to initiate further negotiations with the U.S. government in all major issue areas throughout 1978.

Since early 1979, the bilateral climate has improved, and an agreement has been concluded to export a small amount of gas to the United States through an old pipeline. Yet Mexico remains determined not to allow massive exports to the United States.⁵⁴ And its policy elites now seem more careful than ever to treat substantive points—such as volumes, prices, and delivery terms for gas that possibly might be sold—as symbols representing a public test of the best traditions of Mexican nationalism. This may provide a justifiable framework within which to exercise Mexico's new negotiating capacity, but it may also obligate the negotiators to adopt positions (e.g., demanding a very high gas price) that seem to favor risking failure rather than compromise.

Isolationism versus Internationalism. As the gas export controversies reveal, some expressions of Mexican nationalism convey a strong desire for self-sufficiency and autonomy. The ultimate philosophical vision is of a Mexico that can afford an autonomous, almost hermetic, isolation from the rest of the world, and especially from the United States. Therefore, independence, sovereignty, and dignity would be greatest when self-sufficiency is greatest, and self-sufficiency would be greatest when no foreign involvements are necessary, because these inevitably lead to entangling compromises and some form of dependency and exploitation. National identity would be most secure if Mexico were self-sufficient.⁵⁵

This philosophical tendency emerges in Mexican nationalist thinking that interprets both exports and imports of basic commodities as indicators of dependency. For example, in the early 1970s petroleum imports were viewed as signs of Mexico's growing dependency and vulnerability; now the prospects of major oil and gas exports are subjected to similar interpretations. Although this tendency is most noticeable in the petroleum area, it also emerges in other issue areas. Food production in particular is providing controversial choices: whether to avoid impending food shortages by encouraging export crops based on comparative advantages while importing the necessary cereals and foodstuffs, or whether to emphasize domestic food production even if this requires sacrificing remunerative food exports. Economic rationality seems to favor the former option. But traditional nationalists claim that this choice would increase dependency and vulnerability and thus favor the option of becoming as self-sufficient as possible.

Although this philosophical strain in Mexican nationalism does not dominate government decisionmaking, it appears to be widespread, inside and outside the government, and it does constrain the policy choices that are available to the government. Nationalist principles cannot be ignored in any major decision. They must be confronted in efforts to make fundamental changes in Mexico's domestic and international circumstances.

Various statements by President López Portillo show his concern about isolationist tendencies in Mexican nationalism and his desire to lead the way toward establishing new principles of Mexican internationalism. He has emphasized

⁵⁴ Current export policies seem to reflect those initially prescribed by Bermúdez in the mid-1950s. See above, note 28.

⁵⁵ Octavio Paz, *The Labyrinth of Solitude: Life and Thought in Mexico* (Grove Press Inc., New York, 1961, translation of Spanish original) helps to clarify this philosophical tendency in Mexico's culture.

achieving self-determination as the proper goal—not self-sufficiency. And he has spoken against the simplistic assumption that Mexico could or should isolate itself from the world of trade because of the new petroleum resources. Accordingly, "we cannot live isolated; but trading does not mean being dependent; it means exchanging."⁵⁶ His approach indicates that self-sufficiency and exclusivism are inappropriate objectives for Mexico and that defensive intentions to protect national independence and sovereignty are inadequate bases for foreign policy decisions. Mexico lives in a world characterized by interdependence and exchange and must participate in helping transform the international system so that nations treat each other as coequal sovereignties according to universalistic principles.⁵⁷

What these ideas mean is not clear. So far, however, neither Mexican nationalism nor emergent internationalism have encouraged Mexico to join OPEC. A very practical reason for Mexico not to join OPEC is that it would risk losing U.S. trade preferences, as has happened to such OPEC members as Venezuela and Ecuador under the U.S. Trade Law of 1974. This could prove costly to Mexico because more than two-thirds of its trade is with the United States. Apart from this economic deterrent, however, there are other reasons for Mexico not to join OPEC. Indeed, the very nationalist ideals that caution Mexico to keep petroleum exports low, and to diversify export destinations away from the United States, also discourage Mexico from joining OPEC.

Many Mexican leaders have repeatedly declared that Mexico's interests and traditions would not be served by membership in OPEC.⁵⁸ To join as a member might subject Mexico to new rules (e.g., pricing constraints, production quotas, market restrictions) that would restrict the country's freedom of action, lessen its negotiating capacity and commercial flexibility, and expose it to new pressures from the industrial powers—all contrary to Mexico's intense desires for self-determination. Although Pemex respects OPEC's position and policies, Díaz Serrano has declared that "we do not want to bind or join the fate of our petroleum industry with international fate and control. We believe that our independence is better for national interests than association with OPEC."⁵⁹ Moreover, "because of special historical circumstances, we have chosen the path of self-determination and we are not going to join OPEC."⁶⁰ Meanwhile, Mexico can still benefit from OPEC's existence, especially by paralleling its pricing policies.

⁵⁶ Translation of reportage in *Excelsior*, April 9, 1978, pp. 1, 8.

⁵⁷ Ibid.; and the President's speech on the state of the nation, *Excelsior*, September 2, 1978, p. 33-A.

According to the translation of an interview reported in *El Día*, February 11, 1979, p. 6, President López Portillo stated:

I have always maintained that Mexico's traditional stance—non-intervention, the peaceful resolution of differences, self-determination—was the substantially defensive approach of a country in the process of decolonization, but that many problems are not resolved with defensive approaches. Therefore, we must move forward and seek the big solution within an order that is felt to be increasingly necessary and important, because the basic problems in creating it are economic, and as long as the jungle of international relations is not put in order and until nations coexist in what I would call a civil society, many problems cannot be resolved, because self-determination, nonintervention, and the peaceful resolution of differences are not enough. The force of economics has to be organized. That will be my accent.

⁵⁸ See the quote from Bermúdez on p.55. Detailed, historical discussions of Mexico's reasons for not joining OPEC appear in George W. Grayson, "Mexico, the United States, and OPEC," May 1979 (mimeographed); and Edward J. Williams, "Mexico, Oil and the OPEC," *Latin American Digest*, Fall-Winter, 1977-1978, pp. 4-6.

⁵⁹ Speech reported April 20, 1978.

⁶⁰ Remarks made in Venezuela, June 5, 1979, reported in the *Foreign Broadcast Information Service*, June 7, 1979, p. V-1.

President López Portillo has stated that in the future Mexico might rethink its position about joining OPEC. But for now his priority is not to have Mexico join, "because we think that if decisions are to be made in the field of petroleum, such decisions ought to be general, universal, and in keeping with the new economic order" to be promoted through the United Nations.⁶¹ Nonetheless, the President's speech before the United Nations in September 1979 did not clarify just how Mexico's elites envisage harmonizing the nationalist and internationalist strains in current Mexican policy thinking.

How Mexico's policy elites decide to fuse the traditional principles of Mexican nationalism with the emergent principles of Mexican internationalism will be crucial for the future formulation of Mexico's petroleum policies.⁶² For the fusion to succeed, it will have to deal with a possible contradiction. On one hand, the petroleum factor provides Mexico with great new opportunities and capabilities to realize the traditional principles. On the other hand, Mexico's petroleum situation suggests that those traditional principles, although necessary, may not be sufficient for framing Mexico's policy choices and roles in the years ahead. The petroleum factor thus presents a difficult, long-term challenge for Mexicans: to maintain the continuity of past nationalist traditions, which emphasize defending Mexico against foreigners, and simultaneously to achieve a transformation within those traditions, so that positive international roles extend from them.

Nationalism is still relevant, but it will require reformulation to deal with Mexico's radically changed situation. The outcome of such rethinking will affect Mexican receptivity to U.S. policy concepts, such as interdependence, partnership, and community-building, that envisage a closer, more cooperative relationship in all issue areas in the decades ahead. In addition, Mexico's policies toward current instability in the Caribbean and Central America may have profound importance for the future of Mexican nationalism.

Fortunately for Mexico as well as the United States, Mexican nationalism is not written in stone. It is not explicit dogma or ideology that prescribes how Mexico's leaders respond to new situations. Nationalism is transmitted more as an indefinite mindset within Mexico's political culture and assumes a variety of expressions. The nationalism espoused by private businessmen is different from that of policy intellectuals. Indeed, different political factions and institutions often compete for legitimacy and attention by using the same nationalist language, but they apply different interpretations that reflect their own immediate values and interests. For example, the interpretations of common concepts such as "economic independence" and "rational use of petroleum resources" are often widely divergent and even contradictory depending on who is speaking.

⁶¹ Translation of an interview in *El Día*, February 11, 1979, p. 6.

⁶² Mexico has a long and honored history of working to establish equitable international principles, which it uses to guide bilateral negotiations with the United States. Its new Foreign Minister, Jorge Castañeda, has made important contributions to this diplomacy, as seen in his articles "Revolution and Foreign Policy: Mexico's Experience," *Political Science Quarterly*, September 1963, pp. 391-417, and "En busca de una posición ante Estados Unidos," *Foro Internacional*, Vol. 74, October-December 1978, pp. 292-302.

In his address on June 6, 1980, to the 42d Annual Conference of the Council on Foreign Relations in New York, Foreign Minister Castañeda stated: "Mexico has left behind the cautious and somewhat defensive attitude that for years marked its international behavior and has now begun to play an active role in world affairs, with all the inherent risks and problems." He further declared, "In order to defend its specific interests, Mexico's present situation requires it to participate more actively in international life."

Although the traditional principles of Mexican nationalism lend themselves to close-minded and intolerant views of U.S.-Mexican relations, in practice these same principles can be adapted to flexible, pragmatic, and innovative interpretations. Otherwise, Mexican nationalism would lack the capacity to evolve in response to new material changes in Mexico's situation at home and abroad. A question Mexico's leaders will face is how to blend symbolic elements of the traditional principles together with empirical assessments of Mexico's changed situation in order to expand and modernize the limits of tolerance without harming the essences of Mexico's independence, sovereignty, and dignity.

Such change will take time. Many Mexicans sense that time, like petroleum, is now on Mexico's side. But political time, like petroleum, is a nonrenewable scarce resource that should be used rationally in the present to guarantee the well-being of future generations. It appears that neither the Mexicans nor the Americans made effective use of the time "window" for conducting governmental negotiations over gas and other important concerns during 1978 and 1979. Mexican commentators have typically blamed the Americans for making mistakes and creating difficulties in these negotiations, but a complete explanation must include a critical analysis of the influence that traditional Mexican nationalism has had on Mexico's negotiating behavior.

A Maximum Nationalist Export Level: No More Than 49%?

According to extreme interpretations of the traditional principles of Mexican nationalism, zero petroleum exports would be the best policy. However, other versions of nationalism indicate that not all Mexicans are hostile to long-term petroleum exports.

What would be the highest export level that would still be consistent with the traditional principles? Mexico's policy elites have yet to determine a long-term export ceiling. But there are indications that a tentative criterion has emerged in some Mexican policy thinking.

This potential criterion appears to assume that exports may remain consistent with the traditions of Mexican nationalism as long as Mexico does not export more petroleum than it produces for internal consumption. Specifically, there is a tendency to believe that total petroleum exports should never exceed 49% of Pemex's total petroleum production; at least 51% and preferably more must be reserved for domestic consumption. (Total petroleum production should properly include natural gas as well as oil.)

