

FUTURE  
ISSUES



A VIEW OF  
U.S. OIL  
&  
NATURAL GAS  
TO 2020

ABRIDGED EDITION

A REPORT OF THE NATIONAL PETROLEUM COUNCIL • AUGUST 1995



**F U T U R E  
I S S U E S**



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**ABRIDGED EDITION**

(Does not include contractor reports—Appendices C and D)

**A REPORT OF THE NATIONAL PETROLEUM COUNCIL • AUGUST 1995**

**Philip J. Carroll, Chair, Committee on Future Issues**

**NATIONAL PETROLEUM COUNCIL**

H. Laurance Fuller, *Chair*  
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Marshall W. Nichols, *Executive Director*

**U.S. DEPARTMENT OF ENERGY**

Hazel R. O'Leary, *Secretary*

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The National Petroleum Council is a federal advisory committee to the Secretary of Energy.

The sole purpose of the National Petroleum Council is to advise, inform, and make recommendations to the Secretary of Energy on any matter requested by the Secretary relating to oil and natural gas or to the oil and gas industries.

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# PREFACE

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By letter dated December 30, 1994, the Secretary of Energy requested the National Petroleum Council (NPC) to undertake a study of the role that the oil and gas industry plays in the nation's economy and of the issues and policies affecting the industry's future. Specifically, she requested:

the National Petroleum Council to identify the issues and policies that will most likely shape the industry over the next twenty-five years, and advise me on the most constructive and realistic resolution of these issues with respect to the future vitality of both the industry and the economy. Your report will be most useful if it includes a candid review of the oil and gas industry's role in the nation's economy and is specific about the issues and policies that may alter the industry's vitality in the next century. Your analysis should focus in particular, although not exclusively, on government policies intended to reconcile energy needs and environmental compliance strategies which you have identified to me as being so critical to your future.

(See Appendix A for the complete text of the Secretary's request letter and a description of the National Petroleum Council.)

The NPC established a Committee on Future Issues to prepare a proposed response to

the Secretary's request. The Committee was chaired by Philip J. Carroll, President and Chief Executive Officer, Shell Oil Company. William H. White, Deputy Secretary of Energy, served as the Committee's Government Cochair. The Committee was assisted by a Coordinating Subcommittee, charged with conducting the study analyses and preparing a draft report, and by several ad hoc work groups. (See Appendix B for rosters of the study groups.) Charles River Associates Incorporated was retained by the NPC to assist in analyzing the role of the oil and gas industry in the economy under the supervision of an Economic Review Panel. Arthur D. Little, Inc. was retained by the NPC to assist the Coordinating Subcommittee in its effort to identify future issues for the industry.

For purposes of this report, the term "oil and gas industry" includes: oil and gas exploration and production; the oil field service and supply companies that support those activities; oil refining; gas processing; the transportation, distribution, and storage of crude oil, natural gas, and petroleum products; and the retail sale of natural gas and petroleum products to the end-consumer. The response to the Secretary's request involved contributions from representatives of the various segments of the oil and gas industry including integrated and independent producers, refiners, processors, transporters, distributors, and marketers as well as service and supply companies. Additionally, the study sought and

considered the views of a broad range of thought leaders on oil and gas issues including government policy makers and regulators; environmental, consumer, and labor organizations; customers; other energy suppliers; and academia and other industry observers.

An overview of the study's results follows this Preface. The Secretary's request for a candid review of the oil and gas industry's role in the nation's economy is addressed in Chapter One, "The Oil and Gas Industry's Role in the Nation's Economy." Chapters Two and Three respond to the request to identify the issues and policies that will most likely shape the in-

dustry over the next 25 years. Issue identification was accomplished through a series of 45 interviews and three facilitated workshops involving thought leaders from both within and outside of the industry. Chapter Two, "Views of the Past and Future," leads up to the issues by looking for lessons in the past 25-year history of the industry and describing views of the future. A set of key issues for the future of the oil and gas industry is presented in Chapter Three, "Issues for the Next 25 Years." Recommendations to aid in the resolution of these issues in the future are described in Chapter Four, "Approaches to Future Resolution of Issues."



# OVERVIEW

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The mission of the U.S. oil and gas industry is to provide reliable and affordable energy supplies in a manner reflecting shared societal concerns for environment, health, and safety. The challenge to the industry over the next 25 years is to achieve this mission within a rapidly changing, increasingly global, highly competitive landscape. This study effort has identified four groups of issues that will likely shape the industry and affect its ability to meet this challenge: energy security, industry-government interface, environmental concerns, and the industry's image. Because of the importance and pervasiveness of the industry's products to the nation, successful resolution of these issues is critical. History shows that the industry can function most effectively and efficiently in an environment that relies on market forces to the maximum extent possible.

Accordingly, the NPC finds that the constructive and realistic resolution of these issues requires leadership within the oil and gas industry to improve and expand communication with stakeholders outside the industry, and leadership within the government to improve coordination of policies affecting the industry.

## **INDUSTRY'S ROLE IN THE NATION'S ECONOMY**

The "oil and gas industry" is a significant and crucial component of the domestic economy. The industry is large—it employs 1.5 million men and women and represents

between 3 and 5 percent of the economy, depending on the measurement used. According to the most recently available data, oil and gas is larger in total output than health services and pharmaceuticals, larger than the domestic automotive industry, and larger than the *total* of education and social services, computers and computer services, and iron and steel manufacturing. Industry wages are about 14 percent above the U.S. average, and over 8 percent of industry employees are scientists or engineers, as compared with U.S. industry average employment of 1.4 percent scientists and engineers.

More importantly, oil and gas are fundamental enablers of the domestic economy. More oil and gas are consumed indirectly via the goods and services people buy than through direct sales of fuel to individual consumers. Using substitutes for oil and gas is very difficult in today's economy. Trying to do so before the technology for cost-competitive alternatives is developed could jeopardize the well-being of the nation's citizens and the competitiveness of its manufacturing industry.

## **VIEW OF THE PRESENT AND FUTURE**

Today the industry is affected more than ever by both domestic and international competitive forces and environmental concerns. Prices of crude oil, natural gas, and petroleum products all respond to a volatile international

marketplace. In the natural gas business, all aspects from production through local distribution are being transformed by deregulation, enhancing competition among gas suppliers and among fuels. Service companies from other countries have become significant competitors to U.S. firms. The refining and marketing businesses face increased regulatory costs driven by stringent requirements on fuel composition as well as increased pressure from national oil companies and other international competitors. The growing cost of environmental protection is a key factor in this equation. The industry recognizes the need to take appropriate steps to safeguard the environment for future generations, but those costs add to pressures on international competitiveness.

These increased competitive forces and new technology have significantly affected the character of the industry. The development and use of technology have dramatically reduced the costs of finding oil and gas, of processing them into products, and of delivering these products to individuals and businesses. The oil and gas industry is as high tech as other industries carrying that label, such as computers and telecommunications. Moreover, the competitive marketplace has created niches for a highly diverse set of companies within the industry, often resulting in different goals among industry members. This diversity is an asset because of the flexibility it provides in meeting the changing competitive forces facing the energy marketplace. However, for that reason, oil and gas companies often do not appear as much an "industry" as do more homogeneous sets of companies, such as automobile manufacturers.

This report includes a view of the oil and gas industry over the next 25 years from a broad range of parties: public interest and environmental organizations, industry observers and analysts, customers, and industry participants from companies involved with all aspects of the business. As might be expected, the views of 2020 foreseen by these diverse groups covered a wide spectrum. Many believe that consumption patterns and the level of worldwide use will reflect a continuation of existing trends, with energy use rising with growing

population and economic development. Others foresee a radically different world, with flat or declining fossil fuel use, either forced by environmental considerations or made possible by technological advances in the production and use of energy.

There was, however, surprisingly broad agreement on key elements of the outlook for the United States over the next 25 years. This consensus can be characterized as follows:

- The United States and the world will still be using large amounts of oil and gas in 2020, not significantly different from the more than 60 percent share of world energy consumption these fuels represent today.
- At the same time, continuing advances in the technology of the production and consumption of these fuels will lead to improvement in the efficiency of their use and in the effective management of their environmental impacts.
- There is no expectation that the decline in domestic oil production will be reversed, though steps can be taken to slow the decline. As a result, there is a broad belief that the United States will be increasingly dependent on oil imports.
- While U.S. import reliance will continue and likely grow, there is broad optimism that, with the development of oil resources in Russia, other republics of the Former Soviet Union, China, Latin America, and Africa, the United States will have access to a diversity of supply sources that will reduce its vulnerability.
- The U.S. natural gas resource base is substantial, and its development is a means of limiting dependence on imports of both gas and oil.

This view of the future, though widely held, is far from certain. The challenge facing the industry and the nation is the establishment and maintenance of a business and regulatory environment that will permit the industry to adapt and evolve in an increasingly global and competitive marketplace.

## ISSUES FOR THE NEXT 25 YEARS

This study identified a range of issues that can be grouped into the following four categories: energy security, industry-government interface, environmental concerns, and the public perception of the industry. The diverse set of thought leaders participating in this study were consistent in the concerns they expressed:

- **Energy Security.** Stemming from declining U.S. oil production and increased reliance on imports, energy security is of broad concern. A rational regulatory framework and reasonable access to resources in the United States are of critical importance to the oil and gas exploration and production segment of the industry.
- **Industry-Government Interface.** Maintaining and improving the industry's ability to compete, both globally and domestically, will require more efficient regulatory processes and consistent foreign policy stances. In particular, regulations that better utilize market forces and trade policies that do not place U.S. firms at competitive disadvantage would play a powerful and positive part in the future health of the economy.
- **Environment.** The array of environmental issues, from local environmental quality to global climate change, will play a significant role in the industry's future.
- **Industry Image.** The industry recognizes that the understanding and opinions of its many stakeholders will serve as important determinants of policy rationality and future opportunities, and must therefore be addressed.

## APPROACHES TO RESOLUTION OF ISSUES

The oil and gas industry can most successfully carry out its mission and realize its value to the nation in an environment driven by market forces. Balancing this with the need to meet environmental and other societal goals and given the inherent uncertainties of our energy future, a more flexible and responsive

policy and regulatory framework is required. The NPC therefore recommends the following actions:

- **Encourage responsible development of domestic resources.** Recognizing the likely increase in import reliance, actions should be taken to encourage the development of abundant domestic natural gas supplies, to negotiate realistic standards to allow access to the most promising remaining oil resources, and to reassess legislative and regulatory constraints that inhibit the ability of the industry to make the most effective use of those resources.
- **Encourage development of as wide a range as possible of foreign import sources.** U.S. policy should seek to avoid reliance on imports from a limited number of nations.
- **Use sound science in legislative, regulatory, and judicial processes.** Government should use the most up-to-date scientific and risk assessment information available. Both the quality of the science and its communication to decision makers are critical.
- **Require cost-benefit analyses for regulatory interventions.** Government should use cost-benefit analyses to ensure that decisions are made with full awareness of the trade-offs involved.
- **Use goal-oriented regulatory mechanisms where regulatory intervention is necessary.** Government regulatory actions, where appropriate, should specify desired outcomes rather than specific compliance methods.
- **Encourage science, economic, and energy education.** Industry should further its efforts in the educational arena. Industry has a strong history of supporting educational programs, yet more could be done. An understanding of the role of energy in the nation's economy will contribute to well-informed public policy.

The effectiveness of the above specific actions depends greatly on trust among stake-

holders and a willingness to work toward common goals. Two characteristics of the industry create challenges to achieving this outcome. First is the poor public perception of the industry, in part because of the industry's own actions, inactions, and stances, but also in part because of the blame the industry took for supply dislocations which were actually attributable to federal regulations. For example, it is now generally recognized that oil product allocation rules caused the gasoline lines and that natural gas price controls resulted in wintertime supply curtailments. Second, the diversity that makes the industry so competitive and responsive necessarily results in a variety of industry voices. Policy-making in the United States responds best to a coherent voice, and the oil and gas industry has to ensure that its diversity does not impede its ability to argue for rational policies. The Council recognizes that the industry has a responsibility to improve its credibility and an opportunity to lead in the resolution of contentious issues. The following two recommendations call for leaders in both industry and government to take the initiative in improving the process by which issues of importance to the industry and the nation are resolved:

- **Industry should improve and expand communication with stakeholders outside the industry.** This improved and expanded communication with stakeholders is intended to provide a basis to resolve more effectively the issues the oil and gas industry will face in the future. Enhanced communication must be championed by industry leaders to be effective, and to show the commitment to real changes in relationships with stakeholders. Effective dialogue will promote resolution of issues through consideration of the positions of all stakeholders, resulting in a realistic basis for action.

- **Government should improve coordination of policies affecting the oil and gas industry.** Policy decisions that affect the oil and gas industry are made in many different departments and agencies of the federal government. Improved coordination would provide an opportunity to better resolve conflicting policies with a fuller understanding of energy's role in the economy and of the impact of policy measures on the industry. The coordination might be achieved through a working group of high-level government officials from federal departments and agencies whose operations affect the oil and gas industry, such as the Environmental Protection Agency and the Departments of Energy, State, Defense, Treasury, Commerce, and Interior.

There was not time in the study to analyze existing forums, associations, committees, or other mechanisms to determine how best to implement these recommendations. However, it would be desirable to utilize existing structures unless a clear and compelling need is demonstrated to the contrary.

In summary, the NPC believes that the government should continue to improve its approach to regulation and its policy interface with the industry. However, the NPC recognizes that no industry is likely to succeed in a free market unless stakeholders see sufficient commonality between their goals and those of the industry in question. One of the lessons of this study is the realization that there may be more commonality of goals between the industry and its stakeholders than previously thought. These shared goals can serve as a starting point for a more cooperative approach to addressing future issues. The industry should take the initiative to set a new course in its relations with both government and its many stakeholders.

