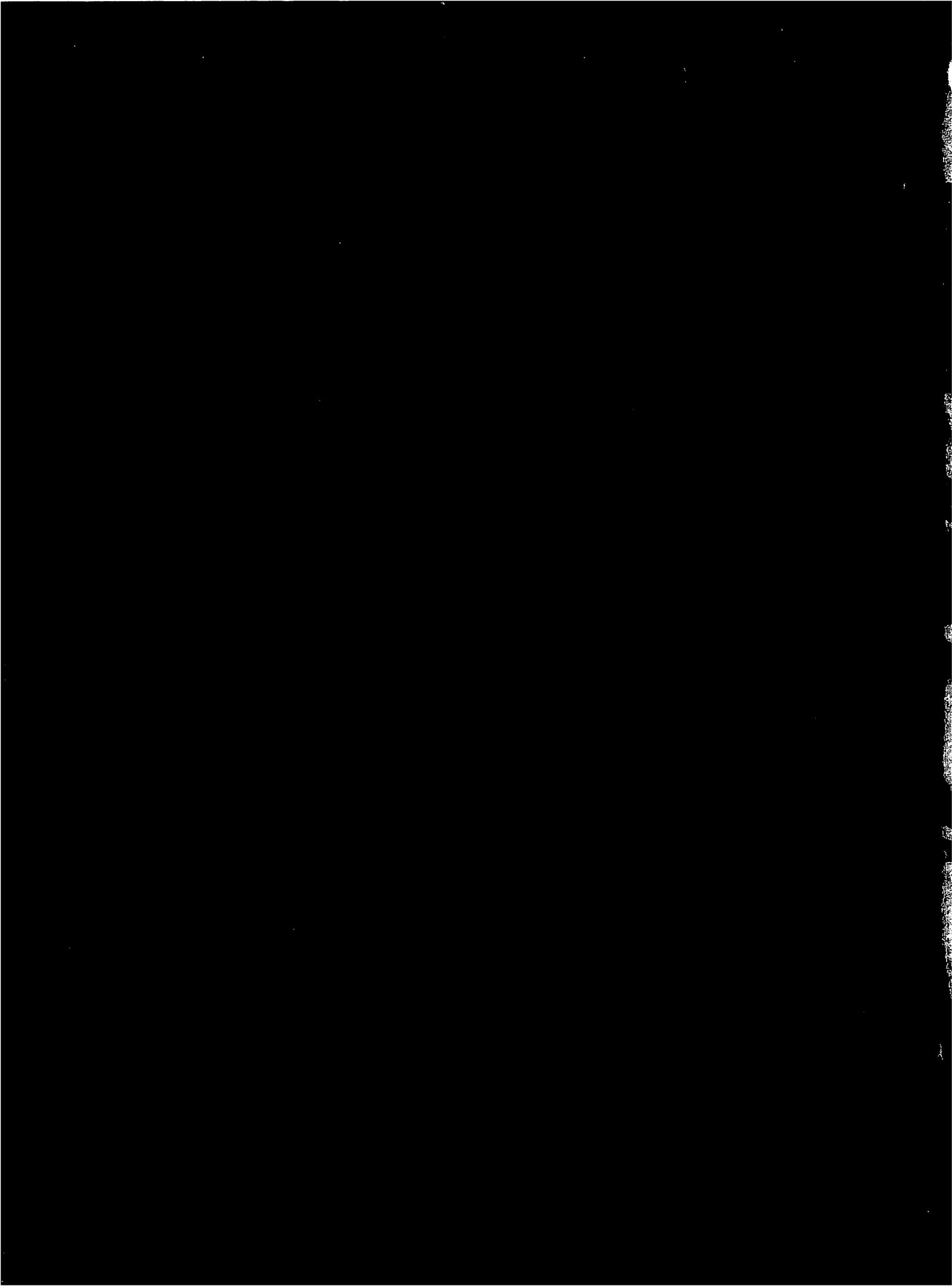


FUTURE  
ISSUES



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

A REPORT OF THE NATIONAL PETROLEUM COUNCIL • AUGUST 1995



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**NATIONAL PETROLEUM COUNCIL**

H. Laurance Fuller, *Chair*  
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**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

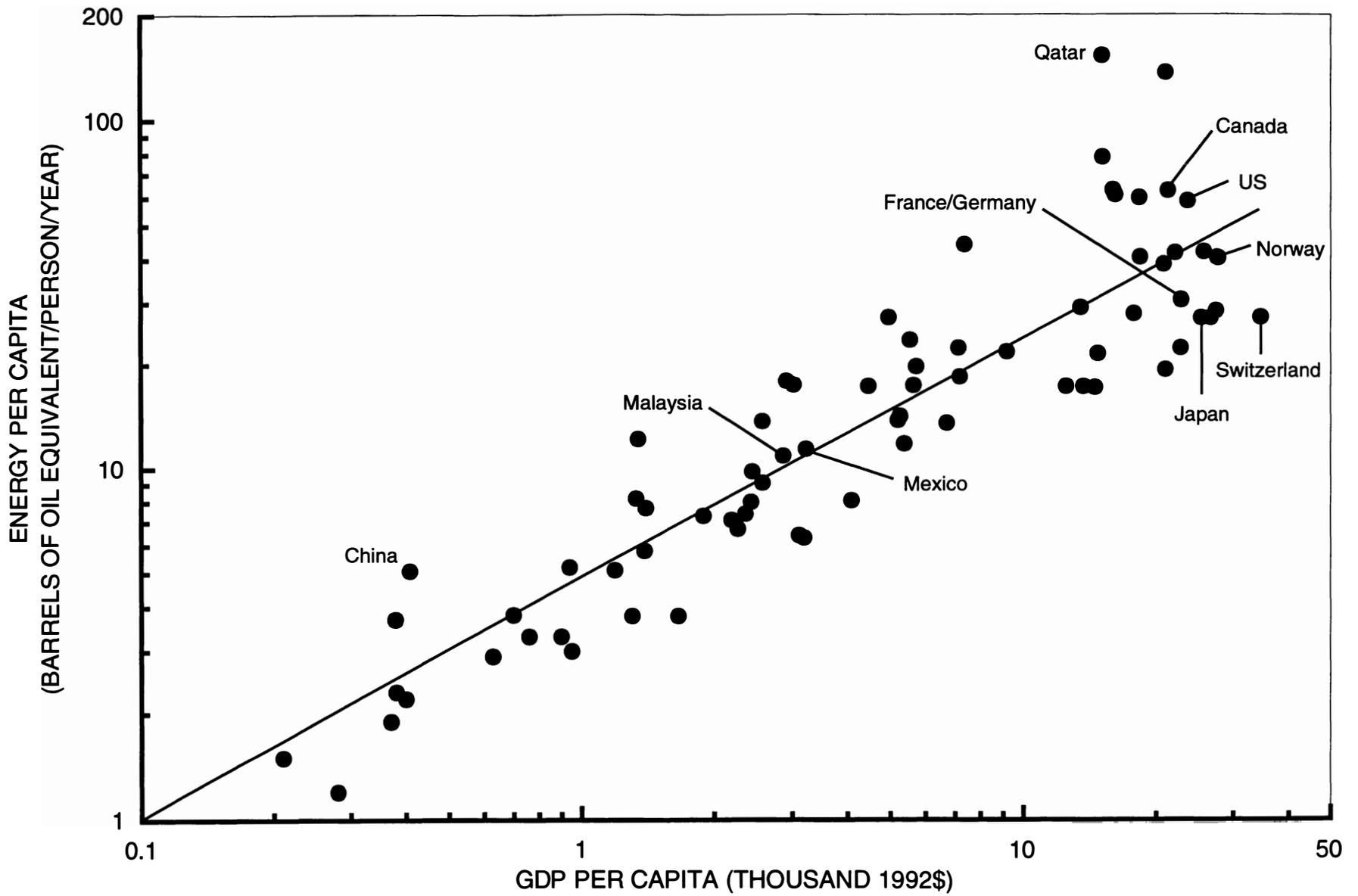


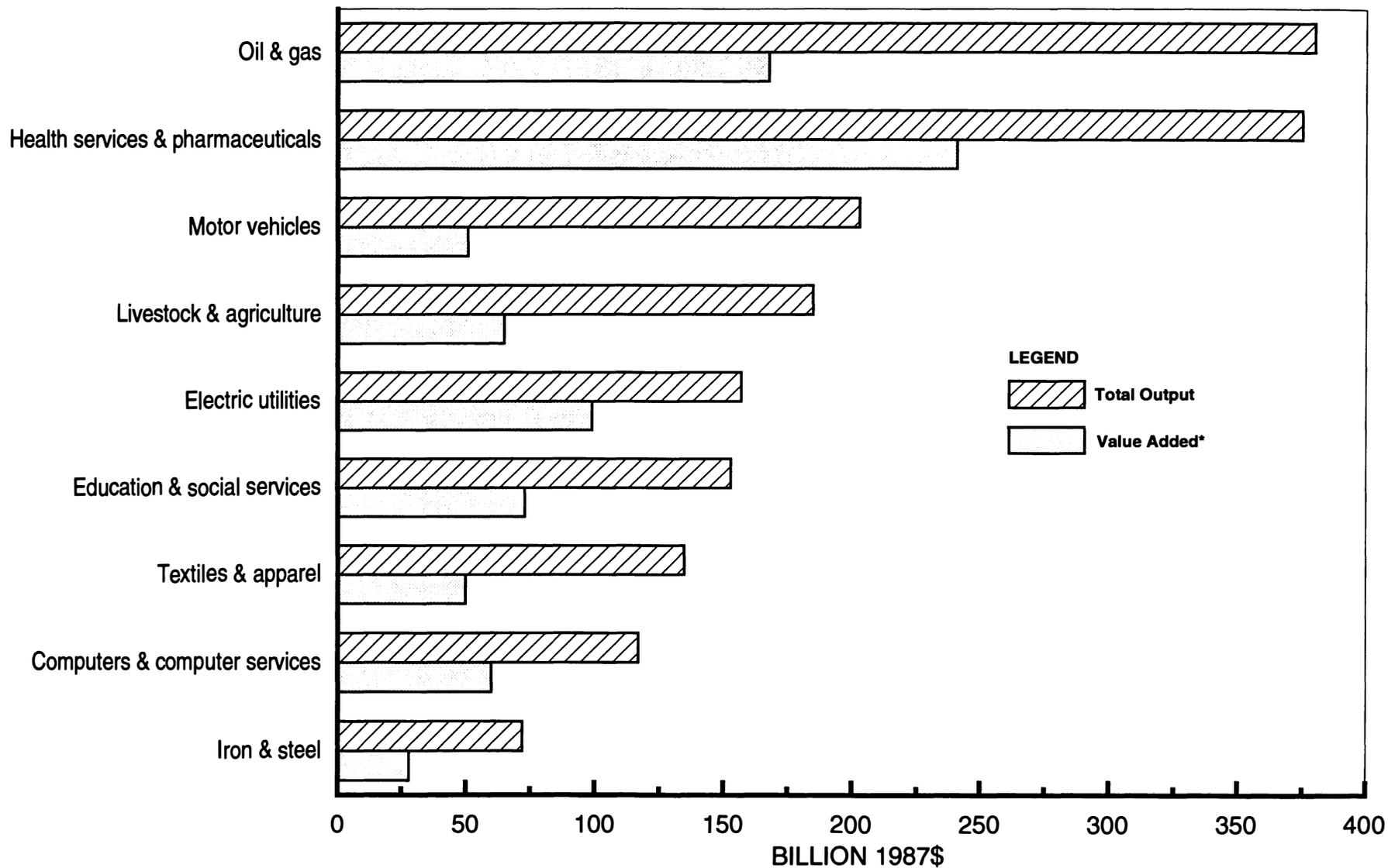
Figure 1-1. Relationship of Per Capita Energy Use to Income.

### **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.

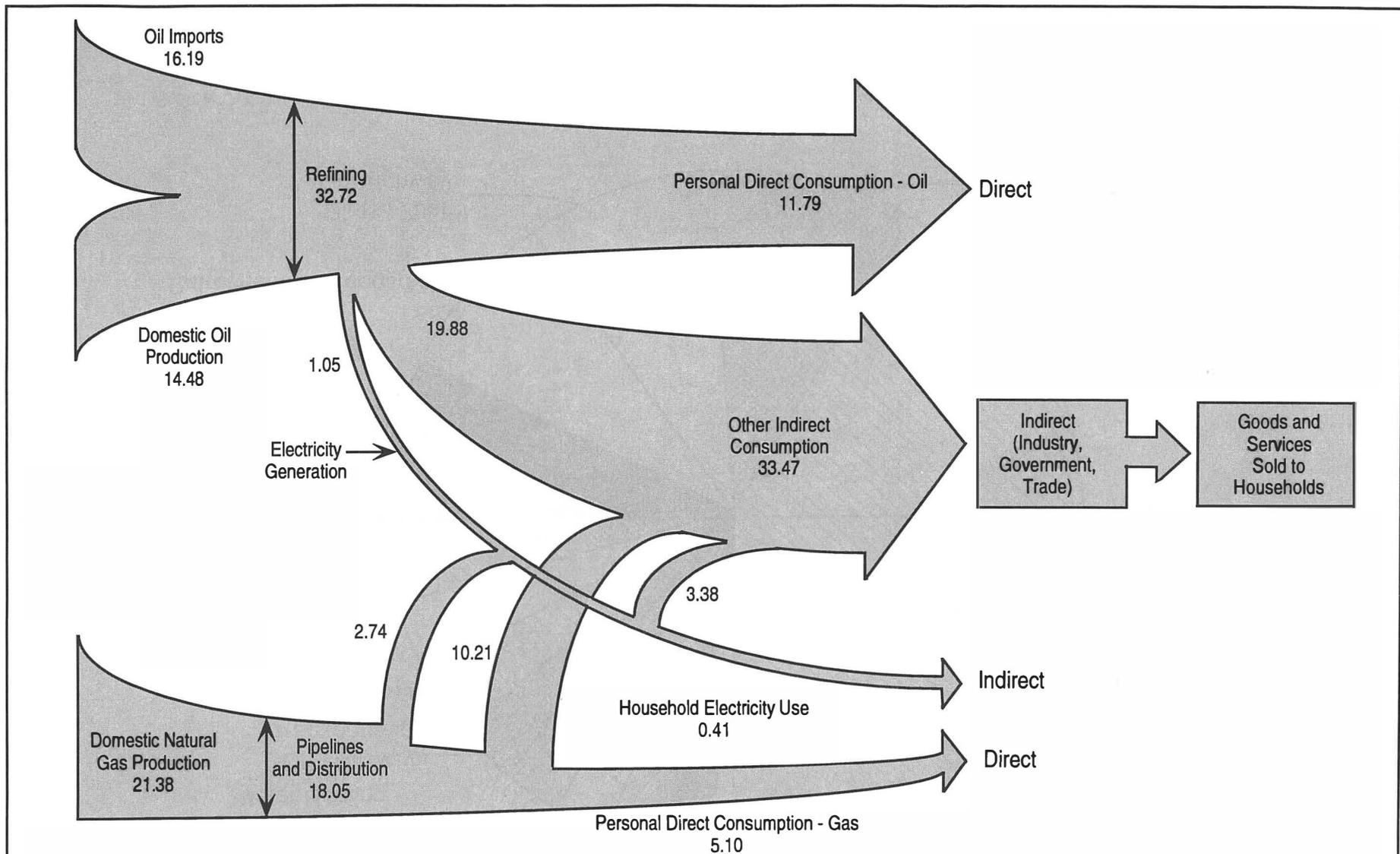
Figure 1-4 gives a sense of the direction of oil and gas energy flows through the economy, but it may be helpful to put this in more common terms. Each *day*, the industry produces enough gasoline to drive 2 million cars from New York to San Francisco, enough jet fuel to fly another 700,000 people over 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.

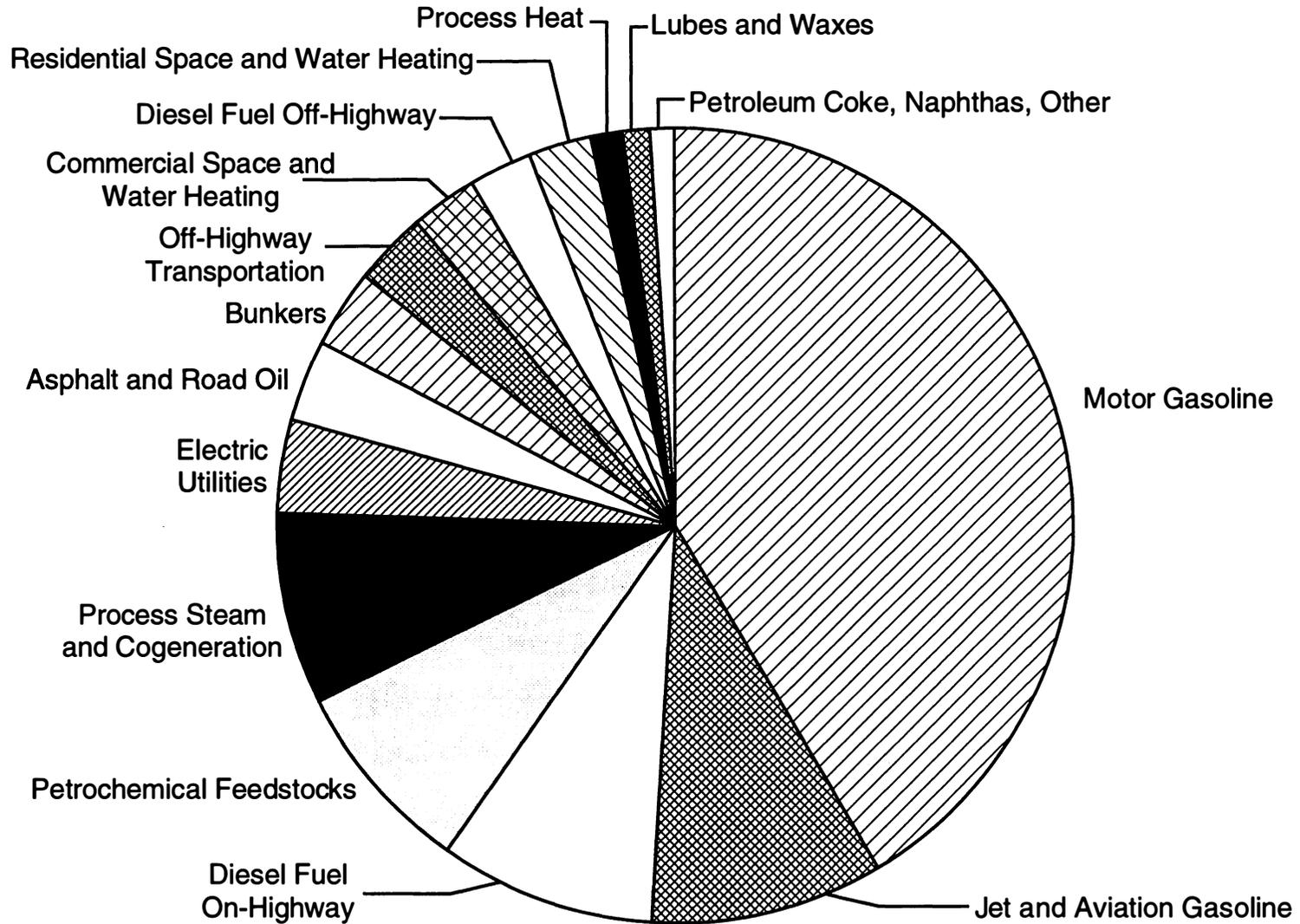
## LOOKING TO THE FUTURE

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.



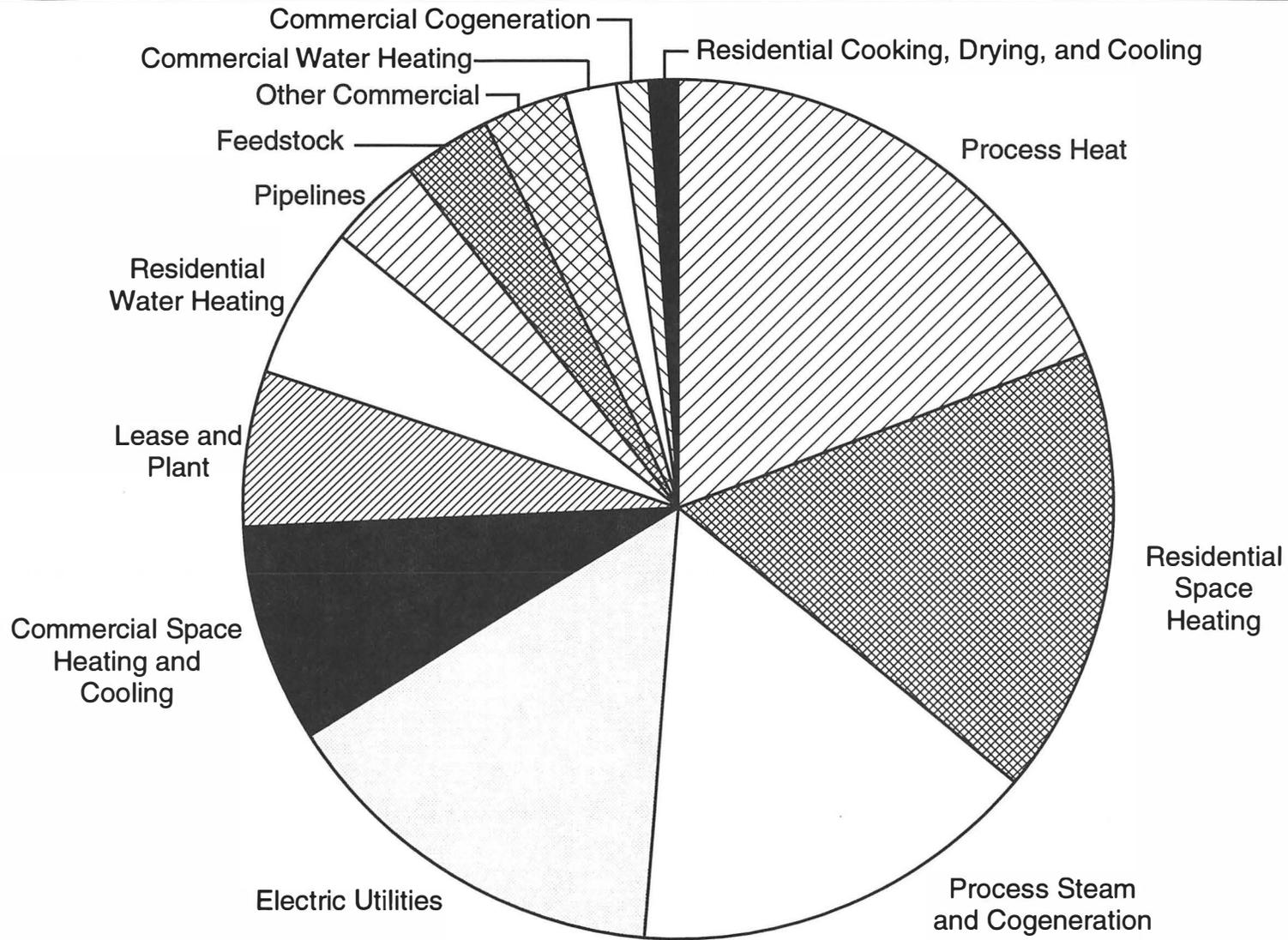
Source: EIA *Annual Energy Review*, 1993, Diagram 1; *Annual Energy Outlook*, 1995.

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.

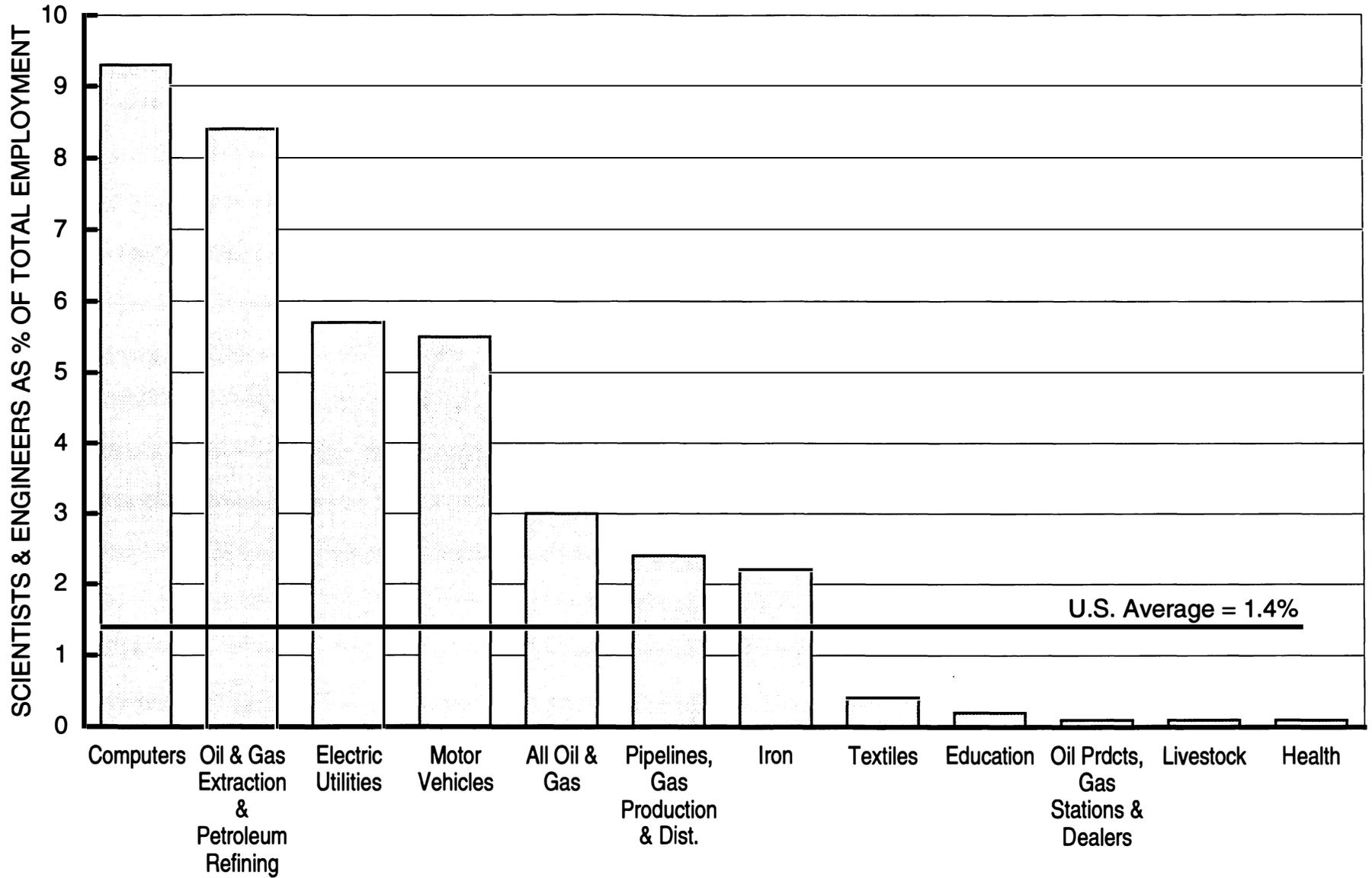


Figure 1-7. Oil and Gas Industry: Quality of Industry Employment.