Several points suggest that this "formula" is implicit in recent Mexican policy considerations. The relationship certainly held for the original 1980 production platform of 2.25 million barrels a day, of which only 1.1 million was supposed to be exported. In the words of one Mexican policy intellectual, reserving the majority for domestic consumption follows "the unwritten rule set down by the 1938 nationalization: that oil is a nonrenewable resource and must be used primarily for internal development."⁶³ A recent projection of Pemex production to 1985—moving to 3.0 million barrels a day with 1.35 million available for export—kept this rela-

⁶³ Carlos Fuentes, "Listen Yankee! Mexico Is a Nation, Not an Oil Well," *The Washington Post*, February 11, 1979, p. L-4.

tionship intact, with exports never exceeding domestic consumption.⁶⁴ Holding export volumes below 50% of total production might be consistent with Mexico's preference not to join OPEC and might offset pressures to do so.⁶⁵ Although these suggestions for a nationalist formula to guide export levels emanate solely from the petroleum sector, further grounds for such a formula can be found in the rules governing the economy at large. In particular, the 1973 Law To Promote Mexican Investment and Regulate Foreign Investment establishes a formula for "Mexicanization" whereby, as a general but flexible rule, foreign investors may not control more than 49% of the capital (e.g., fixed assets) of business enterprises in all areas not otherwise regulated.⁶⁶

Thus, it seems reasonable to suggest that, in order for traditionalists to feel export policies are consistent with the principles of nationalism, Mexico would have to limit exports to 49% or less of total Pemex production, with 51% or more remaining dedicated to domestic use. Although there have been many claims that Mexico's export levels will depend primarily on the country's needs for financial revenues, this tentative criterion invokes an upper limit that would have little bearing on econometric calculations of Mexico's absorptive capacities and foreign exchange requirements. However, such calculations could determine how close to the 49% level Mexico might go, especially in the near term. The criterion also has little bearing on petroleum production capacity and artificial reserves-to-production ratios that are frequently used to project Mexico's export potential. Although Pemex currently estimates the reserves-to-production ratio to be 60 years, in the long term Mexican concerns to preserve adequate reserves and assure domestic self-sufficiency might become a factor in determining how close to approach the 49% limit.

The "formula" has some curious implications. If it proves true, the best basis for projecting future maximum export levels is the level of domestic consumption of petroleum products and natural gas. Consumption is growing at a rate of between 7% and 8% a year, which implies limits on future export possibilities.⁶⁷ Raising the low domestic energy prices toward world levels, in order to promote energy conservation and efficiency at home, could mean less domestic consumption—and thus less exports. Substituting gas for oil or vice versa within Mexico would not affect the overall export level for petroleum (both oil and natural gas). The successful development of alternative energy systems, such as nuclear power, could reduce domestic oil and natural gas consumption, and thus lower the potential

⁶⁴ See the article in *Oil and Gas Journal*, June 25, 1979, pp. 52-53, based on Philip R. Woodside of the U.S. General Accounting Office, "Comments on Oil and Gas Reserves in Mexico," June 1979 (mimeographed).

⁶⁵ What export level may qualify a country for OPEC membership is unclear. According to OPEC's statutes, "Any country with a substantial net export of crude petroleum, which has fundamentally similar interests to those of Member Countries, may become a full Member of the Organization, if accepted by a majority of three-fourths of the Full Members, including the concurrent vote of all Founder Members." See *The Statute of the Organization of the Petroleum Exporting Countries*, published by The Information Department, OPEC, Vienna, November 1971, Chap. II, Art. 7, para. D, p. 7. Obviously, "a substantial net export of crude petroleum" is a phrase open to political interpretation.

One interpretation is that the producing country exports at least half of its total production, consuming (and importing) the other 50% or less to meet domestic demand. This explanation was given in a news commentary in *El Sol de México*, May 29, 1977, p. 5.

⁶⁶ In this vein, Pemex has expressed pride that more than 50% of the investment capital for constructing the gas trunkline from southeastern Mexico came from domestic sources.

⁶⁷ Mexico has a high domestic energy demand growth rate, but also a very low energy consumption per capita.

export level. However, developing energy-intensive export industries, such as petrochemicals, could mean higher domestic crude consumption, and thus higher export potentials. And socioeconomic development programs that serve to raise energy consumption per capita could also imply higher export potentials.

It is possible, of course, that Mexico will produce more petroleum for export than for domestic use during the 1980s. Most non-Mexican projections indicate that will be the case. If so, the "formula" we have presented here would not prove true. Nonetheless, the day that exports exceed domestic consumption will not pass unnoticed in Mexico. Such a development could cause some symbolic strain on Mexican nationalism. However, it could mean that Mexico's leaders have succeeded in formulating internationalist principles and national objectives that can accommodate what might otherwise represent a serious violation of old nationalist standards.

POTENTIAL IMPLICATIONS FOR U.S. POLICIES

As we have discussed, petroleum and Pemex represent "symbolic realities" that exert a powerful influence on the essences of Mexican nationalism: state sovereignty, economic independence, and national dignity. How these essences are treated, by Mexicans and by foreigners, will profoundly affect how Mexico determines its petroleum export policies. Some potential implications for U.S. policies are as follows:

- The United States should not plan for Mexico to develop a petroleum production profile that will entail rapid production increases to high export levels during the 1980s.⁶⁸ High export rates would be inconsistent with traditional nationalist principles.
- Nationalist principles require diversifying petroleum exports away from the United States toward other markets among the advanced industrial nations and in the Third World. The objective is to reduce "dependency" on the U.S. economy, partly on the premise that less dependency will mean less "vulnerability" for Mexico. Yet this objective, like others, is tempered by a pragmatic concern to maximize income revenues, per barrel, through sales to the "natural" U.S. market.
- The same symbolic principles that aim to keep export volumes low and away from the United States also aim to keep Mexico from joining OPEC. Mexico's leaders aspire to maximize independence and self-determination for their country; joining OPEC might compromise their freedom and flexibility of action.
- Mexican nationalism and recent petroleum policies imply a tentative criterion: The maximum export level that could be kept minimally consistent with the traditional principles of Mexican nationalism would be an export level amounting to no more than 49% of total Pemex production, with 51% or preferably more destined strictly for domestic consumption.

If the criterion proves true, it means that the best indicator of potential future export levels will be the level of domestic crude petroleum con-

⁶⁸ This conclusion coincides with the findings of Sec. II, which examined the resource base and technical production possibilities.

sumption. If the "formula" does not prove true, this could mean a serious symbolic strain in traditional nationalism, or possibly a modernizing transformation.

- Past U.S.-Mexican negotiations on petroleum indicate that no other issue area is so likely to mobilize intense expressions of traditional/leftist nationalism within Mexico. This reaction normally imposes constraints on the options open to the Mexican government and forces its bureaucratic politics and negotiations to emphasize the defense and affirmation of the traditional principles. Even technical negotiating details may be treated as important political issues affecting Mexico's sovereignty and independence.
- Past encounters demonstrate that Mexico's policymaking elites ascribe high priority to state sovereignty because they believe that the state is still not strong enough, that it stands at a critical stage of its institutional development, and that it represents the only real bulwark against U.S. and other foreign pressures. Thus, petroleum (and other) issues involving the United States will normally be treated more as a risk for Mexico's sovereignty and the state's roles within Mexico than as an opportunity for economic or technological benefits. According to nationalist principles, U.S. policy initiatives to assist Mexico's economic development should be rejected if they could compromise political sovereignty.
- Dealing with petroleum provides Mexico with great new opportunities and capabilities to promote the traditional principles of Mexican nationalism. At the same time, dealing with petroleum reveals the insufficiency of those principles for Mexico to frame its domestic and foreign policies in a radically changed situation. The petroleum factor thus presents a difficult long-term challenge for Mexicans: maintaining the continuity of past nationalist traditions that emphasize defending Mexico against foreigners, while simultaneously achieving a future transformation within those traditions in order to extend its international roles.
- The strain of this challenge is, and will be, most evident in Mexico's dealings with the United States. The traditional nationalism implies that entanglement and interdependence with the United States could easily increase Mexico's vulnerabilities. Although the petroleum factor gives Mexican negotiators new bargaining leverage to adopt tough positions, the desire to exhibit nationalism may be a stronger force in driving them to pursue uncompromising postures whenever petroleum relations become highly publicized.
- To improve U.S.-Mexican relations, U.S. policies must show increasing sensitivity to and respect for Mexican nationalist principles. To do so successfully, U.S. policy actions may have to be more responsive to Mexico's sense of sovereignty than to what Americans consider economic rationality. However, to the extent that Mexican nationalism affects U.S.-Mexican relations, it seems likely to constrain negotiations on petroleum matters and discourage receptivity to overall policy concepts such as interdependence, partnership, and community. If greater U.S.-Mexican cooperation is to be achieved in the future, and if Mexico's leaders are unable to adapt old nationalist concepts to meet new realities, U.S. policymakers

may have to wait for a more advanced formulation of Mexican internationalism that will accommodate increased bilateral relations.

Symbolism matters, but so does substance. Too much attention to symbolic sensitivities can make the policy dialogue stale, unproductive, and defeatist. As we wrote in an earlier paper on past negotiating encounters,

This sensitivity to Mexico's dependence has constrained both governments to treat the issues in an ad hoc fashion, in isolation from each other, and to avoid explicit bargaining and negotiations. Respecting symbolic sensitivities has taken precedence over resolving the issues. Ritual dialogue has proven safer than substantive reciprocity.... The resulting picture often resembles a kind of disagreeable stand-off.⁶⁹

Thus, symbolic differences have been exploited in the past for purposes of psychological manipulation and defensive rhetoric, often designed to delay policy decision by the other side's government. Future issues are sufficiently urgent and important, however, that waiting games and delaying tactics could prove costly for both sides. If U.S. policymakers are to take increasingly respectful and serious account of Mexico's traditions in petroleum and other issue areas, they will surely need substantive indications that these traditions are open to positive negotiating outcomes.

⁶⁹ David F. Ronfeldt and Cesar D. Sereseres, *Treating the Alien(ation) in U.S.-Mexico Relations*, The Rand Corporation, P-6186, August 1978, p. 20.

IV. IMPLICATIONS FOR U.S. INTERESTS, OBJECTIVES, AND OPTIONS FOR THE 1980s

Mexico's petroleum resources and policies are of vital interest to the United States in two major areas: U.S. energy security and U.S.-Mexican relations. Both are of long-term as well as immediate concern. The first involves not only resolving the problems of oil import dependence during the next decade, but also diverting the world energy economy from conventional petroleum resources during the next half-century. The second affects currently sensitive issues such as immigration, trade, and border relations, and poses critical questions for the long-term evolution of the U.S. economy and society.

This section offers a framework for guiding future U.S. policy toward Mexico's petroleum. Proceeding from an assessment of U.S. interests, we identify key issues for U.S.-Mexican energy relations, suggest preferred policy objectives, and identify possible long-range policy concepts. Our approach takes into consideration Mexico's apparent interests and likely petroleum policies.