# CHAPTER ONE

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## THE OIL AND GAS INDUSTRY'S ROLE IN THE NATION'S ECONOMY

In the simplest terms, the role of the oil and gas industry in the economy is to produce oil and gas and supply its products to consumers and to other industries. Those energy products enable the activities of other industries and the way Americans live. Oil and gas are affordable forms of energy that are transportable and storable. These qualities make them efficient sources of energy for transportation and heating uses, and flexible sources of energy for generating electricity. With current technologies, the mobility and flexibility of oil and gas are unmatched. The challenge in responding to the Secretary's question is to explore what these simple facts mean for the nation's economy and to provide measurements where possible.

The NPC retained Charles River Associates Incorporated (CRA) to examine the role of the oil and gas industry in the national economy. CRA performed a re-analysis of the national input-output tables, assembled statistics on the industry, and considered the role of oil and gas in the economy. CRA's summary of its research is contained in Appendix C of this report.

### **DEFINITION OF THE INDUSTRY**

First, it is necessary to define "the oil and gas industry" as the NPC is using the term. For the purposes of this report, the term includes: oil and gas exploration and production; the oil field service and supply companies that support those activities; oil refining and gas processing; the transportation, distribution, and storage of

crude oil, natural gas, and petroleum products; and the retail sale of natural gas and petroleum products to the end consumer. The oil and gas industry defined in this way includes nearly 1.5 million people working for more than 40,000 companies. Most of these people and companies serve primarily the domestic market, but the headquarters, engineering, and research functions of many multinationals are included, and export markets are critical to many service and supply companies.

This is an inclusive definition of the oil and gas industry, but even so it cannot lead to complete measures of the oil and gas sector of the economy. The industry is a surprisingly fluid and dynamic entity. Technical services that might have been provided within companies not long ago may now be provided by independent contractors and consultants; other functions like credit card operations are now often contracted out, and thus become parts of other sectors of the economy. The relative roles of oil and gas companies and project engineering contractors are constantly shifting. The petrochemical industry is not included in this definition of the oil and gas industry, but it is highly integrated with some components of the oil and gas industry, and of great economic importance in its own right.

To obtain perfect measures of the industry is not important, but to recognize the dynamic process of reshaping and adjusting to new technologies and evolving economic realities is critical. Even the definition reveals an important role of the oil and gas industry in the

economy—it is a source of business opportunity for individuals and companies large and small, focused both domestically and internationally, and thus economic opportunity for the nation.

## **ROLE OF THE OIL AND GAS INDUSTRY**

Before turning to measurements of the oil and gas industry, it is useful to step back and consider the role of energy in an economy. Figure 1-1 shows the relationship between energy use per capita and gross domestic product (GDP) per capita in 1994 for 77 countries. As economies develop, both income, represented here by GDP per capita, and energy use rise, illustrating the role of affordable energy in enabling economic development. And more developed economies have been able to devote more attention and resources to environmental quality, public health, and education, making considerable progress over the last several decades. The link between economic development and environmental quality is best captured in the familiar maxim, “poverty is the worst polluter.”

The role of the oil and gas industry in the nation’s economy might be described as to supply reliable and affordable energy in the form of oil and gas and their products, while reflecting societal concerns for the environment, health, and safety. This is not a static task, and the oil and gas industry is continuously restructuring as technology and the needs and wants of society change. Producing properties are reallocated to the size and type of firm that can most efficiently produce them. Distributors with strong ties to their markets take a larger share of the retail business. Brokers fill a market niche in the deregulated natural gas business. The diversity of the industry, and the competition and the changing roles of the players within it, provide the dynamic force and flexibility to adjust to the needs of the time, thus providing gains in efficiency for the nation.

## **MEASURING THE OIL AND GAS SECTOR OF THE ECONOMY**

The first step in measuring the size and value of the industry is to review the standard

measures of the oil and gas sector of the economy—the role of the industry as a producer in the economy. Measures of the size of the oil and gas industry are summarized in Figure 1-2. The industry generally represents 3 to 5 percent of the economy—surprisingly large for one sector of the economy considering the breadth of economic activity in the United States. This is illustrated with the comparative graph in Figure 1-3. The total output of the oil and gas industry exceeded that of health services in the most recent compilation of data in this form. “Value added” is the total output of a sector of the economy less the cost of inputs that sector purchases from other sectors. On this basis, the oil and gas industry is larger than the domestic motor vehicle industry, computer industry, and many other well-known industries regarded as critical for the U.S. economy.

Figure 1-2 also indicates the scale of the spending by the oil and gas industry to produce its products. The spending includes taxes, royalties, environmental investment, and wages. Notably, wages for the oil and gas industry are 14.2 percent higher than the U.S. average. Spending also includes, perhaps most critically, investment and research and development. The industry must invest heavily to produce the high “value added” shown in Figure 1-3. Despite being in a low-growth mode in its domestic markets, oil and gas is responsible for about 3 percent of private domestic investment and 3 percent of industrial research and development in the United States. The industry is an important customer for other U.S. industries through its investment and its operations. For example, the industry consumes 8 percent of construction industry output, 5 percent of mining industry output, and 4 percent of chemicals, plastics, and paper products. The large construction share reflects the importance of investment by the oil and gas industry.

## **ROLE OF OIL AND GAS IN CONSUMPTION**

The oil and gas industry plays a broader role in the economy in terms of the importance of its products. The flows of direct and

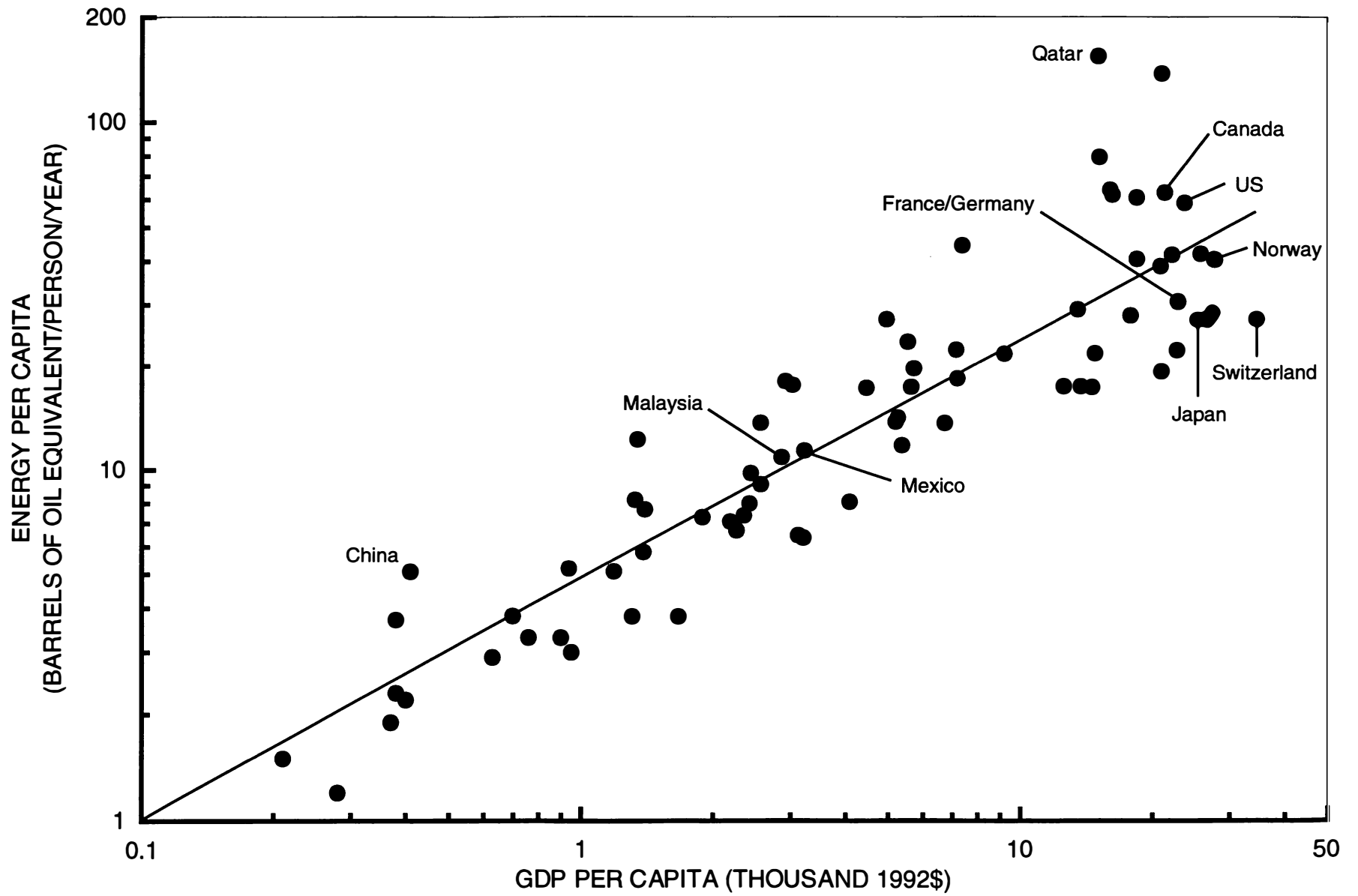


Figure 1-1. Relationship of Per Capita Energy Use to Income.

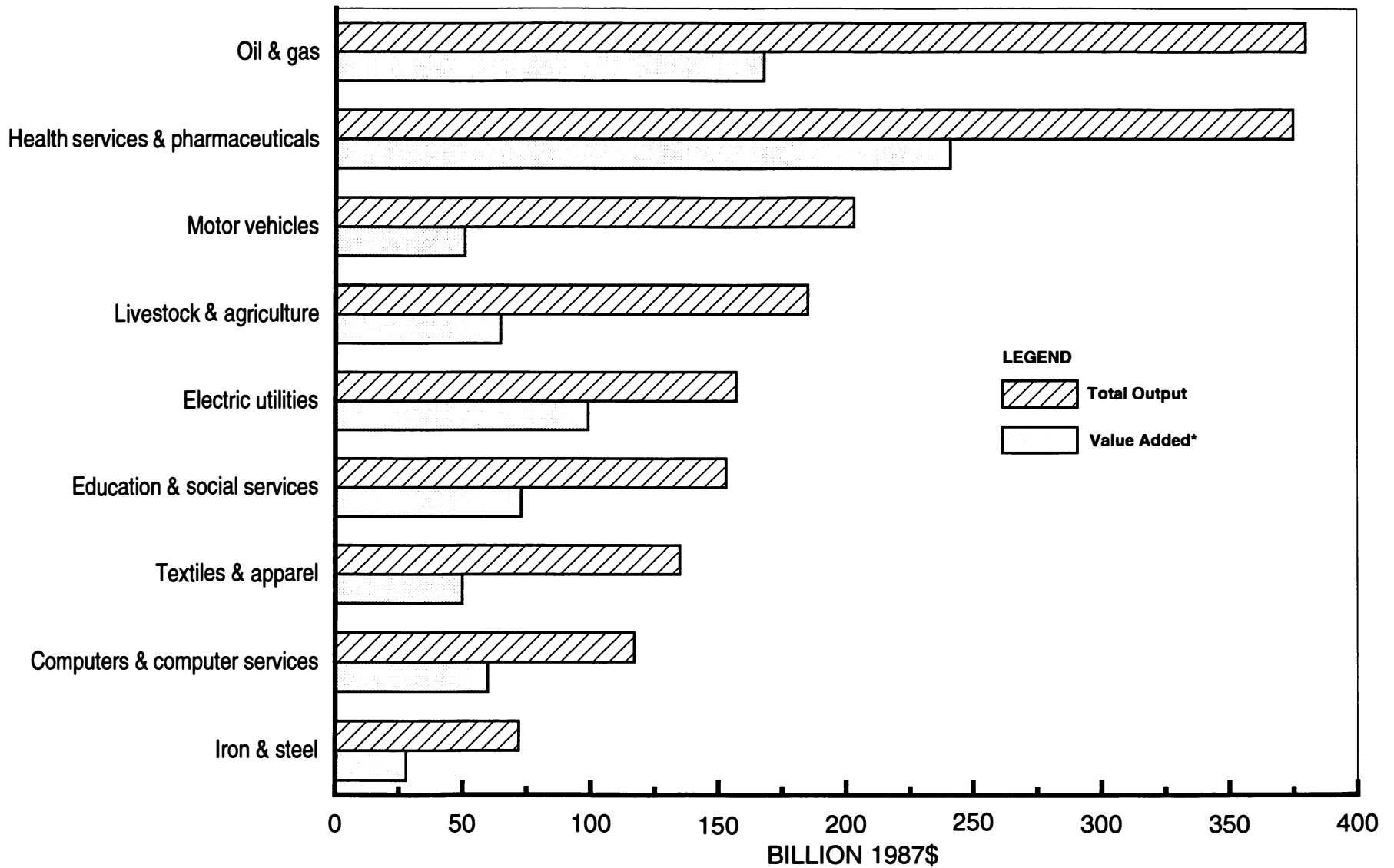
### **The Oil and Gas Industry Provides:**

- **4.7% of U.S. gross output (\$380 billion in 1987)**
- **3.0% of private, nonresidential U.S. domestic investment (\$22.5 billion in 1987)**
- **2.9% of all industrial research and development funded by U.S. companies (\$2.2 billion in 1991)**
- **4.3% of all federal, state, and local taxes (\$91.9 billion in 1991)**
- **84.4% of federal mineral lease royalties (\$3.1 billion in 1993)**
- **1.4% of U.S. employment (1.5 million jobs in 1993)**
- **20.8% of U.S. spending on pollution abatement in manufacturing (\$5.3 billion in 1992)**
- **Wages 14.2% higher than U.S. average (\$30,117 v. \$26,361 in 1993)**

*Note: Employment data includes petroleum industries in mining, manufacturing, transportation, wholesale & retail trade.*

**Figure 1-2. The Oil and Gas Industry in Perspective: Value to Economy.**





\* "Value Added" is the total output of a sector of the economy less the cost of inputs that sector purchases from other sectors.