# 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 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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**APPENDIX B**  
**STUDY GROUP ROSTERS**



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**APPENDIX C**

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**REPORT OF  
CHARLES RIVER ASSOCIATES  
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# The Value of Oil and Gas in the U.S. Economy

**Submitted to:**

**National Petroleum Council  
Future Issues Committee  
Washington, DC**

**Prepared by :**

**Charles River Associates  
Suite 750 North  
1001 Pennsylvania Avenue, NW  
Washington, DC 20004-2505**



# Key Messages on Value

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1. **Size -- Relative to other industries and the economy as a whole**
2. **Quality-- Jobs, technology, R&D**
3. **Pervasiveness -- As a supplier and as a purchaser**
4. **Criticality -- The value of oil and gas is measured by the cost of the next best alternative**
5. **Implications -- Policies affecting oil and gas reverberate through the economy**

The Secretary of Energy asked the National Petroleum Council to include “a candid review of the oil and gas industry’s role in the nation’s economy.” That review can be summarized in the five key messages shown on this chart: Size, quality, pervasiveness, criticality, and implications for economic growth.

**Size:** the oil and gas industry is as large as any of the other industries whose health has concerned national policy makers over the last few decades.

**Quality:** the oil and gas industry provides the kinds of high-wage, high-tech jobs, technology advances and exports that national policies are trying to promote and encourage.

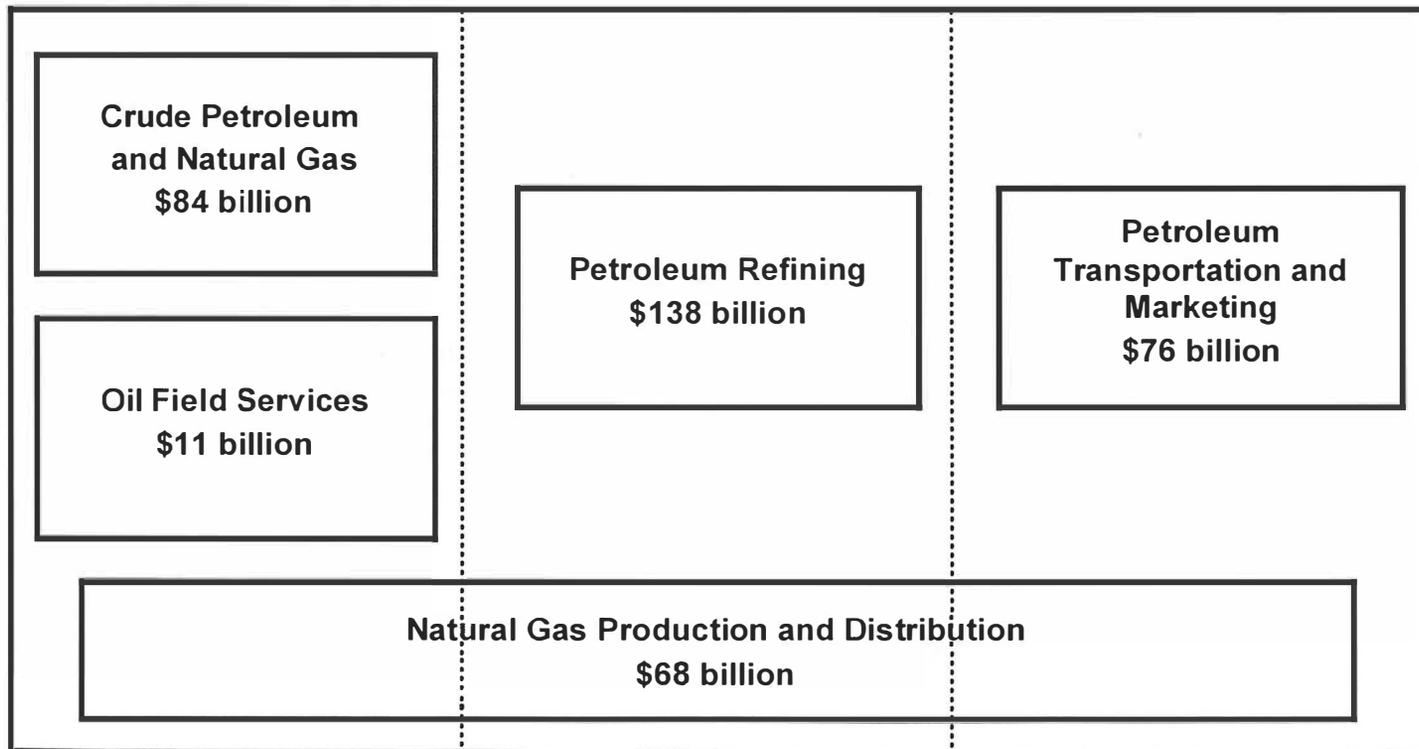
**Pervasiveness:** oil and gas are not just consumer products. They are used in all sectors of the economy, and serve as enablers making it possible for households and businesses to carry out vital activities.

**Criticality:** the value of oil and gas can be measured by the cost of making do with the next best alternative. In many cases, especially in the short run, there are few good, inexpensive alternatives to oil and gas. The value of oil and gas, measured in this way, is far larger than what is actually spent on those fuels, because users get a value that exceeds what it costs to produce and distribute these products.

**Implications:** because of its pervasiveness and criticality, policies affecting the oil and gas industry reverberate through the rest of the economy and can change the structure of industries and the performance of the whole economy.

# Oil and Gas Industry Total Sales

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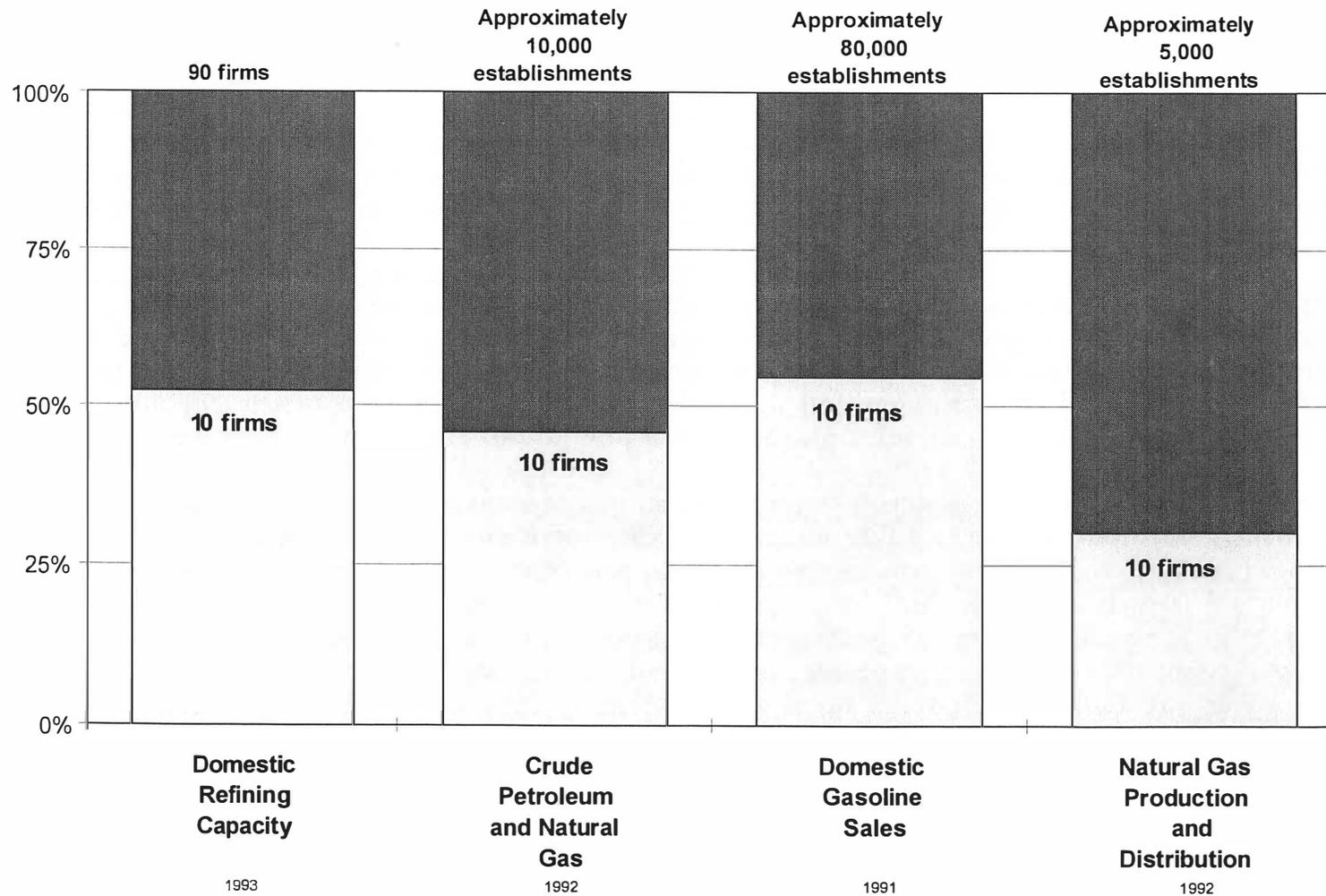
To start, our first challenge was to draw an accurate picture of the oil and gas industry and to fill it in quantitatively with information on how large the different parts are. The task was to take these five segments of the industry and work through to the final sales of refined petroleum products and natural gas to households. The oil and gas industry is defined to include all major operational areas. Upstream, the crude petroleum and natural gas industry explores for, develops and produces oil and gas. It is supported by the oil field services industry, and sells its products largely to the petroleum refining industry and to the natural gas production and distribution industry. Petroleum refining sells products through wholesalers and retailers to end users, including businesses, governments and households.

The standard economic statistics for the oil and gas industry do not include the value added by the downstream portions of the industry involved in wholesale and retail trade, but the oil and gas portion of wholesale and retail trade was included in these calculations so that the picture of the petroleum industry could include the value added in delivering products to consumers both in the forms they need and the places they need them. Natural gas production and distribution includes the natural gas pipelines and distribution companies that take natural gas from the wellhead through to deliveries to final consumers.

In addition, we have worked to remove the double counting that sometimes distorts the size of an industry when all of its parts are added together. Further, petroleum has been traced both forward into the products where it is an important component and backwards into a picture of the industries and parts of the economy that are dependent upon the industry for business, for sales, and for their livelihoods.

Source: 1987 Input-Output Accounts, U.S. Bureau of Economic Analysis

# The Petroleum Industry Includes Many Firms, Both Large and Small



Sources: API "US Petroleum Industry," 1993; *Oil and Gas Journal*, 9/20/93; BLS *Employment & Wages* 1993; EIA *Petroleum Supply Annual* 1993.



The petroleum industry is composed of a large number of diverse companies. No one company dominates any segment of the industry, and competition can be found at all levels of industry activity.

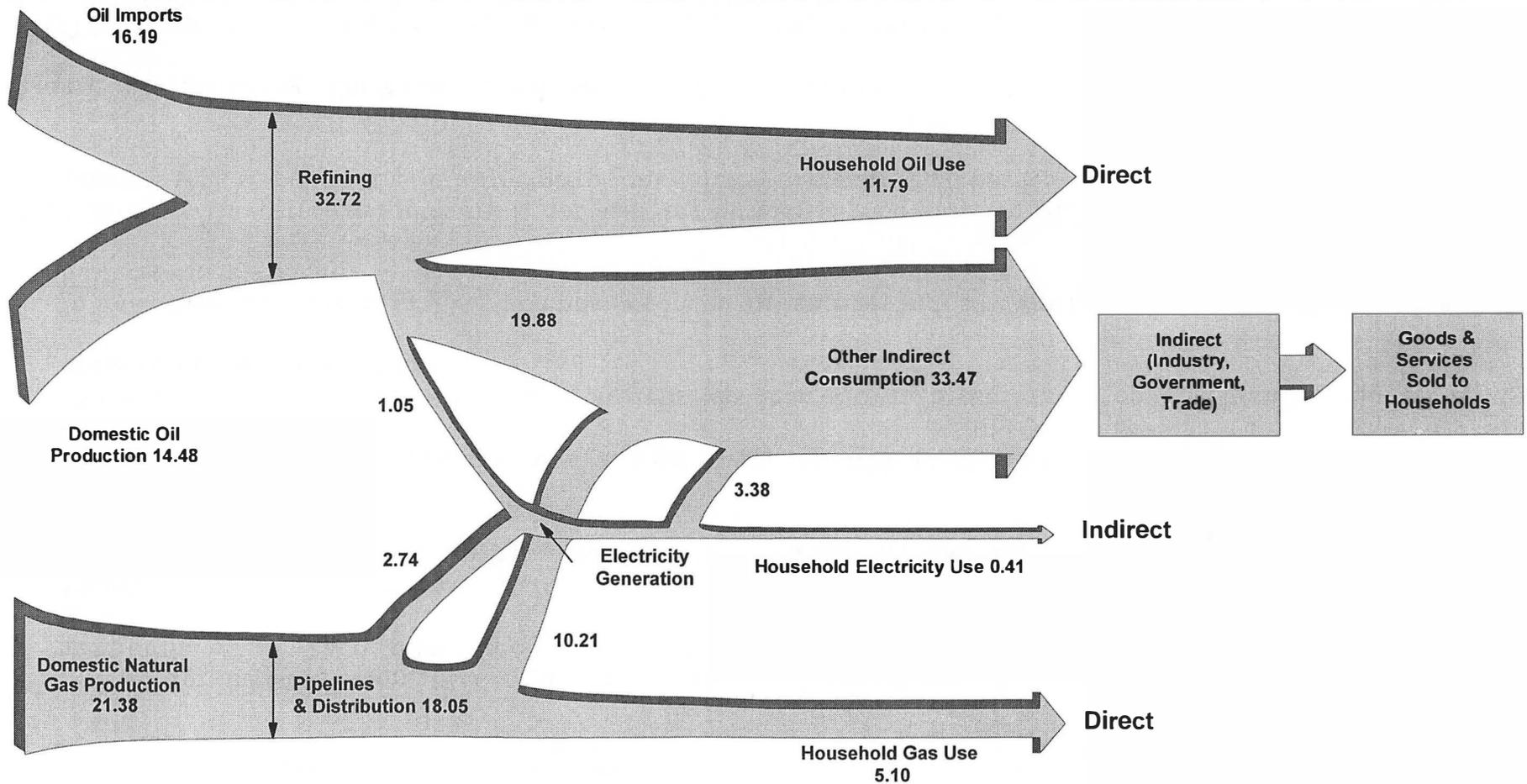
- Industry concentration is greatest in refining, where capital requirements and economies of scale are large. In the refining business, no one company has more than 7% of domestic capacity, and the top ten companies comprise just over 50% of domestic capacity.
- Industry concentration in production of oil and gas is very low, with a large number of participants.
- Domestic gasoline sales concentration is actually less than shown, because most of the “branded” outlets are operated by independent firms.
- In total, there are more than 40,000 companies in the oil and gas industry, operating more than 95,000 separate business establishments.

**Conclusion:** The petroleum industry is not just “big business.” The industry has many small and medium sized operators as well; so policies that hurt the petroleum industry also hurt small businesses.

Source: API (marketing), Oil & Gas Journal (production), EIA (refining)

*NOTE: “Establishment” is a term used in government economic statistics to denote “an economic unit, generally, at a single physical location where business is conducted or where services or industrial operations are performed.” A firm may consist of many establishments; in general, a retail store is an establishment. With regard to retail gasoline stations, however, some of the 80,000 estimated establishments may include multiple stations, particularly in rural areas, implying that the number of retail gasoline stations is even higher than the 80,000 shown.*

# Flows of Direct and Indirect Oil and Gas Consumption (Quadrillion BTU)



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

Refined petroleum products and natural gas find their way into the goods and services consumed by households in two ways. Gasoline, heating oil, propane and natural gas are purchased directly by households for use as sources of energy. In addition, households purchase oil and gas indirectly when those fuels are used in producing other goods and services that households consume.

The flows of oil and gas from the wellhead or point of importation to consumers are depicted in the above chart. It shows that about 12 quads\* (the equivalent of 6 million barrels) per day of petroleum products and 5 quads (5 TCF) of natural gas are consumed directly by households. The remaining 38 quads of oil and gas used in the economy find their way to consumers indirectly.

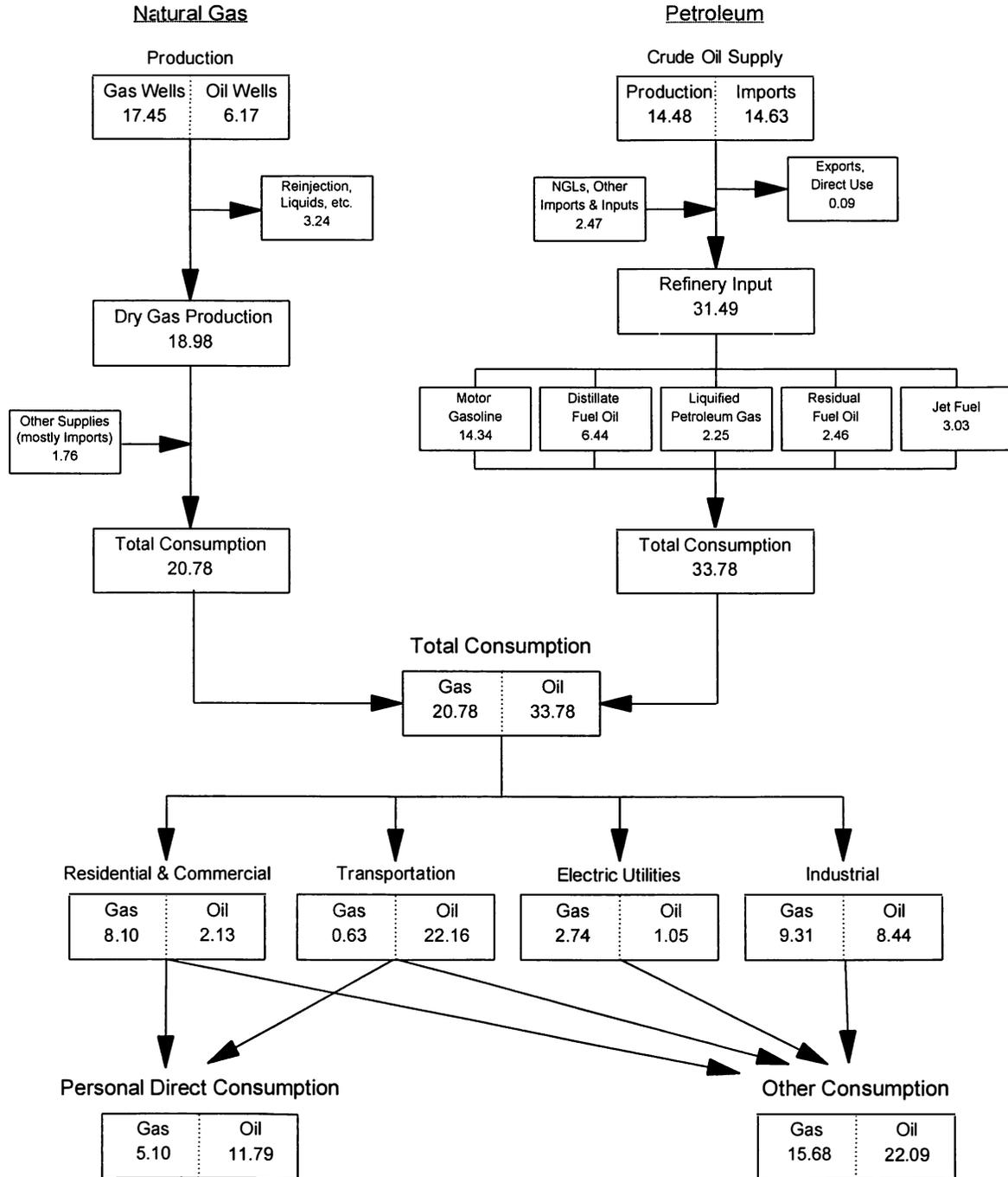
We start with oil imports, domestic oil production, domestic natural gas production, and some natural gas imports as the upstream component of the industry. These products move from the wellhead or from the point of import through refining and pipelines and distribution systems where they begin to find their way into use. Some go directly into household use, which is shown at the top as petroleum refined products, and some go directly to households as natural gas for appliances and heating.

Some oil and gas finds its way to consumers through the generation of electricity, and the remainder provides the energy and feedstock requirements of businesses and the government. Over two-thirds of the oil and gas consumed annually is used in this indirect way, not in ways that are apparent to the consumers who buy the goods and services produced by means of petroleum. In BTU terms, then, oil and gas benefits consumers in two ways: directly, as a fuel for transportation (motor gasoline) or heat (heating oil, natural gas, LPG); or indirectly, as an input to other products consumed by households (e.g., transportation used to get milk to markets).

\* Energy is measured in units of Quadrillion BTU or quads, in order to treat oil and gas on a common basis. One quad is approximately equal to 500,000 barrels per day of crude oil equivalent, or one trillion cubic feet of natural gas.

Source: 1993 Annual Energy Review, EIA DOE

# U.S. Energy Flows for Gas and Petroleum (Quadrillion BTU)



Sources: EIA *Annual Energy Review*, 1993, Diagram 2 and Diagram 3 (converted to Quadrillion BTU using 1993 conversion factors in Appendix A); *Annual Energy Outlook* 1995.

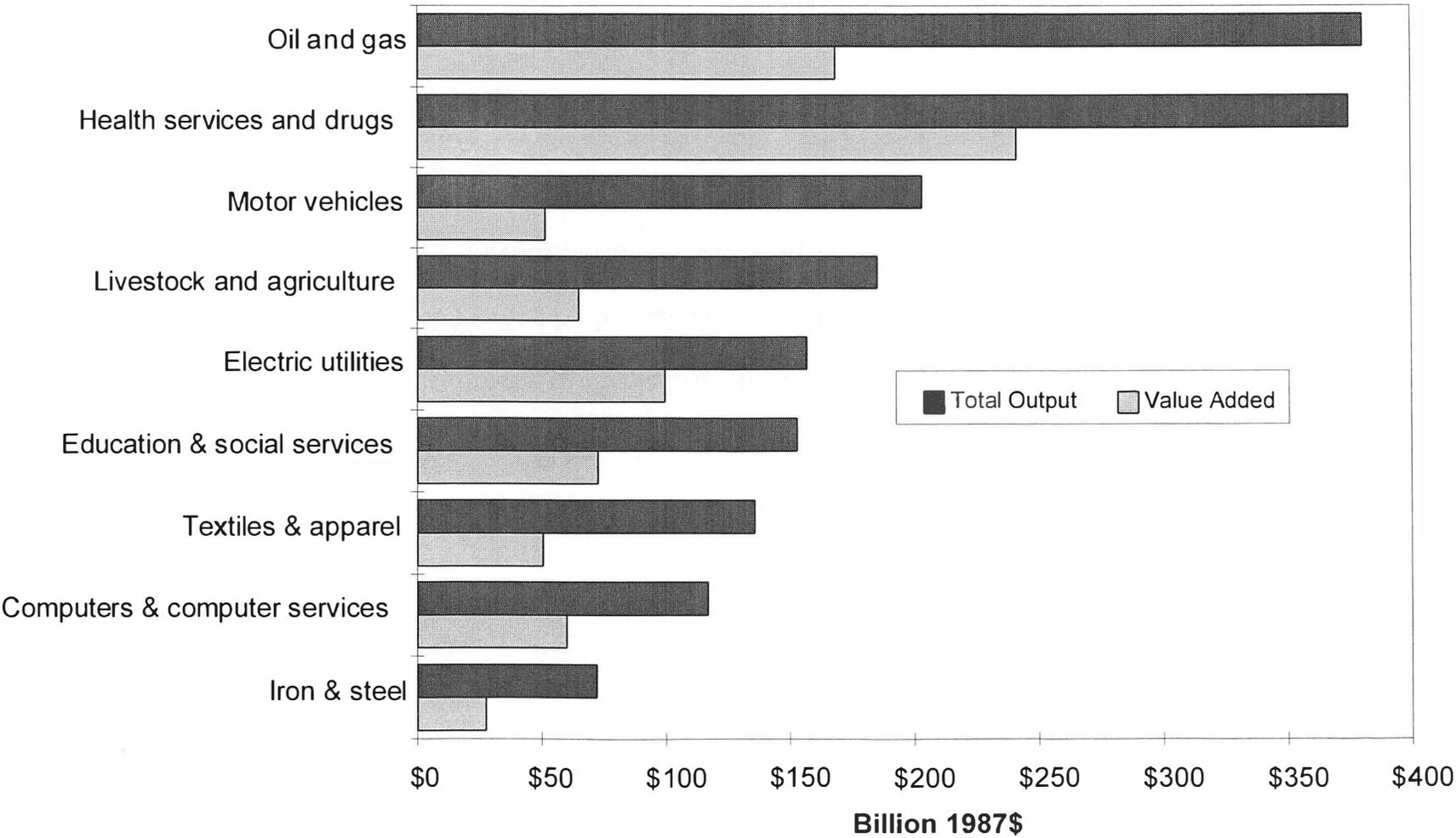
This chart shows the detailed flows of oil and gas through the domestic economy.

Some points of interest:

- About 1/4 of gas production is from oil wells.
- Oil is over 60% of petroleum consumption (less than 40% is natural gas).
- Less than 1/4 of natural gas is directly consumed by households.
- About 1/3 of oil is directly consumed by households.
- Only about 1/2 of the oil used in transportation is directly consumed by households.
- Electric utilities use almost 3 times as much gas as oil.

Source: 1993 EIA Annual Energy Review

# The Oil and Gas Industry Is Very Large Relative to Other Industries



Returning to those five messages after looking at this background, the first of the messages has to do with size. In terms of total output, the oil and gas industry is comparable in size by all these measures to many of the industries that are usually thought to be critically important to our nation's economy, our standard of living, and the creation of jobs and economic activity. This is largely due to the fact that most other domestic industries use significant amounts of oil and gas. Indeed, the fact that much of the use of oil and gas is concealed may have made the oil and gas industry seem smaller or less important than other industries.

This chart describes both the value added in each industry and the total output of the industry. The concept of value added measures the difference between the value of goods and services sold by an industry and the value of the inputs that are purchased, or essentially the activity that takes place within the industry. In terms of value added, the oil and gas industry is larger than many other industries, including motor vehicle manufacturing, iron and steel, and computers and computer services. The health services and drug industry is only somewhat larger. If we focus on total output, which is reflected by the entire bar, the oil and gas industry is slightly ahead of the health services and drug industry and is considerably larger than the domestic motor vehicle industry and the entire computer industry. The relative size of the oil and gas industry is often surprising to industry insiders and government policy makers

This chart is not intended to suggest that there is some kind of contest to be the largest industry. Indeed, how industries are defined and how their products are valued can change rankings significantly. Moreover, the United States has a large and diversified economy that is not dominated by any one industry. Nevertheless, it is interesting to observe that the oil and gas industry plays as important a role in the economy as many industries that are discussed repeatedly as being critical and worthy of national attention.