PREVAILING ASSUMPTIONS IN U.S. PUBLIC POLICY DISCUSSIONS

Recent public policy discussions in the United States have focused on several interrelated assumptions concerning U.S. policy toward Mexico. These assumptions are (1) that Mexico's petroleum is vital to meeting U.S. energy needs, (2) that the United States can exert a strong influence on Mexico's petroleum policies, and (3) that Mexico's petroleum should be the core issue of general U.S.-Mexican relations. Although these assumptions are much more common outside than inside the U.S. government, they have clearly shaped expectations concerning what U.S. policy toward Mexico should attempt to accomplish.¹

Presumptions Regarding U.S. Energy Needs

Mexico's large petroleum reserves are expected by many to make a dramatic difference for U.S. energy security during the next several decades. As indicated earlier, Mexico has been hailed as another Saudi Arabia, perhaps even another Middle East, with the potential to become one of the world's largest oil producers by 1990. High rates of production and exports from Mexico could reduce considerably the dependence of the United States and its allies on the oil resources of the Middle East. Large oil imports from Mexico promise deliverance from the frustrations of juggling oil supply security and Arab-Israeli relations. Mexico's oil exports also offer relief from the threat of embargoes and other forms of political blackmail that rely on the oil weapon. Mexico and hence Mexico's oil do not appear to be

¹ Although the majority of views in U.S. public policy discussions have evinced great optimism and enthusiasm for Mexico's petroleum, rather different views have sometimes influenced policy discussions inside the U.S. government. These views assume that Mexico's petroleum is not nearly so important for U.S. energy security as many would claim, and that determined U.S. initiatives to influence Mexico's petroleum policies would not be worth the effort.

vulnerable to a takeover by a foreign power hostile to the United States. Mexico's oil can be shipped to the United States over short, readily defensible routes. Besides its role in enhancing U.S. energy security, the prospect of large petroleum resources across the border has even led some to believe that the United States will not face serious energy problems in the next decade.

One basic conclusion from this line of reasoning is that the higher the level of Mexico's petroleum exports, the better U.S. interests are served. High Mexican oil production and exports are seen as virtually costless ways of enhancing U.S. energy security. A rapid acceleration in Mexico's oil production and exports to the highest levels that are technically possible is thus postulated to be the best production policy for the United States. The destination of Mexico's exports is only a secondary consideration. Some believe that U.S. interests are best served if most of Mexico's oil exports are shipped to the United States. Others believe that the destination is relatively unimportant as long as the export level is high. Even if a sizable proportion of Mexico's oil exports are shipped to Western Europe, Japan, Israel, and the Latin American countries instead of to the United States, the market power of OPEC would still be weakened, reducing the dependence of major U.S. allies on Middle East oil.

Mexico's oil is important not only for the general behavior of the world oil market, but it also promises to be important to the United States during major disruptions in oil supplies. Should another embargo occur or should military action or revolution curtail supplies from the Persian Gulf, Mexico, if it has excess production capacity, could compensate for the resulting shortfall by quickly increasing production. Mexico's oil thus may offer relief from both the chronic and the acute problems of the world oil market.

Presumptions Regarding U.S.-Mexican Relations

The presumed importance of Mexico's petroleum to U.S. energy security has led many to conclude that energy should take precedence over other issues in U.S.-Mexican relations. The primary objective of U.S. policy should thus be to get Mexico to increase its petroleum production and exports as rapidly as possible. That U.S. policy *could* achieve this objective is regarded as self-evident. The major question is *how* this objective should be achieved. Some favor positive means, suggesting that the United States offer Mexico concessions or incentives in other issue areas, such as trade and immigration, to induce it to increase production. Even more ambitious proposals recommend such measures as a special energy treaty between the United States and Mexico or the creation of a common market based on energy trade. Others have proposed negative means, suggesting that the United States use whatever leverage it has in other issue areas, such as trade and immigration, to compel Mexico to raise production and exports. Whether the views recommend carrots or sticks, the guiding assumption is that oil is too important not to dominate U.S. policymaking toward Mexico.

Presumptions about the Interplay between Security and Interdependence

This entire line of reasoning emphasizes the importance of Mexico's petroleum for U.S. energy security and the stability of the world petroleum market. The significance of Mexico's petroleum for U.S.-Mexican relations and for Mexico's own

future is usually treated as a secondary matter—considered less for its intrinsic importance than as a complex arena in which to seek leverage to raise Mexico's petroleum exports to levels more in tune with perceived U.S. energy security interests. Some believe that there should be no conflict between U.S. interests and Mexican interests, the casual assumption being that what is good for the United States would ultimately be good for Mexico. Others have recognized the possibility of conflicting interests between the two countries and have sought to identify common or intersecting interests as a positive basis for improved U.S.-Mexican relations and hence as a foundation for larger production and exports. But even those with positive approaches appear willing to risk problems in U.S.-Mexican relations and in Mexico's economy for the sake of enhancing U.S. energy security.

In sum, the U.S. public policy dialogue on Mexico's petroleum has generally emphasized that U.S. interests in energy security deserve paramount attention compared with U.S. interests in U.S.-Mexican interdependence. There has been only occasional notice—mainly from experts on Mexico—that strong emphasis on near-term U.S. energy interests may lead to policies that conflict with, or at least diverge from, long-term U.S. interests in having a stable, cooperative, and productive neighbor.

The Mexican Mirror

Public policy discussions within Mexico have focused on perceptions of U.S. interests and objectives that are very similar to those that predominate in the United States.² Petroleum is seen as the one factor that makes Mexico important to the United States. The combination of Mexico's extensive petroleum resources, the great U.S. appetite for petroleum, and the proximity of the two countries make it inevitable that Mexico be identified as a critical and strategic source of supply for the United States. Mexico's importance is enhanced by the fact that it is not in the Middle East, is not an Arab country, and is not a member of OPEC—and is therefore free of the associations that otherwise appear to hobble the exercise of U.S. power.

The predominant view in Mexico is that U.S. interests would be served best by increasing Mexico's petroleum production and exports as rapidly as possible, even if this means a relatively rapid depletion of Mexico's reserves. Current levels of production and stated production goals are seen as being too low for U.S. interests. It would also be in U.S. interests to have most of Mexico's petroleum exports go directly to the United States, rather than provide indirect benefits by being diffused throughout the world market. Mexico's petroleum is seen as being particularly essential to the United States during crises in the international oil market.

These perceptions in Mexico assure that U.S. policies, regardless of the language they use and the means they employ, are viewed as designed to pressure Mexico into exploiting its petroleum to the advantage of U.S. energy security. Except possibly for the ultimate U.S. interest in preserving political and economic stability in Mexico, other U.S. interests, objectives, and policies toward Mexico, such as in the areas of trade and immigration, are seen as serving U.S. energy

² Mexico's policy analysts have not understood that some views that have influenced policy discussions inside the U.S. government depart from the majority views expressed in public discussions (see footnote 1 above).

objectives. Many Mexicans worry that the long-term result will be the integration and subordination of Mexico's economy to that of the United States.

Mexican perceptions of U.S. interests and objectives toward Mexico's petroleum mirror the dominant assumptions of the U.S. public policy discussion in many key respects. However, because these perceptions are filtered by Mexican nationalism and a more acute awareness of Mexico's own concerns and goals, the interests and objectives of the United States are viewed in a predominantly negative light.

Toward a New Assessment of U.S. Interests and Objectives

Our research leads us to doubt the validity and adequacy of many elements in the "conventional wisdom" that prevails in the public policy discussions in both countries.³ In what follows, we propose an alternative assessment that still accords major significance to Mexico's petroleum as a factor affecting key U.S. interests and policies. However, whereas many analysts only stress the near-term importance for U.S. energy security, we also emphasize the potential long-term implications for U.S.-Mexican interdependence. Whereas many observers have posited an almost linear correlation between the level of Mexico's petroleum exports and the presumed benefits for the United States, we argue that a moderate Mexican production/export profile would avoid the shortcomings of both high and low rates of production and thus would be of the greatest overall benefit to the United States. Although many analysts have recommended a major U.S. policy effort to stimulate Mexican oil exports, we foresee that Mexico's definition of its own interests will result in a production/export profile close to the one most beneficial to the United States. Thus, we find no strong reasons why the United States should use special pressures or concessions to make Mexico export petroleum at high levels. The current pace of Mexico's petroleum development seems adequate and reasonable. Under some crisis conditions, a short-term surge in Mexican production could be important. Under normal market circumstances, it would be convenient but not necessary that most oil imports go directly to the United States. Perhaps more important is that petroleum revenue earnings are used to purchase U.S. goods and services.

From these and other findings discussed below, we conclude that U.S. interests are best served by "optimizing" Mexico's petroleum exports over the long term, not by "maximizing" such exports over the near term. Mexico's petroleum cannot solve the problems of U.S. energy security. At best, it is only part of the solution. Treating Mexico as the cheap solution to U.S. energy problems could prove very costly to other important U.S. interests.

MEXICO'S PETROLEUM AND U.S. INTERESTS

This section briefly examines U.S. interests in two areas of concern, U.S. energy security and U.S.-Mexican relations, as a prelude to assessing what Mexican petroleum policy outcomes would be preferable for the United States.

³ Our assessment also differs from the influential views that have been voiced in policy discussions within the U.S. government (as mentioned in footnotes 1 and 2).

U.S. Energy Security

During the 1970s, energy security became a major policy issue in the United States. Although it appeared in the rhetoric of U.S. energy policy before the 1970s, it did not become a salient concern until we began to experience a lack of energy security. Because our national experience with energy security as a serious problem has been so brief and because the political and economic dimensions of energy security are complex, there is still no consensus as to what may be an acceptable level of energy security. Recommendations vary from total autarky (no energy imports), to limited imports from secure sources only, to imports from both secure and insecure sources backed up by emergency storage. Conceptual disagreements aside, both the level and the composition of energy imports are now recognized as central to the problem of energy security.

Although the United States did import oil before 1970, the import situation did not pose substantial security problems. Oil imports supplied less than one-fourth of total U.S. oil consumption. Both the absolute level of oil imports and the proportion of imports in the total supply increased at only a slow rate from 1950 to 1970. During this period, the absolute increase in domestic oil production was more than double the increase in imports. Moreover, oil imports were cheap—so cheap that import quotas were promulgated to protect domestic oil producers. There was little concern about the security of U.S. oil imports, because most originated in the Western Hemisphere, particularly in Canada and Venezuela.

After 1970 the situation changed dramatically. Domestic oil production began to decline from its all-time peak in 1970. Domestic production of natural gas, which was the most important source of additional energy in the United States during the 1960s, reached a production plateau. As energy prices continued their downward decline, domestic energy demand continued to grow rapidly. The result was an explosion in oil imports. Total imports nearly doubled, and crude oil imports grew nearly 150% between 1970 and 1973. The composition of imports by country of origin changed sharply as well. Eastern Hemisphere sources provided more than half of the increase in total imports, and their share of total imports expanded from 16% to 36%.

The pressure that this shift created in the world oil market set the stage for the sharp increases in world oil prices that began in late 1973. World oil production could no longer continue to increase at the rates it sustained during the 1950s and 1960s. The demand for ever larger absolute annual increases in production was frustrated by a sharp decline in the amount of oil discovered since the early 1960s. Amid the confusion of conflicting interpretations and often counterproductive policies during the mid-1970s, Americans experienced an oil embargo, occasional shortages, and a more than doubling of real petroleum product prices. As the exporting countries changed their policies, U.S. dependence on OPEC oil increased. From 1973 to 1979, U.S. oil imports from Canada and Venezuela dropped more than 50%. By 1979, less than 25% of U.S. imports came from the Western Hemisphere. Saudi Arabia, Nigeria, Iran, Libya, Algeria, Indonesia, and Abu Dhabi emerged as major sources of U.S. oil imports.

As the result of these changes, the United States now faces a host of problems that can be lumped together under the heading of energy security. Oil supplies can be disrupted either by embargoes or by military activity. Such disruptions threaten the economy with critical shortages. The threat of disruptions places a potential

constraint on the conduct of U.S. foreign policy. The problem of paying for oil imports as oil prices leap to new heights is putting increasing strains on the economy. Most of the oil imported to the United States is shipped over long and militarily vulnerable routes.