**Figure 1-3. The Oil and Gas Industry is Very Large Relative to Other Industries.**

indirect oil and gas consumption are illustrated in Figure 1-4. Direct consumption refers to oil and gas products used directly by consumers, such as natural gas and heating oil used to heat homes and gasoline used to fuel automobiles. Indirect consumption includes the oil and gas embodied in other goods and services that the consumer buys, from natural gas used to generate electricity or heat offices to the oil and gas inputs used to produce and distribute the products of manufacturing industries. Only some 30 percent of oil and gas is used directly at the retail level; the other 70 percent is embodied in other goods and services. Even with respect to the oil used in transportation fuels, only half is used directly by consumers for personal transportation. Fully half is part of the industrial and commercial web of the economy.

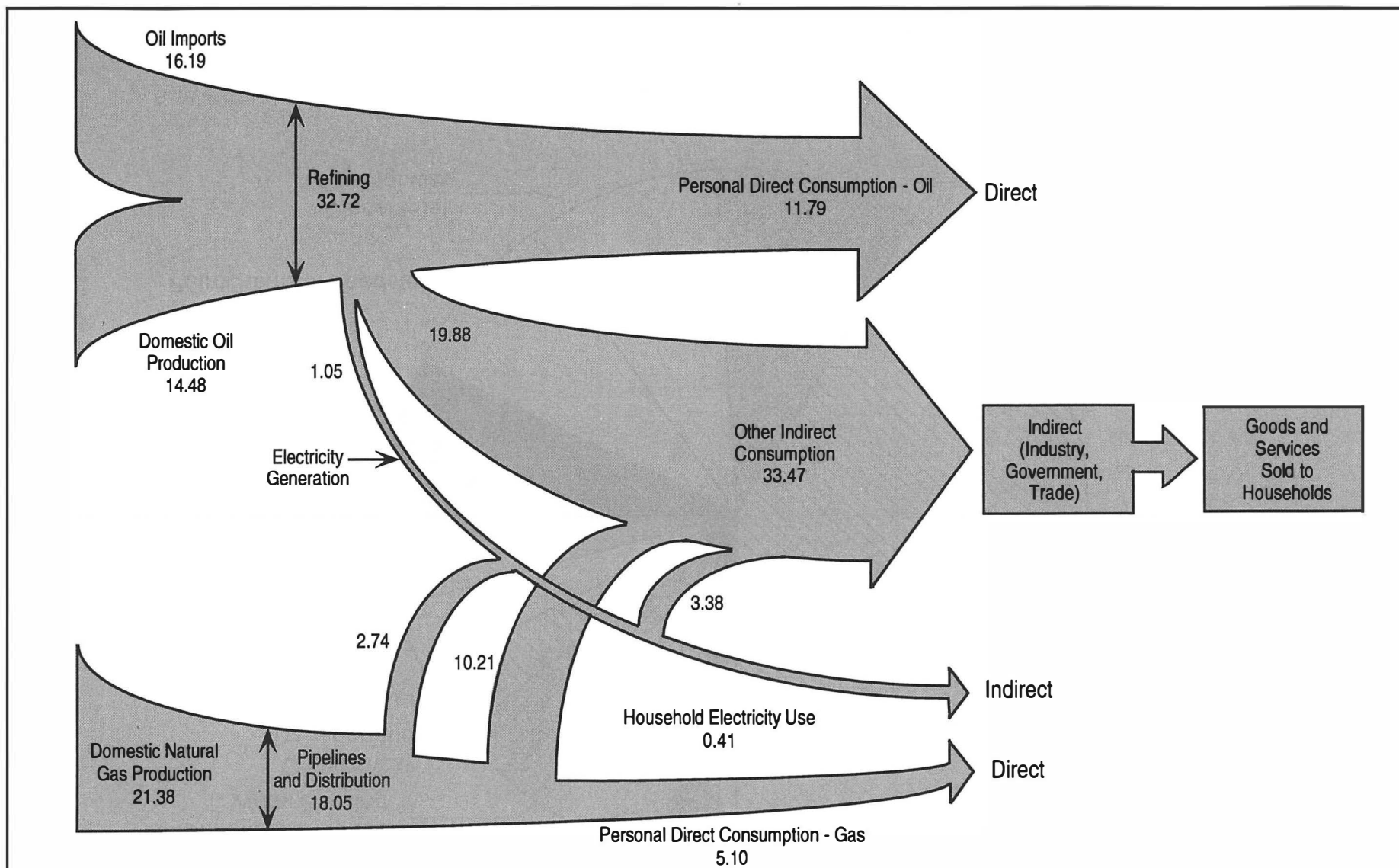
Figure 1-4 gives a sense of the direction of oil and gas energy flows through the economy, but it may be helpful to put this in more common terms. Each *day*, the industry produces enough gasoline to drive 2 million cars from New York to San Francisco, enough jet fuel to fly another 700,000 people over the same route, and enough natural gas to satisfy the *annual* heating and cooling needs of 163,000 single-family homes. At an individual level, everyone is familiar with oil and gas consumption. However, people are less familiar with the pervasiveness of the industry's products and the vital role of the industry in the national economy.

A revealing way of thinking about the value of a product is in terms of what it would cost to replace that product in its various uses with the best available alternative. The pie charts in Figures 1-5 and 1-6 show the distribution of oil products and natural gas respectively supplied by end use. Between motor gasoline, aviation gasoline, on- and off-highway diesel use, and other categories, almost 70 percent of petroleum products are going to transportation uses. For most of these uses, cost-effective alternatives do not now exist. The major substitutes for natural gas in its various uses are oil products and coal, but natural gas has been gaining market share because of its cost effectiveness, flexibility, and environmental benefits. Substituting away from natu-

ral gas means higher cost and/or lower quality. In the broadest sense, for each use of oil and gas, the value is the cost of switching to an alternative. This will vary with the specific use and over time, as new technologies become available both for alternative energy sources and for more efficient ways of using oil and gas. But oil and gas serve a vital role in the economy because the market system has found them the most efficient energy sources to serve the consumer and industrial needs of the nation. Other energy sources would be more costly, and consequently, would reduce the national wealth.

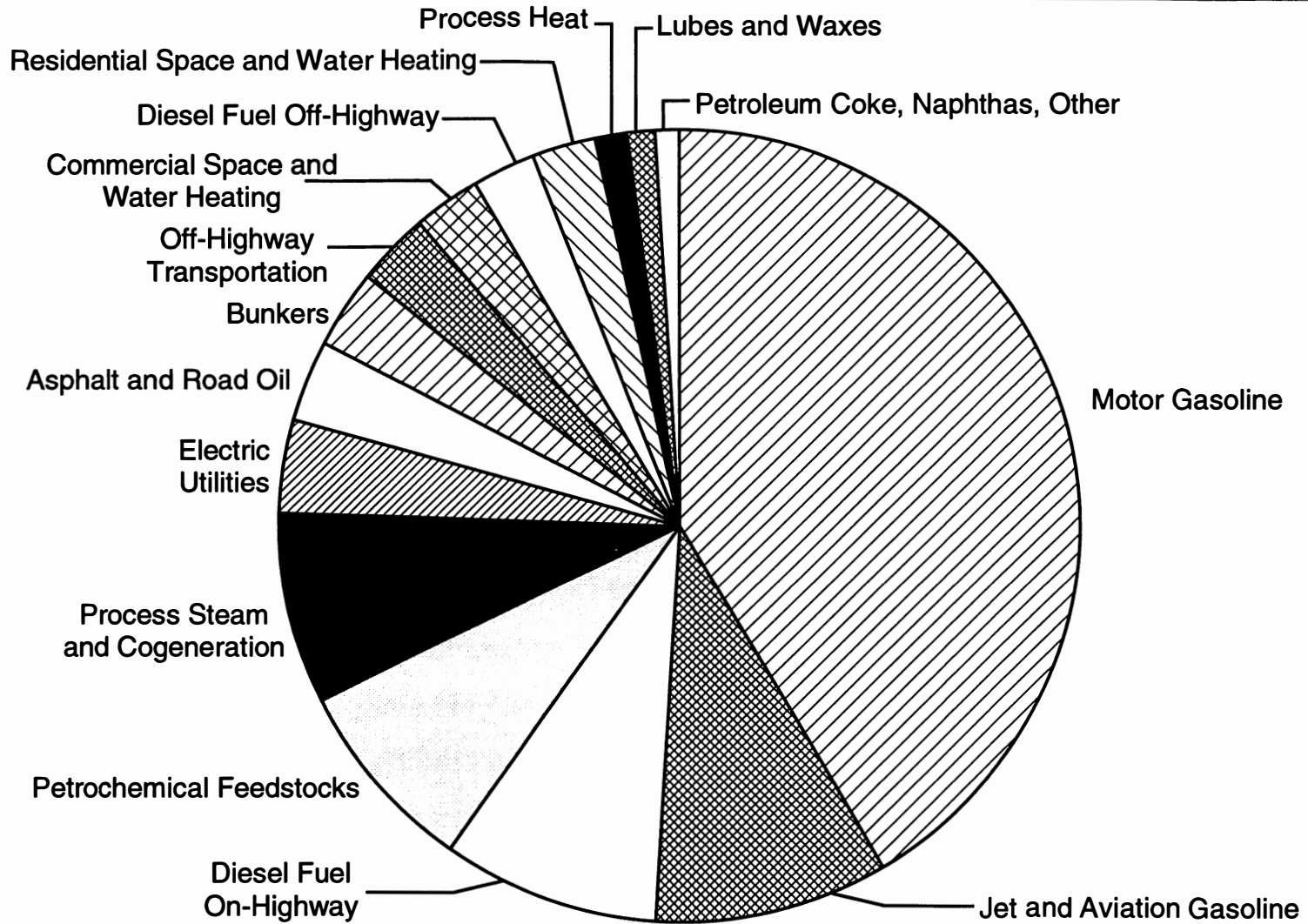
## LOOKING TO THE FUTURE

The U.S. oil and gas industry must find the means, including new technology, to meet the future challenges it faces, both in lowering cost to maintain competitiveness and in minimizing environmental impacts. In responding to these challenges, the oil and gas industry is increasingly becoming a knowledge business, and an exporter of knowledge services to the rest of the world. The United States has been the leader in oil and gas technology since the beginning of the industry. The emphasis on technology is reflected in the quality of employment in the oil and gas extraction and refining segments of the business. The proportion of scientists and engineers in total employment is shown in Figure 1-7. At over 8 percent, it is well above the U.S. average of 1.4 percent, and much higher than in other segments of the economy. The importance of computerization and knowledge advances has paralleled or led that in other sectors of the economy. Three dimensional seismic and pinpoint directional drilling, for example, have not only lowered exploration and development risks and costs, but have allowed activities to proceed with reduced impact on the environment. As a knowledge industry, the oil and gas sector is a source of opportunity for U.S. companies and individuals in those knowledge areas in which the U.S. economy must succeed to be competitive in the evolving world economy. This has been and will continue to be an important dimension of the role of the oil and gas industry in the U.S. economy.



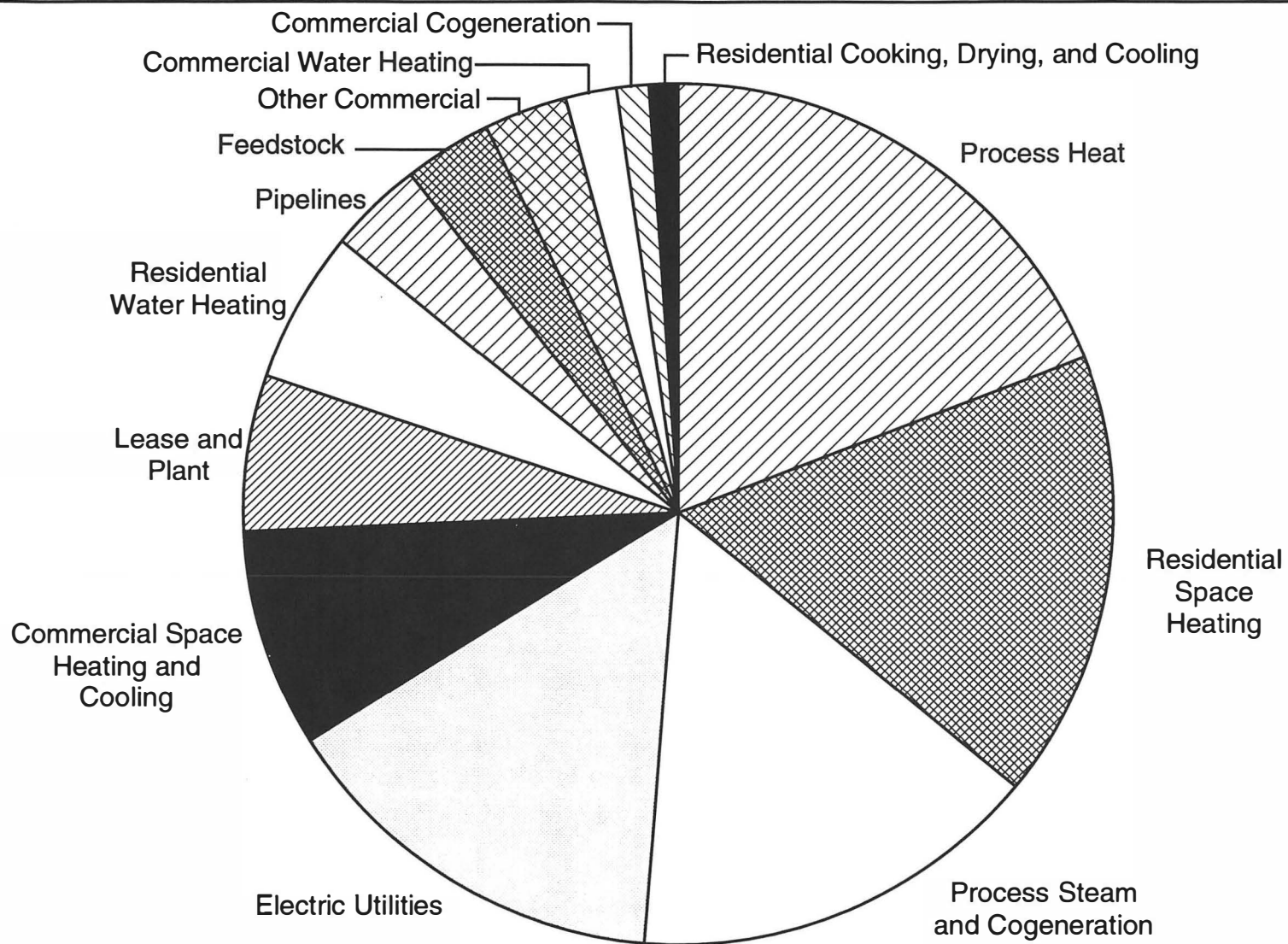
Source: EIA *Annual Energy Review*, 1993, Diagram 1; *Annual Energy Outlook*, 1995.