Source: 1987 Input-Output Accounts, U.S. Bureau of Economic Analysis

# The Oil and Gas Industry in Perspective: Value to Economy

---

- **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)**

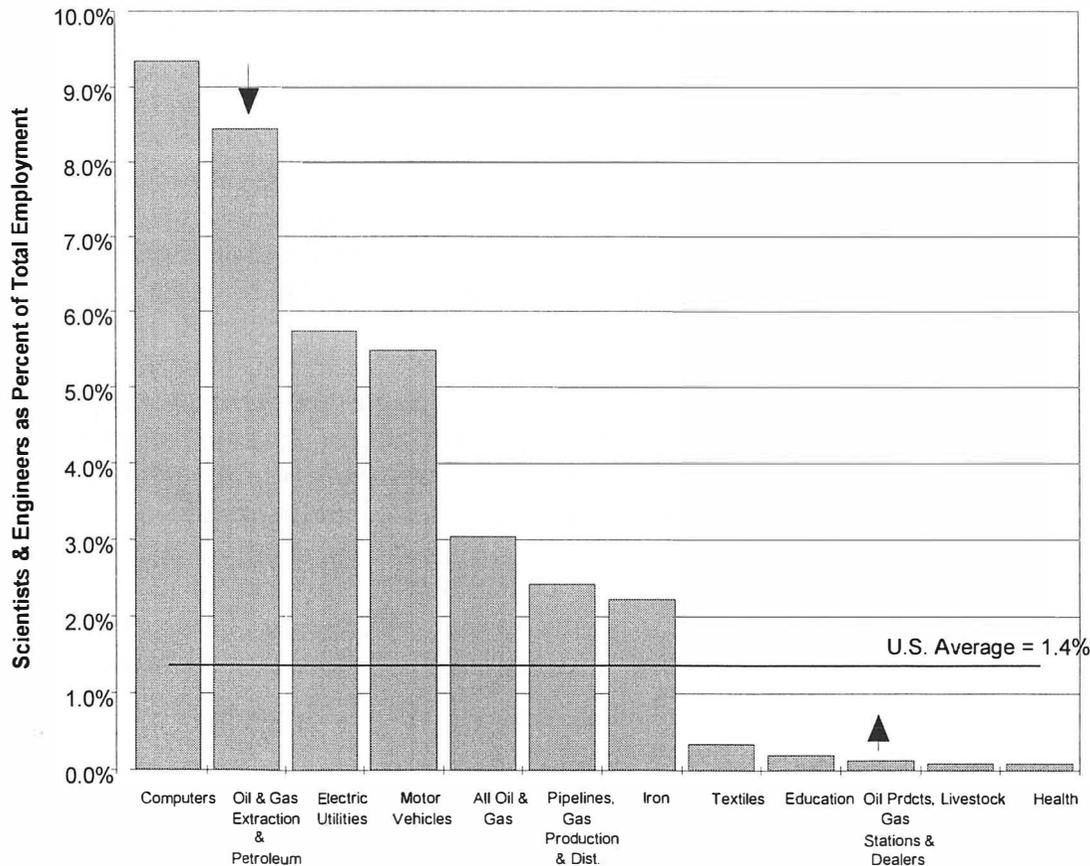
As one of the largest U. S. industries, the oil and gas industry accounts for between 3 and 5% of U.S. economic activity by different measures. It accounts for 4.6% of the economy's gross output, that is, the sum of the output of all industries, both what they deliver to each other and what goes on to households in final consumption.

It is a capital-intensive industry (as shown by its high output per employee), accounts for about three percent of U.S. investment and three percent of all private U.S. research and development, and pays three percent of all federal, state, and local taxes. Where oil and gas truly stands out is in payments of royalties to federal and state governments, in its share of national spending for improving the quality of environment, and in the quality and wages of the jobs it provides.

It is an industry that employs relatively few workers for the value it creates, but the wages that these workers earn are considerably higher than the U.S. average. Finally, the oil and gas industry pays for a large portion of total U.S. environmental investment dollars, due to the ongoing upgrades in current operations and the cleaning up of old environmental problems.

Source: 1987 Input-Output Accounts, U.S. Bureau of Economic Analysis, National Sciences Foundation, OGJ, EIA, U.S. Statistical Abstract, Minerals and Mining Services, Bureau of Labor Statistics

# Oil and Gas Industry: Quality of Industry Employment



- Oil and gas extraction and refining segments are technology-intensive, and employ a high proportion of engineers and scientists
- Job loss in the oil and gas industry has been predominantly in the extraction and refining segments
- Job gains have been in the low-technology areas

The U.S. oil and gas industry is a high technology, information and science oriented industry that creates the kind of jobs that national policy attempts to promote and protect. This chart points to the issue of quality by focusing on the quality of the industry's employment. Its oil and gas production and petroleum refining sectors are far ahead of other industries in the percentage of scientists and engineers in their total labor force -- 9% versus the U.S. average of 2.4%.

The industry's employment trends are disturbing, however. The contraction in employment in the petroleum industry in the last five to ten years has been in the high technology segments, while increases in employment have been in the admittedly low technology jobs in retail gasoline sales.

Source: Bureau of Labor Statistics

# The Oil and Gas Industry Provides Opportunities for Technology Exports

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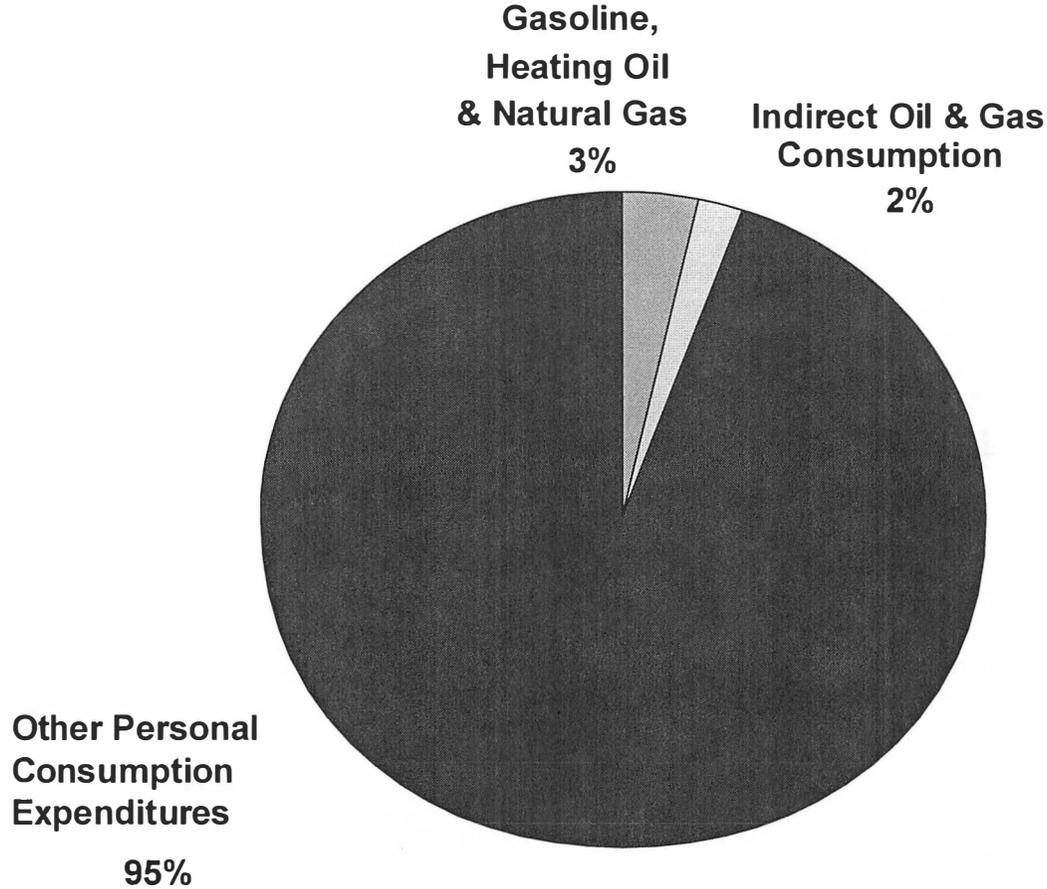
- The U.S. oil and gas industry has been a leader in international oil and gas exploration, production, transportation, and processing technologies
- Domestic firms have led exploration into new basins and new technology uses
- Domestic service firms have led the creation and use of new oil and gas technologies, including 3-D seismic, directional drilling, offshore and remote platforms, and catalytic processing

The large role of scientists and engineers in key parts of the industry is only one indication of its high-technology status. Oil and gas extraction and petroleum refining have made critical breakthroughs in information technology in recent years, such as the development of 3D seismic exploration methods. These advances have supported handsome returns to the U.S. economy from technology exports and represent a significant source of industry strength. Further, the industry has been uniquely successful in technology transfer to other countries in which the international oil and gas companies are involved.

U.S.-originated oil field services, exploration and pipeline technologies, and refining and processing technologies dominate the global oil and gas industry. The U.S. has provided the world oil and gas industry with technological leadership for the past 50 years.

# Oil and Gas Are Important to Consumers in Two Ways

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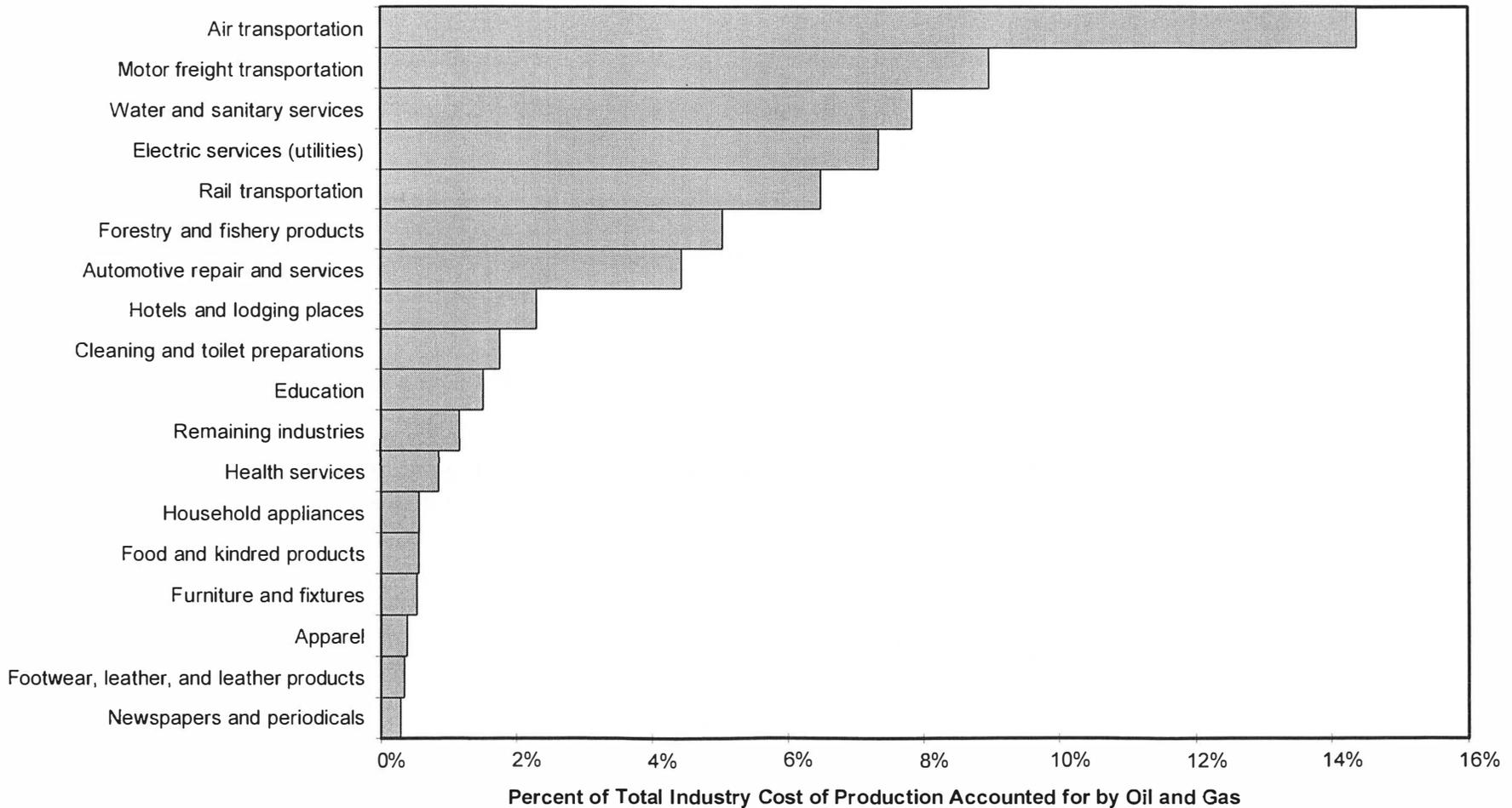


Turning now from quality to pervasiveness, oil and gas serve as facilitators and enablers in the production of virtually all the other goods and services that are delivered to consumers in the U.S. economy. Oil and gas make the production and enjoyment of these goods and services possible even though oil and gas are not, in the aggregate, a large component of cost. This chart shows that as a share of total dollar expenditures by consumers, direct purchases of oil and gas for their energy content (motor gasoline, heating oil and natural gas) are about 3% of household expenditures. In addition, households consume oil and gas indirectly because these fuels are needed to produce virtually all the other goods and services consumers buy. These indirect purchases are about another 2% of household expenditures, but they carry a critical role in those goods.

Taken together, direct and indirect use of oil and gas amounts to 5% of the value of personal consumption.

Source: 1987 Input-Output Accounts, U.S. Bureau of Economic Analysis

# Oil and Gas Are Important Inputs to Many Other Industries



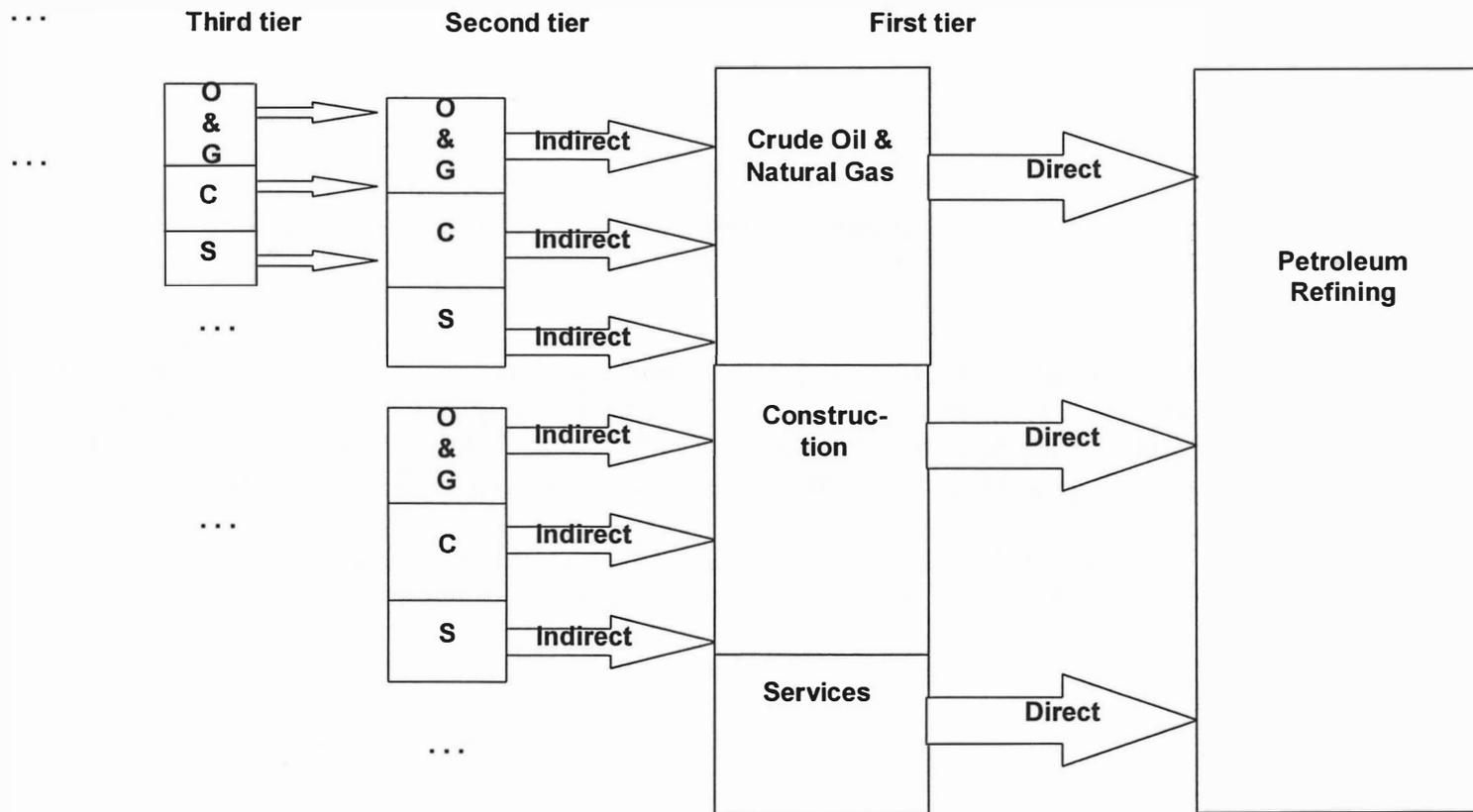
This chart reflects the importance of oil and gas to other industries by showing that it is used widely in producing other goods and services. It measures the percentage of the cost of producing various commodities that is accounted for by oil and gas.

These estimates include the energy that is used directly by the industry in question to produce the commodity in question. For example, the jet fuel purchased by airlines in providing air transportation.

Air transportation is clearly at the top of the list, with over 14 percent of the cost of air transportation attributable to oil and gas. A significant share of electricity is generated using oil and gas. Education and health services are also above average in the percentage of their costs that is attributable to oil and gas. All the important categories of personal consumption appear in chart 18, illustrating the many and pervasive ways in which oil and gas appears in the commodities that households buy.

Source: 1987 Input-Output Accounts, U.S. Bureau of Economic Analysis

# The Oil & Gas Industry Makes Direct and Indirect Purchases from Other Industries



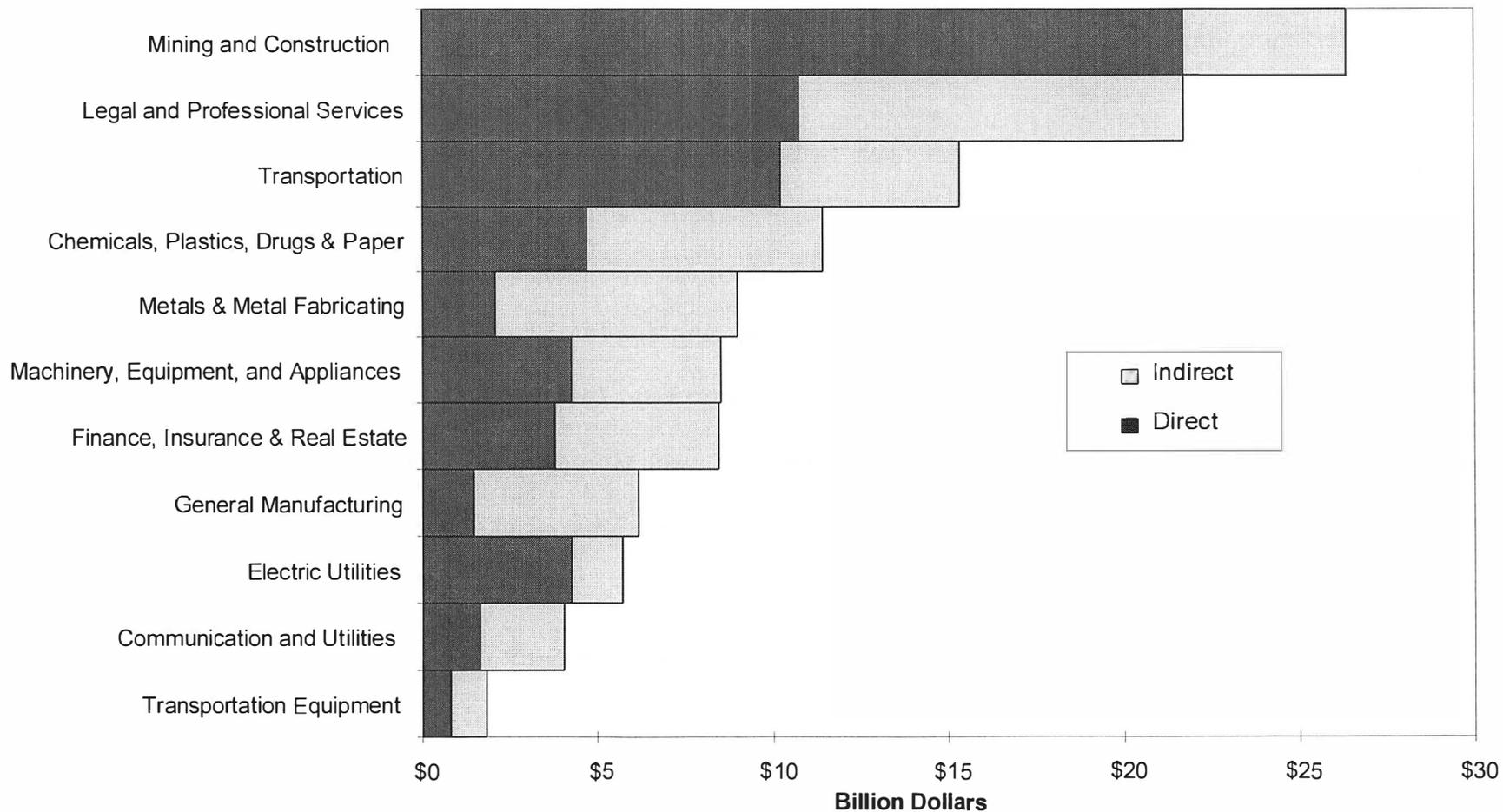
The oil and gas industry is also an important customer to other industries as its purchases “flow” through the economy.

For example:

1. A refinery purchases construction of a tower from a construction company (first tier).
2. The construction company buys tower support beams from a steel fabrication company (second tier).
3. The steel fabrication company buys bulk I-beams from a steel manufacturing company (third tier).
4. The steel manufacturing company buys taconite ore from a mining company (fourth tier).
5. The mining company buys electricity from an electric utility to reduce raw ore to taconite (fifth tier).

This process shows how a single purchase by the oil and gas industry can support a variety of industries, including sales, profits, and jobs.

# The Oil and Gas Industry Creates Jobs and Sales in Many Other Industries



The oil and gas industry's pervasive influence on the economy is also due to its widespread purchases of goods manufactured by other industries. This chart shows the industries outside the oil and gas industry whose livelihood is most dependent upon the production and distribution of oil and gas. The oil and gas industry purchases goods and services from other industries both directly and indirectly. For example, purchases of construction services for drilling platforms or refineries are direct purchases. Purchases of pipe or steel products by construction companies for these projects are indirect purchases. Purchases of electricity by the steel companies manufacturing those products also count as indirect purchases by the oil and gas industry. Purchases by the oil and gas industry in support of current operations, which are expensed, and purchases for investment purchases, which are capitalized, are both included.

The mining and construction industries are heavily dependent on the oil and gas industry, and they are cyclical industries that are especially dependent on investment spending -- a volatile component of spending by the oil and gas industry. The next largest purchases are for legal and other professional services. Each of the major segments of the economy are represented, showing the pervasive impact of the oil and gas industry on jobs and activity in other industries throughout the economy.

Source: 1987 Input-Output Accounts, U.S. Bureau of Economic Analysis

# The Oil and Gas Industry Is an Important Customer to Many Other Industries

---

- The Oil and Gas Industry buys directly and indirectly 3.5% of U.S. Gross Production:
  - 4 % of construction industry output
  - 6 % of leasing/royalty industry output
  - 7 % of non-coal mining industry output
  - 3 % of drugs, chemicals, plastics, and paper industry output
  - 1 % of finance, insurance, and real estate industry output

The oil and gas industry is an important customer to a variety of other domestic industries, purchasing 3% of U.S. gross production and up to 8% of the output of other industries. As the industry has gotten smaller over the past decade, this list of suppliers shows which industries have lost sales as a result.

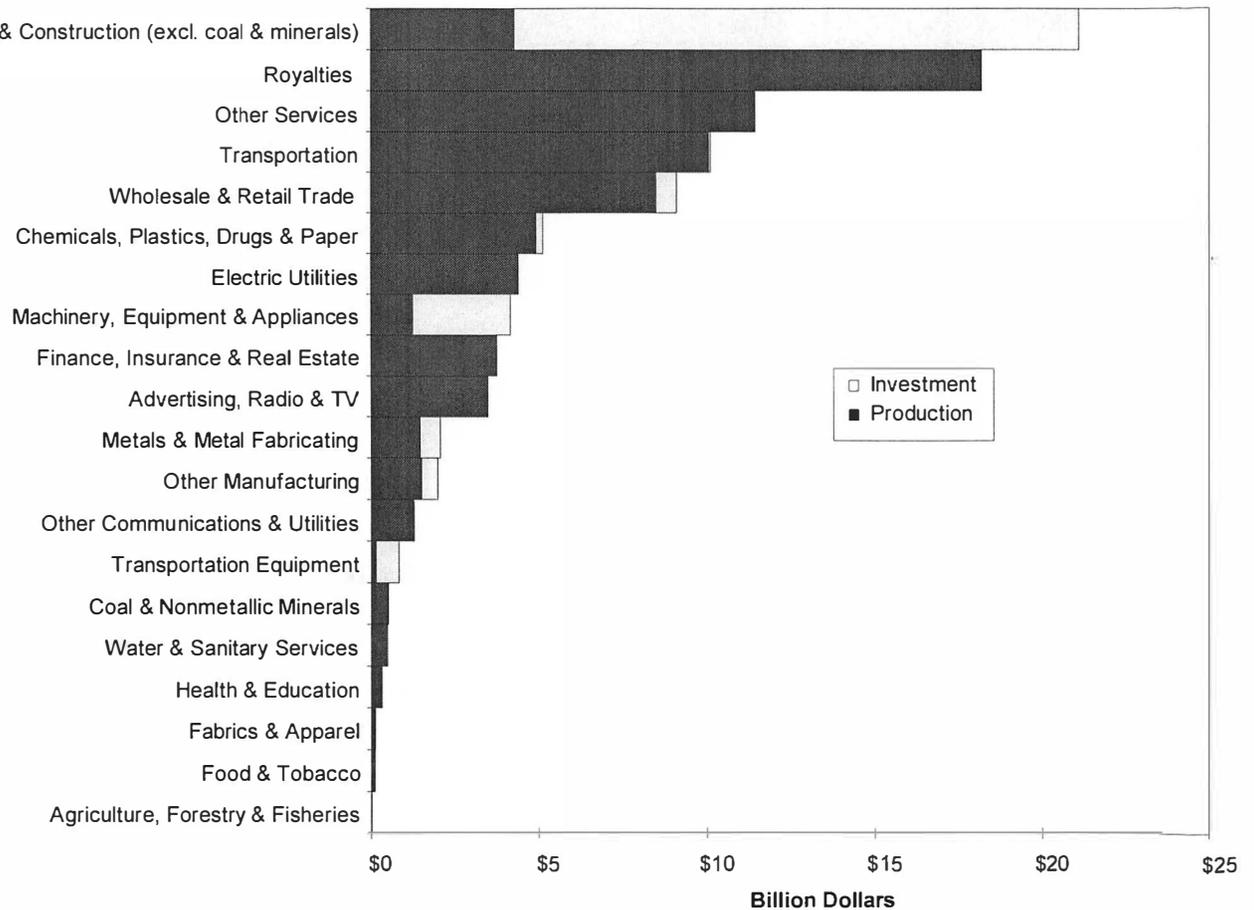
Source: 1987 Input-Output Accounts, U.S. Bureau of Economic Analysis

# Direct Purchases by the Oil and Gas Industry for Current Production and Investment

- The Oil and Gas Industry is an important customer, creating business for many industries.