Energy security promises to be a persistent problem in the decades ahead. The United States will continue to need large oil imports for the foreseeable future. Domestic oil production will decline during the 1980s and 1990s. Alternative domestic sources of energy supply will begin to play a role, but because they require significant leadtimes, they are unlikely to make a major contribution before 1990. The necessary transformation of the economy to more efficient patterns of energy use should offset most, if not all, of the decline in domestic oil production. But, because of the long lifetime of the energy-using capital stock, the effect of this process will be only gradual and probably will not reduce imports significantly during the next decade.

Several alternatives have been proposed to enhance U.S. energy security during the transitional period of continued dependence. One of the most prominent proposals has been to encourage oil production in the non-OPEC countries. This promises to improve U.S. energy security in several ways. Greater production in the non-OPEC countries should enable the United States to diversify its sources of imports, making it less vulnerable to the oil weapon. If the increases occur in the Western Hemisphere, the United States should be able to obtain a greater proportion of imports over more defensible routes. An increase in non-OPEC production should reduce OPEC's pricing power, thereby moderating future price increases and possibly even resulting in declines in the real price of oil. The petroleum revenues of non-OPEC countries seem more likely to be recycled through trade and debt repayments.

Unfortunately, an uncooperative Mother Nature undermines the proposal to encourage non-OPEC oil production. This proposal is based on the hypothesis that large amounts of oil will be found in many areas of the world. However, the most salient characteristic of world oil resources is that they are concentrated in a few areas. The 10 most important petroleum provinces of the world (out of more than 400 that have been explored) contain 73% of the oil discovered to date. The 30 most important contain 90% of the world's known conventional oil resources. All that has been learned about oil accumulation over the past several decades indicates that this concentration reflects basic differences in geologic endowment, not differences in exploration effort. Outside of the OPEC countries and the Communist countries, the only major oil discoveries in the world that have occurred in the 1970s have been in the North Sea and Mexico. Smaller discoveries have been made in Brazil, Chile, Cameroon, Chad, Egypt, Zaire, India, Malaysia, and the Philippines, but these have only marginal export potential or are only contributing to the economy of each nation. Because North Sea oil production seems likely to peak within a few years and to be relatively short-lived, Mexico offers the only demonstrated potential for large increases in oil production and exports from a non-OPEC country during the 1980s.

Major increases in Mexico's oil production will affect any program to restrain world oil prices and foster a more orderly transition to new energy sources during the 1980s and 1990s. Moreover, Mexico promises to be a relatively secure and reliable source of foreign oil, particularly for the United States. It has had a stable government for more than half a century. It is free of the frustrating entanglements

of Middle East politics. Its oil can be shipped to Gulf Coast refineries in the United States over short, readily defensible routes. The United States is by far its largest trading partner. As long as the United States continues to be an importer of oil, only Canada, with its overland pipelines to the United States, could be a more desirable source of oil from the standpoint of U.S. energy security. But, because Canada will probably be little more than self-sufficient in oil over the next decade, Mexico is the most secure of any country that could export sizable amounts of oil.⁴

Mexico's oil thus has unique importance to U.S. energy security. But that importance and its implications for U.S. policy can be easily overstated, particularly in an environment characterized by frustration over long gasoline lines, anger over rising energy prices, and foreboding over the decline of U.S. power. Despite the high salience that recent events have given to energy security, it is still only an instrumental value. The importance of energy security resides in its contributions to higher ends—such as promoting economic and social welfare, maintaining freedom, and assuring peace. Approaches to energy security that ignore its instrumental character can eventually be counterproductive. Because U.S. energy security interests in Mexico's oil involve several long-term considerations, approaches to enhancing those interests need to be broad and farsighted.

One such consideration is that U.S. energy security is not independent of the energy security of its allies and neighbors. Thus, U.S. interests in Mexico's petroleum policies must recognize the potential consequences of petroleum development for Mexico's own energy future. A rapid increase of petroleum production now could result in Mexico itself facing energy shortages by the early decades of the next century, particularly if energy demand in Mexico continues to grow at rapid rates. Mexico, like the other countries of the world, has to begin to make the transition from conventional sources of petroleum to other sources of energy. But, barring major technological and economic breakthroughs in solar and nuclear power, Mexico has few immediate alternatives to oil and natural gas. Therefore, its economic development requires short-term increases in petroleum consumption and a transition from conventional petroleum to other energy sources that begins later and takes longer than that of other medium- to large-size economies. Conserving petroleum supplies to maximize recovery and to guarantee energy supplies through a lengthy transition will probably be an essential feature of Mexico's petroleum policy. As such, this policy is important to the United States as well.

Another important consideration is the effect of petroleum development on Mexico's political and economic evolution. As we have seen in Iran, rapid petroleum development can create political and economic instability. Short-term measures to enhance U.S. security by increasing an ally's oil production can have perverse consequences, for example, a subsequent drop in production, often with little warning, and a loss of some of the conditions, such as a presumably stable government, that originally made the oil from that country a supposedly secure source.

These considerations suggest that U.S. energy security interests in Mexico's petroleum are not as simple and straightforward as earlier public assessments have presumed. Instead, U.S. energy interests are complex and multifaceted. Even if policy attention is restricted to energy security considerations alone, potentially

⁴ Mexico's status as a secure source could be jeopardized if unrest and instability in the Central American and Caribbean nations spilled over into Mexico.

conflicting interests still need to be balanced against each other. No single dimension is adequate to guide policy effectively.

U.S.-Mexican Relations

United States-Mexican relations, for many years a subject of minor or parochial interest, have become increasingly essential to the overall progress and security of the United States. Mexico's new importance has suddenly loomed in the past few years; and it promises to extend well into the 1980s, broadly influencing U.S. domestic and foreign policies. The stakes include much more than energy, and extend to affecting who Americans are, how they treat each other, and what kinds of work they do. During 1979, the preparation of Presidential Review Memorandum # 41 (PRM-41), two meetings between President Carter and President López Portillo, and organizational changes within both their governments attested to the new priority that energy, immigration, trade, and border issues have imparted to U.S.-Mexican relations.

Petroleum has obviously helped to awaken high-level U.S. policy attention to Mexico. Indeed, the discovery and development of the petroleum resources of southeastern Mexico have changed how Americans as well as Mexicans think about Mexico. Many Mexicans like to think that the petroleum will serve to create a "new" Mexico, free from domination by the United States. Yet for many Americans the petroleum promises to free the United States from the "old" Mexico. Without the newly discovered petroleum, the United States could certainly expect to have an overpopulated, impoverished country on its southern border for many decades. Without the petroleum, Mexico would become more and more an energy importer. Without the petroleum, Mexico would be unable to cope with the extraordinary challenges of socioeconomic development. Without the petroleum, Mexico's dependency on the United States would probably become burdensome and troublesome for the U.S. government. Without the petroleum, most Americans would still regard illegal immigration as the critical issue in bilateral relations. Without the petroleum, few Americans could be optimistic about the possibilities of beneficial relations with Mexico. Without the petroleum, many Americans might not be learning to pay increasingly respectful and responsive attention to Mexico. For the United States, the risks and difficulties, as well as the opportunities and benefits, of dealing with the "new" Mexico seem preferable to those associated with the "old" Mexico.

Nonetheless, exactly how to think about post-petroleum Mexico and how to incorporate petroleum into that thinking remains unclear. Petroleum abundance has served more as a high-level incentive to upgrade relations than as the object of clearly defined policy expectations. There has been a tendency, noticeable especially outside the U.S. government, to treat petroleum as though it were the dominant U.S. interest in Mexico, and as though extracting petroleum should be the dominant U.S. objective. Such a tendency disregards the growing complexity of U.S.-Mexican relations and the increasing difficulty of claiming that any one interest or issue area deserves to dominate. The path of Mexico's petroleum development will affect other important issue areas, such as trade and investment, migration and employment, and border relations. Conversely, events and aspirations in these areas will influence Mexico's future petroleum policies. Because these issue areas are interrelated, and because all are of concern to the United States, it is not

reasonable to argue that any one issue should dominate U.S. interests and objectives over the long term.

The present situation—one in which many Americans and Mexicans act as if all other U.S. interests were subordinate to energy security—suggests a metaphor that may serve to illustrate the interrelatedness of U.S. interests in Mexico. The United States is depicted as having a “mountain” of interests in Mexico, with Mexico’s emergence as a petroleum power forming the “peak” of those interests. Before the recent major oil discoveries, this metaphorical mountain appeared distant and inconspicuous. It did not stand out on the horizon of U.S. attention. Now, however, the new oil and gas added to the other U.S. interests—which have also grown in significance—mean that the mountain looms near and large and sports a prominent peak. Yet that peak rests on the mountain below, is inseparable from it, and should not be viewed without the mountain as a whole. American observers who become so mesmerized by the peak that they lose sight of the mountain as a whole are as misguided as those Mexicans who assume that the new peak is all that interests the United States.

The increasing importance and complexity of U.S.-Mexican relations derives from essentially the following considerations:

- Foremost is the traditional interest in having a stable, friendly, and progressive Mexico as a neighbor. What the United States “needs” above all else from its neighbor is to have its public and private sectors perform effectively and productively in developing the economy in ways that improve the lives of its peoples and that proceed in harmony with the United States. This traditional and ultimate interest is now affected by the possibilities that Mexico has arrived at a critical stage in its political, economic, and institutional development. Mexico faces great development tasks for which oil revenues alone will not spell salvation and cannot be the sole resource. Yet petroleum development and petroleum revenues will play central roles in Mexico’s future evolution.
- Mexico’s new importance derives from the massive economic, social, and cultural interconnections growing throughout the U.S. borderlands and extending deeper into both countries. The binational relationship is variously represented as organic, symbiotic, dependent, and interdependent. The asymmetry of national power and the disparity of socioeconomic conditions between the two bordering nations is among the greatest in the world. Nonetheless, our two economies and societies are becoming inextricably linked. Deeper interdependence seems likely, barring radical decisions by either government to separate the two nations and their peoples. The most profound interrelationship is taking shape in the American Southwest, owing to the growing influence of the Chicano community, to the influx of Mexican migrant laborers, and to continuing efforts by the Mexican government and the Mexican-American community to expand their mutual ties. Thus, the borderlands could become the melting pot or the boiling caldron of future U.S.-Mexican relations.
- As an emerging medium power, Mexico has gained stature within the framework of U.S. global interests. Besides possessing strategic energy resources, Mexico is one of our most valuable trade and investment partners and influences the determination of multilateral principles and doc-

trines. Mexico is currently the fourth most active U.S. trade and investment partner—and in the future could become second only to Canada, our leading trade and investment partner. Within a few years, the traditional U.S. trade balance with Mexico may change from a traditional surplus position to a new deficit. Mexico's government is showing new determination to influence multilateral policy initiatives in the United Nations and in regional Latin American meetings, especially in regard to energy, trade, and regional security issues. It is currently developing new policies to influence the outcomes of ongoing political struggles in the Central American countries, sometimes in ways that run counter to U.S. interests and objectives.

Thus, there is, and must be, increasing recognition within the United States that what happens in Mexico and to U.S.-Mexican relations may have vital consequences, both positive and negative, for U.S. domestic and foreign policy concerns other than energy.

Such recognition is complicated by the fact that within the United States the perception of Mexico's significance varies greatly from region to region. Mexico's oil is shipped entirely to the eastern half of the United States, which is more dependent on imports than other areas. Natural gas imports from Mexico will probably be distributed to most major consuming centers throughout the United States. Oil tool and oil service firms in Texas and California are most likely to benefit from Pemex's development programs. The effect of the immigration of Mexican workers on the U.S. economy and society is concentrated in the Southwest, even though its benefits are also realized outside the border states. The regional effect of trade relations is not clearcut. For agricultural trade, however, there are visible benefits to the Southwest and Midwest, but Florida growers complain about the influx of Mexican winter fruits and vegetables. Overall, the southwestern states are affected by all aspects of U.S.-Mexican relations across all issue areas. At the other extreme, people in the Northeast have little day-to-day experience with the varied dimensions of U.S.-Mexican interdependence and tend to focus exclusively on energy issues.