Figure 1-4. Flows of Direct and Indirect Oil and Gas Consumption (Quadrillion BTU).



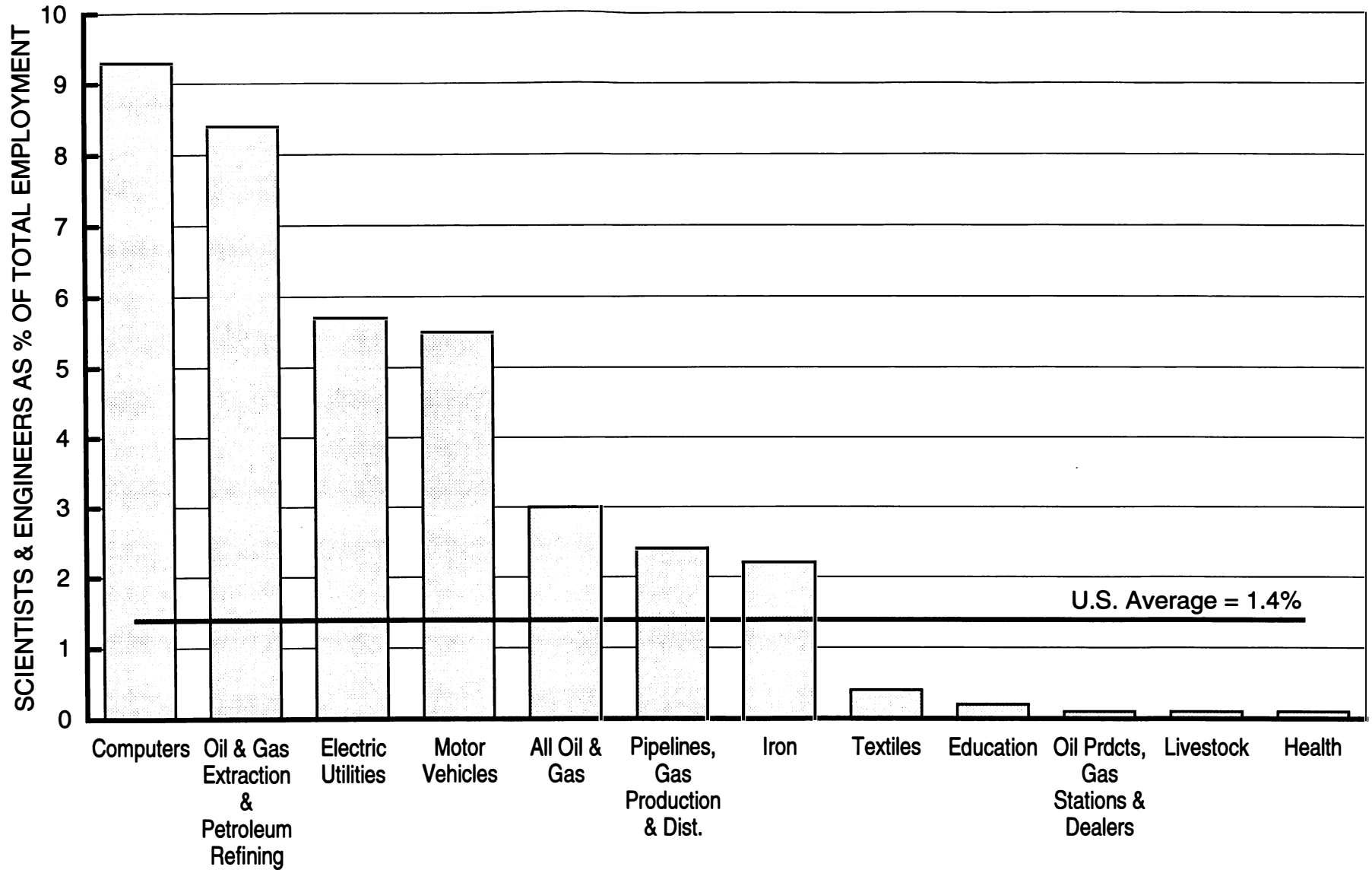
Source: GRI Baseline Projection Databook, 1994.

Figure 1-5. Distribution of Oil Products Supplied by End Use.



Source: GRI Baseline Projection Databook, 1994.

Figure 1-6. Distribution of Natural Gas Supplied by End Use.



**Figure 1-7. Oil and Gas Industry: Quality of Industry Employment.**

# **CHAPTER TWO**

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## **VIEWS OF THE PAST AND FUTURE**

### **INTERVIEW AND WORKSHOP PROCESS**

To research opinions on future issues for the oil and gas industry, Arthur D. Little, Inc. (ADL) conducted a series of 45 interviews and three facilitated workshops involving thought leaders. As an introductory step for the issue development process, ADL asked interviewees first to comment on how things have changed over the past 25 years, and then to present their view of the future in the year 2020. This exercise was useful to put respondents in the frame of mind to consider future issues, and the results of the exercise provide useful context for the issue discussion in the next chapter.

The interviewees and workshop participants were chosen jointly by ADL and the NPC to represent a range of views from inside and outside the oil and gas industry. ADL personnel conducted the interviews and provided anonymous interview summaries and analysis to the NPC, as described in Appendix D. The NPC did its own analysis of the interview and workshop information. This chapter presents that information, supplemented with some history of developments in oil and gas markets, the results of an NPC study of the oil and gas outlook conducted in 1970, and a brief summary of the current Energy Information Agency (EIA) outlook for oil and gas.

### **PAST AS PROLOGUE: 1970 TO 1995**

#### **1970 Recalled**

Before thinking about the future, it is instructive to look back at the past to see how earlier efforts at gazing into the future have fared. Since this study attempts to address the next 25 years, it is useful to go backward 25 years to 1970 to see the outlook then looking forward to 1995, and contrast that with what has really happened.

In 1970, World War II had been over for 25 years. A year earlier two Americans had walked on the moon, a high point for the nation. The United States had enjoyed high economic growth and prosperity over the post-war period, although there was a perception in the late 1960s that the rewards were not equally distributed across society. The civil rights riots and the assassination of three major national figures between 1963 and 1968 made it clear that some major social problems existed. The turbulent times at home reflected tensions throughout the world. The Cold War with the Soviet Union had been underway for the past quarter-century, and the United States had been fighting in Vietnam since the mid-1960s.

In technology, the moon landings were the signal events, and there promised to be significant technological spin-offs from the program in such fields as telecommunications, health, energy (solar), and prepared foods.

The hand-held calculator, although priced above \$100, was replacing the slide rule. The computer was a large mainframe with input from a deck of key-punched cards and output on wide green-striped paper. Telephones were rotary dial; copy machines were just beginning to replace carbon paper; and VCRs, fax machines, and cellular phones were still far in the future.

Energy was not something Americans thought or worried about. The post-war prosperity had been fueled with inexpensive oil, mainly from the rich oil fields of the southwestern United States, but increasingly from abroad, especially from the Arabian Gulf. Populations were expanding to “bedroom communities” that began to surround every major city, and commuters drove large cars made in Detroit. They fueled their cars with leaded gasoline, costing less than 40 cents per gallon, bought in stations with attendants who washed their windshields and checked their oil, coolant, and tires.

The energy forecasts of the day understandably anticipated that these consumption trends would continue, for it was the only pattern known in the quarter-century since the war ended. There was growing awareness within the industry and associated government and academic circles that the oil fields of the onshore lower-48 states had essentially peaked in oil production, but this production was expected to be replaced by increasing volumes from the offshore Gulf of Mexico, Atlantic and Pacific, and the new promising areas of the North Slope of Alaska. Moreover, there was so much cheap Middle Eastern oil that imports had to be limited by quotas to protect domestic production and prevent price declines. The Organization of Petroleum Exporting Countries (OPEC) had been formed and the host countries wanted more money and control, but their oil remained under concession to the multinational oil companies. No fundamental change in oil markets was foreseen.

Natural gas was considered a by-product of oil production. Wellhead price controls on interstate gas trade by the Federal Power Commission (FPC) had been in effect since the 1954 *Phillips* Supreme Court decision. In

1970, the controlled price was about 17 cents per thousand cubic feet (MCF) at the wellhead. Wellhead operators sold their gas to interstate pipeline companies, similarly regulated by the FPC, and the pipelines in turn sold it to local distribution companies, regulated by state and local Public Utility Commissions. Thus natural gas was completely controlled from wellhead to consumer, and this situation was expected to prevail.

An understanding had been building that the quality of the nation’s air and water had deteriorated. Driven by the first Earth Day in 1970, President Nixon established the Environmental Protection Agency to begin the cleanup and regulate future actions affecting the environment. Major environmental legislation was enacted during the 1970s. The Clean Air Act of 1970 established air pollution control goals including auto emission reductions. Congress enacted major revisions in federal water pollution law in 1972 and the Clean Water Act in 1977. The Resource Conservation and Recovery Act was enacted in 1976 to address hazardous waste disposal, and the Superfund Act followed in 1980.

## **Energy Forecasts**

Projections made by the National Petroleum Council in the early 1970s reflected the sense of little change in sight. The study said it was “judged unlikely that growth in [energy] consumption would depart significantly from ... 4.2-percent per year rate during the 1971-1985 period,” the limit of the 15-year outlook. “A range of 3.4-percent to 4.4-percent annual growth embraces the probable changes that could be effected” in demand. As Table 2-1 shows, the actual 15-year average annual increase in U.S. energy use was 0.6 percent.

Table 2-1 also shows that oil consumption was expected to grow within a range of 0.9 to 4.8 percent, but actually grew at an average of 0.6 percent per year. Domestic oil production was predicted to grow within a range of -0.4 (decline) to 2.5 percent, and actually came in near the bottom of the range at 0.1 percent per year, even with the addition of oil from the North Slope of Alaska. Natural gas use was expected to grow within a broad range of 0.1 to



**TABLE 2-1**  
**NPC'S 1972 STUDY OF THE U.S. ENERGY OUTLOOK**

	1970 Actual	NPC Forecast for 1985			1985 Actual
		Low	Interm.	High	
Energy					
Quad BTU/year	67.8	112.5	124.9	130.0	74.0
Avg. Ann. Increase		3.4%	4.2%	4.4%	0.6%
Oil Demand					
MMB/D	14.7	16.7	22.6	29.5	16.0
Avg. Ann. Increase		0.9%	2.9%	4.8%	0.6%
Domestic Oil Prod. (Crude Oil & NGLs)					
MMB/D	11.3	10.6	13.9	16.4	11.4
Avg. Ann. Inc.		-0.4%	1.4%	2.5%	0.1%
Natural Gas Demand					
TCF/year	21.7	21.9	36.5	44.2	17.4
Avg. Ann. Increase		0.1%	3.5%	4.9%	-1.5%

4.9 percent, but actually *declined* an average of 1.5 percent per year. Thus the average supply and consumption growth estimates were almost all at or below the low end of the NPC range, and the variances between actual and forecast were more volatile than they had been in earlier decades. Along with most other forecasts of the day, the NPC study failed to foresee the massive upcoming changes in energy markets.

### 1970-1995

In 1973, oil in many of the OPEC nations was expropriated from private oil companies and nationalized. Arab nations enforced a selective oil embargo which quadrupled the price of crude oil. The embargo combined with federal price and allocation controls to create product dislocations and shortages—the infamous “gasoline lines.” Matters settled down somewhat for six years as the United States struggled with higher energy prices, but the Islamic revolution in Iran in 1979 triggered a more than doubling of the crude oil price and caused more “gasoline lines.” The price of crude oil, about \$3 per barrel for the four decades 1933-73, rose to about \$35 per barrel in 1982.

As for natural gas, prices in the interstate markets began to lag those in intrastate markets

shortly after 1970, and shortages outside the gas producing states began to develop. Despite the growth estimates, 1972 would remain the year that U.S. natural gas consumption peaked. The problem was greatly exacerbated by the cold winters of 1976-77 and 1977-78, when curtailments extended to schools and hospitals in the Midwest made it obvious that price controls cause shortages. This led to the first steps toward decontrol, a process that is now essentially complete all the way to the city gate.

After 1979, higher oil prices provided incentives to increase exploration and development efforts in areas outside OPEC, such as the North Sea, Mexico, and the United States. Shortly after the end of the NPC forecast period, in 1986, the price of oil collapsed, and marginal U.S. production declined with it. The low prices since then may have increased demand somewhat, but energy efficiency improvements begun during the 1973-81 high price period have continued to depress consumption. Meanwhile, environmental concerns led to restrictions that prevented the U.S. industry from exploring in the lower-48 state offshore areas (except the western Gulf of Mexico) and in some promising areas of the North Slope of Alaska. Today, U.S. crude oil production has declined to less than 7 million barrels

per day. Oil demand today is hardly above 1970 levels. The United States imports close to half of its needs and the industry has shrunk dramatically. Compared with 1970, only 13 of the 87 largest independent upstream companies, 15 of the 31 largest integrated oil companies, and 3,600 of 13,000 recorded production lease operators still exist today.