- The top two industries which the Oil and Gas Industry deals with directly are Mining & Construction, and Finance, Investment & Real Estate.

- The Oil & Gas Industry buys for investment as well as for daily operations.

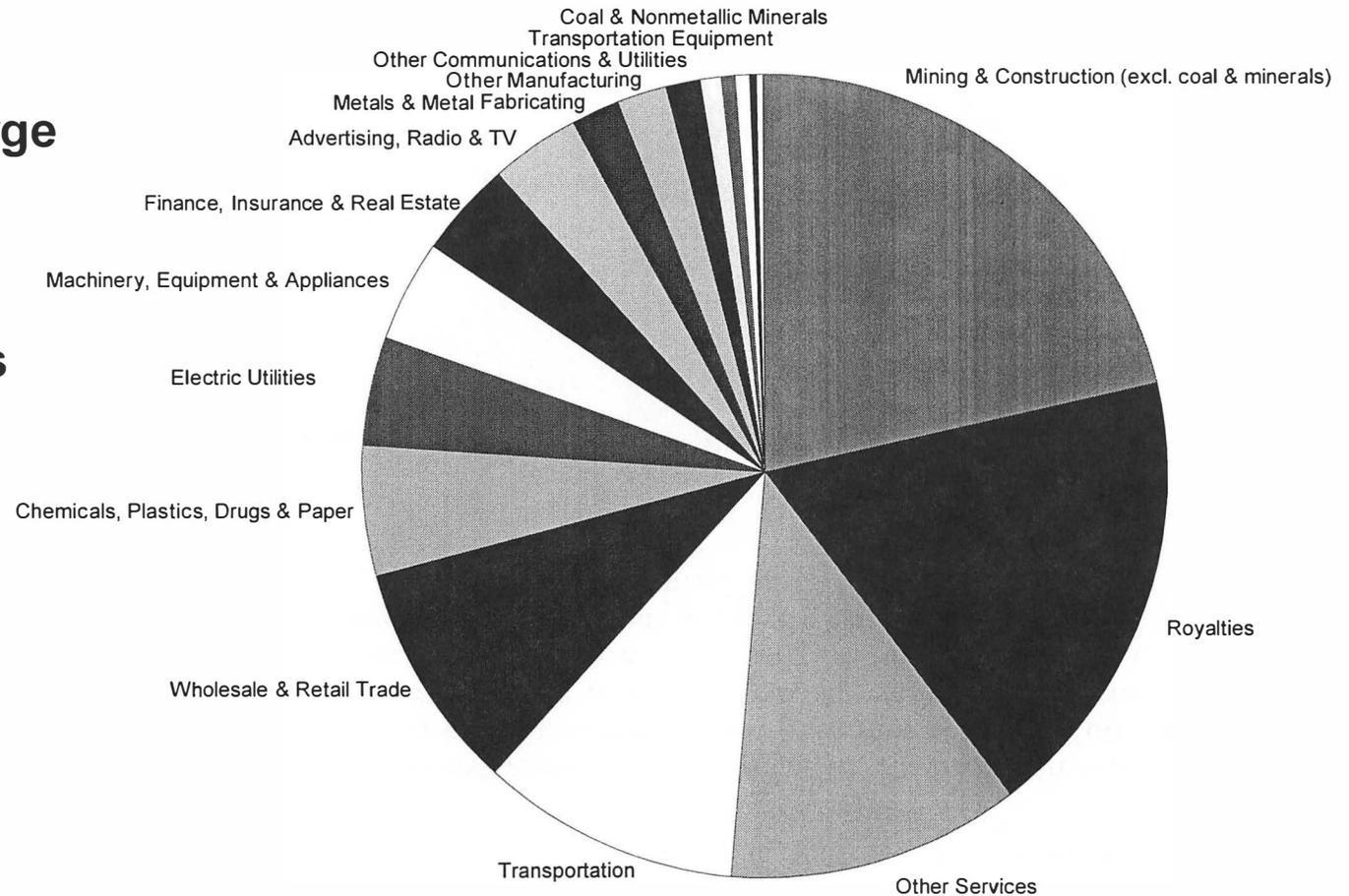


This chart shows how the direct purchases by the oil and gas industry are divided among its customers through its production and investment expenditures. In other words, both purchases the oil and gas industry makes for daily operations (that are expensed) and those for investment purposes (that are capitalized) are shown here. For example, reducing oil and gas industry investment would reduce sales in a few industries (primarily mining and construction, machinery, equipment and appliances). These are the industries hardest hit when negative events affect the oil and gas industry. Reducing oil and gas production expenditures (by reducing sales volumes) tends to affect a wide range of industries.

Source: 1987 Input-Output Accounts, U.S. Bureau of Economic Analysis

# How Oil and Gas Industry Purchases Are Spread Across Other Industries

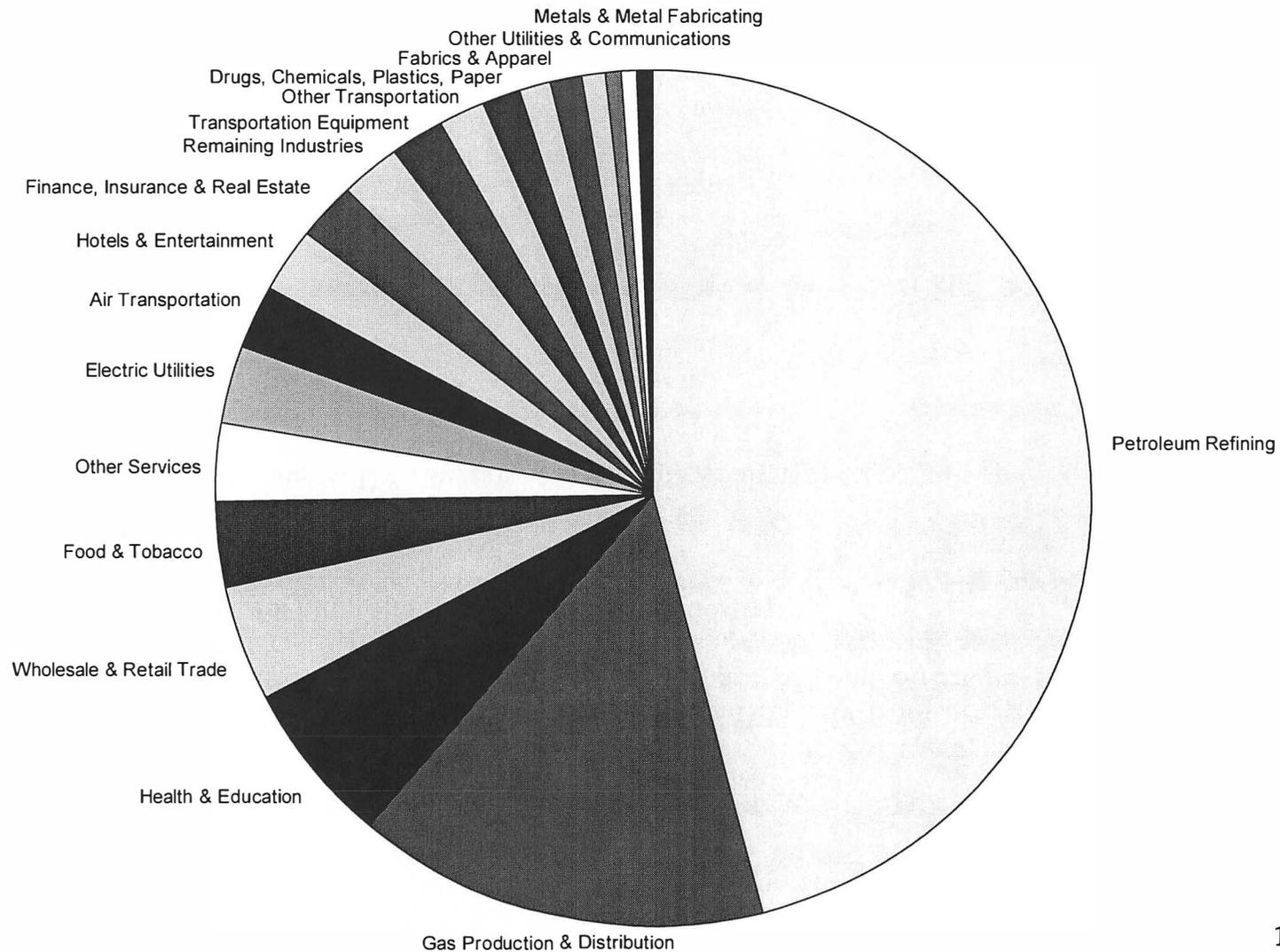
- Oil and Gas Industry purchases support a large number of domestic industries
- Construction purchases are most of purchases from "Mining & Construction"
- Royalty payments are a large part of "Finance, Insurance, and Real Estate"



The previous chart showed the absolute dollar amounts purchased directly from other industries by the oil and gas industry; this chart shows those same dollar amounts as a share of total direct purchases. Again, mining and construction are large suppliers to the oil and gas industry. Several services, such as finance, advertising, and transportation are also significant suppliers to the oil and gas industry.

Source: 1987 Input-Output Accounts, U.S. Bureau of Economic Analysis

# Direct and Indirect Oil and Gas Requirements for PCE Components



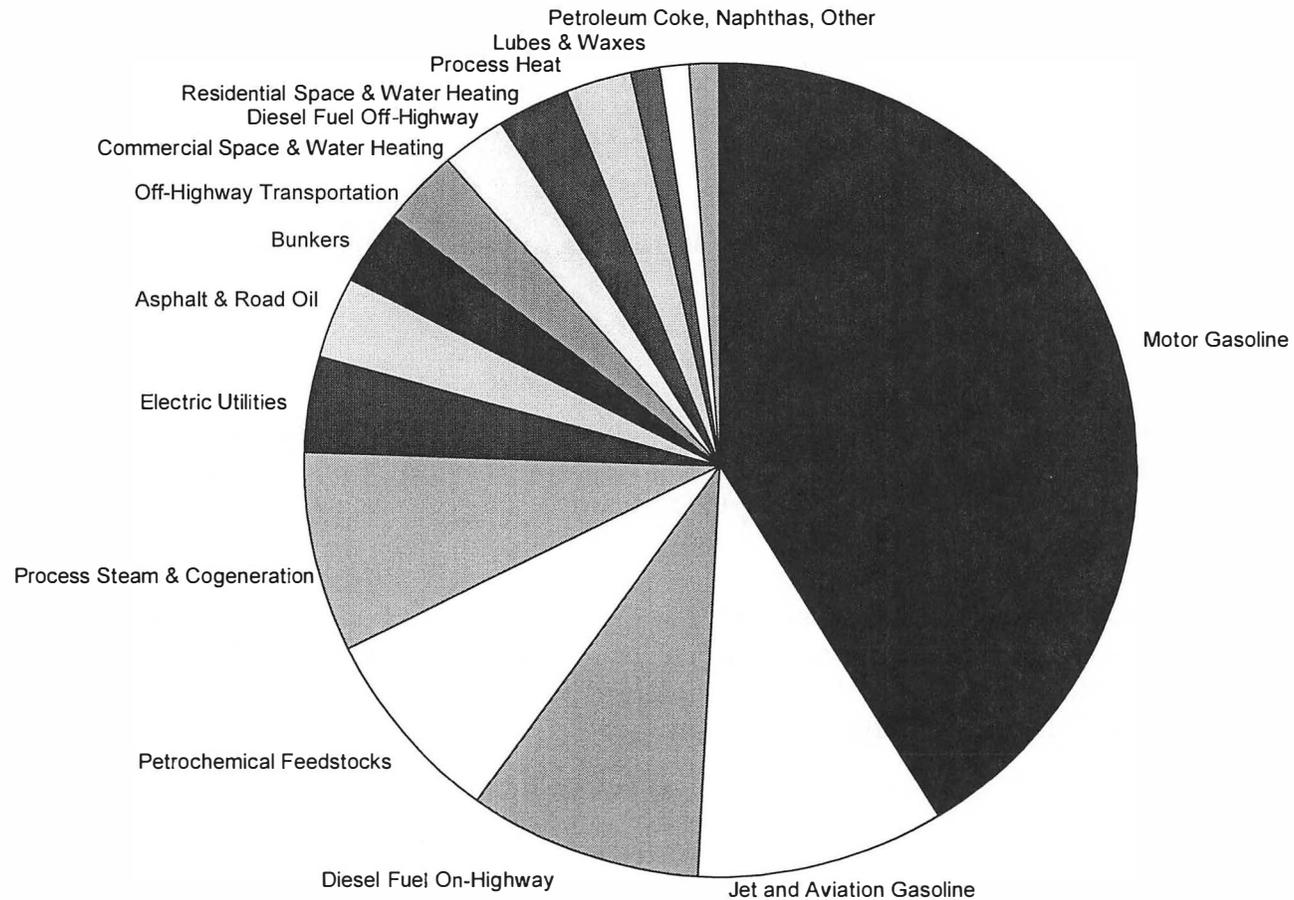
This chart shows how oil and gas is consumed in the economy -- both direct and indirect uses as a share of personal consumption. Direct personal consumption includes petroleum refining and related products (gasoline, heating oil, natural gas, propane) and gas production and distribution. Indirect personal consumption includes the consumption by households of other goods and services that use oil and gas as an input. For example, people consume air transportation, which in turn consumes jet fuel.

Health and education make up the largest indirect consumption category. This represents the oil and gas consumed directly by hospitals, universities, public schools, etc., and all of their indirect consumption as well. For example, hospitals consume natural gas for heat directly, but they also consume natural gas indirectly, as part of laundry services done by another firm.

Source: 1987 Input-Output Accounts, U.S. Bureau of Economic Analysis

# Oil Has Few Adequate Alternatives in Many End Uses

Percent of Total Petroleum Products Supplied



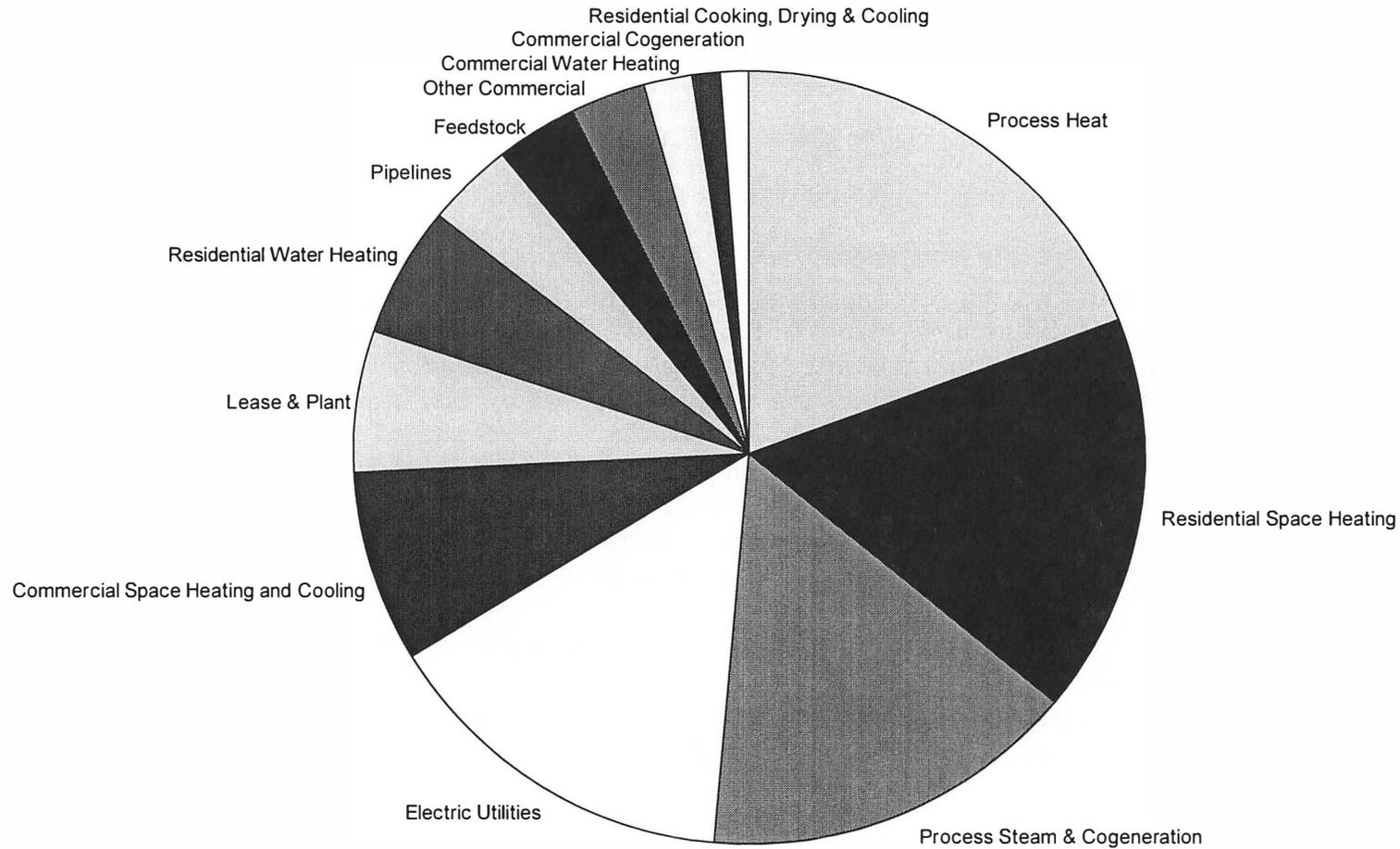
The preceding discussion indicates that the oil and gas industry is intricately connected to the employment and output of many other industries. How important are these connections? One way to assess this importance is to consider what alternatives would be available to serve the purposes now served by oil and gas if those fuels were no longer available or affordable. This chart helps to address this question, by showing the major end uses to which oil is put.

The difficulty and cost of finding alternatives to oil and gas depends upon how these fuels are being used. In the case of jet fuel, there is literally no substitute for petroleum-based fuels. The alternative is use of another, slower form of transportation. The same lack of direct substitutes is true of many other end uses. In other cases, there are substitutes that are just as good at satisfying consumer demand as oil and gas, but simply cost more.

At some point, the only possible way to restrict gasoline consumption is by reducing driving. The cost of this alternative equals the value that consumers derive from the lifestyle that mobility makes possible. For small reductions in driving, the change in lifestyle may be minor -- postponing some discretionary driving, for example -- but lifestyle changes required to achieve large reductions in fuel use could involve significant changes in where people live and how they get to work.

Source: Gas Research Institute

# End Uses of Natural Gas

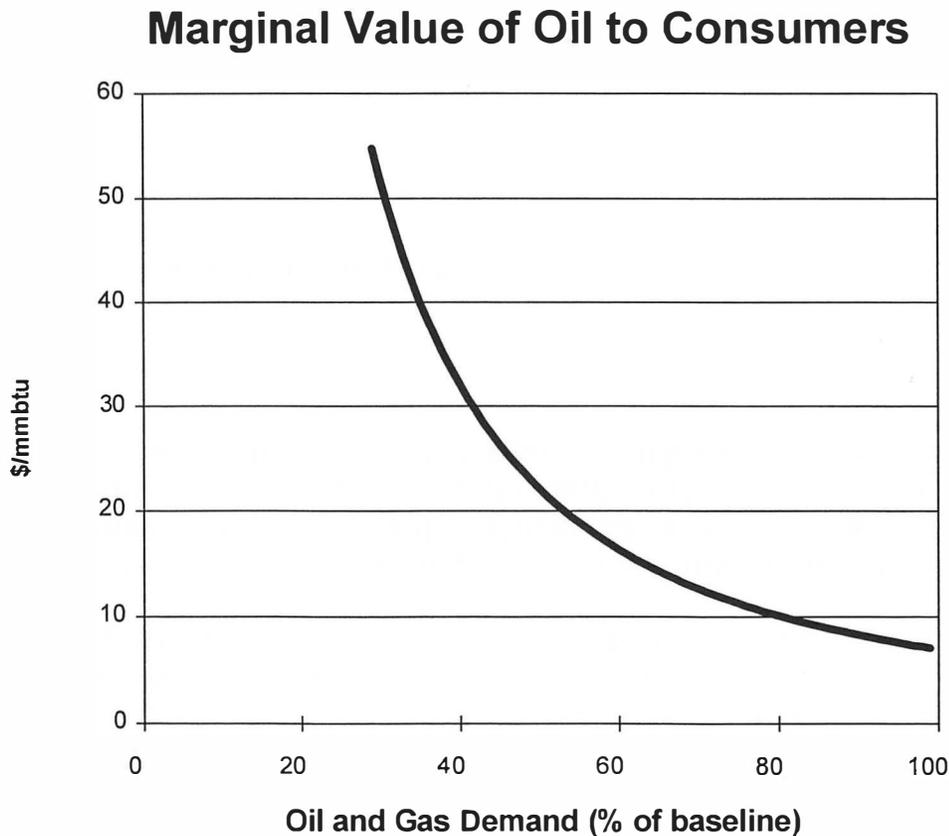


Natural gas has a wide variety of markets and uses. Only about a quarter of all natural gas sold is consumed directly (by households). That includes home heating, residential hot water, and residential cooking, drying and cooling. The other three quarters of natural gas sold in the US is consumed indirectly, mostly for process heat, steam, electricity generation and for natural gas production, processing and transportation. The rest is used in commercial establishments (heating, cooling, hot water) and as a petrochemical feedstock.

While there appear to be many non-oil substitutes for natural gas, they are generally capital intensive, expensive, and environmentally undesirable. Using coal or wood in households as a substitute for natural gas would increase air pollution. Using electricity would require massive investment in new generation capacity. The new capacity would be either coal or nuclear powered, causing other environmental consequences.

Source: Gas Research Institute

# The Value of Remaining Oil Use Increases As Use is Restricted



Source: General Equilibrium Energy-Environmental Policy Analysis Model, 1995

- The value of oil and gas is measured by the cost of the next best alternative
- As oil demand is forced down, the remaining uses become more and more valuable

It is possible in principle to estimate the cost of the next best alternative to oil and gas for all the different ways in which oil and gas are used. The exercise would entail asking the question: What is the cost of the next best alternative to oil and gas or what would someone be willing to pay in order to keep oil and gas rather than have to go to the next best alternative? Arraying these costs in order, in dollars per million BTUs, gives a curve like that in this chart. The chart depicts the cost of the next best alternative, which rises as oil and gas consumption is restricted further and further. According to the EIA baseline forecast, oil and gas will carry an average retail price of about \$7 per million BTU in 2020 (in 1990 dollars). When 100% of baseline demand is available, oil and gas will be used up to the point at which the lowest valued use has a value just equal to the market price.

If use were to be restricted by, say, 20% and the lowest valued 20% of use were eliminated, the next best alternative to oil and gas might be some alternative fuel costing \$10 per million BTU. If demand were cut by 50%, what it would cost to find a replacement for the next barrel of oil or MCF of natural gas would be considerably higher than the \$7 that consumers would pay with no restrictions. The reason is that now it might be necessary to figure out how to eliminate some feedstock uses for which the cost of an alternative is not \$7 per million BTU but \$20. And that \$20/MBTU would have to be paid to find an alternative if policy were to restrict oil and gas use that far. This key notion is critical to truly understand the value of oil and gas in the economy, that is, the costs of substitution of the next remaining increment of oil and gas use rises progressively.

How costly it is to find substitutes for oil and gas determines how much reduced availability of oil and gas affects other industries and the economy in general. Restricted availability means that users have to turn to alternatives if they are to continue to enjoy energy services. Since the alternatives generally cost more, they either have to make do with fewer energy services or reduce their consumption of other goods and services. The magnitude of the impacts of such restrictions depends upon how much more costly are the substitutes for oil and gas. As suggested in the above chart, for some uses (e.g., discretionary driving), substitutes can be found fairly easily, without significant increases in cost. But in other cases (e.g., jet fuel), substitutes are much more difficult and expensive to find.

Source: General Equilibrium Energy-Environmental Policy Analysis Model, 1995



**APPENDIX D**  

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**REPORT OF**  
**ARTHUR D. LITTLE, INC.**



# **Future Issues for the U.S. Oil and Gas Industry**

**Report to  
the National Petroleum Council**

**June 26, 1995**

Arthur D. Little, Inc.  
1001 Fannin Suite 2050  
Houston, Texas  
77002

Reference 48675



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## Introduction

Arthur D. Little, Inc. was retained by the National Petroleum Council (NPC) to identify issues that will shape the U.S. petroleum industry over the next 25 years and possible approaches to resolving these issues. The study was conducted through a series of structured interviews and workshops, engaging over 90 thought leaders representing diverse constituencies:

- The petroleum industry,
- Customers (industries that purchase oil and gas products),
- Public-interest and environmental groups,
- Government policy-makers and regulators, and
- Industry observers (including consultants, financial analysts, trade media, and academics).

We began with open-ended interviews with about half of the participants on their perceptions of the past, the future, and key issues facing both the petroleum industry and the nation over the next 25 years. We then facilitated three workshops with the remaining participants, each workshop involving a distinct constituency, in order to contrast views of the different groups regarding key issues and response options. Finally, we synthesized lessons learned from the interviews and workshops to prepare this report, which is divided into four sections:

### **I. Executive Summary**

Details key findings of the study, including the primary issues facing the petroleum industry, response options which may be considered by government and industry decision-makers, and opportunities for the industry to reposition itself as a proactive, forward-looking force in the national and international communities.

### **II. Views of 2020**

Reports on the participants' opinions about the future state of the U.S. economy and the petroleum industry, reflecting broad geopolitical, economic, technological, environmental, demographic, and energy-specific trends.

### **III. Likely Future Issues**

Synthesizes major issues for both government and industry arising from conflicting views of the future (trends, drivers, concerns) and value systems (stakeholders' interests). Includes an outline of several possible response options to each issue.