In sum, petroleum is not the dominant U.S. interest in Mexico. It is only a coordinate interest area within an increasingly complex and multidimensional relationship, in which trade, immigration, border, and other issues are also significant. Petroleum represents not only a separate energy interest but also a factor energizing the entire bilateral relationship. The petroleum factor compounds the complexity of that relationship in part because it opens up so many possibilities and uncertainties. These could range from more cooperation to more conflict, and from greater independence to greater interdependence at national levels. Thus, the United States should not view Mexico only in terms of solving its energy problems—just as we do not expect Mexico to treat the United States as an easy solution to its unemployment problems. The paramount long-term U.S. interest remains the traditional one: to have a stable, friendly, and progressive Mexico as a neighbor.

The Long-Range Interplay between U.S. Energy Security and U.S.-Mexican Relations

Both key areas, U.S. energy security and U.S.-Mexican relations, are of long-range interest to the United States. Conditions in either interest area could im-

prove or deteriorate during the 1980s. In any case, both areas are likely to entail major uncertainties and risks for years, if not decades, to come.

In general terms, neither interest area appears to merit clear priority over the other in the long run. The stakes are high in both areas. One scenario that suggests their roughly matched importance is that of a Mexico which, because of very high rates of oil production and exports during the 1980s and 1990s, could approach resource depletion while having to sustain twice the current population and more than twice the current work force soon after the turn of the century. Such an eventuality would surely be detrimental to U.S. interests in both energy security and neighborly relations. Because of its proximity and its linkages to the United States, Mexico is not just another oil-producing country like Libya or Kuwait. Mexico would still be very important to the United States even if it had no petroleum resources. The fact that it does have major petroleum resources does not diminish the other reasons for its importance.

Under some short-term circumstances, one interest area or the other might merit top priority. United States interests in energy security would temporarily become predominant if an international crisis shortage were to call for a short-term surge of Mexican oil production. United States interests regarding U.S.-Mexican relations would probably deserve priority if Mexico's petroleum development and revenue accumulations were to induce political and economic instability in Mexico, and undermine U.S. interests in immigration and trade issues.

For most other circumstances we have considered, the two interest areas not only merit roughly equal weight but also suggest similar preferences regarding the possible outcomes of Mexico's future petroleum policies. The major issues regarding Mexico's petroleum, alternative objectives, and the preferred alternatives are discussed in the next section.

KEY ISSUES AND PREFERRED OBJECTIVES

Several key issues in Mexico's petroleum development will require decisions during the next several years. These include decisions about the appropriate level of oil and gas production and exports, the installation of an emergency production capability, the destinations and composition of oil exports, and the efficient use of energy and energy supply diversification in Mexico. Each issue area presents several policy alternatives. Because of the different consequences of the alternatives for U.S. interests, the United States should not be indifferent to which choices are made. In the discussion below, we describe these key issues and the basic alternatives, consider the varying implications of the alternatives, and on the basis of our assessment of U.S. interests identify those alternatives that seem preferable. We also estimate the probable direction of Mexico's own policy.

As the discussion reveals, our research leads to preferences that differ markedly from those currently voiced in U.S. public policy discussions. Furthermore, our research suggests that Mexico's continuing reassessments of its own policy interests and objectives will probably lead to decisions not very different from those most desirable to the United States—despite current tendencies in Mexico's own policy discussions. Thus, our assessment leads us to the conclusion that a major U.S. policy effort to influence Mexico's petroleum policies is unlikely to be necessary.

Production, Exports, and the Rate of Development

The central issue in Mexico's petroleum development—and the issue of most interest to the United States—is Mexico's choice of oil production levels. This choice will affect the level of Mexico's oil exports and thus control its effect on the world oil market. The choice will also determine Mexico's export revenues and affect its domestic energy future.

Although a variety of production paths are theoretically possible, Mexico's basic alternatives can be usefully simplified to low, moderate, or high production levels. These three levels are defined technically below by (1) the relationship between Mexico's oil exports and its domestic oil consumption during the next 20 to 30 years, and (2) the production life of Mexico's oil resources, as estimated in Sec. II:

- If Mexico's oil production is kept at a low level, its oil exports would never exceed its internal oil consumption, and peak annual oil production would be only 1/75 to 1/90 of ultimate recoverable resources. This means a peak production level of 2.5 to 3.5 million barrels per day.
- If Mexico's oil production is increased to a moderate level, its exports could be as much as double internal oil consumption during the next 20 years, and peak annual oil production would be 1/50 to 1/60 of ultimate recoverable resources. This means a peak production level of 3.5 to 5.5 million barrels per day.
- If Mexico's oil production is raised to a high level, its exports would be more than double internal oil consumption by the late 1980s, and its peak annual oil production would be 1/40 of its ultimate recoverable resources. This means a peak production level of 5.0 to 7.5 million barrels per day.

Each of these three technically defined choices has widely different implications for U.S. interests. If Mexico chooses a low production level, its oil exports will also be low, never exceeding 1.5 million barrels per day. As a result, Mexico's oil would have marginal moderating effects on world oil prices and very limited capacity to enhance the security of oil supply for the United States and the other major oil-importing countries. A low production level would enable Mexico to avoid the strains of petroleum-induced growth, but the resulting oil export revenues could prove insufficient to fuel Mexico's economic development—unless Mexico's economic and political systems have become so rigid and conservative that they can only make productive use of low petroleum revenues. A low production level would permit a leisurely transition from conventional petroleum to other sources of energy for Mexico's economy.

Should Mexico choose a moderate production level, its oil exports will probably vary between 1.0 and 2.5 million barrels per day from the early 1980s to the year 2000. This would have a moderating effect on world oil prices during the next 20 years if oil demand does not grow in the major oil-importing countries. If total oil imports into the United States did not increase, exports of this size from Mexico would enable the United States to reduce its imports from the Middle East and Africa by 0.5 to 1.5 million barrels per day, providing a noticeable difference in the security of supply. The moderate production level should provide sufficient oil revenues for Mexico's development needs, although it could experience some strains from rapid growth and excess financial liquidity during the 1980s. At this

level Mexico would have petroleum self-sufficiency for the next 40 to 50 years, which is ample time for the necessary transition to other sources of energy if appropriate steps are taken.

Opting for a high production level would make Mexico a major oil exporter of 3 to 5 million barrels per day between 1985 and 2000. This would have a substantial moderating effect on world oil prices if oil demand does not grow in the major oil-importing countries. The effect on U.S. oil supply security would be marked as well. But these effects are unlikely to last beyond the turn of the century, because Mexico's oil export capacity would decline rapidly after 2000 if this alternative is pursued. The high production alternative would subject Mexico's economy to the twin shocks of rapidly growing oil export revenues during the 1980s and rapidly declining oil export revenues after 2000, with declining revenues threatening to be particularly destabilizing. The high production alternative would give Mexico only 30 to 40 years to make the transition from petroleum to other sources of energy.

Considering all aspects of U.S. interests that are affected by the choice of production levels, we conclude that the choice of a moderate production level by Mexico would best serve U.S. interests. Such a choice would provide the best balance of potentially conflicting U.S. interests in Mexico's petroleum development. A moderate production level in Mexico, if coupled with efforts to transform oil consumption in the United States and the other petroleum-importing countries, would help stabilize the world petroleum market and enhance U.S. energy security. Simultaneously, it should enable Mexico to promote national development without major risks of destabilizing its society and economy. In contrast, the choice of the low production level would do little for U.S. energy security, and the high production level could be economically and politically disruptive.

It is too early to forecast what Mexico's eventual choice will be. The original production ceiling of 2.5 million barrels per day will be reached in 1980. By 1982, production could easily exceed 3 million barrels per day. Potential coalitions in Mexico apparently favor either increasing production very slowly from the original ceiling level, thereby committing Mexico to a low production level, or increasing production more rapidly to a moderate level of production. Fears of becoming another Iran or Venezuela and of rapidly depleting Mexico's major economic resource have precluded support for the high production path. The advantages of a moderate level of production to Mexico are the sizable oil export revenues to fund major development projects; the continued diversification of trade, investment, and technology relations with countries other than the United States; greater international stature for Mexico; and the avoidance of possible foreign pressure to raise oil production levels. The advantages of a low production level to Mexico are the guarantee of long-term energy self-sufficiency, avoidance or reduction of the potential strains of rapid economic growth, and a limitation on expanded energy and commercial ties to the United States.

Analyzing in detail the potential consequences for Mexico of alternative petroleum production choices is an enormously complex task that goes beyond the scope of our research effort. Such an analysis has been undertaken in Mexico, and the results should help in determining Mexico's future petroleum export decisions. These decisions hinge on the resolution of several fundamental concerns. The foremost of these is that petroleum development policies should be subordinated to national development policies and that both should be integrated into what has been called the "National Project" through such plans as the National Industrial

Plan and the Global Development Plan. In so doing, Mexico should avoid letting petroleum development distort national economic growth, exceed the "absorptive capacity" of Mexico's economic and political systems, and result in unproductive investments and expenditures. Mexico's government leaders are indeed making a determined effort to subordinate petroleum development to national development, and to design rational long-range plans. Nonetheless, the meaning and implications of many of the concerns are uncertain.

For example, if rapid petroleum development would entail drawing men and materials away from the development of other sectors, thereby distorting the overall pattern of industrial development and employment, it would behoove Mexico to restrain the rate and level of development. Such an argument is often used to oppose high petroleum exports. However, a high petroleum production and export strategy is only possible through the rapid development of the onshore and offshore fields in southeastern Mexico, which does not require large additions of manpower and technology. The rapid development of Chicantepec is more likely to have such distorting effects. But its long-term development has little or nothing to do with oil exports, and, in fact, such development has been supported primarily as a means to promote regional employment and industry.

Another argument against rapid development is that the "absorptive capacities" of Mexico's economic and political systems are limited, and that Mexico should not risk straining them as did Iran. This argument has also been presented as a rationale for avoiding high export strategies that would raise excessive amounts of foreign exchange. Yet despite the concern about Mexico's absorptive capacity, and the desire to avoid straining it for the sake of stability, an examination of many standard indicators of absorptive capacity (e.g., installed infrastructure, transportation, communications, and skilled manpower) shows that Mexico ranks much higher than Iran, Venezuela, or any other country in OPEC.

We expect that within a few years Mexico should be able to make productive use of revenues⁵ from a moderate export profile without straining its overall absorptive capacities and distorting its prospects for long-term economic growth. This should not be taken for granted, however. In particular, Mexico's leaders will have to resolve current issues and problems concerning the improvement of the economic infrastructure (e.g., port capacity and transportation systems) and the selection and management of major investment projects.

For the near term, most indications are that the government will approach the process of economic growth with great caution to avoid possible disruption of the established order. It appears that many nationalist elites, including quasi-leftist intellectuals, conservative domestic businessmen, central government technocrats, and provincial political leaders, have mutual interests, albeit for different reasons, to proceed slowly and to avoid the potentially adverse effects of continued rapid development.

Development Rate. The rate at which Mexico increases its production has been singled out as a key factor in the overall production decision. Mexico, it has been said, lacks the capability to develop its petroleum resources rapidly enough; therefore, the United States should provide technical assistance through U.S. gov-

⁵ Mexico's policies not to diminish its foreign debt or make foreign investments mean that its government will want to constrain petroleum revenue earnings to avoid excess liquidity and destabilizing inflation rates.

ernment agencies and the major oil companies to enable Mexico to accelerate development of its oil resources. Even if one disregards the fact that neither Mexican nationalism nor Pemex professionalism would accept the reentry of foreign firms and loss of control over the pace of development, the characteristics of the major oil fields in Mexico make this issue irrelevant.