Considering the magnitude of the changes over the past 25 years, it is not so surprising that the vision of the future held in the 1970s did not come to be. But there is a lesson in this—it is possible that changes of a similar magnitude will occur over the next quarter-century, and it would be wise to expect surprise. Useful planning does not depend on accurate forecasts of the future, but in applying the lessons of the past to adjust to whatever might occur in the future. The power of market forces is the most striking of the lessons from this period of history. This is illustrated by the surge in world oil supply in response to higher oil prices in the 1970s, and then by the response of demand to those prices. And the

cost of trying to ignore market forces was evident in the shortages that resulted from price and allocation controls. Another impressive feature of this period was the speed of technological change. The capacity of the nation to make real environmental improvements has been demonstrated in improved air and water quality, but widespread concerns exist today about the costs of regulation at both the corporate and individual levels.

## EIA OUTLOOK

The review of the past 25 years suggests some caution on the subject of forecasts. Nevertheless, they can provide useful bases from which to raise issues about the future. The Energy Information Administration's 1995 *Annual Energy Outlook* provides a view of the energy future of the United States and the world through the year 2010. A summary of the reference case projection from the EIA outlook is given in Table 2-2. The EIA reference case is basically a "trends continued" case. The NPC

**TABLE 2-2**  
**EIA 1995 ANNUAL ENERGY OUTLOOK**

	1993	2010	Average Growth (Percentage)
<b>World</b>			
Gross Domestic Product (%)			2.7
World Oil Demand (MMB/D)	66.7*	88.7	1.6
OPEC Oil Production (MMB/D)	27.0	46.7	3.3
World Oil Price (1993\$/Barrel)	16.12	24.12	2.4
<b>United States</b>			
Gross Domestic Product (%)			2.2
U.S. Energy Demand (Quad BTU)	87.3	103.9	1.0
U.S. Natural Gas Demand (TCF/Year)	20.2	24.6	1.2
U.S. Oil Demand (MMB/D)	17.2	20.9	1.1
U.S. Oil Production (MMB/D)	6.9	5.4	- 1.4
U.S. Oil Imports (MMB/D)	7.6	12.2	2.8
Net U.S. Imports (% Primary Supply)	44	58	

\* 1992, latest available data, Energy Information Administration, *International Energy Outlook*, 1995.

Source: Energy Information Administration, *Annual Energy Outlook*, 1995.

does not adopt this case; it is used here as the most convenient reference point from which to consider certain issues about the future. Although company energy forecasts are not generally released publicly, there seems to be a general view that EIA forecasts of supply and demand volumes for this case are somewhat higher than outlooks within the industry.

This EIA case assumes annual world GDP growth averaging 2.7 percent, led by growth in the Asia/Pacific region. World oil demand increases, but much more slowly than GDP. To supply total world oil demand of 89 million barrels per day (MMB/D), substantial increases in oil production will be required, concentrated outside of the developed countries where oil reserves have been more intensively exploited. OPEC oil production rises by just under 20 MMB/D—a 73 percent increase, and production from the rest of the world declines slightly. The outlook for oil prices is for relatively little change in the near term and slow increases after 2000 as world capacity tightens.

The EIA outlook for the United States is based on average economic growth of 2.2 percent per year of GDP. Energy demand grows at less than half this rate as economic activity becomes less energy intensive and energy efficiency gains continue. The trends in oil and natural gas demand are similar to those for total energy. Domestic oil production will continue to decline. This leads to an increasing percentage of imported oil, reaching 58 percent in 2010. These production and import trends foreshadow future issues for the oil and gas industry and the country.

## **THE NEXT 25 YEARS**

One of the most interesting results of the ADL interview and workshop process was the collection of people's views of 2020. Many of the views were quite similar, but to understand the scope of the challenges the oil and gas industry may face over the next 25 years, minority views may be every bit as important as the consensus. First the most commonly held views of the future will be described, and then this view will be contrasted to some of the minority views.

There is a clear expectation among interview and workshop participants of a very dynamic world, characterized by further increased global integration, in 2020. Driven by rapid telecommunications advances, global markets will become increasingly transparent and competitive. International trade organizations will play an increased role in world affairs, and more international standardization in taxes, business regulation, and environmental matters is likely. Strong Asian economic growth is expected, with Asian countries gaining proportionately more influence in world affairs. Political instability is expected to persist in the major oil-producing countries of the Arabian Gulf and the former Soviet Union.

The workplace will be dramatically altered, driven by automation and rapidly improving information technology. The trend toward focusing on the most value-adding activities and out-sourcing the rest will continue. These rapid advances are seen as having significant impacts on society, and there are concerns over the possible development of a "two-tier" society. Also, demographic shifts toward older and more culturally and ethnically diverse Americans will alter the workforce and the customer base. Steady improvement is foreseen in energy efficiency, but at measured rates because of ingrained habits and the slow turnover in capital stocks of cars, houses, appliances, factories, and equipment. Most think that gasoline-powered vehicles will still be the predominant form of personal transportation used in 2020, although a few believe that there will be significant penetration of electric cars in urban areas. Even if there are major technological improvements in alternative energy sources before 2020, long time lags will prevent their taking a large share of energy markets in this period.

Environmental concerns will continue, with greater focus on global issues, such as climate change, and local issues, such as siting of facilities. Movement away from "one-size-fits-all" national issues is expected. Most believe regulation generally will move toward market-oriented, performance standard-based methods. There will also be continued deregulation in many areas, including energy. However,

some respondents spoke of the necessity for keeping the pressure on government to make regulatory reform happen.

Most respondents expect that worldwide oil and gas demand will have increased by 2020, driven by rapid growth in newly industrializing countries, particularly in Asia. There are expected to be ample world supplies of oil and gas to satisfy this demand. Some people believe that oil prices will gradually move upward in real terms as resource utilization rises, others believe in generally flat to decreasing prices. The trend of technological improvement in the petroleum industry is expected to continue. Although there is a possibility of price spikes, the possibility of sustained rapid upward movement in prices is generally discounted, because supply and demand responses would be triggered.

In the United States, natural gas demand is expected to rise because of its environmental advantages generally and because of increased use in electrical generation. Beyond the possible rise in gas demand, the national energy mix is expected to be similar to today's mix. There is more uncertainty about future growth of oil demand in the United States, but general agreement that domestic production will continue to fall. Natural gas will increasingly be the driving force for the domestic industry. Some believe that energy forms will be increasingly substitutable in the future, so that a "BTU market" will develop.

The major contrast to this view of the energy future was the belief held by a few respon-

dents that oil demand was going to drop significantly, with corresponding effects on oil industry size, structure, employment, and profitability. There were contrasting views as to how this might arise: driven by technological breakthroughs in efficiency and alternative energy technologies, or driven by severe demand restrictions forced by concerns about sustainable development and global warming. The strongest advocates of the technology scenario believe that the technology already exists to improve drastically the efficiency of energy use, but that barriers delay commercialization. An example of such a technology is the hybrid electric vehicle built of composites that could achieve 150 miles per gallon. Others see important alternative fuel technologies, such as fuel cell and solar applications, as now in the process of rapid technological improvement. Some people believe renewables will be competitive with new fossil fuel electrical generation capacity over this time frame. Renewables could account for 10 percent of world energy supply by 2020. Rapid technology development scenarios would clearly be beneficial for the world economy, but demand management to force use of renewables would have negative economic consequences. Finally, if there is a major disruption in supply, there may be increased focus on limiting the amount of oil imports, increasing domestic oil production, or even decreasing consumption. These uncertainties, and the trends seen in the consensus view of the future, will be major drivers of issues for the oil and gas industry over the next 25 years.

# **CHAPTER THREE**

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## **ISSUES FOR THE NEXT 25 YEARS**

The NPC has identified eight issues likely to be of key importance to the oil and gas industry over the next 25 years, based on its own deliberations and the ADL interviews and workshops. The issues are summarized in the box on the next page.

The term “issue” has been taken to mean a focus of policy debate in the future. One of the eight issues, Industry Image, does not quite fit the mold of a focus for policy debate, but it was of sufficient importance to the future of the industry to be included on the list. The intent was to be inclusive of the concerns identified in the NPC information-gathering project. Concerns were grouped under issue labels that reflect the terms in which these issues are usually discussed. As a result there is considerable overlap across the issues.

The issues have been grouped into four categories: energy security, industry-government interface, environment, and industry image. In the final section of this chapter, crosscutting themes touching each category are identified.

### **ENERGY SECURITY**

U.S. crude oil production has been declining almost continuously for 25 years, after reaching a peak of 9.6 MMB/D in 1970. Production was 6.6 MMB/D in 1994, and most current forecasts show a continuing decline. Declining domestic production implies rising imports, which now supply about half of do-

mestic petroleum demand. The EIA 1995 *Annual Energy Outlook* provides a representative view of this import growth. As shown in Table 3-1, the absolute level of imports is projected to rise from 7.6 to 12.2 MMB/D, and the import share of demand from 44 to 58 percent between 1993 and 2010.

Natural gas imports are also expected to rise significantly over the 1993-2010 period. The EIA outlook shows 3.6 trillion cubic feet (TCF) of natural gas imports in 2010, up from 2.1 TCF in 1993, with most of the imports expected to be from Canada. However, liquefied natural gas (LNG) becomes the marginal source of imports in scenarios with high gas demand growth or lower North American supply assumptions.

Some believe that declining domestic oil production and rising imports of oil and gas will have negative economic and security impacts. And the decline is of great concern to those who make their living in the domestic production industry, particularly in smaller companies that do not have the resources and capabilities to develop opportunities outside the United States. Added consideration of production and energy security form a more complex picture.

### **Declining U.S. Oil Production**

Over 80 percent of the world’s oil and gas wells have been drilled in the United States. In

## Future Issues for the Oil and Gas Industry

### *Energy Security:*

#### **Declining U.S. oil production**

Continuing decline of domestic oil production, policies contributing to that decline, and actions to limit the decline

#### **Supply security and availability**

Compatibility of rising oil and gas imports with national energy and economic security, and implications of import reliance for energy policy

### *Industry-Government Interface:*

#### **Global competitiveness**

Opportunity for U.S. oil and gas industry to compete in global markets, and competitiveness in world markets of U.S. industries that consume oil and gas

#### **Role of government in markets**

Extent and nature of government involvement in the energy industry and in energy markets in the United States

### *Environment:*

#### **Environmental quality**

Impact of oil and gas operations and of the use of oil and gas products on the environment

#### **Global climate change**

Possible association of emissions of carbon dioxide and other greenhouse gases with changes in climate patterns, and implications for energy policy

#### **Sustainable development**

Compatibility of oil and gas development and use by current generations with the ability of future generations to meet their needs

### *Industry Image:*

#### **Industry image**

Stakeholders' understanding and opinion of the industry as factors in future policy toward the industry and future opportunities for the industry

**TABLE 3-1**  
**GROWTH OF OIL AND GAS IMPORTS**

	1993	2010
<b>Oil (MMB/D)</b>		
Domestic Demand	17.2	20.9
Crude Oil Imports	6.7	8.9
Oil Product Imports	0.9	3.3
Total Imports	7.6	12.2
Oil Import Share of Demand	44%	58%
<b>Gas (TCF)</b>		
Domestic Demand	20.2	24.6
Natural Gas Imports	2.1	3.6
Gas Import Share of Demand	11%	15%

Source: Energy Information Agency, 1995  
*Annual Energy Outlook.*

areas where exploration is currently permitted, most of the large oil reserves have been discovered and developed. While gradual depletion of resources is the major factor in the downward trend of oil production, policies by various levels of government are serving to exaggerate the trend. The policies include restrictions on access to land, taxes and royalties that are not consistent with marginal economic operation of much domestic production, and regulatory requirements that raise costs. The Arctic National Wildlife Refuge (ANWR), parts of the Outer Continental Shelf, and certain federal lands in the lower-48 states are examples of areas with the potential for significant oil and gas reserves that are currently off limits. Examples of costly regulatory burdens include Superfund joint liability provisions, Oil Pollution Act of 1990 (OPA'90) financial requirements, the Risk Management Program of the 1990 Clean Air Act Amendments, and Enhanced Air Monitoring proposed by the Environmental Protection Agency. The Superfund provisions impede the transfer of marginal wells to smaller producing companies, with lower costs, a process which prolongs their producing life.

One aspect of the continuing policy debate over declining U.S. production is whether policies now limiting domestic production can be made less restrictive and costly while preserving the public interest. There is controversy over the appropriateness of incentives (or reduced *dis*-incentives) for domestic production, with divided views within the industry. There have also been divided views within the industry on the use of tariffs or quotas to limit imports and encourage domestic production. These policies are recognized to have major implications for consumers, as well as for U.S. export competitiveness and international trade agreements.

### **Energy Security and Availability**

The issue of supply security and availability centers on the possible vulnerabilities created by reliance on imported crude oil and products and natural gas to satisfy a large share of domestic demand. There is concern that growing oil imports increase exposure to economic shocks resulting from oil supply disruptions, and both oil and gas imports contribute to the national trade deficit. Most of the world's remaining oil reserves lie in unstable areas, and the "gasoline lines" of the 1970s are still a powerful memory.

Security of supply was a major subject in the interviews and workshops. Some non-industry respondents felt that "petroleum trade disruptions will occur periodically as a result of potential tensions in producing countries or elsewhere in the world." Workshop participants believed diversification of supply to be an important factor in security. Non-industry participants at one workshop saw demand reduction as a significant contribution to resolution of the issue. Another workshop differentiated between dependency and vulnerability, noting that U.S. dependence on oil imports was a fact of life, but need not imply vulnerability. The Strategic Petroleum Reserve was recognized as one mechanism for limiting vulnerability.

There appears to be general agreement that future disruptions of oil supplies in world oil markets are likely. The debate centers on how significant such events will be for the United States, whether additional measures are required to protect against such disruptions,

and, if so, what measures. The future importance of this issue depends greatly on the amount of spare oil production capacity in the world and on the degree to which production becomes concentrated in one country or region of the world. Most long-term outlooks for the oil market show increasing concentration of world production in the Arabian Gulf after the year 2000. Existing spare production capacity will be brought into use and substantial new capacity will be required to support expected demand growth in developing countries. If this outlook for the future is correct, these factors will make the world market more susceptible to the loss of production capacity in large producing nations. The potential significance of such curtailments is hard to assess, but probably more significant than the Iraqi invasion of Kuwait (because there will be less spare capacity in the world) and less significant than the oil disruptions of the 1970s (because most segments—other than transportation—of the economy are less sensitive to oil shocks now).