## **Introduction**

### **IV. An Opportunity for New Industry Leadership**

The focus of this section is to assist industry leaders in defining their role in shaping the future of the petroleum industry and the national economy.

Although statements in this section are often supported by direct quotes from the participants, they represent the opinions of Arthur D. Little.

In addition, the report contains two appendices:

#### **A. The Value of the Industry**

Added at the request of NPC to supplement an economic study of the petroleum sector conducted by Charles River Associates. It reports on participants' qualitative comments regarding industry attributes, and does not involve any analytical work on the part of Arthur D. Little.

#### **B. The Interview/Workshop Methodology**

Details the methods used in undertaking the survey and analyzing results.

Arthur D. Little would like to express its gratitude to the National Petroleum Council and our interview/workshop participants. We appreciate this unique opportunity to engage in dialogue with thoughtful people of diverse viewpoints, and increase our understanding of industry issues in all their complexity.

## Introduction

### Participants in Arthur D. Little's Interview Program (March, 1995, various locations)

Dwayne Andreas - Archer Daniels Midland Company  
Truman Arnold - Truman Arnold Companies  
Wally Baer - RAND  
Dick Balzhiser - Electric Power Research Institute  
Larry Bickle - Tejas Power Corporation  
James Blackburn, Jr. - Blackburn & Carter, P.C.  
John Bookout - Shell Oil Company  
Philip Carroll - Shell Oil Company  
Thomas Cruikshank - Halliburton Company  
Keys Curry, Jr. - Destec Energy, Inc.  
Errol Davis - Wisconsin Power & Light  
Alfred DeCrane, Jr. - Texaco, Inc.  
Richard Farman - Southern California Gas Co.  
Joe Foster - Newfield Exploration Company  
Stephen Goldmann - Exxon Corporation  
Arthur R. Gralla, Jr. - Bank One, Texas, NA  
Christine Hansen - Interstate Oil and Gas Compact Commission  
Hal Harvey - Energy Foundation  
Paul Hilliard - Badger Oil Corporation  
Charles Imbrecht - California Energy Commission  
John Jennrich - Natural Gas Week  
Bob Kelly - Enron Corporation  
Daniel Lashof - Natural Resources Defense Council  
John Lichtblau/Lawrence Goldstein/Cheryl Trench - Petroleum Industry Research Foundation, Inc.  
Brian Lidsky/Charles Norman - John S. Herold, Inc.  
Amory Lovins - Rocky Mountain Institute  
George Mitchell - Mitchell Energy & Development Corporation  
Paul Mlotok - Morgan Stanley  
Patrick Noonan - Conservation Fund  
Bill Nordhaus - Yale University  
Lucio Noto - Mobil Corporation  
Ken Roberts - Mobil Corporation  
Ray Russell/Bill Jewell - Dow Chemical Company  
Richard Schmalensee - Massachusetts Institute of Technology  
G. Henry Schuler - Center for Strategic and International Studies  
Peter Schwartz - Global Business Network  
Jeff Share - Independent Journalist  
Jeff Skilling - Enron Corporation  
Don Smith - National Petroleum News  
Lawrence Smith - Shell Oil Company  
Jack Jenkins Stark - Pacific Gas and Electric Company  
Linda Stuntz - Stuntz & Davis  
R. Patrick Thompson - New York Mercantile Exchange  
John Wells - John Gray Institute  
Daniel Yergin - Cambridge Energy Research Associates

## Introduction

### Participants in Arthur D. Little's Workshop Program

#### **Workshop 1: Government Policymakers and Regulators**

**April 19, 1995**

**Washington, D.C.**

Robert Armstrong - U.S. Department of the Interior  
Ben Cooper - U.S. Senate Energy & Natural Resources Committee  
Bruce Ellsworth - New Hampshire Public Utilities Commission  
Lee Gerhard - Kansas Geological Survey  
Patricia Fry Godley - U.S. Department of Energy  
Joshua Gotbaum - U.S. Department of Defense  
Steve Harper - U.S. Environmental Protection Agency  
Frank O. Heintz - Maryland Public Service Commission  
Tom Keane - Federal Highway Administration  
Maureen Koetz - U.S. Senate Energy & Natural Resource Committee  
Matthew McManus - U.S. Department of State  
Elizabeth Anne Moler - Federal Energy Regulatory Commission  
John Patton - Planning and Development, Santa Barbara County  
Sue Sheridan - U.S. House Commerce Committee  
Theodore Streit - West Virginia Oil and Gas Conservation Commission  
Elizabeth Wagner - U.S. Department of Treasury

#### **Workshop 2: Public-Interest and Environmental Organizations**

**April 20, 1995**

**Washington, D.C.**

Robert Craig - Keystone Center  
Thomas J. DiLorenzo - Center for the Study of American Business  
Amos S. Eno - National Fish and Wildlife Foundation  
Christopher Flavin - World Watch Institute  
Jerry Katz - National Energy Education Development Project  
Michael S. Koleda - Council on Alternate Fuels  
Bill Magavern - Public Citizen's Critical Mass Project  
Michael McCloskey - Sierra Club  
Richard Morgenstern - Resources the Future, Inc.  
Paul H. Parker - Center for Resource Management  
Robin Roberts - John Gray Institute  
Edwin Rothschild - Citizen Action  
Jack Sheehan - United Steelworkers of America  
Edward Wall - President's Council on Sustainable Development

## **Introduction**

### **Workshop 3: Industry Customers, Observers, and Analysts**

**April 26, 1995**

**New York City**

William M. Burnett - Gas Research Institute

Fred Chitty - Defense Fuel Supply Center

Donald H. Denton, Jr. - Duke Power Company

Harry Foster - General Motors Company

Lawrence J. Goldstein - Petroleum Industry Research Foundation, Inc.

John L. Kennedy - Oil and Gas Journal

Mary Jane McCartney - Consolidated Edison Company of New York

John P. McTague - Ford Motor Company

Walter Mead - University of California at Santa Barbara

Albert Momeny - The Boeing Commercial Airplane Group

Robert P. Neuschel - Northwestern University, Kellogg School of Management

Ronald Schuh - Occidental Chemical Corporation

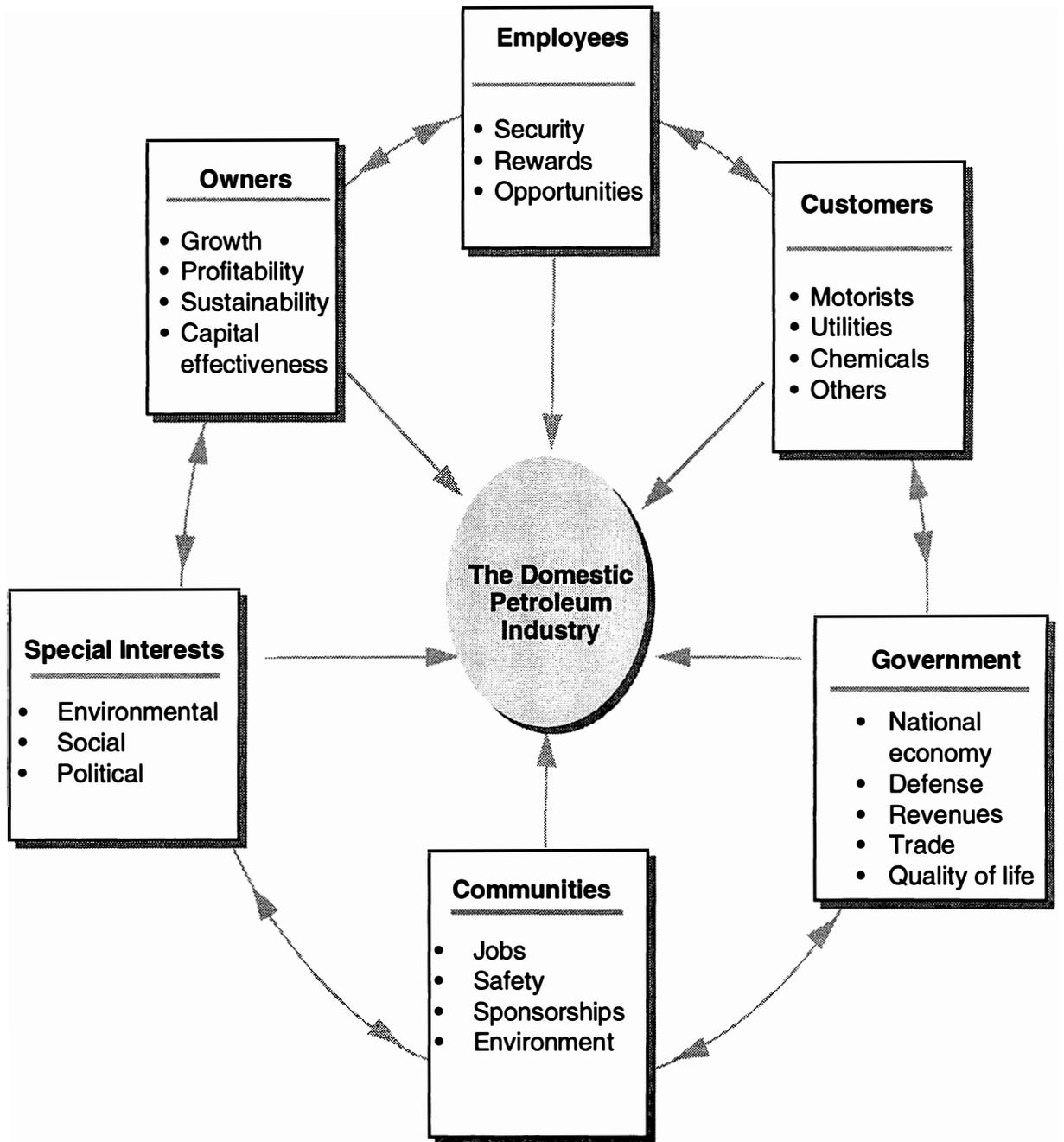
Matthew R. Simmons - Simmons and Company International

Bruce Stram - Enron Capital and Trade Resources

James Sweeney - Stanford University

James Tanner - Wall Street Journal

The industry's main challenge is to lead effectively by balancing the complex needs of its stakeholders and improving relations with all of them.



## **I. Executive Summary**

### **A. The Industry at the Crossroads**

Over the past 25 years, the U.S. petroleum industry has faced a series of difficult challenges of significant consequence for its various stakeholders. Although some of these challenges have been met with enormous success, others have been considerably more vexing . . . and publicized. From periodic supply disruptions and price volatility, to the rising tide of environmental performance expectations and regulations, entrenched public distrust, shareholder disaffection, and subsequent cost-cutting programs, the barrage of criticism expressed from so many quarters—customers, communities, shareholders, and employees—has left the industry reactive and defensive.

However, our research shows that the petroleum industry has a rare historic opportunity to reposition itself from the largely defensive and reactive posture of the past quarter century, into a more positive, proactive, and forward-looking force in national and international communities.

This repositioning can be based on genuinely impressive accomplishments. Over the past two decades, the petroleum industry has diversified the sources of crude oil supply available in world trade. It has introduced technologies that have opened up substantial new resources to commercial development with minimal environmental impact and maximum safety. It has reduced emissions and leakage from all stages of the petroleum supply chain. It has developed, distributed, and marketed an array of environmentally friendly fuels including natural gas, reformulated gasoline with sophisticated additives, and low sulfur diesel. And it has remained central to the country's economic progress by providing cheap energy, national security, jobs, tax revenues, technology, and a high degree of efficiency.

These accomplishments are likely to be sustained by the innovative spirit of the industry if it can learn to foster the good will of other constituencies. Technology advance is likely to continue to drive down finding and development costs, allowing production from existing fields to be prolonged and new fields to be discovered. The international trend of privatization and opening-up of previously closed areas will allow the full capabilities of our oil and gas companies to be applied globally, further diversifying supply sources, and improving environmental and safety performance in these countries. Petroleum products will progressively become cleaner and more environmentally friendly around the globe. However, the industry bears a particular responsibility to take a lead in improving relations with its many stakeholders (Chart I-1). It can do so by communicating clearly (what it is doing, why it is doing it, and how its efforts will benefit other stakeholders), balancing other constituents' needs, and building bridges whenever possible.

Other stakeholders should also be cognizant of the value of the industry to the nation. The Government's responsibility is to balance the interests of the different parties using multiple criteria. It must consider the economic interests of the nation as a primary

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criterion. But there will be other criteria that are of particular importance to certain constituencies that must also be weighed. Environmental and public-interest groups have a responsibility to join the debate and negotiate in good faith with the industry and with Government at all levels to develop policies and standards that achieve reasonable objectives cost-effectively. We believe that the nation would benefit from a cooperative, team-building spirit which the industry, the Government, environmentalists, the public, and all other stakeholders should strive to create. We further believe that this new spirit will only emerge if the industry takes a leadership role in defining and articulating a vision that can muster broad-based support.

## B. Views of the Future

Even though our sample of thought leaders represented a wide diversity of constituents, we found a surprising level of commonality in many views of the future. While there wasn't a full consensus on any individual trend or issue, in most cases a strong majority of respondents shared a common vision. Generally, these views outline a positive scenario which suggests continuing growth in the U.S. economy and the petroleum industry. Minority views regarding petroleum demand, however, suggest alternate scenarios where the industry may experience much more difficulty. We summarize below the majority and minority responses of our participants regarding a number of key economic and political drivers. These views are discussed in more detail in Section II, where they are supported by representative comments from the respondents.

### ***Majority View***

***Geopolitics.*** The group generally expects to see increased globalization and free trade by 2020, with world and domestic markets becoming increasingly free and highly competitive. Companies and workers alike will face increasing competitive pressures. Particularly rapid economic growth is expected in Asia, and Asian countries are expected to gain influence in world affairs. Oil producing regions in the Middle East and Commonwealth of Independent States (CIS) are expected to remain politically unstable, with the attendant risk of supply disruptions.

***Workplace.*** Automation and technology are likely to dramatically change the workplace. In addition, demographic shifts, such as aging, will likely change the workforce and customer base in the U.S.A.

***Government.*** While direct government interventions are expected to shrink in favor of market-oriented mechanisms and increased deregulation, most people believe that the U.S. government will still be sizable.

***Public Perception of the Industry.*** According to our participants, to change negative public perception of the petroleum industry, and the oil segment in particular, would require a sustained proactive effort. Some respondents question whether the perception can be changed at all. It is certain to be one of the industry's most significant challenges.

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*Technology.* Technology, especially information and communication technology, is expected to advance rapidly, and will likely have a significant impact on society as a whole. However, the impact of technology on energy is expected to be dampened somewhat due to the relatively slow turnover rate in capital stocks such as cars, factories, buildings, and equipment (including equipment used by the petroleum industry to produce and manufacture its products).

*Environment.* Environmental concerns will continue. There may be a greater focus on global and local, rather than national, environmental issues. Many participants expressed hope that current command and control regulations will give way to more flexible, market-oriented ones.

*Industry Structure.* The industry will become increasingly efficient and focused on customers, competition, and marketing issues. Participants had different views on the future mix of companies by size and operations, but agreed that we will probably see a mix of large and small, domestic and international companies.

*Energy Markets.* World petroleum supply and demand are expected to increase. There is little agreement on whether prices will increase or decrease. In the U.S., most respondents expect current trends to continue: flat to slight growth in demand, continuing reduction in domestic production, and increasing imports.

### **Minority View**

A number of participants believe that petroleum demand will drop significantly—perhaps as much as 50% from current levels. A change this size would likely have serious negative impacts on industry size, structure, employment, and profitability. Two primary factors were identified as probable triggers for such a scenario: technology breakthrough and demand management.

*Technology Breakthrough.* The rapid commercialization and adoption of new efficiency and alternate-fuel technologies would drastically improve the efficiency of energy use in the U.S. and the world. Many of these technologies are believed to be available today, but due to a variety of barriers, have not been commercialized. New entrepreneurial enterprises, coupled with government incentives and jump-start programs, could break through these barriers. In this case, the economy would be a net beneficiary, since the new technology is expected to provide equivalent end-use benefits (transportation, home comfort, industrial production) at a lower cost. The price of petroleum would be expected to drop in this scenario.

*Demand Management.* The possibility of demand management could arise if dramatic and negative environmental effects, such as global warming, would induce governments to tightly restrict carbon emissions. Alternatively, U.S. dependence on foreign oil could be managed by reducing domestic demand. In either event, the Government could impose high taxes on products, or mandate restrictions on fuel economy and use to drive down demand. Unlike the technology breakthrough case, demand management is viewed as less beneficial to the economy, since the price of the commodity would

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increase, affecting all end-users of oil and gas products. However, because higher prices might encourage technology breakthroughs, these negative impacts could be somewhat mitigated.

### C. Likely Future Issues

By analyzing direct comments by participants and conflicting views of the future from different respondents, we identified a number of pressing issues the industry will face over the next 25 years. For the sake of simplicity, these issues (which are discussed in detail in Section III and summarized in Charts III-2 through III-7) are grouped into six major areas of concern:

**Globalization and National Policy:** How should national policy be crafted in a global economy?

**Government Intervention:** How to optimize the Government's involvement in oil and gas markets?

**Supply Security:** How to secure low-priced energy supplies to protect U.S. competitiveness despite increasing imports?

**Environmental Impact:** How to deal with the environmental impact of the industry's operations and products?

**Public Perception:** How should industry relate to the public?

**Societal Change:** How should industry respond to social and demographic changes?

#### ***Crafting Policy in a Global Economy***

Further integration of the global economy will vastly complicate U.S. Government policy-making, challenging it to balance the interests of companies operating in the global arena with national goals and priorities. In protecting national interests, the Government will be faced with a host of policy options that have the potential to cause significant harm, while achieving only moderate success in terms of national objectives. As one of our participants put it, "the Government should think through all actions for international ripple effects and unintended consequences." The general view was that to improve effectiveness, the U.S. Government will need to seek multilateral solutions in many areas which previously could be solved through unilateral action. From our interviews and workshops, we identified three major issues the Government may face concerning globalization:

- Should the U.S. adopt foreign policy that supports the U.S. petroleum industry in the global arena? Available policy options include supporting U.S. companies in foreign commerce via tax incentives and foreign privatization assistance

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(especially newly opened markets), discontinuing unilateral trade embargoes, and diplomatic actions and military interventions.

- Should the U.S. adopt a protectionist policy for domestic production or refining? Import barriers such as duties and quotas, price supports, and environmental relief are discussed as available policy options.
- Should the U.S. promote a level playing field in international trade? Policy options include free-trade agreements; international standards on environmental issues, trade, and regulations; and tax policies.

### ***Optimizing Government Involvement in Markets***

Most participants accepted the premise that free markets are the most powerful and practical means of representing individual freedom of choice. They concluded that Government should fully recognize the power of market forces and use policy to harness them, while limiting monopolistic positions that create market inefficiencies, and eliminating misguided incentives that lead to economically irrational behavior. While many participants agreed that Government has a legitimate role to balance conflicting societal needs, most thought that past intervention methods have been inefficient or even counterproductive. The widespread view was that market-based regulations would be more effective than a command-and-control regime, and that the Government's best role would be to set the framework to ensure efficient markets, but stay out of day-to-day market operations.

The policy options discussed by the participants centered around three key issues:

- Should market forces be given greater freedom in energy markets? Policy options regarding this issue include removing economic regulation and product mandates, assuring efficient market structures that control anti-trust behavior, and providing tax structures that fairly account for externalities.
- Should the Government promote conservation and efficiency technology? Among the policy options discussed by our participants on this issue were supporting basic research, mandating efficiency standards, supporting new technology entrants, and mandating new technology (such as Zero Emission Vehicles).
- Should the Government reduce its cost? Identified options included eliminating the DOE, simplifying the EPA, and reducing the national deficit.

### ***Providing for Supply Security***

None of our experts disputed that U.S. oil and gas production is declining, and imports are rising. While energy supplies are crucial for maintaining a strong and competitive U.S. economy, world oil and gas supplies are vulnerable to disruption caused by political instability in major producing regions. Future supply and price shocks are therefore almost certain. What's to be done? Many participants felt that Government

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and industry leaders must work together to develop effective strategies for dealing with future supply problems. While programs to mitigate these future disruptions are not cost-free and may cause some immediate pain, they would presumably save the nation from even greater pain in the future ("You can pay me now or you can pay me later").

Four key issues were raised by our participants regarding supply security:

- Should the U.S. Government seek to increase domestic production, and, if so, by what means? Policy options discussed include allowing greater access to federal lands, improving royalty and taxation terms, sponsoring recovery technologies, and imposing import restrictions.
- Should the U.S. strive to diversify its supply sources? Diversification could be accomplished through developing special relations with hemispheric producers, encouraging development on new international petroleum sources, and discontinuing the practice of unilateral trade embargoes against producing countries.
- Should the U.S. intervene politically to mitigate effects of supply disruptions? Options in this regard include diplomatic actions, military intervention, and adding to the Strategic Petroleum Reserve.
- Should the U.S. seek to reduce demand? Conservation measures, taxes, and greater use of alternative fuels were discussed as available policy options on this issue.

### ***Managing Environmental Impact***

The participants agreed that American society strongly values environmental quality. New global environmental issues, such as global warming and sustainable development, are joining local issues, such as spill prevention, air pollution and congestion, as important societal concerns. At the same time, the cost of environmental protection is increasing to alarming levels. Viewpoints clash: the industry wants environmental regulations that are tested for economic reasonableness and sees past regulations as overly prescriptive; many environmentalists would like to see petroleum completely replaced by a less-polluting alternative.

Finding satisfactory solutions to these problems is central to U.S. energy policy as it struggles to balance energy needs of the country with environmental protection strategies. Many participants expressed that the time has come for the industry to reach out to other stakeholders; for the Government to minimize direct controls and foster common-ground goal-based solutions that achieve reasonable objectives cost-effectively; and for environmentalists to pragmatically join the national debate.

Our participants discussed three key issues related to environmental policy development:

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- Can the industry find a positive position in the multilateral debate on global issues? Many participants thought so, pointing out that the industry is well-positioned to develop sound scientific and economic models; educate public on trade-offs; and develop future contingency plans.
- Should the industry proactively develop technologies designed to decrease oil consumption? While some participants warned that premature development of alternative fuels could reduce economic efficiency and national wealth, many thought that the industry simply cannot afford to ignore the multi-energy future in which they will have to compete—like it or not. Increased use of natural gas was seen as an obvious piece of the puzzle in reducing dependency on oil and benefiting the environment. Some participants pointed to conservation and efficiency technologies as another big area of opportunity for the industry, which may need to become part of the energy offering in the not-too-distant future.
- Should the industry join forces with the Government and environmental groups to develop better-balanced, more goal-oriented policy options? Many participants agreed that a new breed of market-based, goal-oriented approaches would have a better chance to provide improved efficiency and environmental performance. Good, proven mechanisms already exist that could be used in revamping existing laws: e.g., the use of cost/benefit and risk analysis might help balance opposing social concerns; full-cycle costing would account well for externalities. The development of sound scientific protocols, mandatory peer review and solid information was considered by many participants to be a necessary prerequisite for developing rational policy that balances social goals based on facts, not politics.

### ***Relating to the Public***

Our participants identified public relations as a very serious problem for the industry. Industry participants admit that the industry has often acted in an arrogant, combative manner. Many participants felt that the industry needs to change and become more collaborative—even cooperative—to build support from a broad range of constituents. This support is needed to ensure a feasible regulatory regime.

While the gas sector has managed to acquire a somewhat positive image, "big oil" is consistently perceived in a negative light. Some of these ingrained perceptions are reflected in Government policy and regulations, which may hinder good industry/Government relations and have a negative impact on the industry. The situation is exacerbated by varied interests within the industry, which create inconsistent positions vis-à-vis other stakeholders. Public impatience and short-sighted focus may also inhibit the industry's ability to develop long-term solutions.

Our participants identified four major approaches the industry may wish to consider in dealing with its image problem:

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- Public education may center on increasing cost/benefit awareness and on demonstrating the industry's value to the economy. The industry could use its existing customer base to disseminate educational information.
- Image improvement could be sought through advertising, better customer service/value, less confrontational positions, and charismatic spokesperson(s).
- A more unified industry position on issues might be presented to the public through the introduction of a new forum for building or identifying common positions, by enhancing or consolidating existing segment associations/programs, and by encouraging industry members to coordinate their actions.
- Finally, the industry's underlying performance could be improved through a centralized program that sets performance criteria (environmental, etc.), institutes internal industry rewards, and then publicizes accomplishments.

All these measures are discussed in Section III; in addition, Section IV is entirely devoted to the broader subject of improving the industry's leadership capabilities and relations with other constituencies.

### ***Responding to Societal Changes***

Demographic change, including aging, is likely to place an increasing burden on our social systems. Increasing global competition and automation may cause a growing gap between the "haves" and "have-nots". The U.S. educational system is failing to keep pace. These burdens fall on all members of society, including the petroleum industry. Our participants expressed concern with how the industry will respond to these social and demographic changes.

- Should the industry proactively adapt its operations to changing demographics? Available options include modifying market operations for aging, security, and language, and increasing training and skill development.
- Should the industry proactively involve itself in educational issues? The industry might consider developing curriculum materials and hosting teacher or professor seminars.
- Should the industry support Government efforts to reduce social class conflicts? Proactive support of public education systems and higher taxes to support social programs were identified as policy options on this subject.

## D. An Opportunity for New Industry Leadership

As noted at the onset of this Summary, Arthur D. Little believes the petroleum industry has an historic opportunity to reposition itself in a more positive light. If the natural gas industry could improve its reputation and standing based on its real accomplishments, the oil sector can too—if it has the will to do so.

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First and foremost, the industry needs to learn to communicate—loudly, clearly, and effectively—in order to inform and educate the public, gain influence, and improve its own image. As discussed earlier, the participants identified poor public relations as one of the top areas of concern for the industry. We think that in order to improve its relations with other stakeholders and develop leadership role, the industry must better communicate its understanding of the issues, its accomplishments, goals, and responsibilities. For instance, it must effectively communicate that the future is not risk-free: most likely, there will be further supply interruptions, price perturbations, and, unfortunately, occasional accidents and spills. The industry bears the responsibility of explaining the causes of such events and of developing serious and credible crisis-response strategies, policies, and standards. These strategies and policies must be developed in cooperation with the constituencies that may be affected (Government, local communities, and consumers) and those that represent their interests.

The industry must also articulate the costs of avoiding risks, and take the lead in developing cost/benefit approaches that are seen to be fair and rational, and that can guide legislative and regulatory processes.

To channel the industry's relation-improvement and leadership efforts effectively, some rethinking of its institutional framework may be necessary. Although leadership should (and will) come from individual companies, industry associations will also need to be integrally involved in improving the industry's relations with the Government, the public, and other constituencies. However, industry associations have historically adopted an advocacy role on behalf of their members that will be difficult to transform into a more consensus-building outreach approach. A new institutional framework may be required to bring together a wider variety of stakeholders to forge agreements on many of the identified issues. The industry should also consider "jump starting" the dialogue by adopting and enforcing operational principles along the lines of the "Responsible Care" program instituted by the Chemical Manufacturers Association, which has proven effective in the chemical industry.