The major oil fields of the Southeast, which have thick, highly fractured reservoirs, require a relatively small number of wells for full development. As a result, these fields are being placed in production within two to three years after discovery and are being fully developed within five to six years after discovery—a rate of development as rapid as occurs anywhere in the international petroleum industry. The high productivity of the wells, particularly those offshore, means that Pemex is clearly capable of increasing production rapidly with no more need of external services than in industry elsewhere. Exploratory drilling efforts could be intensified slightly. But the relatively small area of the productive trend indicates that most of the onshore prospects will be drilled by 1982 and most of the offshore prospects by 1985.

The development of the Chicontepec area is designed to be a long-term project benefiting domestic employment and industry within the petroleum sector. Using foreign labor and technology to intensify the projected pace of development would defeat this primary objective. Other than the temporary use of external oil tool and oil service companies and consultants on recovery techniques, Pemex has the capabilities to handle the currently planned rate of development.

The characteristics of the major producing areas, Pemex's demonstrated results in increasing production capacity, the very low probability that Mexico will exceed a moderate production level, and the undesirability of U.S. pressure for more than a moderate production level all indicate that U.S. intervention to accelerate the rate of development is unnecessary and inadvisable. At present rates of exploration and development, Mexico can reach moderate levels of production by 1985.

Gas Production. Now that the Mexican and U.S. governments have agreed on the pricing of natural gas exports, the key issues for the United States are the natural gas production level set by Mexico and the duration of export commitments. Mexico could decide to limit its gas production to casinghead gas (gas produced with oil), shutting in production from the nonassociated gas fields in the Macuspana, Burgos, and Sabinas basins. Under this alternative, most of its gas production would be consumed in Mexico. Only small amounts would be exported to the United States.

Alternatively, Mexico could opt for larger exports to the United States by producing both casinghead and nonassociated gas. Substantial exports to the United States appear to be possible only if nonassociated gas is produced. Earlier speculations that Mexico would have to export large quantities of gas if it wants to increase oil production have proved incorrect. Most of the large offshore oil discoveries in the Southeast, unlike the onshore discoveries, have low gas-oil ratios and thus will not be producing large amounts of gas. If the Sabinas Basin proves to be a major gas province or if the deeper structures in the Southeast prove to contain large amounts of gas, Mexico will have sufficient reserves to provide for its own needs for several decades and export 1 to 3 billion cubic feet per day as well. Natural gas is a direct substitute for petroleum products in most industrial, com-

mercial, and residential uses. Thus, increased supplies of gas from secure sources are just as important as oil supplies for U.S. energy security.

One way to advance U.S. interests, while protecting Mexico's interests, would be to institutionalize any future natural gas trade agreements according to existing North American precedents. For example, the procedures used by Canada to determine gas exports to the United States could serve as a useful model for gas exports from Mexico to the United States. Reserves are dedicated to export only if they are considered surplus to those estimated to meet national requirements for some future period, thus safeguarding the energy supplies of the exporting country. In the present situation, proved reserves above 30 to 40 years of current demand or projected demand two to four years hence seems like a reasonable level for determining exportable quantities from Mexico. Delivery of exportable reserves could then be scheduled over a long-term contract (10 to 20 years), providing the United States with a reliable supply over a period sufficiently long to plan for and acquire replacement or substitute sources of supply.

A precedent in U.S.-Mexican energy relations already exists for long-term gas delivery contracts. In 1955, Pemex signed a 20-year contract for gas exports to the United States. This contract contained provisions protecting Mexico's interests, assuring sufficient reserves for domestic use. Nonetheless, it was opposed by Mexican nationalists on the grounds that it would squander the national patrimony and risk Mexico's economic independence and state sovereignty. Similar criticisms will probably arise if efforts are made to negotiate future contracts. Unlike oil, which is exported by ship and is thus theoretically highly flexible as to destination, natural gas will be exported through a fixed pipeline—a tangible symbol of the links between the two nations that is offensive to those who resent such links and automatically equate them with dependence. The appropriate goal of institutionalization is to develop a record of evidence and create contract provisions so that Mexico's interests and sovereignty are clearly and convincingly safeguarded in the gas exports that do occur.

Emergency Production Capacity

It would be in the U.S. interest for Mexico to have excess oil production capacity that could be used to raise exports rapidly during any sudden international supply shortfall. In the event an international crisis or even a natural disaster should temporarily disrupt world oil supplies, additional Mexican production—if Mexico's government chose to provide it to the international market—would help to reduce the adverse effects of the crisis, especially if such production complemented efforts by the importing countries to cope with the disruption through demand restrictions, supply sharing, and drawdowns of emergency stocks.

Whether Mexico will have excess production capacity depends on its future production plans. If it decides to keep oil production at low levels, or if it moves to moderate production levels at slow rates, it could have significant excess oil production capacity by the mid-1980s. The gap between actual production and production capacity could grow if new wells prove more prolific than anticipated, or if the next administration decides not to use all the productive capacity made available from earlier investment decisions. The installation of such excess capacity could also be initiated by a deliberate decision of the Mexican government aimed at giving Mexico the flexibility to increase production rapidly. To begin giving Mexico such

flexibility, President López Portillo has recently indicated that Pemex should now have excess capacity measuring about 10% of total production (or about 250 thousand barrels per day) for meeting possible domestic or international objectives.

If Mexico should decide to develop a policy for the emergency use of excess capacity, it would probably do so only within a multilateral context that protected Mexico's national sovereignty while providing for responsible international cooperation in coping with the emergency situation. In developing such a policy, Mexico would surely have to deal with the same problem that President López Portillo identified in his speech proposing Mexico's plan for world energy cooperation before the United Nations on September 27, 1979:

The first problem, in the presence of so many protagonists with opposing interests, undefined policies, unresolved claims, accumulated resentment and articulated reproaches, is how to pose the problem without giving rise to suspicions of partiality, manipulation, or complicity.

As he stated, "Defining the problem constitutes a substantial part of the solution."⁶

One multilateral framework already exists among the major consuming countries: the International Energy Agency (IEA). The IEA and Mexico could explore the possibilities of an agreement regarding emergency oil production. Such an agreement could serve to protect Mexico from direct pressures from the United States or others; provide Mexico with substantial international influence; and define safeguards specifying that Mexico would not be requested to use its excess production capacity unless and until the IEA member states had implemented IEA emergency procedures. IEA rules require that member states take major steps to restrict demand in order to reduce the adverse effects of a supply disruption, and that certain sharing procedures be followed to dispose of any additional production that may become available during an emergency. Because the IEA countries are not likely to take such stringent measures except in a genuine crisis, this condition would help protect Mexico's sovereignty during an oil supply emergency. As an IEA member, the United States could not press for special emergency supplies from Mexico without invalidating its IEA membership.

A multilateral framework that included various exporting as well as importing nations would probably be more interesting to Mexico. Such a framework for emergency supply does not yet exist, although President López Portillo's proposals to the United Nations recognize the international needs such a framework could serve, and the risks of not developing one. Because arranging a global approach presents many difficulties, an alternative might be a regional approach for Latin America or the Western Hemisphere, whereby Mexico, Venezuela, the Caribbean refinery nations, and possibly other suppliers would agree to develop and use excess capacity for meeting specified emergency requirements within the region.⁷

If long-term gas export contracts are eventually signed with Mexico, the United States could seek emergency gas supply agreements as well. Such emergency arrangements could even be incorporated within long-term contracts for a fixed amount of total exports. Temporary increases above normal contractual rates could be permitted for a specified period, as long as these were balanced by subsequent

⁶ "Address by José López Portillo, President of Mexico, at the Thirty-Fourth Session of the United Nations General Assembly," New York, September 27, 1979, p. 39.

⁷ Recent Mexican and Venezuelan negotiations to supply oil to Central American nations on special terms may lay the groundwork for the eventual evolution of a more comprehensive approach.

decreases in off-peak seasons or by reductions in the duration of the contract. By allowing such rearrangements of the timing of delivery, Mexico could avoid committing itself to total exports greater than those previously fixed in the contract negotiations. This type of approach should prove more workable than ad hoc attempts to negotiate additional supplies during an emergency or crisis.

Export Destination and Composition

Most of Mexico's crude oil exports are currently shipped to the United States. In 1978, the United States received 315 thousand barrels per day of the 365 thousand barrels per day that Mexico exported, or 86% of the total. The proximity of U.S. Gulf Coast refineries to the oil fields of Southeast Mexico provides the United States with a comparative advantage over Japan and Western Europe in bidding for Mexico's oil. Under normal conditions in the world oil market, Japan and Western Europe would have to pay a higher delivered price to compete with the United States for Mexico's oil, or Mexico would have to discount the price to compete with other oil exporters in the bidding countries.

The Mexican government has announced its intention to diversify its oil export destinations, reducing the proportion going to the United States to as little as 60% as total Mexican exports increase. To this end, it has reached agreements on future oil exports and trade with Canada, France, and Japan. Mexico's efforts have been facilitated by recent conditions in the world oil market. Because substantial amounts of Middle East and African crude oil exports are now being sold for higher prices on the spot market, Japan and the Western European countries can now import undiscounted, contracted Mexican oil for a lower delivered cost than they can import spot market purchases from their traditional sources.

The issue for the United States is whether it should take any action to influence the destinations of Mexico's oil exports. Three basic alternatives are possible:

1. The United States could do nothing, letting international market forces and Mexican policy take their course.
2. The United States could act unilaterally, seeking to make the U.S. market as attractive as possible to Mexico.
3. The United States could seek bilateral arrangements with Mexico, seeking to obtain a high proportion of its oil exports.

The second alternative appears to be preferable. A higher share of Mexican exports to the United States gives us marginal advantages. The Western European countries and Japan are already so heavily dependent on Middle East and African oil that small reductions in that dependence are unlikely to greatly affect their behavior. However, the marginal advantages to the United States of receiving a high proportion of exports are not so great that they justify any major efforts to obtain it, particularly when these efforts may fan the flames of Mexican nationalism. Besides having counterproductive results, such efforts may be unnecessary. Neither Pemex nor the Mexican government has shown a willingness to discount the posted price of crude oil to obtain greater diversity in destinations. As exports increase and if the international oil market returns to some semblance of normality, Mexico may be unable to reduce the proportion going to the United States to 60% without such discounts.

To increase the attractiveness of the U.S. market to Mexico, a unilateral step that the United States could examine would be the removal of petroleum product price controls and other regulations affecting the rate of return on refinery investment. Current Mexican crude oil exports are predominantly medium-gravity crude oils from the Reforma fields in the Southeast, similar to the major export grades from the Middle East. Beginning in 1980, most of the future increase in exports is likely to consist of heavier crudes from the offshore fields. Small amounts of heavy production can be blended successfully with the medium-gravity crude currently being exported. However, because heavy crude production promises to become a substantial proportion of the total, Pemex has now established two export grades. If U.S. refineries on the Gulf and East coasts are to use heavy Mexican crude instead of their traditional light, low-sulfur crude to produce either the traditional mix of U.S. products, or an even larger proportion of light products as utility and industrial use of residual fuel oil is reduced by regulations and market forces, then they will have to make substantial investments in downstream refinery capacity and refinery modifications. The necessary investment is less likely to be made if the return on investment is insufficient or uncertain because of regulations and controls.