Economic vulnerability is not an easy concept to define. As far as the trade balance is concerned, the import bill is considerable, but the annual cost of U.S. petroleum imports as a share of all imports has declined from about 25 percent in 1975 (and from a peak of about 30 percent in 1980) to less than 8 percent in 1994. In terms of level of import reliance, almost all industrial countries import a larger share of their oil than the United States. Further, the security question should be framed on an energy rather than an oil level, and U.S. energy dependence is low compared to most other countries. The vulnerability concern appears to be that supply disruptions will generate high enough price spikes to affect U.S. macroeconomic performance. Careful analysis of the impact of the oil crises of the 1970s indicates that regulatory rigidity (associated with price controls) and mistakes in monetary management, were the major causes of disruption of the economy. However, large price variations have become a normal feature of crude oil markets over the past two decades. Paper markets in crude oil futures like the NYMEX can be used to hedge against the risk of price changes. The leverage of oil prices on the U.S. macroeconomy has declined greatly since the

1970s, because the rest of the economy has grown far more rapidly than oil consumption. In any case, crude oil prices are determined in a world market, and the level of U.S. imports is only one of many influences on the oil price.

Reliance on oil imports is sometimes associated with the need for the United States to maintain substantial military capacity to protect Arabian Gulf oil supplies, and it is further argued that a substantial share of U.S. defense spending is therefore a cost of using imported oil. The counter-argument is that the United States would be maintaining the military capacity in any case, and that dividing up the cost of the military between specific threats is unrealistic. While the “security cost” argument has many weaknesses, it is clear that Arabian Gulf oil supplies to world markets have been a significant factor in U.S. foreign and military policy, and would be regardless of the level of U.S. oil imports.

If policies to mitigate supply security concerns are required, both supply-side and demand-side actions are possible. Diverse world supply and the maintenance of spare world production capacity are important factors for limiting vulnerability to individual countries or regions. U.S. foreign and defense policy will continue to play an important role in limiting supply disruptions related to outside threats to producing countries. But oil is a global commodity traded in a world market, so policy to limit vulnerability to supply shocks is an international issue. The International Energy Agency was established after the first oil crisis in 1973, with one objective, to facilitate international cooperation among oil-consuming countries at times of supply disruption. Thus the Strategic Petroleum Reserve (SPR) in the United States and similar petroleum reserves in other countries can be used in a coordinated fashion during a crisis. The SPR and similar reserves in other countries would serve to counterbalance extreme price movements.

## **INDUSTRY-GOVERNMENT INTERFACE**

Two issues have been grouped under the industry-government interface heading: global



competitiveness and the role of government in markets. The global competitiveness issue arises from the continuing movement toward a highly competitive global economy. This trend impacts both the U.S. oil and gas industry, which needs the opportunity to compete in world markets, and U.S. industries that are consumers of oil and gas and that must also compete in world markets. The role of government in markets is an umbrella issue that captures the enduring controversy over the extent and nature of government involvement in the energy industry and in energy markets in the United States.

## **Global Competitiveness**

Interviewees and workshop participants foresee a much more competitive world by 2020. Many Asian countries will continue to grow more rapidly than OECD (Organization for Economic Cooperation and Development) nations. A better business environment, including better growth opportunities, lower labor costs, and less stringent environmental regulation, might contribute to a shift of manufacturing capacity away from the United States to Asia. The leading role of the United States in the world economy will decline further as new economic powers emerge, including such populous nations as China and India. Nevertheless its technological base and leadership in knowledge industries will ensure that the United States remains a major economic power.

The U.S. oil and gas industry will face increasing competition in home markets and abroad. In the U.S. market, oil products competition is likely the most immediate concern, because of the high regulatory costs faced by U.S. refiners. It is not clear whether some of these regulations could pass cost-benefit tests.

The opportunity to compete in foreign markets is critical for the petroleum industry, particularly the service and support segment, because growth in domestic petroleum markets is likely to be limited. Without access to markets abroad, the U.S. petroleum industry may not be able to maintain its position as a leader in and exporter of technology and knowledge services, because the domestic in-

dustry alone will be too small to support continuing investment in that leadership. To succeed, the U.S. petroleum industry must be viewed by international customers as a reliable investment partner and supplier of services. The U.S. government has an important role in future exports of U.S. oil and gas technology and services. This role includes promoting protection of intellectual property and assisting in development of commercial practices, and of legislative frameworks for investment in the oil and gas sector of developing countries.

One aspect of global competitiveness as an issue for the petroleum industry and U.S. industry in general is the frequent lack of congruence between U.S. foreign policy and the needs of U.S. industry as exporters. Unilateral embargoes have little or no effect on the embargoed countries when their exports trade in world markets, but such sanctions prevent U.S. exporters from establishing long-term relationships in important future markets. The resolution of this issue over the future will require a higher priority for the interests of exporters on the part of those who decide foreign policy. Strong commercial ties have historically been more effective in advancing U.S. interests than attempts at isolation.

## **Role of Government in Markets**

The debate over the appropriate extent and means of government intervention can be expected to continue indefinitely. There is a long history of regulation of the oil and gas industry at the federal and state levels, involving pipelines, production levels, and price. In the 1930s, public utilities were regulated under the Public Utilities Holding Company Act and natural gas pipelines under the Natural Gas Act, and this regulation was extended back to the wellhead by the Supreme Court in 1954. Oil was regulated in the 1970s under the Emergency Petroleum Allocation Act and the Energy Policy Conservation Act, including price controls on oil and products. There has also been regulation of the technology of automobiles and appliances that consume energy (e.g., oil and gas products and electricity). And of course, like other sectors of the economy, the oil and gas industry must comply

with the broad sweep of regulations covering health, safety, the environment, labor, and other areas. There have been significant deregulation initiatives in oil and gas markets in recent years, but the debate over the role of government continues.

It is the government's role to protect the public interest, but many believe that too much and the wrong kind of intervention in markets suppresses economic activity without creating commensurate benefit. Estimates of the cost of government regulation run as high as hundreds of billions of dollars per year. At issue are both what is being regulated and how regulation is being implemented. A consensus is developing that rigid command and control regulation often forces high-cost solutions and stifles innovation, while more flexible goal-based regulation provides incentives to solve problems more innovatively and cost-effectively. This perception was widely held by workshop participants and interviewees.

Future debates over the role of government in the energy industry and energy markets will include the continued deregulation of natural gas to the end consumer; access to resources in the United States; taxation and royalties for U.S. domestic production; the government role in research, development, and dissemination of technology; regulation of future choices among energy-consuming technologies; deregulation of electric utilities; regulation of financial instruments for energy markets (e.g., "paper barrels"); taxation of motor fuels to raise revenues for general funds over and above legitimate social costs; subsidies on competing fuels; permitting for industry construction projects, particularly pipelines running across several jurisdictions; and of course environmental regulation in all of its forms.

## **ENVIRONMENTAL ISSUES**

Three dimensions of environmental issues have been identified: environmental quality, referring to the local environmental impacts of oil and gas operations and of the use of oil and gas products; global climate change, covering the global environmental issue of the possible

effect of carbon dioxide and other greenhouse gas emissions on climate patterns; and sustainable development, the concern over the compatibility of ongoing oil and gas development and use with the ability of future generations to meet their own needs. The latter issue goes beyond environmental concerns, but, as discussed below, the main issues raised about oil and gas in the sustainable development debate are environmental, so it is included in this grouping.

### **Environmental Quality**

The issue labeled here as environmental quality is an umbrella for the many specific environmental concerns that are associated with the oil and gas industry related to land, air, and water; species protection; visibility and aesthetics; and health. Due to its characteristics as an extractive industry with large processing facilities and transportation infrastructure and with products used in combustion, the oil and gas industry is a natural focus of environmental concern. To protect the public interest, governments have addressed this concern with regulations aimed at safeguarding air, water, land, species, and health. Because these regulations have become constraining factors for both oil and gas operations and the composition and use of petroleum products, the extent and form of regulation are major issues for the oil and gas industry and for the consumer. While the specific focus of the debate may evolve over time, environmental quality will surely be a continuing issue for the oil and gas industry in the future.

The industry, and particularly oil companies, are viewed by many as lacking concern for the environment and commitment to protecting it. Many environmental and consumer groups believe that low probability risks to health and to the environment must be treated as serious problems, and they may dispute the probability assessments provided by industry. Some stakeholders feel that the environment is so important that it should be protected at any cost. The industry and other stakeholders favor economically efficient environmental protection that weighs the costs of protection against the benefits. There are sometimes

contradictions between the public concern over environmental quality and public willingness to accept intrusive or costly measures to preserve that quality. This divergence of views presents a challenge for sound and consistent policy-making that both meets community expectations and reflects underlying economic trade-offs.

American industry generally is of the opinion that U.S. environmental policy has lacked consistency and awareness of cost, and instead has been too ready to respond to the public concern of the moment without adequate scientific basis. Policy response has frequently been overly prescriptive and rigid. In addition, legislation and regulations have often been unclear or applied retroactively, which has led to reliance on the courts to resolve regulatory specifics, at great expense to all parties. Natural resource and punitive damages provisions are further industry concerns over legal application of environmental principles. These concerns are reflected in the current regulatory and legal reform initiatives.

The crux of the debate on environmental regulation is the level of environmental controls and the methods by which these controls are achieved. Most in industry believe that the level of environmental protection must reflect sound scientific assessments of risk and economic analysis of the costs and benefits. However, some environmentalists resist the balancing of benefits and costs, and the public often has little awareness of the trade-offs involved in increasing the level of protection. An additional issue in debate over regulatory mechanisms is whether specific methods and technologies for reducing environmental impacts should be mandated or whether only the goals of the regulation should be set, leaving companies free to achieve those goals in the most cost-effective manner. The industry and many other stakeholders favor goal-based regulation, which allows individual companies flexibility to meet those goals in the manner most suited to their situation and offers more scope for technological improvements to provide environmental protection in the most efficient manner.

An important dimension of the environmental quality issue is satisfying the public expectation that the oil and gas industry operate in an environmentally responsible manner. This is both a matter of environmental performance and of communicating that performance to the public. Possible measures that have been suggested for improving performance and credibility include: strengthening the API Strategies for Today's Environmental Partnership (STEP) Program to include accountability and sanction provisions similar to those in the Chemical Manufacturers Association's Responsible Care Program; monitoring of environmental performance by outside parties; and programs to communicate measures that the oil and gas industry has taken to protect the environment.

## **Global Climate Change**

Concern over global climate change relates to the possibility that emissions of carbon dioxide and other greenhouse gases will result in alterations in climate patterns. Global climate change is one of the most uncertain of the issues that the oil and gas industry and society generally, will face over the next 25 years, and the potential impact could be great. Some people believe that the danger posed is serious enough to require immediate drastic action, and many think that response to global climate concerns may be a dominant theme for the oil and gas industry over the next 25 years.

There is general agreement that, if fossil fuel consumption is in fact causing significant long-term detrimental climate changes, the oil and gas industry will be significantly impacted. One interviewee, for example, said, "Global warming is a key uncertainty. If calamities can be directly attributed to it, the whole future of the energy industry could be changed." The differences in views of this issue arise from polar opinions of the likelihood that fossil fuel consumption is having a significant effect on the climate system. One comment was, "The fears about global warming are likely to be greatly exaggerated. You get amazing results from a small input of fact." In contrast, another response was, "Most of our international neighbors believe that global warming is real

and that concrete steps should be taken soon.” And at the other end, a third comment was, “Global warming will not occur. The current computer models are weak. Inaccuracies in their basic assumptions indicate that warming conclusions are inappropriate.” It should be noted that respondents differentiated the effects of global climate change on the oil and gas segments of the industry: “Natural gas will increasingly become the favored transitional fuel toward a fully renewable sustainable economy.”

The focus of the debate over the likelihood and magnitude of climate change is the current ability to predict future climate trends using general circulation models of the global climate system. General circulation models do not capture well the complex interactions within the climate system. In addition, such models require assumptions about levels of emissions over the next several centuries, which depend on assumptions about economic growth and fuel choices over this period. In particular, models predicting significant long-term warming assume rapidly rising coal use in the 21st century and beyond.

People who believe that global climate change requires immediate drastic action interpret model results to mean that the potential consequences are so serious and/or the likelihood of climate change so high that severe steps to limit it must begin. Others believe that the predictive power of climate models is wholly insufficient to justify economically costly actions. Most in the oil and gas industry fall into the latter group. Whether prediction from such models is meaningful depends on the ability to represent accurately key physical climate processes through independent theory and measurement. With the current lack of knowledge of the physical processes being modeled, such as clouds, ocean circulation, and the biosphere, meaningful prediction is not possible. To those in the oil and gas industry, the situation is reminiscent of earlier model-based concerns that the earth’s resources would soon be exhausted (such as the 1970s’ report of the Club of Rome, *The Limits to Growth*), and predictions that oil and gas and other resource prices would rise precipi-

tously. In fact, market forces acting on energy supply and demand proved these predictions wrong. The industry has learned to be wary of predictions, and instead to maximize flexibility to adjust to external conditions.

There is also dispute over the nature of the risk posed by global climate change. Economic studies of the mean warming predicted by climate models indicate that economic impacts of these predicted climate changes on industrial countries would not be very great, although impacts on very low-lying developing countries could be catastrophic because of sea level rise. However, those most concerned about global climate change have increasingly focused their attention on the potential physical threat from changes in climate patterns, including more extreme storms and shifts in ocean currents, and on the threat to ecosystems. There is little knowledge and high uncertainty about such climate impacts.

If climate change is a serious problem, it must be dealt with on a global level and this spawns questions of governance with respect to international agreements. A truly global solution to the issue would involve substantial shifts in resources and consumption patterns around the world. Conflicts between countries related to equity and the export or displacement of pollution are likely to arise.