A public-relations effort by itself, however, is not enough. To reshape its image and the role it plays in the society, the industry must take new initiatives, forge new alliances, lead, and plan for the unexpected. In Section IV, we discuss four broad opportunities for industry action:

### ***Shaping Environmental Policies***

There is a rare opportunity for the industry to provide leadership in developing more broadly-based environmental policies. We might think of this as an opportunity to reengineer the entire value chain of environmental performance, as a single business process. Many driving forces are now poised to support increased cooperation, while some previously restraining forces have relaxed and now permit a more cooperative approach to solving environmental problems.

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### ***Interacting Effectively on Multiple Societal Levels***

A common view that surfaced during our study was that global and local issues may grow in importance relative to national issues. The industry needs to be actively involved on all three levels. To do so, it must consider the appropriate forums to address these issues as it plans its dialogue with the various constituents. Global issues entail such concerns as climate change, free trade, and the relationships between multinational companies and national governments. National issues will include the need to set consistent, but locally appropriate, standards across states. Local issues have traditionally centered on emissions, aesthetics, taxes, employment, and safety.

### ***Understanding Differing Worldviews and Building on Similarities***

Each constituency encompasses a variety of different worldviews. This can be frustrating for members of other constituencies who sometimes cannot discern the common threads through the cacophony of conflicting opinions. However, these common threads do exist, and it is worthwhile for the industry to spend the time and effort required to understand them. The industry should not assume that its own values of economic growth and restrained government are shared by other groups. Failure to understand the values of other constituencies will frustrate resolution of issues.

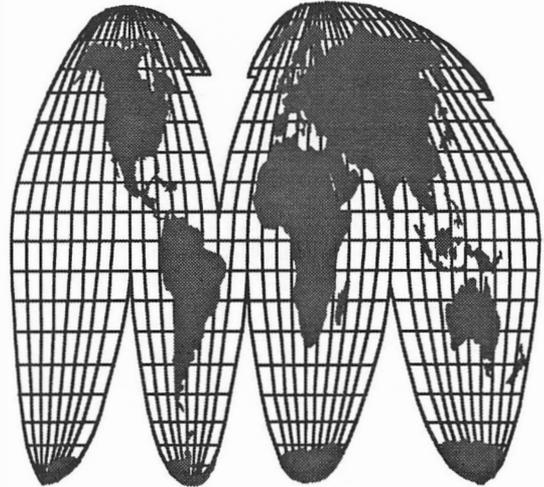
### ***Planning for Risk and Uncertainty***

Industry should expect and plan for the unexpected, especially in regard to key uncertainties arising from geopolitical instability, environmental impacts, and technology change. In particular, a more refined crisis-response capability would not only prepare the industry for dealing more effectively with inevitable crises, but may also improve public perception of the industry. Beyond disasters, the industry needs to improve its ability to structure uncertainty in order to develop well-founded policy positions despite uncertain information.

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## Many leading thinkers share similar views about the situation in 2020.

- Driven by telecommunications and increasing international free trade, the world has become a global community. Asia has grown strongly. U.S. dominance has declined, but is still significant.
- Oil producing regions in the CIS and the Middle East continue to be politically unstable.



- The workplace has become more automated and streamlined. Technology has helped leverage highly skilled workers. Intellectual capital is highly valued.
- “Middle-class” jobs have changed. Some believe the middle class has been reduced.
- Demographic shifts (such as aging) may have changed the labor force, customer base, and social burdens.

## II. Views of 2020

In our interview/workshop process, we asked our participants to describe their personal views of 2020. We prompted the thought leaders with a range of questions about key political and economic drivers, including:

- Geopolitics
- Workplace
- Government
- Public Perception
- Technology
- Environment
- Industry Structure
- Energy Markets

Surprisingly, many of the views were quite similar (Charts II-1 -- II-4). Although our process was not structured in a way which permits statistical analysis, we often found that a strong majority of respondents shared a common vision.

In the following discussion, we identify the common views and illustrate them with selected comments from our participants. In the last portion of this section, we describe minority views on alternate scenarios where petroleum demand is expected to fall significantly.

Throughout this document, the comments from respondents are shown in shaded boxes. We have agreed to maintain anonymity for the participants in our process, but we have identified each one according to their membership group.

### A. Majority View of 2020

#### ***Geopolitics***

All respondents who commented believe that the world will become much more globally integrated by 2020, with greater development of international free trade.

Despite some countries' protectionist intentions, it is impossible to isolate one economy from the global market. (Industry)

NAFTA and GATT will ultimately create a more vibrant economy. (Observer)

The global marketplace will dominate. (Customer)

Increased global free trade is the best economic system and provides the highest standard of living. (Industry)

This trend will be reinforced by increasing use of telecommunications and information technology.

## II. Views of 2020

Telecommunication will accelerate globalization. (Environmentalist)

The pervasiveness of global telecommunications will prevent governments from isolating their populations. (Industry)

Today we are in the data age, not the Information Age. But by 2020, we will be in the Information Age. (Industry)

The Internet builds cross-disciplinary information exchange, an explosion of learning and increasing speed of intellectual advancement. (Observer)

Economic growth in Asia is expected to boom, with a consequent increase in Asian influence in world affairs. The United States is likely to continue a leadership role, but its ability to dominate will have declined relative to other countries.

We are seeing the rise of Asia as a world power... We may stand on the brink of the end of the European Era, which has dominated the world for 500 years. (Observer)

We will see a world like 1910, with five or six major, co-equal powers. (Industry)

The U.S. cannot be the policeman of the world. (Industry)

The U.S. keeps its role as international policeman, and keeps complaining about it. (Customer/Observer Workshop)

The U.S. will maintain its competitive advantages, including innovation, freedom and technology. (Government/Regulator)

The level of debt will be an increasingly important issue as the U.S. moves down in the international pecking order. (Industry)

The dollar will be replaced as the international marker currency. (Customer/Observer Workshop)

A nearly unanimous opinion among respondents concluded that oil producing regions in the Middle East and Commonwealth of Independent States will continue to be politically unstable. Instability in these regions may periodically affect world petroleum supplies.

There are at least six crises waiting to happen in the Middle East. (Industry)

Iran will attempt a strike at Saudi Arabia before their Soviet hardware deteriorates. (Industry)

There are a dozen countries who could close the Straits of Hormuz and sink our tankers. (Industry)

## II. Views of 2020

The Persian Gulf will remilitarize. (Environmentalist)

The chance that a nuclear device will be exploded in anger over the next 25 years is greater than 50%. (Observer)

The most worrying areas are the former Soviet Union and the Middle East. (Industry)

Countries in the Middle East will continue to support terrorism. (Industry)

By 2020, China has annexed Siberia. (Customer/Observer Workshop)

In 2020, we will still be negotiating a peace treaty in the Middle East. (Customer/Observer Workshop)

### **Workplace**

Most respondents believe that the workplace will become much more automated by 2020.

New technology will permit increased remote surveillance [of factories and production plants] and increased automation. (Industry)

Information/telecommunications power will continue to double every two years or so. Transmission and processing of information will be very cheap. Info/telecomm technology will be embedded in all kinds of products and services. (Observer)

2020 will also see widespread application of Information Technology creating multiple options for life-style, work-style, etc. (Observer)

Faster communication, information overload in 25 years. (Customer)

The promises which were made 35 years ago are finally being achieved by computers. (Industry)

There will be lots of robotic technology. (Customer/Observer Workshop)

Increased technology will have helped to leverage the skills of workers. Intellectual capital, including entertainment and other software products, will be highly valued and take an increasing share of the economy.

The capabilities of the best people will be highly leveraged due to increasing technology. (Industry)

Tangible products will require far fewer workers to produce. (Customer)

## II. Views of 2020

The workplace will be dominated by the service economy, with increasing emphasis placed on intellectual rather than tangible goods. One guy will make stuff, and the rest will play in rock bands. (Customer)

Many expect the job market to become highly competitive, and think that middle class jobs will be lost. Several respondents are quite pessimistic and forecast a society split into have and have-not classes.

The labor force will need to have skills that the computer cannot replace. (Industry)

Even if manufacturing increases, manufacturing employment decreases.  
(Customer/Observer Workshop)

The middle class is continuously reduced due to automation, streamlining and elimination of middle management functions. (Industry)

Workers will face intense world-wide competition, which will likely hold down wage increases. (Customer)

Middle management will become an endangered species. (Observer)

A key question resulting from the change in technology will be how to manage the elimination of existing jobs. (Industry)

The American Dream will be lost for many. (Industry)

There will be a much greater distinction between the haves and have-nots.  
(Industry)

However, the majority believe that new middle class jobs will arise to replace those lost due to technology and economic change.

In the long term, technology will create more jobs than it destroys. (Observer)

The middle class will not be reduced in size, but will take on different jobs than they have now. (13 of 16 Customer/Observer Workshop members)

Demographic shifts are likely to have a major impact by 2020. In particular, aging is likely to have significant a impact on the labor force, customer base and social burdens.

We are moving rapidly to a geriatric society. (Customer/Observer Workshop)

People will have to work longer because Social Security cannot cope. (Industry)

Changing demographics as the baby boom generation begins to retire will place much more pressure on government resources and the social security system. There is some expectation that Social Security will be bankrupt. (Government/Regulator)

## II. Views of 2020

Will convenience sell to retired people? (Observer)

As the new generation of children enter their twenties and thirties (and are able to vote), we should be aware of the eco-terrorism indoctrination they have received during their formative years. Kids today are being taught to fear environmental disasters, hate business, and support people who fight businesses. The changing mentality of this demographic group is likely to have a large impact on politics in 2020. (Observer)

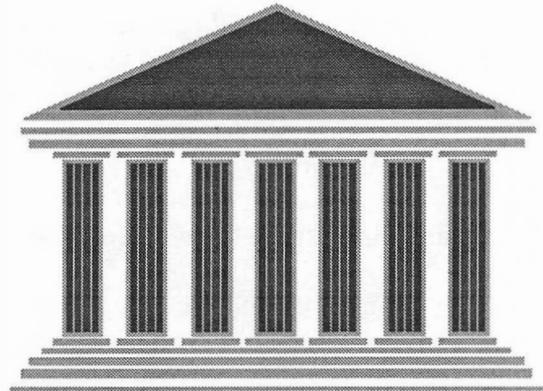
Many also expect the workforce to become much more culturally and ethnically diverse.

Cultural and ethnic diversity will have a large impact on society.  
(Customer/Observer Workshop)

The Southwest U.S. may become a separate region -- almost another country.  
(Industry)

## Many leading thinkers share similar views about the situation in 2020.

- Market mechanisms have replaced government command and control interventions. However, government is still likely to be sizable.
- International trade groups, multinational companies, and local governments are taking a larger role versus national governments. International standards have been adopted.



- The public still holds distrust for the petroleum industry, with a particularly strong dislike for oil.
- Citizens, and their elected officials, still focus on a short-term view.

## II. Views of 2020

### **Government**

Many respondents believe that government command and control interventions in markets and regulations are inefficient. By 2020, they expect these interventions to be replaced by mechanisms which make better use of market forces.

The Federal Government and Washington only make mistakes. The reaction to the 1970's energy crisis was crazy, just plain wrong. (Government/Regulator)

By 2020, energy markets will be fully deregulated. (Industry)

Our government will have adopted more market-oriented regulation techniques. (Observer)

Regulations will be more flexible. (Observer)

The power of courts will have decreased. (Customer/Observer Workshop)

There is a large portion of the respondents who believe that government should be reduced in size. However, there are fewer who believe that this goal can be attained by 2020.

There will be a lot less government in 2020. (Observer)

We will experience decreasing budgets due to the Federal debt. (Government/Regulator Workshop)

Government will be less necessary, less useful, and less contributory; unfortunately, that does not mean there will be less government. (Customer)

In 2020, DOE will still have a few lawyers wrapping up 1970's oil price litigation. (Customer/Observer Workshop)

If you let those [government] suckers alone, they'll just grow and grow. (Industry)

International trade organizations and multinational corporations are likely to take on an increased role in world affairs. International trade standards (possibly including business regulation, taxes and environmental performance) will have been adopted. Together, these trends are likely to conflict with some national goals and sovereignty.

International standardization will happen on an issue by issue basis. (Observer)

We will see standardization of minimum targets globally through ISO 9000 and ISO 14000. (Government/Regulator)

Expect tensions between national governments and global companies. (Industry)

## II. Views of 2020

Truly multi-national companies may gain power relative to national governments.  
(Government/Regulator)

Similarly, local governments are likely to take on a larger role versus the national government. In part, this will be mirrored by a greater dispersion of the environmental movement.

Government structures will be more dispersed on both the Federal and state levels.  
(Government/Regulator)

The environmental movement is recognizing that the action will increasingly be at the local grass roots level. The central organizations are not necessarily popular among the local groups. (Environmentalist)

People will not accept as answers, environmental regulations that are of a national nature, unless they deal with their local concerns. (Environmentalist)

[The U.S. should] develop regional decision systems for federal energy policy [and apply them] to prospects like California's Outer Continental Shelf - [We should] use different arrangements [and] a variety of approaches. [It's] OK if you have different regulations in different regions. (Government/Regulator Workshop)

### **Public Perception**

Most respondents believe that the public currently holds a negative view of the petroleum industry, with a particularly strong dislike for oil. For some, gas currently has a positive perception.

The Exxon spill villainized the whole industry and brought public confidence to a new low. (Observer)

The industry wears a black hat... There is a legacy of stereotypes (the Dallas characters and J.R. Ewing) that will be tough to reverse. (Government/Regulator)  
The gas industry has a more positive image than the oil industry. The AGA [American Gas Association] commercials were effective. (Customer)

A large number believe that the industry should take proactive steps to improve public opinion, however, many believe that this effort will be unsuccessful.

The majors are big, smart, well-organized -- but hated. They should take their most brilliant person and make him head of PR. (Industry)

The oil industry has made similar progress in efficiency and lowering costs to consumers as Wal-Mart and Eckerd drugs. The customer does not recognize how efficient it has become.... We have also made tremendous progress in the environmental performance of oil product terminals, and should publicize the improvement. Other industries have been successful in changing their public image, and the oil industry should make the effort. (Industry)

## II. Views of 2020

The oil industry seems to do a very poor job of presenting themselves to the public. They need to become their own advocates. They need to explain to the public how they operate and why they operate that way. (Observer)

I almost despair of changing public perceptions of the industry. (Industry)

Deep public distrust of oil and gas companies on pricing and availability is almost impossible to reverse. (Observer)

Many believe that the public, and consequently elected officials, are short term focused, and will respond only to crises. Few believe that this will change by 2020, although many believe some crises will occur.

Typical citizens are indifferent to actions in the petroleum industry now. (Customer)

The public is not worried about supply security. (Industry)

The public wants cheap energy and does not want to have to think about it. (Industry)

The people are happy-go-lucky and unaware of impending problems. (Industry)

The electorate and Congress are short-term focused. (Observer)

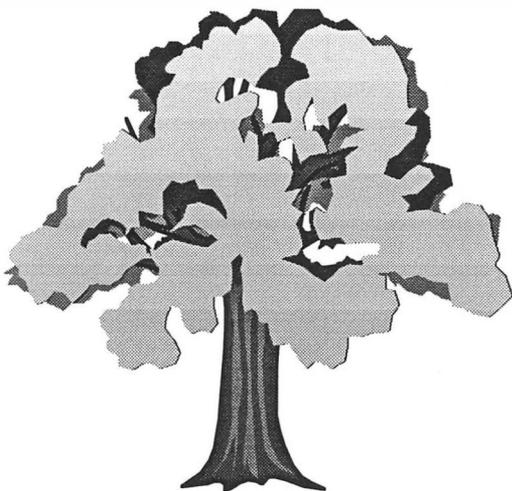
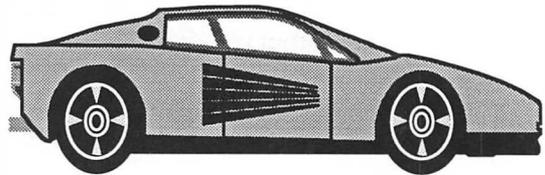
Politicians follow public perceptions. (Industry)

When the media does provide sympathetic portrayal of the industry, as in 1992, when the price slump led to closures and job losses, positive things can happen. (Industry)

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## Many leading thinkers share similar views about the situation in 2020.

- New technologies may have had a strong impact on society, but...
- Capital equipment and personal habits change slowly. (Some believe market forces will have driven swift change, though.)
- Gasoline vehicles will still be widely used.
- The overall energy mix will likely be similar, with possibly higher natural gas and electricity use.



- Environmental performance will continue to be a key issue.
- Natural gas is viewed as environmentally friendly.
- Goal-oriented regulations will be used to ensure environmental performance.

## II. Views of 2020

### **Technology**

Through the 1995-2020 period, many expect rapid technological change to continue, with significant impacts on society.

Technological change is unpredictable but likely to be dramatic. In 1970 we hadn't thought of PC's. (Industry)

We know that the full impacts of new technologies are not fully realized for 30-35 years so should expect much more from the computer revolution as it is matched by advances in education. (Industry)

[Despite slow capital stock turnover,] the impact of emerging technologies can still be translated rapidly. This occurs as people and firms react to perceived new threats and opportunities. (Observer)

Technology may have a positive, incremental impact on industry capabilities.

Domestic production may also be increased by the development of new production technologies which will help reduce the cost of U.S. exploration and production. (Industry)

Technological advances will have also resulted in significant breakthroughs in being able to produce oil from locations that currently are not technically feasible. (Observer)

Refining technologies will have already plateaued long before 2020, and there are not likely to be significant future advances. (Observer)

However, fewer respondents believe that technological change will have significant impacts in energy use. Change there will be dampened by slow capital turnover (cars, factories and buildings), and by ingrained habits. People will continue to prefer to drive cars.

Even if we found the key to fusion tomorrow, it would be 25 years before the impact would be significant. Large infrastructure projects involve huge time lags. (Industry)

For energy use in particular, many of the current trends are likely to continue because of the slow rate of capital turnover in consumer segments such as housing, industry and transportation. On average, capital turnover takes 25 to 50 years. (Observer)

There is tremendous inertia, and it is quite implausible that unidentified technology changes will have much impact in 25 years. (Observer)

Identified technologies seem unlikely to have a significant impact on oil demand trends. (Observer)

## II. Views of 2020

In 2020, most respondents believe that the gasoline-powered vehicle will continue to dominate the transportation fleet. Alternate fuels may increase, but will not seriously challenge gasoline as a preferred fuel.

In the United States, transportation fuel demand will continue to rise from current levels near 10 MMBPD. As yet, there are no alternates to oil. (Observer)

Alternate fuels will make a significant penetration, although diesel and gasoline will continue to provide greater than half of the market demand for transport fuel. (Observer)

Transportation will continue to be heavily driven by oil products. (Observer)

Personal transport will continue to be predominantly in gasoline powered private vehicles. (Customer)

The foundation for oil will be transportation fuel -- there are no ready alternates. (Observer)

### **Environment**

Almost all respondents believe that environmental performance will continue to be important in 2020. However, there is a split opinion on whether environmental standards will become more strict by 2020. Some believe that environmental standards will plateau.

Increased environmental concern is inevitable. (Observer)

Environmental issues will be critically important -- including global warming, NO<sub>x</sub> and air toxics. (Industry)

A clean environment is mandatory. (Industry)

There will be strong reactions to newly-discovered environmental issues. (Observer)

People have realized that the environment is not a free good. (Observer)  
People will be more supportive of trading off environmental issues for economic gains. (Observer)

There will not be a roll-back in environmental rules. (Observer)

Politicians will avoid being branded as the 'lawmaker who wrecked the environment.' (Government/Regulator)

Natural gas is currently viewed as an environmentally friendly fuel. Most respondents believe that gas will continue to be viewed as friendly to the environment in the future. Some believe gas will be used as a solution to many environmental problems.

## II. Views of 2020

Natural gas in 2020 will look charmed. People will continue to grow more environmentally conscious. This, in turn, will make people think more about natural gas. (Observer)

We should encourage the use of natural gas by increasing the costs of conventional fuels (through taxes), or by mandating the use of natural gas alternative fuels. (Environmentalist)

Continued government regulation is expected, but the regulatory mechanism is anticipated to change to a goal-oriented regime which permits greater flexibility for compliance programs.

Government may move toward setting and enforcing performance standards rather than operational detail. Industry will have to prove it can be trusted with the detail. (Government/Regulator)

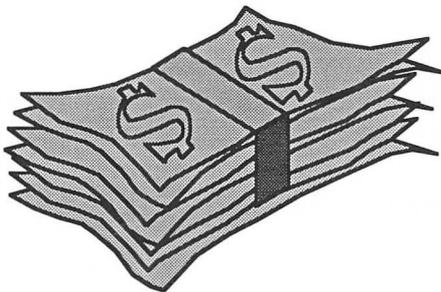
The next step is for the environmental movement to link environmental concerns with economic thinking. (Environmentalist)

Command and control policies will always be inefficient. (Industry)

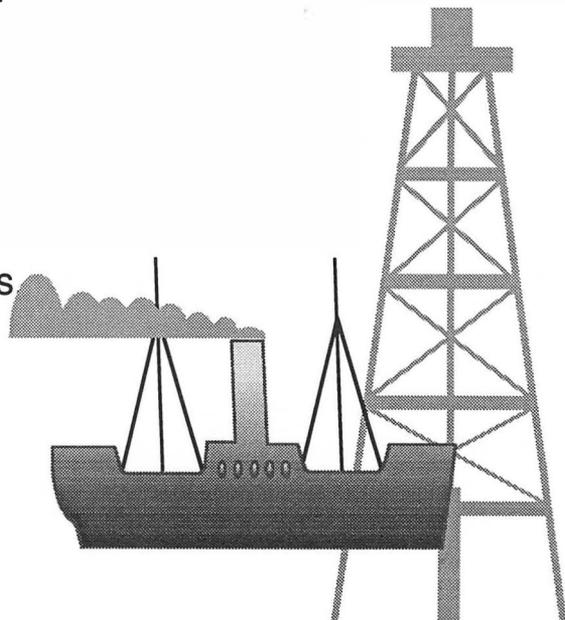
Government intervention will be more goal-oriented rather than the command and control approach used now. (Customer)

Government should establish market incentives to reduce pollution. (Public Interest/Environmental Workshop)

## Many leading thinkers share similar views about the situation in 2020.



- The industry will be even more efficient, with a stronger focus on customers, competitors and marketing. Companies will be focusing on key portions of the value chain and seeking high performance.
  - There will be a mix of large/small, domestic/international companies.
  - Nearly all operations (excluding transportation monopolies) will have been deregulated.
- Worldwide supplies of oil and gas will be plentiful, and worldwide demand will have grown.
  - Domestic oil production will be lower.
  - The U.S. will rely increasingly on imported petroleum supplies
  - Views on U.S. petroleum demand differ widely. Many believe it will be the same as today, or somewhat larger. Some believe demand will be significantly smaller.



## II. Views of 2020

### **Industry Structure**

Driven by international competition, the petroleum industry will become even more efficient, with a stronger focus on customers, competitors, and marketing. Opinions are diverse about the future mix of company sizes and operations, and it is likely that we will continue to see a mix of large and small, domestic, and international companies. Companies are likely to focus on key portions of the value chain and seek high performance.

Newly privatized national oil companies will enter the U.S. market.  
(Customer/Observer Workshop)

Competition will be brutal. (Industry)

As information clutter increases, you may see branded electricity and natural gas.  
(Observer)

Petroleum companies will develop more innovation in marketing. (Customer)

Hypermarkets, which have been murdering the majors in Europe, could enter the US market and cause retail margins to drop. (Observer)

Reengineering, restructuring, and streamlining will increase. (Observer)

We will see increasing de-integration of oil companies. (Observer)

The mini-majors will finally disappear. (Observer)

Most respondents believe that the energy industry will become increasingly deregulated, with the exception of some transportation monopolies.

Pipes and wires will be regulated --- everything else will be de-regulated.  
(Customer/Observer Workshop)

By 2020, most regulation except for true natural monopolies will be swept away and natural monopolies may be narrower than we think. Technology may have eliminated the natural monopoly of local wires and pipes. (Industry)

The key question for distributed generation is whether local governments will grant siting permits for the smaller generation plants. Regulators must determine whether environmental controls can be enforced on hundreds of much smaller locations.  
(Observer)

### **Energy Markets**

In 2020, most respondents believe that worldwide petroleum demand will have increased, driven by economic growth in newly-industrializing countries. Higher demand will be satisfied by plentiful supplies of oil and gas.

## II. Views of 2020

Global oil consumption is growing rapidly, driven by increasing automobile ownership and increasing miles driven in newly industrializing countries in Asia and South America. (Environmentalist)

Worldwide energy demand will increase, perhaps peaking in 2020. (Observer)

[We should expect] very strong world-wide demand, with economic miracles in China, Indonesia.... (Industry)

China and India will be major markets. (Industry)

The world will produce 110 million barrels per day by 2010 [compared to 65 million barrels per day today]. (Observer)

There will be an over-supply of gas in 25 years. Vast quantities of natural gas exist throughout the world, and these will be developed over time. (Observer)

In the United States, a large majority believe that domestic oil production will continue to fall, and consequently imports will rise.

In 2010, domestic oil production is pegged at 3-4 million barrels per day [compared to 7 million barrels per day today] -- perhaps a bit more if ANWR is opened. (Observer)

Domestic production will inevitably decline. (Industry)

The US will never be independent of oil imports. Achieving import independence would require a very high price to drive increased production. (Industry)

Natural gas demand is expected to rise, buoyed by electricity generation demand and its clean-burning qualities.

Gas demand in the U.S. is likely to be significantly higher (30%?) and supply will not be a problem because technology and price signals will have solved it. (Industry)

Gas and electricity will essentially be fungible and a key issue will be whether to generate power at the gas source or pipeline gas to market-based generators. (Customer)

Because of low cost, air quality concerns, flexibility for peak shaving and low capital cost, the power generation industry will move strongly towards natural gas. (Customer)

Natural gas will increasingly become the favored transitional fuel toward a fully renewable sustainable economy. (Industry)

## II. Views of 2020

There is a wide diversity of views on domestic demand for petroleum. Many believe that demand will be the same as today, or will have grown at a rate slightly below GDP growth. On the other hand, some believe that demand will drop significantly. This latter view is discussed below under *Minority Views of Demand in 2020*.

The U.S. will be using more rather than less oil than today. (Industry)

U.S. petroleum demand will continue to increase about 1-2 percent per year, which is slightly less than the increase in the U.S. gross domestic product. Efficiency improvements in end uses will continue, but these will be offset by higher populations. (Industry)

Steady efficiency improvements (declining energy/GDP ratio) in the developed countries will be barely offset by increased population, leading to flat demand there. (Observer)

The national energy mix will likely be similar, with possibly higher use of natural gas and electricity. Gas is anticipated to replace some coal and nuclear generation capacity.