Mexico, like many of the other petroleum-exporting countries, may flirt with the idea of emphasizing the export of refined products instead of crude oil. This alternative appears to be neither in the best interests of Mexico nor the United States. Because refineries are optimally designed to handle the requirements of specific markets, such a step would reduce Mexico's flexibility and create a new type of dependence. Because a glut of basic refinery capacity already exists in the Western Hemisphere, building refinery capacity beyond that needed to serve its own needs would be a poor use of Mexico's investment capital resources. For the United States as well as for other importing countries, a petroleum product export capability in Mexico would only increase the current surpluses of refinery capacity.

Petroleum Revenues and Trade Diversification

One issue that is related to the direction of Mexico's petroleum exports is the disposition of its foreign expenditures from petroleum export revenues. It may be more important for U.S. economic interests that a high proportion of these revenues go to purchase U.S. goods and services than that a high proportion of the oil exports go directly to the United States. More is at stake than just recycling oil revenues for balance-of-payments benefits. Unlike the other major exporting countries, Mexico ranks as the fourth most important partner of the United States in trade and investment, and could become our second most important partner in the decade ahead. Continued development of this growing market for diversified U.S. goods and services will affect future incentives for Mexican worker migrations and opportunities for expanded production-sharing in agriculture and industry in the North American area. This in turn will condition Mexico's future responsiveness to U.S. energy initiatives.

In receiving a large proportion of Mexico's petroleum export revenues, U.S. interests could be thwarted if Mexico succeeds in using most of those revenues for the nationalist purpose of diversifying trade and investment relations. The United States has traditionally accounted for 60% to 70% of Mexico's imports and exports —a pattern that exhibits excessive dependence on the United States in the view of

many Mexican policy elites. These elites want to reduce that proportion by expanding commercial relations with other advanced industrial powers, notably Japan, France, Germany, Britain, and Spain. Thus, as petroleum revenue expenditures lead to a growth in Mexico's foreign commerce, the United States may experience a decline in its share of Mexico's trade, even though total trade between the two countries increases in absolute terms. The United States may even slide from a traditional surplus to a new deficit position in its balance of trade and payments with Mexico.

The process of diversification would take place at two levels: within the marginal increments to Mexico's expanding commercial relations and within the total composition of Mexico's trade. Mexico's ability to use its bargaining and negotiating power for diversifying its increments to trade would probably be maximized at lower export levels, in view of the high international competition for secure sources of oil and the readiness of many foreign powers to offer commercial advantages to Mexico in exchange. However, at low levels of petroleum exports, the increments will be too small for any changes in the sources and destinations to have a great effect on the overall composition of trade. Mexico's bargaining power to diversify within the marginal increments would appear to be less at higher export levels, assuming constant international conditions. However, Mexico's ability to accomplish significant diversification in its overall trade pattern would probably be maximized at moderate export levels. At high export levels, there would probably be strong tendencies to spend most of its additional foreign exchange in the United States as in the past. Thus, Mexico may best promote its interests in commercial diversification by linking such diversification to a moderate level of petroleum exports.

Important structural factors should constrain Mexico from carrying diversification to such an extreme that the United States becomes a minority participant in trade, investment, and technology transfers. The proximity of the United States, the range of its products and services, the size of its potential markets, and the established ties between the private sectors all mean that no other country is better placed and prepared to respond to the spectrum of Mexico's import and export needs. Mexico would have to pay a very high economic cost to deny the natural benefits of large-scale U.S.-Mexican economic relations.

Mexico's opportunities for diversification would appear greatest in the immediate years ahead. However, its interests and needs for renewed emphasis on U.S. commercial relations should return to the fore in the mid- and late 1980s. In the near term, international competition for oil exports and revenue expenditures should provide Mexico's government with a very good bargaining position to enlarge commerce with distant countries such as Japan and France. However, during the mid- and late 1980s, Mexico should have a range of new export industries coming into production that will need foreign markets, if Mexico's new export-oriented development strategies are to succeed. Because the United States represents the largest and most natural markets for such new exports, Mexico's leaders should then seek improved access. If so, bilateral economic relations could enter a renewed era of growth, offering a range of possibilities for production-sharing based on dynamic comparative advantages. Nonetheless, the issues could prove difficult and controversial to negotiate, especially if Mexico continues to remain outside of the General Agreement on Tariffs and Trade (GATT) and has not laid other groundwork for trade negotiations with the United States.

Mexico's recent decision not to join GATT may have had the advantage of avoiding some possible economic and political costs in the near term. The decision was consistent with the traditional principles of Mexican nationalism, was supported by an odd coalition of protectionist businessmen and quasi-leftist intellectuals, and reflected President López Portillo's concerns to abide by democratic consultations with national sectors. One of the popular arguments against joining GATT was that such a move would give the United States new leverage for pressuring Mexico into producing higher petroleum exports. However, contrary to popular arguments, presumed U.S. leverage should be increased in the future if Mexico remains outside of GATT, has new industries in need of export markets, and must negotiate on bilateral terms. Thus, potential policy linkages between energy and trade relations may become more urgent and controversial in the years ahead.

Some diversification away from strong "dependence" on U.S. trade and investment ties would not necessarily be detrimental to U.S. interests. And it could be beneficial—especially assuming that the absolute value of U.S. participation increased, and that the balance of payments and trade remained positive. It would seem useful, for example, to see Mexico's economic relations expand to some of our energy-short allies. Japan, in particular, might make a useful partner for Mexico. Trade and investment strains could arise for the United States, however, if Japan were to treat Mexico as a cheap-labor access point for entry to U.S. markets without benefit to U.S. trade and investment partners. Apart from a diversification of Mexico's commercial relations to other foreign powers, it might also be beneficial to U.S. interests to see Mexico take a more active role in promoting economic development and commercial relations in the Caribbean Basin, and especially in Central America. This would appear to be a natural interest area for Mexico, where it could provide petroleum on preferential terms to poor countries eager for national progress.

Energy Use and Petroleum Substitution in Mexico

A major issue and potential dilemma for Mexico is the future rapid growth in the domestic demand for energy, particularly for petroleum. This issue is readily overlooked because current demand (1.1 million barrels per day of oil and gas in oil equivalents in 1978) is so low when compared with even the low estimates of Mexico's petroleum potential. If demand remained at 1.1 million barrels per day and Mexico did not export oil or gas, it could be self-sufficient for at least another 200 years.

The problem is that demand is not standing still. During the 1960s and 1970s demand for petroleum in Mexico grew by more than 7% per year, a rate of growth that produces a doubling of consumption every decade. The new Industrial Development Plan, which stresses energy-intensive industries, projects an even higher growth rate for the 1980s, possibly as high as 10% per year. The attainment of such growth rates is not implausible, especially if the internal consumption of petroleum continues to be heavily subsidized. (Because of the marked increase in world prices in 1979, the price to Mexico's industry of natural gas and residual fuel oil is now less than 10% of the world price.) Mexico will not face any energy resource constraints in attaining this rate of growth during the 1980s. The marginal cost of increased production in the Southeast is also less than the internal price, relieving

Mexico of obvious economic pressures to reduce the current subsidy of internal consumption.

Exponential growth at rapidly doubling rates in the consumption of a finite resource cannot, however, continue indefinitely. Moreover, the longer exponential growth is permitted to proceed, the more difficult it becomes to make the inevitable transition from that resource to its substitutes. Higher absolute levels of use both sharply reduce the lifetime of the finite resource and compress the time available to make the transition to substitutes.

If Mexico is to avoid substantial problems in accomplishing the energy transition that will be necessary in the first part of the next century, it will have to begin restraining its growth rate in energy demand and developing petroleum substitutes during the 1980s. Such measures do not conflict with Mexico's national development objectives. In the long run, they are essential to guarantee the permanence of the development that does occur. Rapid development into the next century, followed by prolonged petroleum shortages that devastate Mexico's economy, is not in the long-term interests of either Mexico or the United States.

Because energy sources other than petroleum cannot be developed to any substantial degree during the 1980s, Mexico's immediate efforts should focus on energy conservation. The growth rate in energy demand can be reduced if future investment incorporates recent advances in industrial energy efficiency. If energy-efficient plants are to be built, the Mexican government will have to begin to reduce the prodigious gap between internal and world prices, particularly for industry. In view of the great political reluctance to do this rapidly, the government may have to intervene by setting standards or by subsidizing the additional costs of energy efficiency. Either could be added to the incentives promoting industrial development in Mexico.

Energy production in Mexico has relied so heavily on petroleum sources (over 90%) that Mexico will soon have to begin developing alternative sources of supply, especially for electricity generation. Here the choices are limited, and the problems Mexico may face in developing sufficient energy supplies from these sources provide another reason for emphasizing energy conservation now. Mexico lacks major coal deposits, as well as nonconventional sources of petroleum such as oil sands and oil shale. Geothermal and hydroelectric offer some limited potential. The main alternatives for Mexico may be nuclear power, using Mexico's potentially abundant uranium ore resources, and solar power, if the necessary technological and economic breakthroughs occur during the next decade.

Nuclear energy development is certainly becoming the leading alternative advocated within Mexico's new energy policy communities. This alternative is being promoted largely by left-leaning nationalists who apparently seek to establish new institutional bases independent of Pemex and its associated union, and who believe that multinational enterprises have reaped too many benefits from low petroleum prices. It has even been suggested that increased U.S.-Mexican trade within the energy sector—including oil, gas, electricity, and related technology transfer—might be linked in support of nuclear development in Mexico. However, even though long-range nuclear development should complement U.S. interests, the process may generate bilateral policy controversies (as has already happened regarding U.S. nuclear fuel shipments for the single reactor now under construction).

The role for the United States in all these areas—energy conservation, pricing policies, nuclear and solar development—appears to be limited. Pressures on Mex-

ico to reduce the growth rate in energy demand, or to develop alternative sources of supply, would be perceived as interference in Mexico's domestic affairs. Moreover, the U.S. government currently lacks the credibility to urge other governments to stop subsidizing domestic energy consumption. Thus, the United States cannot go much beyond offering technical information and assistance. The U.S. role could become more prominent if major advances are made in new energy technologies that are also relevant to Mexico's needs. Nonetheless, policy trends within Mexico indicate a growing awareness of the need to take steps in all these areas.

Overview Comment

In regard to most key issues discussed above—the general export level, the rate of development, and the destination of petroleum exports—Mexico's interests and policies seem likely to evolve in directions that will be reasonably congruent with preferable outcomes for the United States. To the extent this assessment proves valid, there is no clear need for the United States to create special incentives, concessions, or pressures designed specifically to spur Mexico's petroleum development and exports. The installation and use of emergency production capacity involve issues that could be addressed through multilateral initiatives. Bilateral tensions in the future are more likely to arise from issues outside the narrow petroleum area, particularly in trade relations and nuclear energy development. United States policies should emphasize the maintenance of a broadly cooperative climate that does not disturb Mexico's momentum in the petroleum sector, while seeking to make the natural U.S. market even more attractive for Mexico's petroleum exports.

ALTERNATIVE LONG-RANGE DIRECTIONS FOR U.S. POLICY

This report has focused primarily on specific, individual issues in U.S.-Mexican energy relations. Going beyond these issues, several new concepts have emerged recently regarding the overall directions of U.S.-Mexican energy relations during the 1980s and 1990s. One set of concepts derives from a strong concern to promote U.S. energy interests. Another set emphasizes a general concern for future U.S.-Mexican relations beyond simply energy. All the concepts are tentative, providing a useful framework for thinking about long-range possibilities but not for laying specific, near-term plans.