Although it is a current debate, climate change is an issue of the future. No current resolution is possible due to the lack of clear scientific understanding of the potential for global climate change. What is at stake for the oil and gas industry in the global climate issue is the future market for its products, particularly oil. For society, what is at stake is a secure, economic energy supply to support and maintain the world’s economies and their growth. If carbon dioxide emissions were found to be a major factor likely to result in dangerous changes in climate patterns, then policy measures would have to be taken to reduce such emissions in the future. However, global climate science is not a field likely to provide definitive answers in the near term. Thus, the scientific debate can be expected to continue and evolve for a long time. And meanwhile public perceptions of the signifi-

cance of the issue will be powerfully influenced by short-term trends in climate.

## **Sustainable Development**

Sustainable development is a subject now linked with environmental issues. The concept of sustainable development arose in response to concerns over the compatibility of environmental quality with the need for economic growth. The Bruntland Commission, established by the UN General Assembly in 1983 to outline strategies for dealing with global environmental problems, described sustainable development as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. The commission also incorporated concerns of social equity (poverty, inequality among nations) in addition to those of intergenerational equity in their work on sustainable development. Some use the term sustainable development as an expression for the objective function that society should pursue, and try to plan policy approaches to achieve that objective. The most accepted economic expression of the sustainable development concept is that current generations should take responsibility for ensuring that future generations will be able to be as well off as they are. In principle, this allows for current generations to use nonrenewable resources, as long as they bequeath capital and technology to future generations so that they may be as well off overall.

The concept of sustainable development certainly has merit as a principle linking the concepts of economic well-being and environmental goals; however, more precise and operational definitions have proved elusive and controversial. Accordingly, some people call for continued work on operational definitions of the concept. Many others, frustrated with the question of definition, have accepted sustainable development as a broad principle to be applied in all facets of life and to be considered in all aspects of policy. Additionally, there are those who question whether sustainable development is a useful element in the development of policy, because of its myriad of definitions and interpretations.

There are two primary aspects of sustainable development applied to energy. The first concerns the depletion of oil and gas resources. The interview and workshop process indicated little concern among stakeholders relating to this aspect of sustainability. There is broad agreement that world oil and gas resources are ample, and that technological advances will reduce the growth of future energy demand and bring forward both conventional and alternative energy supplies. In fact, since 1970, the assessment of remaining reserves has more than doubled to 1,830 billion oil and gas equivalent barrels, in spite of the fact that 736 billion barrels of oil and gas equivalent have been consumed in the interim.

The second and more debated aspect of sustainable development applied to oil and gas relates to the environmental impacts of exploring for, producing, processing, and distributing oil and gas and their products and to the impacts of consuming these products. Participants in the interview and workshop process generally used the term in this latter context, as an umbrella for the environmental issues that may affect the well-being of present and future generations. Many stakeholders see sustainable development as the critical future issue for the oil and gas industry and closely associate it with concerns over the impact of possible global climate change.

Both the resource depletion and environmental aspects of intergenerational equity may apply differentially to the diverse segments of the oil and gas industry. For example, some public interest stakeholders see oil consumption as of great concern relative to sustainability, but increasing gas consumption as a move in the direction of sustainability.

The concept of sustainable development is not amenable to precise definition, and certainly not to definition applicable to a single part of the economy, such as the oil and gas industry. It is an expression of society's concern that the environment not be damaged, with the effect that those alive today and future generations lose the opportunity to enjoy the well-being they expect. In this context, sustainable development will be a continuing issue for the

oil and gas industry in its relations with the public, government, and other stakeholders.

## INDUSTRY IMAGE

The perception of a negative public image of the oil and gas industry was reflected in the interviews and workshops conducted for this study. While it is tempting to ignore evidence of this perception, the importance of public policy to the industry in the future requires that the issue be taken seriously. Stakeholders' understanding and opinions of the industry will affect future policy and thus future opportunities for the industry.

One workshop participant expressed the image problem in this way: "The industry wears a black hat... There is a legacy of stereotypes (e.g., the *Dallas* characters typified by J. R. Ewing) that will be tough to reverse." How well this represents the public image is not clear, but certainly the industry is perceived to be big, wealthy, and powerful. Possibly that wealth is thought of as the product of luck in finding oil or market power in selling it, rather than of hard work, advanced technology, and heavy investment.

Some interview and workshop participants distinguished perceptions of the oil and gas segments of the industry, with gas having a more positive image than oil. A major concern for the oil industry is the negative perception of its product, centering on oil's impact on the environment. In contrast, natural gas benefits from positive environmental perceptions.

The NPC did not undertake research on public attitudes for this study, but two important themes emerged from the interview and workshop process:

- The industry is difficult to deal with.
- The industry lacks a unified vision.

The perception that the industry is difficult to deal with was expressed by representatives of environmental and other public interest groups. In the words of one interviewee: "Environmentalists firmly believe that the oil industry has been the most difficult industry to deal with. Obviously, some companies have

been exceptions, but mainly the industry has fought the environmentalists all the way." As environmental issues are likely to remain important over the next 25 years, the industry must work to change this perception.

The charge that the industry lacks a unified vision has some resonance. There are many segments to the industry, and their interests conflict on some issues. This diversity prevents any one voice from speaking for all companies. A consequence of the diversity has been a reduced ability to take strong, unified positions in public debates. Individual companies can and do excel in achieving their own visions, and the results have included such concretely "visionary" tasks as applying advanced technology to finding and developing oil and gas. Ultimately, the problem may be less that the industry has no vision than that it has many.

The interviews of industry leaders also revealed interesting views of the industry's image. Some industry participants expressed belief that the industry's image was an intractable problem. For example, one industry interviewee said, "I almost despair of changing public perceptions of the industry." This feeling is founded on the fact that the image problem has been around for many decades, and has reflected many different public concerns over this time. However, the NPC believes a more positive, forward-looking approach should be emphasized. Performance by the industry on environmental and other matters is viewed as the key to its future image.

The oil and gas industry may never captivate the public, but better communication between industry members and the public can at least improve public understanding of the industry and its value to the country. This understanding will help the public to develop informed and, hopefully, supportive opinions about the industry. Education in the principles of science and economics are key to comprehending energy issues and resolution alternatives facing the oil and gas industry. Firms have supported diverse educational programs covering these fundamental fields of science and economics. In addition to these fundamentals, specific knowledge of the role of

energy in the world and the structure of the industry are background which allows any stakeholder a greater appreciation of the scope of energy activities and constraints on industry activities.

Education applies to the industry as well. Industry should focus on obtaining a better understanding of public and customer concerns. The industry must also continue to improve its performance, particularly environmental performance, and communicate this to the public. Finally, the industry must take leadership in seeking resolution of public policy issues in ways that address the concerns of the affected stakeholders.

## **CROSSCUTTING THEMES**

One crosscutting theme is the future form of the energy market. In what forms will energy be supplied and used in the future, in order to satisfy consumers' needs for affordable and reliable energy sources, while satisfying society's requirements for environmental quality? This question encompasses the physical form of energy—oil, gas, and their current and future competitors, the nature of consuming technologies, and the structure of the market. The latter has been in some aspects the most rapidly changing factor of all, as in the evolving market and commercial structure of the natural gas industry.

Critical issues that will drive the answer to this question over the future include security of supply, local and global environmental concerns, and of course the technology that is developed. The issue of the role of government in markets addresses the relative importance of the instruments through which the energy future develops, market forces and government policy. And industry image will affect all of these factors through the influence of the perceptions of stakeholders on markets and on policy.

Most in the oil and gas industry have strong beliefs that market forces are by far the most effective means of allowing the future pattern of energy use to evolve. Market forces provide individual incentives: on the supply side, to develop resources and new technolo-

gies to meet the needs of the public; and on the demand side, for the public to make fuel choices according to their preferences. Trying to predetermine future choices risks limiting the scope for future technology innovations in directions not now foreseen.

A second crosscutting theme, technology, is clearly one of the key drivers of the energy future, and thus a theme in its own right. The availability of future oil and gas supplies at reasonable cost depends on the industry's ability to continue the current trend of production cost reduction. The competitiveness of U.S. industry in world markets depends on technical leadership. The significance of greenhouse gas emissions depends on the nature of energy technologies used many decades or centuries in the future. Technology can also play a key role in responding to environmental concerns.

The government role in technology is now a subject of debate at the national level. The general belief of most in the industry is that there is an important role for government in basic research and in some other areas where there are problems of scale and safety. The reasons for government involvement in most applied research are not apparent, because private business is closer to the market need for the technology and thus likely to be better focused and able to perform research and development activities more efficiently. Other stakeholders, including government, may hold different views. The NPC is currently working on a separate report on Oil and Gas Research and Development Needs.

A third crosscutting theme is the importance of international policy in the future issues. The concern in global competitiveness was the effect of foreign policy actions on prospects for American business in the world market. Security of supply is a global issue because the oil market is a world market, and the gas market may one day be a global one as well. International policy affects the diversity of world supply as well as the security of producing regions. Global climate change is of course the quintessential global issue, because any effort to control carbon dioxide emissions, should that be necessary, has meaning only on a global scale.

There are certainly many dimensions to be considered in foreign policy, of which the economic is only one. However, there is a clear concern in business circles that there has been insufficient awareness of long-term U.S. economic interests in the consideration of foreign policy.

Finally, communication and cooperation among the oil and gas industry, the government, and various stakeholders is clearly of central importance to the resolution of the future issues identified in this report. In the next chapter, recommendations are made for cooperative approaches to the resolution of future issues affecting the oil and gas industry.



# CHAPTER FOUR

## APPROACHES TO RESOLUTION OF ISSUES

The Secretary of Energy requested the NPC to review the role of the oil and gas industry in the economy, to identify the issues and policies that will shape the industry over the next 25 years, and to advise her on the most constructive and realistic resolution of the issues with respect to the future vitality of the industry and the economy. In response to the Secretary's request, the role of the industry in the nation's economy was addressed in Chapter One and the issues that seem most likely to affect the industry over the next 25 years in Chapter Three. The most challenging part of the Secretary's request is considered in this chapter, approaches to the future resolution of these issues. Investment of time and resources in the means to resolve issues better in the future may provide high returns to the nation, and that is ultimately the goal of this NPC project.

History suggests that unexpected new issues are likely to arise over time. The form of the issues and the timing in which they arise depend on many factors now unknown, including the technology that will be developed, the evolution of knowledge of environmental problems, and the interaction of geopolitics with oil markets. New possibilities for solutions will also become available, dependent on many of the same unknowns. Thus specific resolutions for future issues cannot be mapped out now.

Resolution of future issues is primarily a question of process. There are no "silver bul-

let" processes by which issues of national importance can be resolved. The interests and the values of many different parties are involved, and the nation's legislative, regulatory, and legal processes remain the final arbiters of conflicts. However, many processes through which policy is set and implemented can be improved, and better communication between those with a stake in oil and gas issues can avoid some conflicts.

### **RECOMMENDATIONS<sup>1</sup>**

#### **Industry and Government Actions**

The NPC recommends that the industry and government take the following actions to position the nation for more effective resolution of critical issues it will face.

- **Encourage responsible development of domestic resources.**

Recognizing the likely increase in import reliance, actions should be taken to encourage the development of abundant domestic natural gas supplies, to negotiate realistic standards to allow access to the most promising remaining oil resources, and to reassess legislative and regulatory constraints that inhibit the ability of the

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<sup>1</sup> The report of Arthur D. Little in Appendix D includes its recommendations to the NPC, which reflect the full range of input received in the interview and workshop process and ADL's own opinions. Not all of ADL's recommendations are addressed in this report because there was not sufficient time to address them or there was no consensus within the NPC.

industry to make the most effective use of those resources.

- **Encourage development of as wide a range as possible of foreign import sources.**

U.S. policy should seek to avoid reliance on imports from a limited number of nations. International oil and gas markets, characterized by diversity of supply sources, provide the United States with enhanced energy security and improved flexibility in meeting import needs. Possible policy directions supportive of diversity of supply for the nation include: foreign and commercial trade policies that ensure that access to international supply sources is not unduly restricted and that U.S. companies are not put at a disadvantage relative to international competitors in developing additional supplies; and U.S. encouragement and support for the development of sound legal and regulatory frameworks in emerging economies.

- **Use sound science in legislative, regulatory, and judicial processes.**

Sound science involves the collection, analysis, and interpretation of scientific evidence and experiments in an objective manner with no intentional distortion of the results to favor a specific viewpoint. The question of sound science centers on the quality of information that is input to legislative, regulatory, and judicial processes. These processes should use the most up-to-date scientific information. Both the quality of the science and its communication to decision makers are of critical importance. Many of the scientific questions at stake are matters of considered expert opinion. Thus processes are needed to prepare and communicate a balanced overview of the state of scientific knowledge to policy makers, regulators, and the judicial system as well as to ensure the quality of the science itself.

Risk assessment is a vital application of science to policy decisions. Risk assessment considers the implications of an event and the probability of the event.

Scientifically based risk assessment can serve as a highly effective tool in determining the relative magnitude of risks. All available data should be included in risk assessments, and policy decisions should be based on the weight of evidence of risks.

Peer review is the key process to ensure reliable assessment of the quality of science and its interpretation, and this process should be applied to the science on which government decisions are founded. Existing mechanisms should be maintained and strengthened. The establishment by the government of scientific review boards charged with considering and summarizing the relevant science is an option for communicating a balanced view of the current state of scientific knowledge applicable to important policy decisions.

- **Require cost-benefit analyses for regulatory interventions.**

Cost-benefit analysis is a general term applied to methods to identify the economic consequences of policy alternatives. Cost-benefit analysis involves identifying the impacts of policy measures, calculating the monetary value of those impacts, and discounting the monetary value for time and risk. Use of cost-benefit analysis ensures that decisions are made with full awareness of the trade-offs involved. It should not be thought of as a method to calculate a single numerical result but as a technique to organize information on the economic consequences of policy decisions.