Different forms of energy will be readily substituted, priced on a Btu-equalized basis. (Industry)

Electricity will take a larger share of end user demand, and will become the distribution system of choice for fossil fuels. (Industry)

Electricity will be 45-50% of energy consumption, compared to 36% today. (Customer)

Natural gas will drive out high cost nuclear and coal generation. (Customer)

Rather than to being 'too cheap to meter', nuclear power has become too expensive to produce. In the final analysis, the nuclear power industry appears to be a rather expensive sop to assuage the guilt of atomic scientists who developed the nuclear bomb. (Observer)

In 2020, fusion will still be 40 years away. (Customer/Observer Workshop)

There is no commonality on the direction of future petroleum prices. About half the respondents believed that prices would rise in real terms. For some, the underlying physical limit to the resource suggests that prices must rise. The other half of the respondents believe that prices will remain flat or decrease in real terms. New technology, which might cause demand to drop, was expected to hold down price. Inter-fuel competition was expected to increase, with greater equilibration of prices near Btu value.

Long-term price forecasts are worthless. (Customer)

## II. Views of 2020

OPEC will make a slight curtailment in production volumes, causing oil prices to edge upward over time to \$25 to \$30/bbl -- the 'rational monopolistic price range.' (Observer)

Plan on flat prices. Though the potential for price spikes exists, sustained growth in real terms would likely trigger creative responses in both supply and demand. Prices could be lower than today in real terms. (Industry)

Price expectations should be ratcheted way down. There are going to be plenty of downward pressures to push price down. As a result, prices will be lower than most people think. (Observer)

Regional fuel-to-fuel competition will set prices. (Government/Regulator)

Different forms of energy will be readily substituted, with prices set on a Btu-equivalent basis. (Industry)

I personally believe in the thesis expressed by Julian Simon in his book, The Ultimate Resource, that commodity prices inevitably fall over time. (Industry)

### B. Minority Views of Demand in 2020

A number of people believe that petroleum demand will drop significantly -- perhaps as much as 50% from current levels. A change this size would likely have serious negative impacts on industry size, structure, employment and profitability.

The fundamental question for the oil industry is whether people are going to want our production. (Industry)

U.S. petroleum demand will drop severely, perhaps as much as 8.5 MMBPD or 50%, by 2020. (Environmentalist)

#### ***Technology Breakthrough***

Rapid commercialization and adoption of new efficiency and alternate fuel technologies would drastically improve the efficiency of energy use in the U.S. and the world. Many of these technologies are believed available today, but for a variety of barriers, have not been commercialized. According to a minority view, new entrepreneurial enterprises, coupled with government incentives and jump-start programs, could break through those barriers.

In this case, the economy would be a net beneficiary, since the new technology is expected to provide equivalent end-uses (transportation, home comfort, industrial production) at a lower cost. The price of petroleum would be expected to drop in this scenario.

## II. Views of 2020

Ex-aerospace entrepreneurs will drive adoption of hybrid carbon fiber cars which get 300 mpg. (Environmentalist)

U.S. petroleum demand will decrease as a result of changing technology and improved efficiency. (Government/Regulator)

Renewable energy sources, and in particular solar, will take a much larger share of energy than most people think. New renewables could account for 10 percent of the world energy supply by 2020, but will have a lesser role in the U.S. (Industry)

### ***Demand Management***

Dramatic and negative environmental effects, such as global warming, may induce governments to tightly restrict carbon emissions. Alternatively, the U.S. dependence on foreign oil could be managed by reducing domestic demand. In either event, the Government could impose a high tax level on products or mandate restrictions on fuel economy and use. These actions would drive down demand.

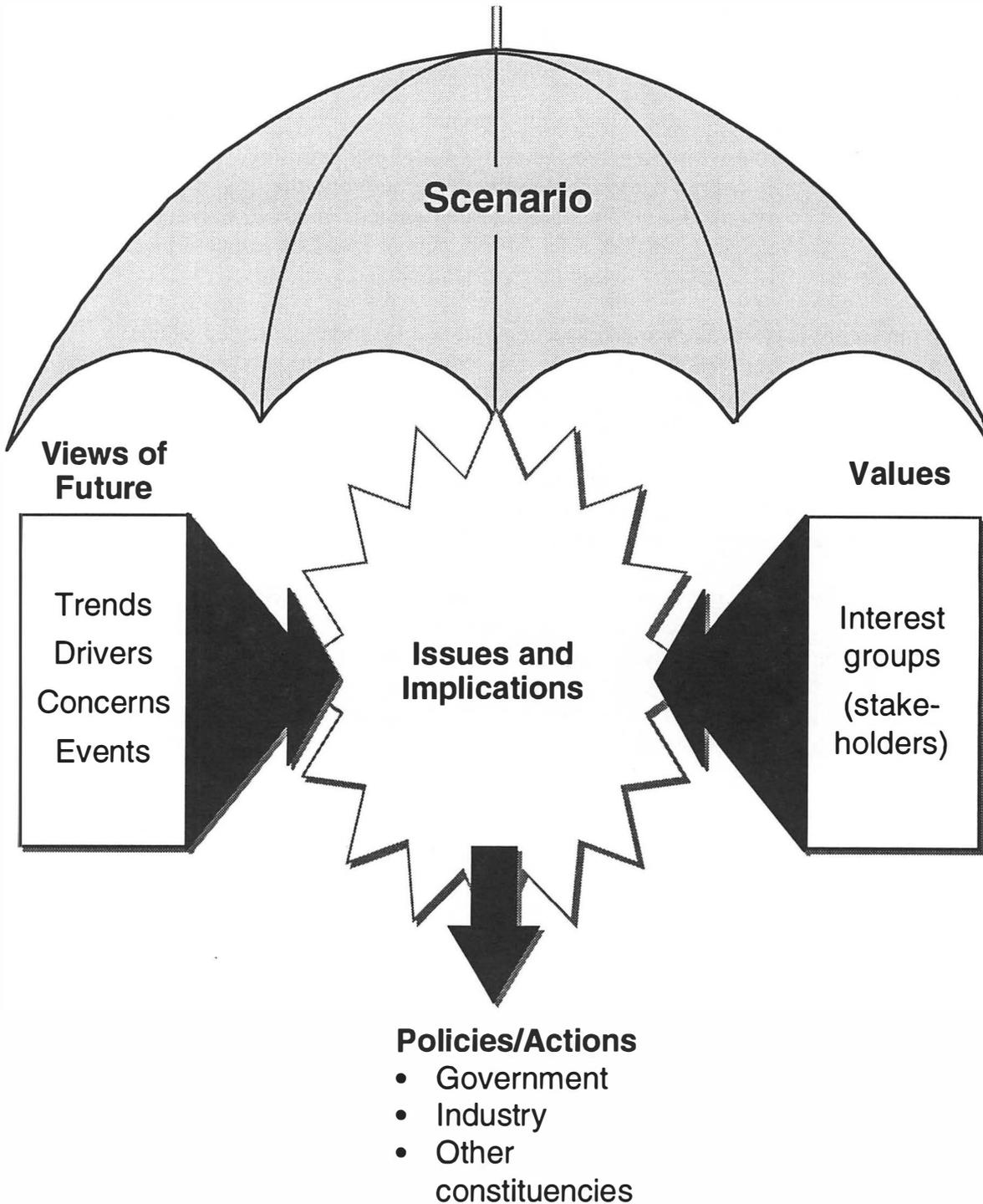
Unlike the technology breakthrough case, demand management is viewed as less beneficial to the economy, since the price of the commodity would increase, impacting all end users of oil and gas products. To the extent that the higher prices provide an incentive for technology breakthroughs, these negative impacts may be mitigated.

There is a downside case where the demand for petroleum products is much below today. This could be caused by the emergence of strong ecological evidence that there are changes to the climate. (Industry)

The best way for the world to make changes and avoid global warming is to ensure that the full cost is paid by users of carbonaceous fuels. As a start, we should impose a \$50 per ton carbon tax. (Industry)

The US should increase gasoline taxes by \$1-2 per gallon and possibly add CAFE standards which would require 45 miles per gallon to be achieved by new vehicles. (Observer)

**Issues arise from the collision of differing values and views of the future.**



### **III. Likely Future Issues**

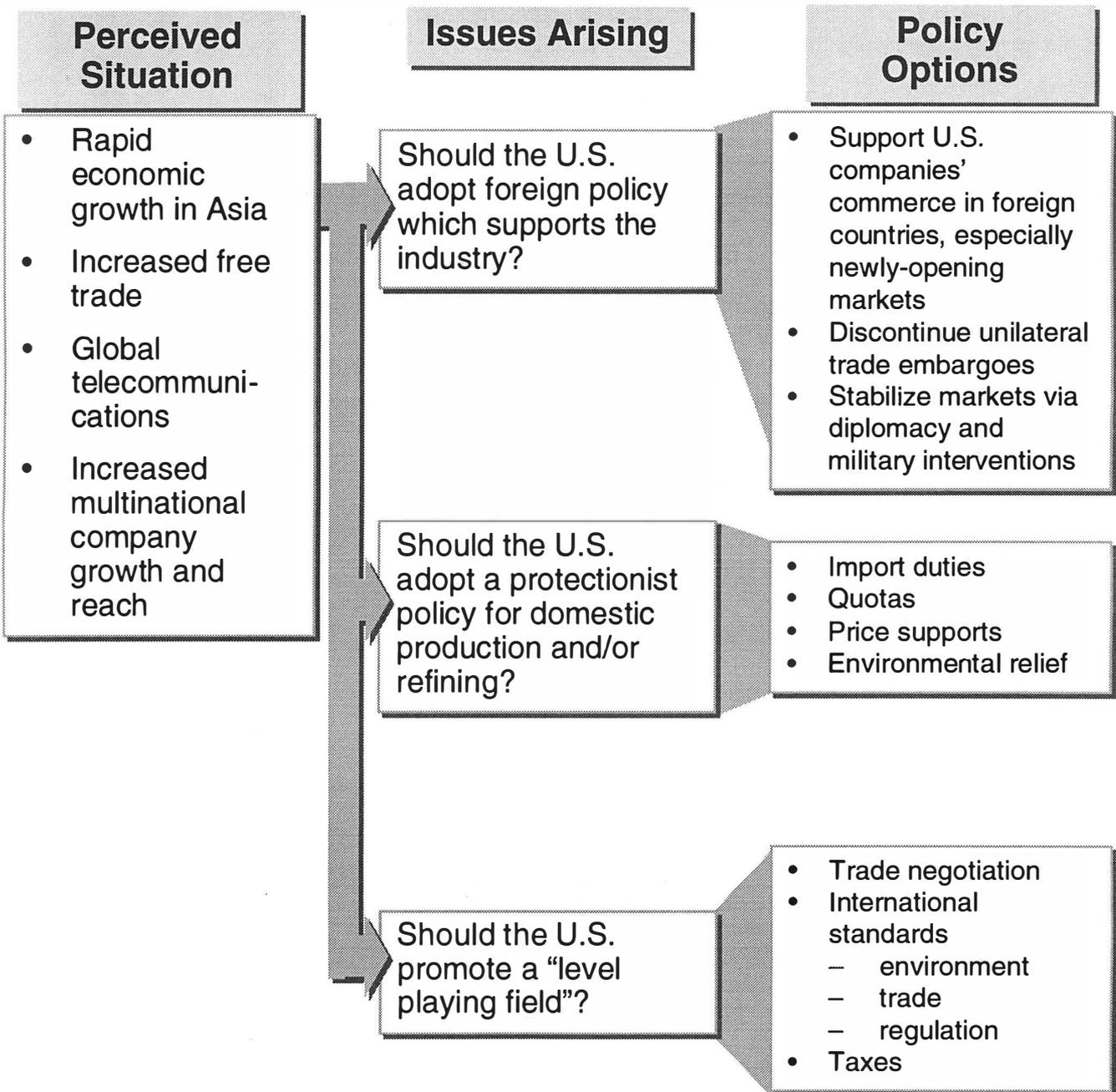
As we are defining it, an issue is an unresolved matter arising from conflicting values and views of the future (Chart III-1). For instance, a conflict may arise between a physical or social trend—such as declining domestic oil production, and a stakeholder value—such as supply security. Or there may be conflict between values of different stakeholder groups—for example, the desire for a pristine environment could conflict with the desire for economic development. Issues may also result from differing expectations for the future, such as whether or not global climate change will occur.

We identified issues by evaluating direct comments of respondents, and by contrasting the conflicting statements from different respondents. To enable presentation, we have grouped the issues into six major areas of concern:

- Globalization and National Policy,
- Government Intervention,
- Supply Security,
- Environmental Impact,
- Public Perception, and
- Societal Change.

Although we have tried to characterize these issues under these broad categories, the issues tend to overlap, particularly when potential policies and actions are considered. For each area of concern, we identify the situation as perceived by various stakeholders, outline the issues arising from the situation, provide a brief outline of debate on the issue, and delineate a variety of policy options and actions available to potentially resolve it. Often, these policy options are controversial in their own right. We also illustrate the issues by selecting quotations from our interview and workshop program.

# How should national policy be crafted in a globally-integrated economy?



### III. Likely Future Issues

#### A. Globalization and National Policy

##### *How should national policy be crafted in a globally integrated economy? (Chart III-2)*

As perceived by our participants, the trend toward globalization will be characterized by rapid economic growth in Asia, increased free trade, increased telecommunications, and the growth of multinational companies in terms of size, number, and influence. As global competition increases, policy leaders will need to take proactive steps to ensure that national priorities and values are balanced with local and global priorities.

[Since 1970, ] energy policy formulation became much more complicated - involving issues of trade, national security etc. (Customer)

*Issue: Should the U.S. adopt foreign policy that supports the industry?*

U.S. industry activities in foreign countries help increase and stabilize the world supply of petroleum, and result in positive tax and employment benefits in the U.S. On the other hand, support for industry may require foreign policy that is opposed by some constituencies, and may require costly government actions, including military actions.

An important factor influencing the future strength of the U.S. economy will be the ability of U.S. companies to operate internationally. (Industry)

The U.S. Government could adopt several policies to actively support U.S. companies as they seek commerce in foreign countries, including the use of diplomatic trade missions and tax policy. In particular, the Government could support U.S. companies as they attempt to enter newly opening markets, and assist foreign governments in their privatization plans.

The State Department has improved its awareness, but it is still driven by politics rather than commercial logic. (Industry)

Globally there are different kinds of issues, many of them a result of U.S. foreign policy. Are we in Vietnam or not? What are the rules in Iran? The U.S. is politicizing exploration in a way that has not been seen before. (Government/Regulator)

American contributions which stabilize Russia will allow private development of their resources. (Observer)

The domestic industry is competing with the international industry for capital and technology, and it is legitimate to ask the question of what tax changes would make it more competitive. (Industry)

The U.S. Government could discontinue all unilateral trade embargoes, which are viewed as ineffective in achieving foreign policy objectives, since other countries

### III. Likely Future Issues

generally step in to replace the excluded U.S. companies. Embargoes also damage U.S. companies and decrease their ability to compete in a global marketplace.

Unilateral foreign trade actions have a very negative impact: we ceded the Vietnam oil business to the French, and are apparently doing the same thing in Iran.

(Industry)

The U.S. must balance its foreign policy objectives with the commercial damage from unilateral trade sanctions. (Observer)

No more unilateral trade embargoes. Stop penalizing the industry.

(Customer/Observer Workshop)

Foreign policy, including military intervention, could be used to stabilize potential markets and increase the receptivity to American companies.

We will continue our current policy of keeping people who are hostile to the U.S. from controlling world oil centers. This will be done through diplomacy, as well as military intervention. (Observer)

Our national energy policy is aircraft carriers. (Observer)

After losing control of the Straits of Hormuz and our oil supply, the U.S. would become immediately a third rate power. (Industry)

*Issue: Should the U.S. adopt a protectionist policy for domestic production or refining?*

The domestic production and refining industries provide energy products which are critical to the U.S. economy and generate thousands of jobs for American workers. The Government could impose import restrictions, including duties or quotas, which protect the domestic drilling and production industry. Alternately, price supports or tax incentives could be used to strengthen the domestic industry, and the industry's activities in countries deemed to be preferred suppliers.

On the other hand, protectionist policy puts free trade agreements at risk, and increases costs to the U.S. economy, possibly causing other U.S. industries to lose competitive capability in world markets.

[We need] an oil import fee for non-hemispheric producers. (Public Interest/Environmental Workshop)

Industry and government should forget about oil import tariffs -- the public reaction would be terrible. (Industry)

U.S. environmental regulations are viewed as costly relative to other areas of the world, particularly for refining. Regulatory relief would help improve global competitiveness.

### III. Likely Future Issues

[We need to] preserve the domestic refining industry. (Customer/Observer Workshop)

As a result of severe downsizing in domestic refining [caused by environmental regulations] we will import more products. In effect, we will be exporting pollution. (Observer)

Reduce the cost of state and federal regulations. (Government/Regulator Workshop)

*Issue: Should the U.S. promote a level playing field in international trade?*

Some countries in the world restrict access to resources and markets, unfairly limiting the ability of U.S. companies to compete. These restrictions may prove very difficult to dislodge, and international negotiations may affect other U.S. foreign policies.

The U.S. Government could negotiate and enforce free trade agreements which have a broad scope.

There will be calls for protection, but they will be largely unsuccessful. (Industry)

It is up to our current government leaders to manage the transition from protected national to free global markets, ensuring that regional trade blocs do not arise. (Observer)

[A foreign oil field services firm] would have had to pay another \$150 million in taxes if it were headquartered in the U.S. (Industry)

International politics and especially international trade will have major impacts on the oil industry in the year 2020. (Observer)

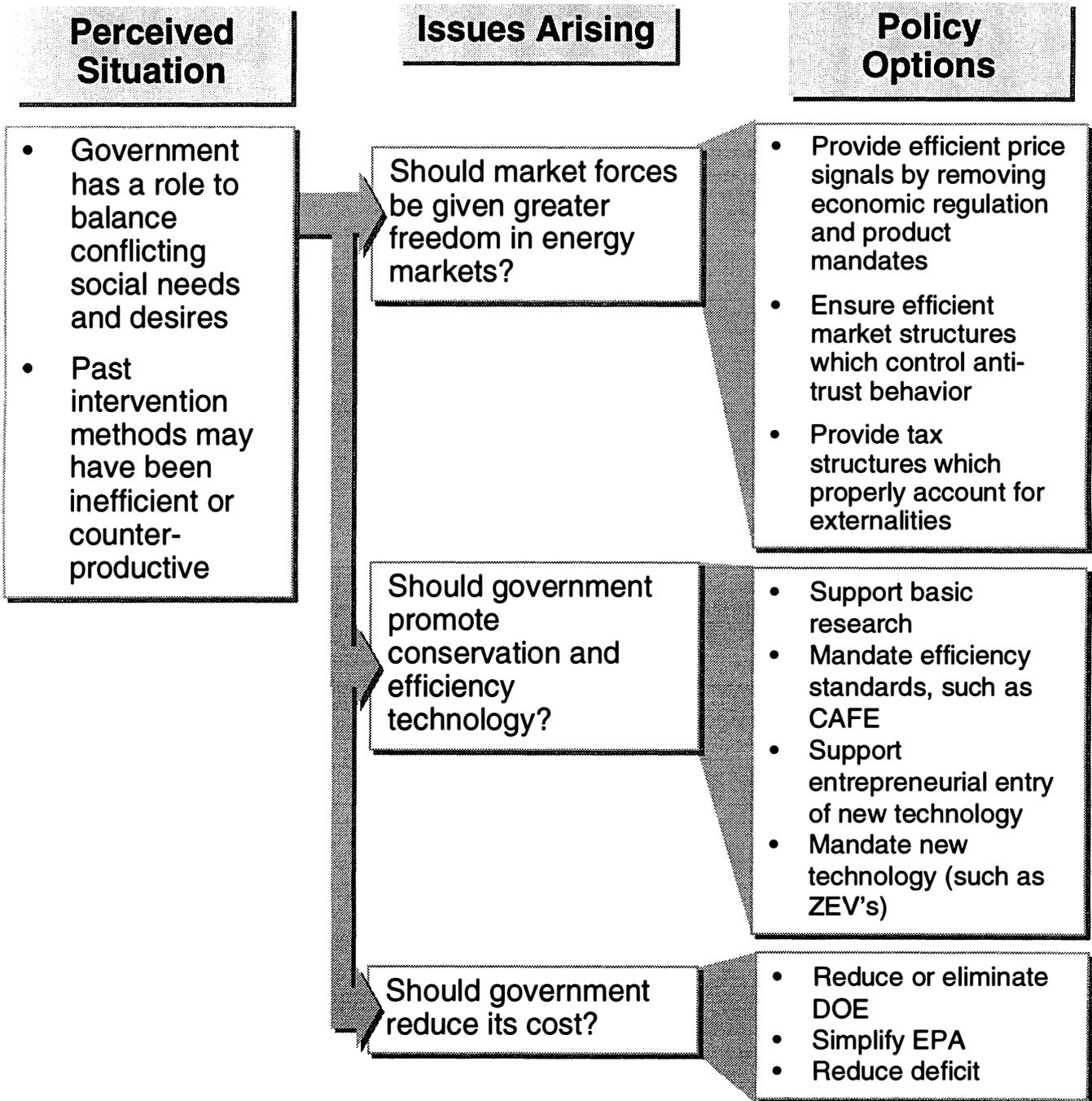
The U.S. Government could also encourage the development of international standards for environmental performance, free trade, business regulation, and taxes.

Global trade will also work to install international environmental and regulation standards to level the playing field between competing nations. (Observer)

Finally, the U.S. could conform its domestic policies to provide a level playing field, including environment, tax, royalty, and other business regulations.

The U.S. should standardize many of its regulatory systems to meet international standards. This would include contract terms, taxes, environmental and business regulations. (Industry)

# How should government intervention in industry markets be optimized?



### III. Likely Future Issues

#### B. Government Intervention in Markets

##### *How should government intervention in industry markets be optimized? (Chart III-3)*

Many respondents suggested that government has an important role to balance conflicting social goals. However, a large number viewed past market interventions as inefficient or even counterproductive.

*Issue: Should market forces be given greater freedom in energy markets?*

Over the past 15 years, there has been a major trend to deregulate markets throughout the economy, including the energy sector. Deregulation tends to increase efficiency and lower costs. On the other hand, existing market participants and other constituencies, such as local consumers, may experience apparent inequities as changes occur. Furthermore, some enterprises may have a strong monopoly position which can exploit a deregulated market.

To paraphrase Winston Churchill, the market may be the worst of all systems, except when you consider the alternatives. (Industry)

The free market system is the most efficient and results in the greatest wealth. (Industry)

Government at all levels could adopt policies which provide efficient price signals to markets. This could be achieved by removing economic return regulation, and other interventions such as product, technology or service mandates.

Policy makers should be careful to implement [only] the minimum required interventions. (Government/Regulator)

Natural gas has been subjected to some of the most silly government attempts to intervene in the market. (Industry)

Government should avoid use of fuel mandates, such as for [clean] coal. (Industry)

As far as possible the government should stay out of the oil business. (Government/Regulator)

Government could develop and enforce an efficient market framework which controls monopolistic behavior.

If the government role is to support a free market, then it should ensure that the markets are fair. To achieve a free market, government must limit the anti-trust activities of players which continue to have monopolistic positions. And, government must ensure enforcement of contracts. (Industry)

### III. Likely Future Issues

Tax structures could be adopted to properly account for externality costs, without requiring the energy sector of the economy to provide an inequitable share of general revenue.

The social cost of driving is under-priced. (Observer)

There should be a level playing field on taxes with no favoritism between big companies and small companies or among fuels (e.g. ethanol and methanol). (Industry)

One major issue is tax policies which currently cross subsidize petroleum products and fail to recognize the entire social cost of their use. (Government/Regulator)

Some of the cost of the Sixth Fleet should be borne by the oil consumers. (Industry)

Government must be very careful when moving on tax issues; the industry is not that competitive that it can take major new taxes, nor will the promised supply responses from tax breaks be any more than marginal. (Observer)

*Issue: Should Government promote conservation and efficiency technology?*

The use of petroleum can be associated with risks of future costs, including dependence on foreign sources of oil and environmental damage. Despite current economic incentives to reduce petroleum consumption, there may be barriers to adoption of conservation and efficiency technology. On the other hand, government action could result in inefficient interventions which reduce overall wealth in the economy. Government mandates, such as the California Zero Emission Vehicle (ZEV), may lock in immature technology at a significant cost.

Government could support research into new technology, using tax relief or direct methods. Most respondents believe that government may have an appropriate role in supporting and performing basic research.

Only a few companies can afford exploratory research for replacements for oil and gas, and most of them have a vested interest in burying the new technology. Therefore, a government role is warranted. (Observer)

Government involvement in and choice of specific energy projects has been poor to disastrous: there are very few examples of winning technologies picked by the government. (Industry)

Government should use a generic R & D tax credit and the patent system to support basic research, rather than try to pick specific industries or projects for special treatment. (Industry)

Government should sponsor basic research. (Customer/Observer Workshop)

### III. Likely Future Issues

Government could mandate efficiency standards, such as CAFE for automobiles. Mandated standards for appliances have been established, and may have pushed the adoption of new technology faster.

A gasoline tax of the order of \$1.00 per gallon should be imposed to discourage gasoline consumption and encourage natural gas. (Industry)

The US should increase gasoline taxes by \$1-2 per gallon and possibly add CAFE standards which would require 45 miles per gallon to be achieved by new vehicles. (Observer)

Government could support entrepreneurial entry of new technology by providing money and reducing regulatory barriers to new entrants.

New, high-efficiency technologies exist today, but haven't been commercialized because to cultural barriers and perverse economic incentives. (Environmentalist)

Potential efficient car market entrants face a number of barriers, including regulations and tests which favor existing companies. (Environmentalist)  
Expect hyper-efficient car entrepreneurs to spring up in California. (Environmentalist)

Government could mandate the use of new technology, such as ZEV's or reformulated gasoline, in an attempt to force technology development and achieve social goals.

[We should] mandate new end-use (car) technology even if it is uneconomic. (Government/Regulator Workshop)

*Issue: Should Government reduce its size and cost?*

Tax burdens and the deficit may limit economic growth. Some government services and functions might be done more efficiently by private companies or through market mechanisms. Some could be eliminated without replacement. On the other hand, many government functions are important to constituent groups, and serve a valid purpose in improving our society.

Several respondents suggested that DOE should be drastically reduced or eliminated. Others suggested that EPA be restructured and simplified.

DOE is fundamentally a disaster, with too many ancillary and largely irrelevant activities. (Industry)

DOE should provide energy information. DOE should demilitarize its operation. (Environmentalist)

DOE's R&D efforts have been a failure. (Industry)

### III. Likely Future Issues

Eliminate DOE. (4-5 Industry members)

A large group felt that the U.S. Government would be increasingly constrained by the large deficit and consequent debt load, and that deficits must be reduced.