Geographic Concepts for U.S. Energy Relations

In recent years, the U.S. and Mexican governments have conducted their energy relations on an ad hoc basis, dealing with individual issues as they arose. Although this approach has clear merits, the question has been posed in U.S. public policy discussions whether better approaches might be developed for long-range coordination and planning in future U.S.-Mexican energy relations. Many observers believe that, as Mexico becomes an increasingly important petroleum producer, a more comprehensive U.S. policy approach will be needed.

In recent policy discussions, three comprehensive geographic policy concepts have emerged:

1. The first is that the United States and Mexico should arrive at a long-term, bilateral energy treaty or special agreement for providing steady, secure petroleum exports to the U.S. markets.
2. Another is that the United States, Mexico, and Canada should work trilaterally to fashion a North American energy common market.
3. The third is that of a coordinated Western Hemisphere approach to energy production and trade. This approach would involve both the countries mentioned above and Venezuela, the Caribbean refinery nations, and perhaps some or all of the South American countries.

Although the primary emphasis of these concepts is energy, it is usually recommended that the United States offer incentives in other issue areas—including trade, financing, technology transfer, and immigration—to assure potential partners that they will gain broad benefits from any special energy arrangements with the United States.

None of the concepts is entirely new. Each has a history that extends back several decades. For example, ideas to promote a Western Hemisphere approach to U.S. energy security became popular in some congressional circles during the late 1940s, when concern loomed that the world would face an energy shortage and that the United States would be vulnerable. However, the ideas were successfully resisted by the major oil companies and by U.S. officials, partly on grounds that Mexico could not be prompted to become a significant oil exporter, and in case it did, U.S. relations with Venezuela, then a leading exporter, would probably be disturbed. Now that Venezuela's conventional oil production has stabilized and Mexico's is rising, the idea is reemerging in a new context. Ideas emphasizing a North American approach were broached with Canada during the 1960s and early 1970s when it was a major source of U.S. oil and gas imports, but discussions did not fare well, mainly because of Canadian nationalism.

These concepts are beginning to receive increasing attention as potentially innovative paths for easing the U.S. energy predicament. All three concepts have been discussed in congressional forums. Several U.S. presidential candidates have spoken in favor of organizing a North American community among the United States, Canada, and Mexico. Nonetheless, to date these concepts lack content; and they risk being no more than empty slogans.

How useful these concepts may prove to be will depend to a great extent on how they are used in U.S. policy formulation. If they are used as bases from which policies on individual issues can be deduced, they will quickly prove inadequate. But if they are employed in a more modest capacity as guideposts, emphases, or organizing ideas for policy, they have the potential to serve a useful role in providing direction and consistency to overall policy efforts.

To implement these concepts would require the cooperation of Mexico and any other potential U.S. partners. Yet Mexico (like Canada in the past and present) has resisted the idea of special bilateral or trilateral energy agreements because they might sacrifice the nation's resources to U.S. interests and jeopardize its national sovereignty and independence. To date, Mexico's leaders have not found it expedient even to explore how such concepts might be molded to suit Mexico's needs and how they might yield benefits, for example, through expanded trade relations and technology transfers. Although Mexico is emerging as a petroleum power, it is still feeling its way into this role cautiously and defensively.

All three concepts imply different advantages and disadvantages, opportunities and risks, for the United States. Of the three, a Western Hemisphere approach would seem to make the most sense in terms of energy issues, since Venezuela and the Caribbean refineries are important, along with Canada and Mexico, in the overall petroleum picture. However, to the extent that linkages to trade and other issue areas may prove determinative, a North American emphasis would seem most appealing. Mexico does not seem likely to agree to any comprehensive bilateral energy relationship with the United States. Nonetheless, opportunities should be found to expand bilateral energy cooperation on specific issues, for example, through electricity exchanges along the border and the development of nonpetroleum energy sources in Mexico.

As a result, none of the concepts should be discarded from future U.S. policy consideration. All merit further exploration and elucidation. Moreover, they are not exclusive alternatives. Indeed, it is conceivable that policies could move along all three paths simultaneously—without concern for ultimate priority. Nonetheless, it would be unwise to expect that Mexico would agree soon, if ever, to any comprehensive energy relationship, regardless of the approach taken. Progress in U.S.-Mexican energy relations will only be achieved through years of arduous negotiations, proceeding step-by-step on specific issues, and involving conflict as well as cooperation on both sides.

Alternative Concepts for Future U.S.-Mexican Relations

Growing recognition of Mexico's general importance for U.S. interests, and recent efforts to design a new U.S. policy framework for managing future U.S.-Mexican relations, have prompted the formulation of two alternative concepts summarizing the basic policy choices open to the U.S. government:

1. One concept emphasizes *internationalism*—treating Mexico much like any other leading developing country and emerging medium power.
2. The other concept emphasizes *community*—treating Mexico as a special partner in the long-range development of the North American area.

Each concept represents a distinct vision of where U.S.-Mexican relations may be heading, what kind of a Mexico the United States wants as a neighbor, and how the U.S. government should be organized to deal with Mexico. Both approaches assume that Mexico's elites will succeed in developing their nation, and that it is therefore not sensible for the United States to treat Mexico as a weak neighbor and dependent client. Both approaches assume that as Mexico progresses as a medium power of economic and strategic value to the United States, its relations with the United States will involve new elements of both independence and interdependence. As this happens, the United States will face a choice: whether to emphasize independence or interdependence in future relations. Mexico will face a similar choice from its own perspectives. Although these are not exclusive alternatives, they have important differences.

A U.S. policy emphasizing internationalism would mean approaching Mexico according to the same general policy principles applied to other leading developing countries and emerging medium powers. A strict construction of internationalism would have the following implications: Key issues would be treated, as much as

possible, within international and multilateral frameworks. Mexico would not be singled out for preferential arrangements or special mechanisms simply because it is a border neighbor. For example, in viewing Mexico's oil export policies, the global dimensions of U.S. energy interests would be emphasized over bilateral or domestic dimensions. Efforts to enlarge U.S.-Mexican trade relations would be conducted strictly within GATT and MTN⁸ frameworks. Immigration and border issues would be controlled to preserve the distinctiveness of the United States. Thus, except for occasional pressing border concerns, Mexico would not receive any more special treatment than the U.S. government affords any other nation of similar international stature. There would be no effort on the part of the United States to move closer to Mexico than international power realities recommend. This approach derives partly from the assumption that Mexico's future development will make it more independent from, rather than interdependent with, the United States, and that separate destinies are best for the United States. Tendencies toward the integration of the two economies and societies would be restricted.

Such an approach would coincide with the assumptions behind most U.S. policies today, notably on trade and migration, and would fit the organizational structure and bureaucratic practices that are traditional in the U.S. government. In addition, this approach would be congruent with Mexican desires to stress their sovereign independence, diversify their foreign relations, and approach U.S.-related issues through international principles and multilateral organizations. However, the internationalist approach would risk downplaying Mexico's importance as a bordering nation. Its growing influence on American society, economics, and politics sets it apart from other major developing nations. The more Mexico's independent development leads to increased economic competition with the United States, the more bilateral tensions may surface that are not amenable to internationalist management approaches.

A U.S. policy framework emphasizing community would mean treating Mexico as an important long-range partner in social and economic development. In a strict construction of community, joint approaches would be sought in all issue areas—energy, trade, investment, technology transfer, labor migration, and border development—in order to maximize the potential economic advantages of being neighbors. Exceptions would be made to U.S. globalism abroad and protectionism at home, in order to promote binational coordination, planning, and preferential agreements in specific areas with Mexico. Trade liberalization would be accelerated. Mexican worker migrations would be accommodated. Improved border relations and greater economic development throughout the borderlands would become significant objectives of U.S. policies. The contributions of the Mexican peoples to the evolution of North American culture, society, and economy would be emphasized and cultivated. The assumption would be made that Mexico's growth would make it more interdependent with, rather than separate from, the United States, and that this is both inevitable and desirable.

The community-building approach would reflect social and economic trends in the borderlands. And it would build boldly on the potential advantages of production-sharing in agricultural and industrial development. The inclusion of Canada could ultimately lead, decades hence, to the evolution of a North American economic community along European lines. However, implementation of a strong commu-

⁸ Multilateral Trade Negotiations.

nity approach would require unusual organizational and policy shifts within the U.S. government. It would require overcoming protectionism in U.S. labor and business circles. And it would require the formulation of new symbols, concepts, and policy practices that would be acceptable to Mexican nationalist sensitivities. In turn, Mexico would have to cooperate, showing much greater receptivity, responsibility, and reciprocity toward the United States than ever before.

During 1978 and 1979, the U.S. government did make concerted efforts to develop a new policy framework promoting interdependence. Application of the concept of interdependence to U.S.-Mexican relations resulted from several timely considerations. Emerging from a period of drift and disorganization in bilateral relations during the early 1970s, the concept helped call attention to the need for adopting a comprehensive approach to difficult issues and interests that were being treated in an ad hoc and isolated fashion. The concept directed attention to an emerging reality, noticeable particularly at the border level, and offered a vision of the future that deserved recognition as an option whose further development would require deliberate policy choices. The concept was intended to facilitate the resolution of specific problem issues, in part by leading to the creation of new organizational mechanisms that could consider the complexity of issue linkages.

However, it was never clear just what "interdependence" could or should mean for the future. Indeed, the concept was left vague. In part, this reflected the difficulties U.S. domestic and foreign policy officials could expect. In addition, there was some recognition that no useful definition could be determined unilaterally. Thus, it was hoped that Mexican participants in the policy dialogue would also contribute to its meaning. Indeed, during 1976-1978 there were signs that a policy framework emphasizing interdependence would be acceptable to Mexican elites, and would respond to their criticisms of the neglect and disarray that was troubling them at the time.

Unfortunately, Mexico's policy community did not take kindly to the concept of interdependence. Indeed, the intellectual response was critical and defensive, in keeping with the traditions of Mexican nationalism. According to the critics, interdependence is unacceptable in principle, and if it were pursued in practice, the main beneficiary would be the United States. The more suspicious and fearful among the critics further contended that the concept represented little more than a rhetorical ploy designed to gain U.S. access to Mexico's oil supplies and to pressure Mexico into a high export policy. Few Mexican policy analysts cared to consider how interdependence might be shaped to Mexico's material benefit over the long term.

These recent experiences indicate that, at least for the present, no clear choice may be feasible between the two distinct alternatives of internationalism and community for future U.S.-Mexican relations. Indeed, neither alternative seems possible in a pure form. Elements of both coexist in current U.S. policies, and some combination of the two may be the most pragmatic outcome to anticipate in the near term. Nonetheless, a more explicit choice is desirable if U.S.-Mexican relations are not to drift and become disorganized again by the tug of competing domestic and foreign policy concerns. The relevant choice should not be between one or the other alternative but should be one of emphasis and direction.

Choosing a direction will depend in part on cooperation by Mexico. To date, Mexico has resisted a choice—and indeed, it may not be in Mexico's interests or capabilities at this time. As noted above, historical resentments and some recent experiences make it difficult for Mexicans to advocate close partnership with the

United States. Nonetheless, to the extent that Mexico ignores that some explicit choice is in its own long-range interests, this could reinforce traditional U.S. tendencies to prefer having Mexico be, as much as possible, a weak and dependent client of the United States.

We recommend that U.S. policies lean toward an explicit emphasis on community, partnership, and interdependence. This direction should ultimately provide the most benefits for U.S. interests and values. However, moving in this direction will pose stiff challenges and great difficulties, even if the two nations succeed in accommodating their competing and sometimes conflicting interests. Grand concepts cannot lead in fruitful directions if they cannot be developed step by step in mutually beneficial negotiations over specific issues.