Stakeholder concerns related to oil and gas production and use often involve health and environmental issues that are not amenable to being reduced to dollar terms. Indeed, there is controversy at the conceptual level over whether it is appropriate or even meaningful to value in dollar terms human life or many aspects of the environment. In these cases, measurements of policy impacts can be kept in physical terms, such as species populations or acres of wetland affected by the decisions. Thus, the outcome of the cost-benefit analysis is

a dollar valuation of those effects that can be valued, plus a set of measures of those effects that cannot be expressed in dollar terms. The important point is that a systematic description of the effects of policy alternatives should be prepared as a foundation for policy decisions.

While cost-benefit analysis is a well-known methodology, there remain many issues in its practical application, including methods of valuing impacts, discount rates, and the treatment of uncertainty. Standards should be established to allow the most effective use of cost-benefit analysis through a process incorporating input from all parties. One option for establishing these standards is the formation of an independent cost-benefit analysis standards board analogous to the Financial Accounting Standards Board (FASB) or the Gas Industry Standards Board (GISB).

- Use goal-oriented regulatory mechanisms where regulatory intervention is necessary.

Government regulatory actions, where appropriate, should specify desired outcomes rather than specific compliance methods. This allows industry to achieve regulatory targets in the most cost-effective manner. Goal-oriented regulation allows individual companies to explore different alternatives for meeting the targets and encourages them to develop new technologies. Industry recognizes that goal-oriented regulations impose responsibilities on industry and an obligation to demonstrate compliance openly and that methods to demonstrate compliance will need to be developed.

- Encourage science, economic, and energy education.

Industry recognizes that education will be of critical importance to the nation and to the oil and gas industry in meeting future challenges. Informed citizens will be most capable of facing up to future national choices, and high quality workers are ever more important as competition

becomes more global. Americans may not make sound decisions on energy-related issues and may not encourage their political representatives to do so without being aware of the consequences of the trade-offs. An understanding of the role of energy and of the energy industries in the nation's economy will contribute to informed choices.

Industry has a strong history of supporting educational programs, yet more could be done in support of science, economics, and energy education. One method to do this would be to utilize a forum (presumably an existing one) for exchange of information about available programs and their effectiveness. This forum would enable industry and educators to leverage successes and create programs that would more successfully achieve the desired results.

## **Industry and Government Leadership**

In addition to the above specific actions, a necessary step toward improving the process of resolving issues is working toward better understanding of the requirements of the key stakeholders. Improved credibility is vital for the industry to become more effective in dealing with important public issues, thus increasing the likelihood of successful resolution of the issues critical to the industry's future. The industry must also ensure that its diversity does not impede its effectiveness in this process. The interviews and workshops conducted for this study demonstrated both the need for action to improve the interface with stakeholders and the value of hearing stakeholder views. Different stakeholders, like the different interests in this diverse industry, will have different views, and consensus will not always be possible; but there can be cooperation to reduce the scope of disagreement and to make resolution of issues smoother and more consistent in the future than it has been in the past.

Both industry and government leadership are required to effect changes in the processes through which issues will be resolved in the future. The following two recommendations call for leaders in both industry and government to take the initiative in improving the process by

which issues of importance to the industry and the nation are resolved.

- **Industry should improve and expand communication with stakeholders outside the industry.**

Improved and expanded communication with stakeholders is intended to provide a basis to resolve more effectively the issues the oil and gas industry will face. Enhanced communication must be championed by industry leaders to be effective, and to show the commitment to real changes in relationships with stakeholders. The dialogue may involve individual companies or groups of companies on a voluntary basis, may use existing organizations or new efforts, and may address particular issues or processes that involve government and/or other stakeholders. To be successful, the efforts must incorporate defined objectives, measurable outcomes, and clear accountability for results. Industry interests may conflict with those of other stakeholders, and it may well be necessary to make compromises on issues of broad public interest. The dialogue will promote resolution of issues through mutual consideration of the positions of industry and other stakeholders, resulting in a more realistic basis for action.

- **Government should improve coordination of policies affecting the oil and gas industry.**

Policy decisions that affect the oil and gas industry are made in many different departments and agencies of the federal government. Improved coordination would provide an opportunity to better resolve conflicting policies with a fuller understanding of energy's role in the economy and of the impact of policy measures on the industry. The coordination may be achieved through a working group of high-level government officials from federal departments and agencies whose operations affect the oil and gas industry, such as the Environmental Protection Agency and the Departments of Energy, State, Defense, Treasury, Commerce, and Interior.

There was not time in the study to analyze existing forums, associations, committees, or other mechanisms to determine how best to implement these recommendations. However, it would be desirable to utilize existing structures unless a clear and compelling need is demonstrated to the contrary.

The major gain to the nation from the industry and government leadership should be better energy policies, which would allow the oil and gas industry to fulfill its potential. For example, there may be opportunities for interaction between the industry and government efforts on such topics as mechanisms to bring the best scientific and economic analysis to bear on future decisions.

These leadership efforts may have other benefits as well. Legal services have become a significant expense for oil and gas companies, and much of the expenditure goes to correct or clarify deficiencies in regulations. The government and various stakeholder groups also consume extensive legal and other resources on these matters. Part of the motivation for improving the resolution process is to decrease as much as possible the need to resolve issues in the courts. All parties agree that they, and the country in this increasingly competitive world, can no longer afford protracted resolution of policy matters in the courts.

## **CONCLUSION**

The Secretary's request to the National Petroleum Council has proven to be challenging. The emphasis in this report is on improving the processes through which future issues will be resolved. Since no one is omniscient about the future, this approach merely reflects some hard lessons the U.S. oil and gas industry has learned about the strength of market forces, the need for flexibility, and the need for communication with outside stakeholders. Therefore, it is the hope of the Council that the Secretary's request results in a process of cooperation to deal with the challenges that arise in the years ahead. In this way the oil and gas industry can fulfill its mission of providing Americans with an affordable, reliable supply of energy while reflecting shared societal concerns for environmental, health, and safety.

# **APPENDICES**



## **APPENDIX A**

# **REQUEST LETTER AND DESCRIPTION OF THE NATIONAL PETROLEUM COUNCIL**







## The Secretary of Energy

Washington, DC 20585

December 30, 1994

Mr. H. Laurance Fuller  
Chairman  
National Petroleum Council  
1625 K Street, N.W.  
Washington, D.C. 20006

Dear Mr. Fuller:

Over the past twenty-five years, the United States has gone from an essentially self-sufficient energy producer to a substantial energy importer. At the same time, the United States has made unprecedented gains in the efficient, economically driven, and environmentally responsible use of energy. The nation is using one-third fewer BTUs per dollar of gross domestic product; and the impact on the environment from energy extraction, manufacturing, transportation, and end-use is a fraction of what it once was. These major changes did not come about solely through gradual evolution; their roots are in the price shocks of the 1970s, the rise of environmentalism, and the spread of market deregulation. During this period, the National Petroleum Council provided my predecessors and me with numerous reports that contributed greatly to the nation's understanding of and adjustment to these changes.

Twenty-five years from now we may see energy production and use as a simple evolution of today's market, or we may see a radically different energy market structure shaped by unforeseeable events. In any event, the Administration faces important policy choices and I want to be assured that we make these choices with a sound understanding of the possible futures from the U.S. oil and gas industry.


Accordingly, I request the National Petroleum Council to identify the issues and policies that will most likely shape the industry over the next twenty-five years, and advise me on the most constructive and realistic resolution of these issues with respect to the future vitality of both the industry and the economy. Your report will be most useful if it includes a candid review of the oil and gas industry's role in the nation's economy and is specific about the issues and policies that may alter the industry's vitality in the next century. Your analysis should focus in particular, although not exclusively, on government policies intended to reconcile energy needs and environmental compliance strategies which you have identified to me as being so critical to your future.



Mr. H. Laurance Fuller  
December 30, 1994  
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Given the urgency and importance of this assessment, I would like to receive your response within the next four to six months and I designate Deputy Secretary Bill White to represent me during your deliberations.

Sincerely,

A handwritten signature in black ink, reading "Hazel R. O'Leary". The signature is written in a cursive style with a large, stylized initial "H".

Hazel R. O'Leary

## DESCRIPTION OF THE NATIONAL PETROLEUM COUNCIL

In May 1946, the President stated in a letter to the Secretary of the Interior that he had been impressed by the contribution made through government/industry cooperation to the success of the World War II petroleum program. He felt that it would be beneficial if this close relationship were to be continued and suggested that the Secretary of the Interior establish an industry organization to advise the Secretary on oil and natural gas matters.

Pursuant to this request, Interior Secretary J. A. Krug established the National Petroleum Council on June 18, 1946. In October 1977, the Department of Energy was established and the Council was transferred to the new department.

The purpose of the NPC is solely to advise, inform, and make recommendations to the Secretary of Energy on any matter, requested by the Secretary, relating to oil and natural gas or the oil and gas industries. Matters that the Secretary of Energy would like to have considered by the Council are submitted in the form of a letter outlining the nature and scope of the study. This request is then referred to the NPC Agenda Committee, which makes a recommendation to the Council. The Council reserves the right to decide whether it will consider any matter referred to it.

Examples of recent major studies undertaken by the NPC at the request of the Secretary of Energy include:

- *U.S. Arctic Oil & Gas* (1981)
- *Environmental Conservation—The Oil & Gas Industries* (1982)
- *Third World Petroleum Development: A Statement of Principles* (1982)
- *Enhanced Oil Recovery* (1984)
- *The Strategic Petroleum Reserve* (1984)
- *U.S. Petroleum Refining* (1986)
- *Factors Affecting U.S. Oil & Gas Outlook* (1987)
- *Integrating R&D Efforts* (1988)
- *Petroleum Storage & Transportation* (1989)
- *Industry Assistance to Government* (1991)
- *Short-Term Petroleum Outlook* (1991)
- *The Potential for Natural Gas in the United States* (1992)
- *U.S. Petroleum Refining—Meeting Requirements for Cleaner Fuels and Refineries* (1993)
- *The Oil Pollution Act of 1990—Issues and Solutions* (1994)
- *Marginal Wells* (1994)
- *Research, Development, and Demonstration Needs of the Oil and Gas Industry* (1995).

The NPC does not concern itself with trade practices, nor does it engage in any of the usual trade association activities. The Council is subject to the provisions of the Federal Advisory Committee Act of 1972.

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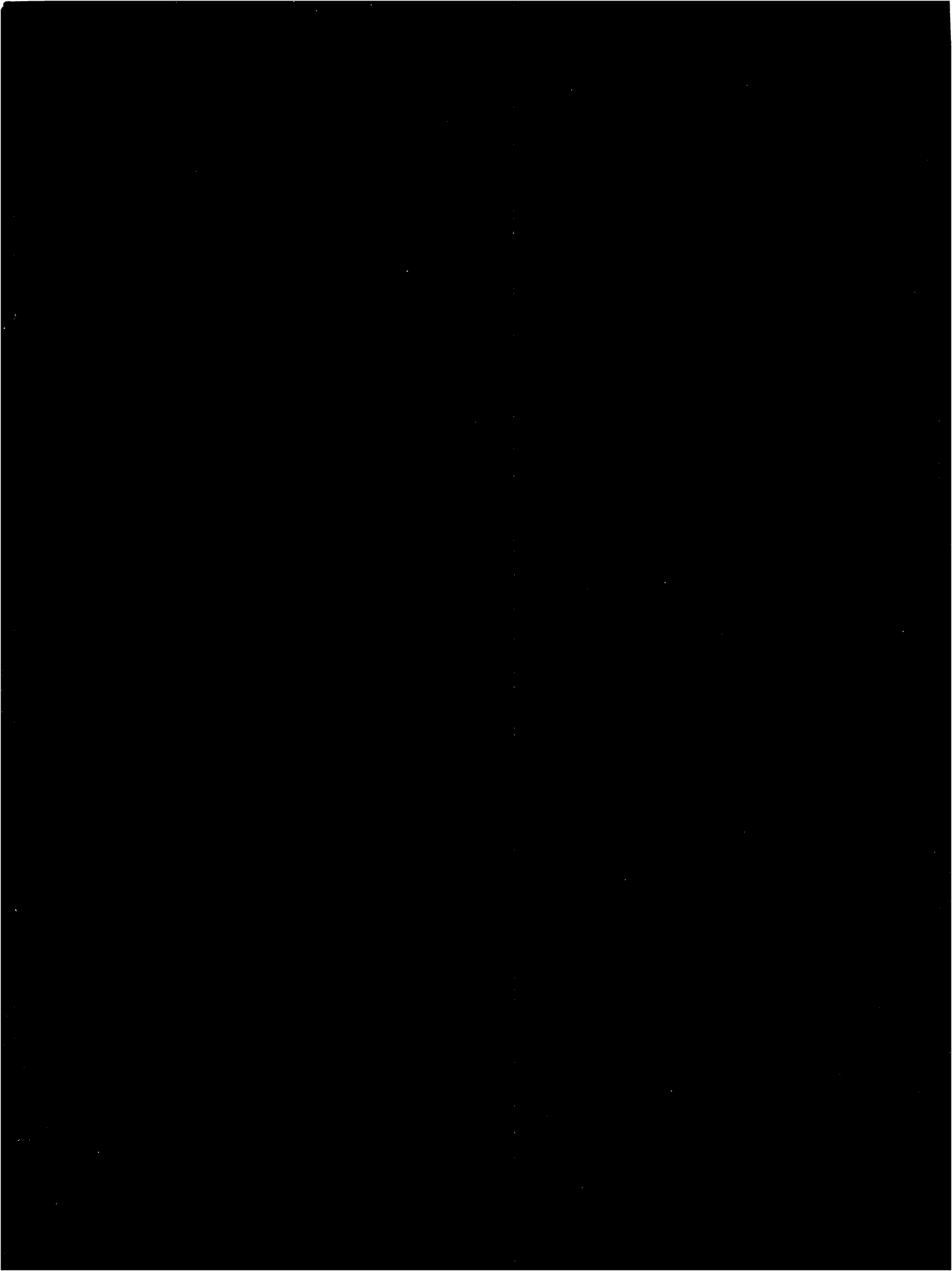
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