Government debt will tightly constrain its ability to make policy. (Industry)

Government budgets will be reduced. (Government/Regulator Workshop)

Deficit reduction will focus on taxes to help balance the Federal budget.  
(Environmentalist)

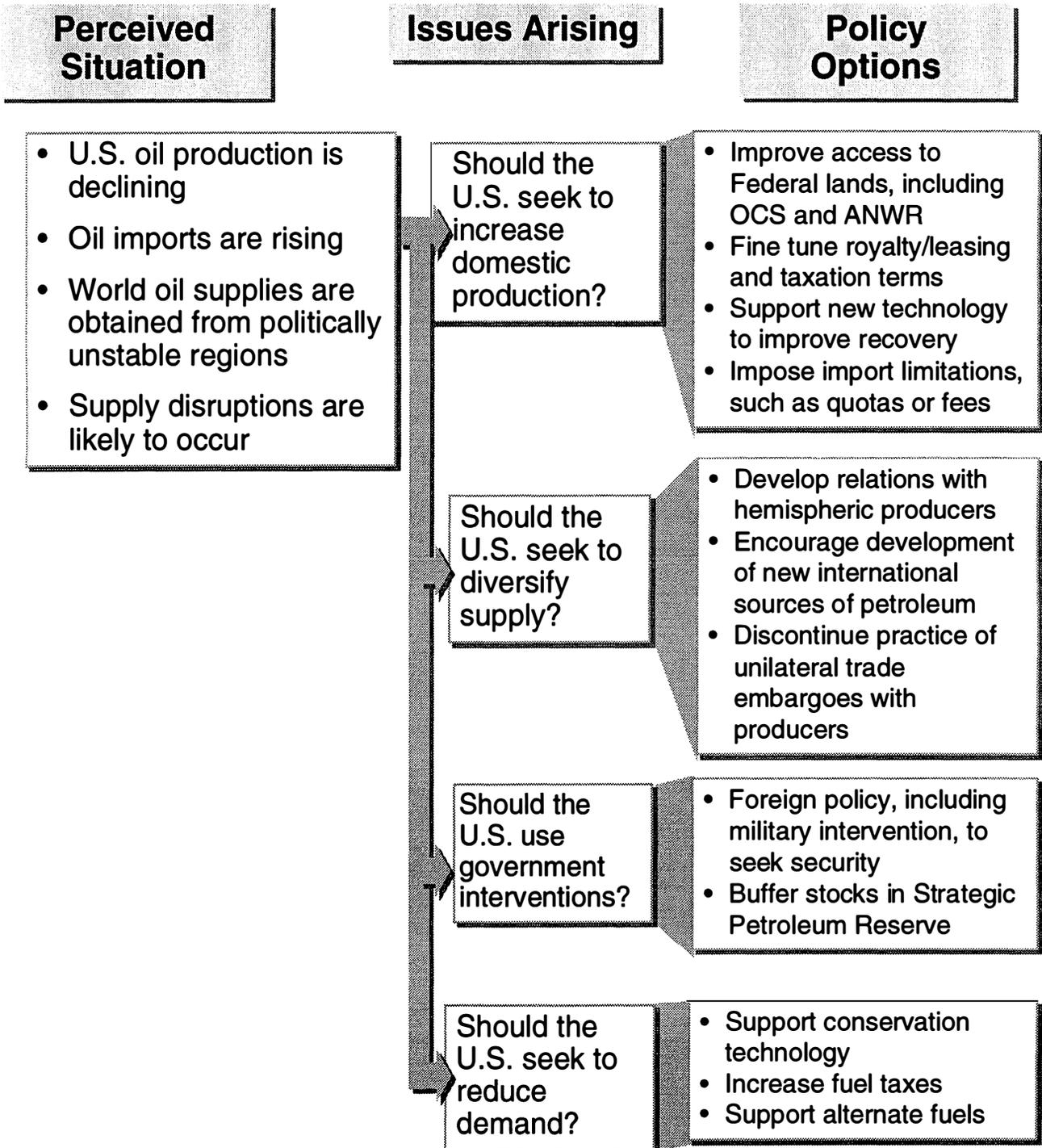
The oil industry is [viewed as] a potential deep pocket to deal with the Federal budget deficit. (Industry)

The industry is not that competitive that it can take major new taxes. (Observer)

**III. Likely Future Issues**

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# How can we ensure secure, low-priced energy supplies to protect U.S. global competitiveness despite increasing imports?



### III. Likely Future Issues

#### C. Supply Security

##### ***How can we ensure secure, low-priced energy supplies to protect U.S. global competitiveness despite increasing imports? (Chart III-4)***

Nearly all respondents believe that domestic oil production will continue to decline. Coupled with flat to slightly rising demand, this means that oil imports are likely to rise. In the global oil market, significant volumes are produced from politically unstable regions, and disruptions may well occur in the future.

Oil imports are costly because of their impact on the dollar, the balance of trade and national security. (Customer)

[We should] do nothing. What is the harm of imports? It's OK, if we are diversified. (Government/Regulator Workshop)

We need to develop a better understanding of the effects of a supply disruption as distinct from import dependency. (Customer/Observer Workshop)

Government policy should be firmly based on the reality that the nation is not going to be independent of oil imports. (Industry)

##### *Issue: Should the U.S. seek to increase domestic production?*

Increased domestic production can help close the import gap while providing other economic benefits, such as an internationally competitive oil field services and supply industry that yields American jobs. However, the U.S. is a highly mature province with limited opportunity to find large fields. Increased domestic production is unlikely to eliminate imports, while it may result in adverse environmental impacts. Some government interventions designed to provide incentives to increase domestic production are viewed as harmful to the rest of the economy.

Given the opportunity and economic incentive, the industry stands ready to invest in new U.S. exploration and production. The opportunity can be enhanced by opening Federal lands, including the Outer Continental Shelf (OCS) and Arctic National Wildlife Refuge (ANWR), to exploration and production. Opening of these lands is often opposed by coastal communities and environmental groups, who believe that the potential for environmental damage is too high.

Government should continue to restrict access to ANWR, opening less-controversial lands first. (Environmentalist)

It's a foolish policy based on emotions, not facts, to cut off access to OCS and ANWR. (Industry)

### III. Likely Future Issues

The restraints on access are not justified by any objective balance of risks. There have been very few major spills associated with wells, compared to many more associated with tanker transport. It makes no sense to adopt policies that exaggerate imports. (Industry)

It is possible to disagree with both sides on the issue of access to public lands. Opening tends to be irreversible. On the other hand, it is not good to lock away everything. (Observer)

The battle to open ANWR will likely become the biggest issue in defining U.S. energy policy, but it is quite irrelevant: it will have little effect on import dependence. (Environmentalist)

Economic incentives could stimulate new production. In many areas, new or existing exploration and production efforts are only marginally economic. Incentives could be provided by adopting flexible terms for royalty, leasing, or taxation. Although some in government prefer to maintain existing terms to maximize revenue collection from these wells, some in industry note that undeveloped resources yield no revenues.

The Federal Government captures royalty income [from the OCS and Federal lands] which goes to Washington, while local communities perceive that they incur risk to their coastlines. (Industry)

[We] need flexibility on royalties and taxes for marginal wells to extend field life and maximize recovery. (Customer/Observer Workshop)

Another economic incentive could be provided by imposing import limitations, such as quotas or fees, which tend to raise the domestic price of oil. These limitations may be no different than protections provided to other industries such as automobiles and steel. However, higher domestic oil prices are expected to reduce the international competitiveness of parts of the American economy.

An import fee would be no different in principle to the protection given to 19 other items, such as steel, autos and textiles, that are much less critical to the nation than oil. (Industry)

Oil price supports or an import fee may violate the GATT trade agreements. (Observer)

We need to support domestic production through an import fee or tax supports. There may be a problem with GATT, but we should be creative in devising ways to support our industry without torpedoing GATT. (Environmentalist)

A problem is that the penalties for doing [import fees] are high, especially in absence of a crisis (dependence). (Government/Regulator Workshop)

### III. Likely Future Issues

Supply independence will have a long run higher cost. (Customer/Observer Workshop)

Government and industry could work to develop and disseminate new tertiary recovery technology. Due to the physics of petroleum reservoirs, only a fraction of the original oil in place is extracted and produced. The remaining oil is a resource which could be produced using new technology.

Better technology and increasing use of secondary and tertiary recovery will permit higher production, maybe as much as half a million barrels per day, from existing reservoirs. (Government/Regulator)

*Issue: Should the U.S. seek to diversify supply?*

Multiple suppliers would reduce the reliance on any individual country, and reduce the impact of a supply cutoff. On the other hand, the world oil market is very efficient and transparent. Even if physical supplies continue to flow to the U.S., a disruption in world oil supplies is likely to cause a significant price impact on the economy.

The Federal Government could seek special relationships with Western Hemisphere producers, including Canada, Mexico and Venezuela to ensure physical supply.

Canada is by far the most important supplier -- [government] should encourage trade barriers to remain low. (Customer/Observer Workshop)

Encourage Venezuela to leave OPEC [with] financing inducements. (Customer/Observer Workshop)

At 60% imports we are vulnerable. We should pursue alliances with Mexico, Venezuela and other Caribbean countries. (Industry)

The Government and industry could encourage international development of world supplies.

Government must help the industry diversify its supply sources internationally, as this will help the country, as well as the industry. (Observer)

Diversify supply for the world. (Customer/Observer Workshop)

Provide and sell E&P technology to the Former Soviet Union and other areas in exchange for long-term [petroleum] supplies. (Customer/Observer Workshop)

A diverse world supply of petroleum will be beneficial in reducing the risk of a supply disruption. Current U.S. foreign policy may reduce development of potential world supplies, through trade restrictions and embargoes. By decoupling trade and energy

### III. Likely Future Issues

policy from other foreign policy objectives, supply security can be enhanced. In particular, the use of unilateral trade embargoes is viewed as ineffective and damaging.

Foreign policy should be reviewed carefully to better consider the commercial impacts and effectiveness of unilateral trade sanctions. Our current policy is particularly ineffective and harmful to US industry... Sanctions should be used only in limited situations, where the ultimate objective is clearly stated -- such as overthrow of the government. (Observer)

Now, in addition to an unfavorable tax regime, [we have] embargoes as a policy measure which ensure we are behind the competition. Only two embargoes have ever worked – South Africa and Iraq. Panama, Cuba, Libya, Angola and Iran have not worked. There has been plenty of dialogue between industry and government; i.e., with Secretary Brown, but there is more than one view in Government. With regard to Iran, why can't we take the Japanese view – that development is the only way out? Didn't we realize that Conoco had been given a jewel by Iran? The industry and (or through) its contractors operates well in these places; we know what's going on. We bring the cutting edge of technology, not just for oil but also for telecommunications and information systems. We provide the means for modernization and an end to isolation (e.g., Burma). The industry brings a whole value package. It is efficient and competitive. (Industry)

*Issue: Should the U.S. Government use interventions to mitigate impacts of disruption?*

In the event of a supply or price shock, the Government has many options for response, including the option of letting markets correct by themselves. Although many options are expected to be effective in mitigating the impacts in the event of a crisis, they are expensive to maintain and to use.

We need 'shock absorbers' to cushion supply dependence. (Customer/Observer Workshop)

The U.S. Government could provide a foreign policy, including military intervention, to seek security.

Ensuring reliable access to foreign crude and products will be the primary responsibility of the Departments of State and Defense. (Observer)

Import dependence reduces ability to pursue an independent foreign policy [and] increases potential need for military intervention. (Government/Regulator Workshop)

### III. Likely Future Issues

Government should maintain a strong military so that if intervention becomes necessary, we are able to respond to major supply disruptions appropriately. (Observer)

The United States has acted under the principal that the chief threat to oil-rich countries is invasion from outside (like Iraq's invasion of Kuwait). However, in [three revolutions], the key threats which ultimately led to the downfall of the ruling monarchy rose from within the countries. (Observer)

The U.S. Government could provide mechanisms to maintain physical supply in the event of a crisis, such as the Strategic Petroleum Reserve. Some believe that the development of forward futures markets can maintain security without the need for the Government to hold oil in inventory.

[We should] provide SPR. (Government/Regulator Workshop)

Tax imported oil to finance the SPR. (Customer/Observer Workshop)

Policy should focus on disruption and recognize that the SPR is a valuable tool. (Customer/Observer Workshop)

The SPR does not contain enough oil to do anything but soothe the minds of U.S. citizens. (Observer)

The Strategic Petroleum Reserve is big enough now -- in fact, may be too big. (Customer)

Why do we need the SPR? Futures markets now allow anyone who is concerned about the security of future supply to lay off that risk to willing speculators much more cheaply (due to contango in year-to-year prices) than actual holding costs. (Industry)

*Issue: Should the U.S. seek to reduce demand?*

Dependence on imports can be reduced if demand for oil is reduced to better match domestic production. There may be other benefits from reducing demand, such as a cleaner environment. However, the methods which can reduce demand may also cause significant economic dislocations and inefficiency, with a consequent loss of wealth. Some methods rely on unproved technology.

Industry and Government could support increased use of efficient end-use technology and conservation. Some favor government-mandated technology.

There is some likelihood that major technology breakthroughs, led by California's ZEV mandate, will dramatically cut demand. (Environmentalist)

### III. Likely Future Issues

I hate to think of the policy decisions which would have to be made to go 'off oil.' People are just not looking at the consequences in California. This is some sort of nasty joke. People pass the regulations but then 'it's off my beat.' I can't believe that the U.S. as a whole could make such an error. (Industry)

There will be more light commuter rail and electric commuting vehicles. Some of the electric vehicles may be wire guided and wire powered. The internal combustion engine will continue to propel larger, more-powerful inter-city and inter-state vehicles. (Customer)

The reduction in demand will be driven primarily by free-market forces, but new technologies will be brought to market faster due to government policy decisions which enable or mandate earlier adoption. (Environmentalist)

Government should focus on least-cost solutions -- conservation. Technology exists today which can reduce energy requirements for lighting, heating and cooling by 80%. (Environmentalist)

Competition will cause an explosion of conservation-based products and services. (Customer)

[We should] accelerate turnover of equipment to higher efficiency. (Government/Regulator Workshop)

There will be improvement in the efficiency of using natural gas, which will push demand down. (Environmentalist)

By increasing prices for fuel through the imposition of higher taxes, consumers could be influenced to install efficient appliances and buy efficient cars. In addition, conservation behavior would be reinforced.

The obvious conclusion is to increase gasoline taxes to European levels. (Industry)

Apart from a prohibition scenario, a 25% reduction in demand could in theory be caused by prices, but they would need to rise to \$60-70/barrel to squeeze that much out of demand. (Industry)

Alternate fuels derived from domestic sources could reduce the country's dependence on foreign oil supplies. Government and industry could work to expand availability and use of these alternates.

New photovoltaic technology is currently cost competitive with fossil fuel generation capacity in certain regions where solar radiation is strong. (Industry)

Alternative fuel sources will be driven by an increase in taxes (potentially a revenue neutral tax) which will increase the demand for alternative fuels. (Environmentalist)

### III. Likely Future Issues

Industry should diversify into natural gas and hydrogen [and] should add natural gas pumps to gasoline stations. (Public Interest/Environmental Workshop)

Oil companies do not appear interested in developing alternate fuels. (Observer)  
There will be breakdowns in barriers to the use of alternative fuels. Companies in the oil and gas industries will be much more involved in other types of energy. (Observer)

It is important especially for the oil industry to diversify into other energy sources. (Environmentalist)

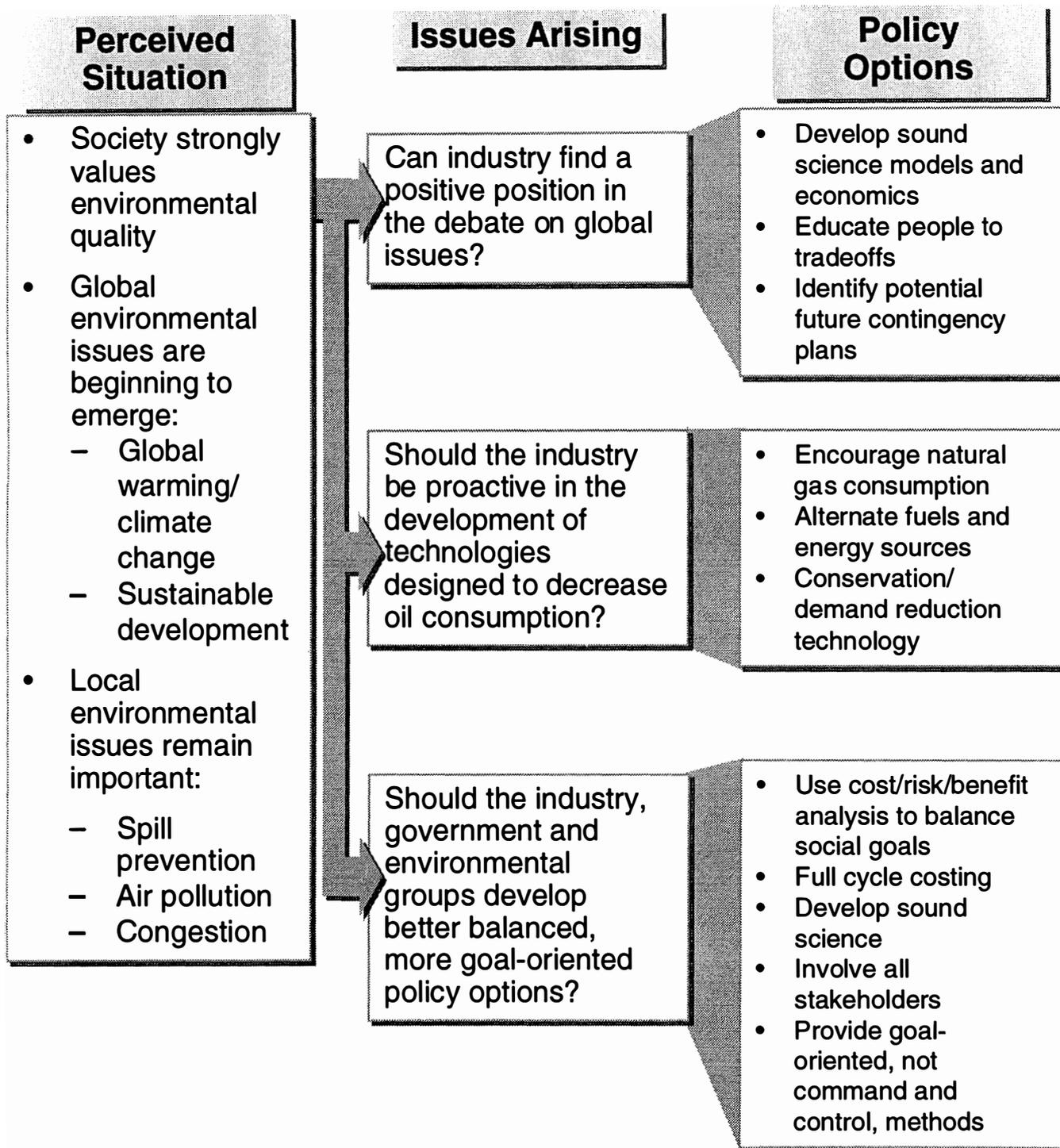
Ethanol is a gasoline additive -- not a substitute for gasoline. (Competitor industry member)

There are no ready alternates to oil for transportation fuel. (Observer)

We should not expect the industry to come up with green fuels on its own. The cost and risks are too high. (Observer)

Alternative fuels are nonsense. It is now widely recognized that electric cars in fact have smokestacks. To produce electricity we burn coal, oil, and gas and 60% of the fuel goes up the stack. We don't save either energy or pollution with the electric car. Why does the government persist in subsidizing fuels to compete with a highly efficient industry? (Industry)

# How should the environmental impact of industry operations and use of its products be addressed?



### III. Likely Future Issues

#### D. Environmental Impact

##### ***How should the environmental impact of industry operations and use of its products be addressed? (Chart III-5)***

American society puts a high value on environmental quality. Most respondents expect this set of values to remain strong, well into the future. Relative to national concerns, global environmental concerns are now commanding more attention. These include the threat of climate change and global warming resulting from release of greenhouse gases like CO<sub>2</sub>. Sustainable development, which seeks a careful balance between economic growth and appropriate use of the finite resources available on Earth, is another. At the same time, local concerns are increasingly more urgent and passionate. These include spill prevention, air pollution, and congestion.

Preservation of the environment will remain as one of the primary drivers of the energy industry and is likely to become increasingly critical over time. (Customer)

The key government policy issue for 2020 will continue to be environmental control. (Government/Regulator)

The term environmentalism will have disappeared. Everyone will be an environmentalist. (Customer/Observer Workshop)

##### ***Issue: Can industry find a positive position in the debate on global environmental concerns?***

Global environmental concerns, particularly climate change, present high-stakes risks with large uncertainties. The negative impacts from climate change could be devastating -- but the science is not well-enough developed to determine with enough certainty whether they will indeed occur. Some advocates would argue that the risk is well worth making costly efforts to reduce greenhouse gas emissions now. On the other hand, significant reductions in CO<sub>2</sub> emissions would likely require major economic sacrifices, with particularly devastating consequences for the coal and petroleum industries. These concerns are further complicated by international relations and the strongly differing stances taken by OECD and newly-developing countries.

Global warming is a key uncertainty. If calamities can be directly attributed to it, the whole future of the energy industry could be changed. (Customer)

By 2020 we will be very clear whether global warming is a true phenomenon with significant negative effects. If there is a smoking gun, it changes everything. (Observer)

The oil industry has been resistant in acknowledging the threat of global climate change. (Environmentalist)

### III. Likely Future Issues

Industry should take a proactive position. (Public Interest/Environmental Workshop)

Scientific uncertainty lies at the root of many of the concerns. Industry and other stakeholder groups could develop improved models and methods for evaluating the threat. Joint work should help promote improved dialogue between the different interest groups.

We need to develop an international framework for the resolution of environmental issues based on good science. (Customer)

[cynically]... 'Good science' is the kind which supports my position. (Government/Regulator Workshop)

[We need] collaborative research efforts. [We should] identify existing organizations which could provide opportunity for joint investments. (Public Interest/Environmental Workshop)

Many interest groups are actively promoting policy positions in the debate. Industry could adopt a proactive education plan to provide information regarding the tradeoffs in these issues. Industry could choose to develop contingency plans which mitigate global concerns.

Global climate change is a key issue. Industry must participate and help shape the debate, as well as be part of the solution. (Environmentalist)

Open discussions with outsiders, using public forum guidelines. (Public Interest/Environmental Workshop)

The next step is for the environmental movement to link environmental concerns with economic thinking. This will not be easy, but must be done. (Environmentalist)

The recent international conferences and agreements about global warming are positive signs that these problems can be dealt with. (Environmentalist)

To be credible in negotiations with developing nations, the U.S. and other OECD countries must take the first steps to decrease their carbon dioxide emissions.... It is unthinkable to suppose that developing nations will be willing to slow down or reduce their development so that the U.S. and Europe can continue at current high consumption levels. (Industry)

The 'expected value' economic analysis suggests that the world could afford to spend large amounts to ensure that global warming does not lead to disaster. (Industry)

### III. Likely Future Issues

*Issue: Should the industry be proactive in the development of technologies designed to decrease oil consumption?*

Oil consumption is viewed by many to be damaging to the environment. Eventually, oil will be replaced by another fuel source, just as other dominant fuels (like wood and coal) were displaced by oil. By adopting a proactive position, the industry will be able to maintain financial health through this cycle. On the other hand, oil is currently an economically valuable, versatile fuel. Premature development of alternates could reduce economic efficiency and reduce social wealth.

Industry could encourage increased substitution of natural gas for oil in many applications.

[Natural] gas is the solution. (Observer)

Natural gas has not been exploited as an alternative fuel. (Observer)

The salvation is natural gas. There is no other way. (Industry)

A strong economic stimulus, driven by increased demand for clean fuel applications, will continue to support increased gas production. (Government/Regulator)

Industry could develop alternate fuels and energy sources.

There will continue to be pressure to invest in fuel technologies that are driven by environmental considerations. (Government/Regulator)

They [industry] should seek to improve the environmental friendliness of gasoline -- otherwise, electric cars may be mandated, completely eliminating gasoline. Long-term cooperation between industry and consumer and environmental groups will provide better solution. (Environmentalist)

There will be substantial breakthroughs in use of alternate fuels because currently research in this area is on the right track. (Observer)

The oil industry will face substantial competition in the energy arena from deregulated electricity and alternative fuels in the future. (Observer)

Enron's move into PV [photo-voltaic solar cells] may be an example of how oil companies could lead the way into the multi-energy future. (Customer)

It is important especially for the oil industry to diversify into other energy sources. (Environmentalist)

Industry could seek to develop and market conservation and efficiency technologies to their customers.

### III. Likely Future Issues

The petroleum industry can make new markets for itself in nega-gallons -- similar to the nega-watts which are used by utilities to sell conservation technology to consumers. (Environmentalist)

Efficiency services will be part of the offering. (Industry)

*Issue: Should the industry, Government and environmental groups develop better-balanced, goal-oriented policy options?*

All stakeholder groups agree that a clean environment is important. However, existing regulation approaches may have been inefficient or counterproductive. A participative approach, with emphasis on market-like mechanisms throughout the process, might yield a better result. Change will require considerable reworking of existing laws and regulations.

In the legislative process, the use of cost/benefit and risk analysis could provide additional information in balancing the value of opposing social concerns, such as the environment, wealth, and jobs.

Congress/Administration should adopt decision-making procedures that encourage environmental protection where we get the highest benefit in relationship to cost. (Customer/Observer Workshop)

We should refocus our systems for environmental regulation to produce the greatest environmental benefit for the amount we are willing to spend by using tools of risk assessment and greater reliance on market-based regulation. (Customer/Observer Workshop)

People will be more supportive of trading off environmental issues for economic gains. (Observer)

[We need] more cost/benefit analysis. (Customer/Observer Workshop)

Scientific uncertainty and 'advocacy' science lies at the root of many of the concerns. Reliance on sound scientific protocols, and better information, could help improve the overall balance of social goals.

We should make every effort to build environmental policies on the facts, not on politics. Environmentalists' positions are formed with no interest in the facts.... By 2020, environmental policy should be more rational and scientific rather than political. (Industry)

The key uncertainty is whether the debate on environment will be framed in terms of good science or bad science. (Industry)

### III. Likely Future Issues

[We] need better information and data gathering. (Government/Regulator Workshop)

A participative approach, which includes all stakeholders, could be adopted. This approach might yield better balance and faster solutions.

Constant litigation erodes confidence in government effectiveness [and ] distracts management attention from more productive issues... (Government/Regulator Workshop)

A better dialogue between the oil industry and the environmental movement is an imperative. There is a lot of misunderstanding, and an opportunity for constructive action exists. Things don't have to end up in conflict. (Environmentalist)

A confrontational approach to environmental regulation is not effective -- but is sometimes necessary. (Environmentalist)

Reduce unnecessary friction between industry, regulators, and others. (Public Interest/Environmental Workshop)

[The recent] election represented a quantum shift. Now is the time for a change in how regulations are determined. (Customer/Observer Workshop)

Goal-oriented regulations, using market-like mechanisms, could provide improved efficiency and increased environmental performance.

Force environmental regulations to be goals oriented rather than command and control. (Customer)

The government's role in environmental protection is to set objectives, and let each company figure out how to meet those objectives most economically. (Industry)

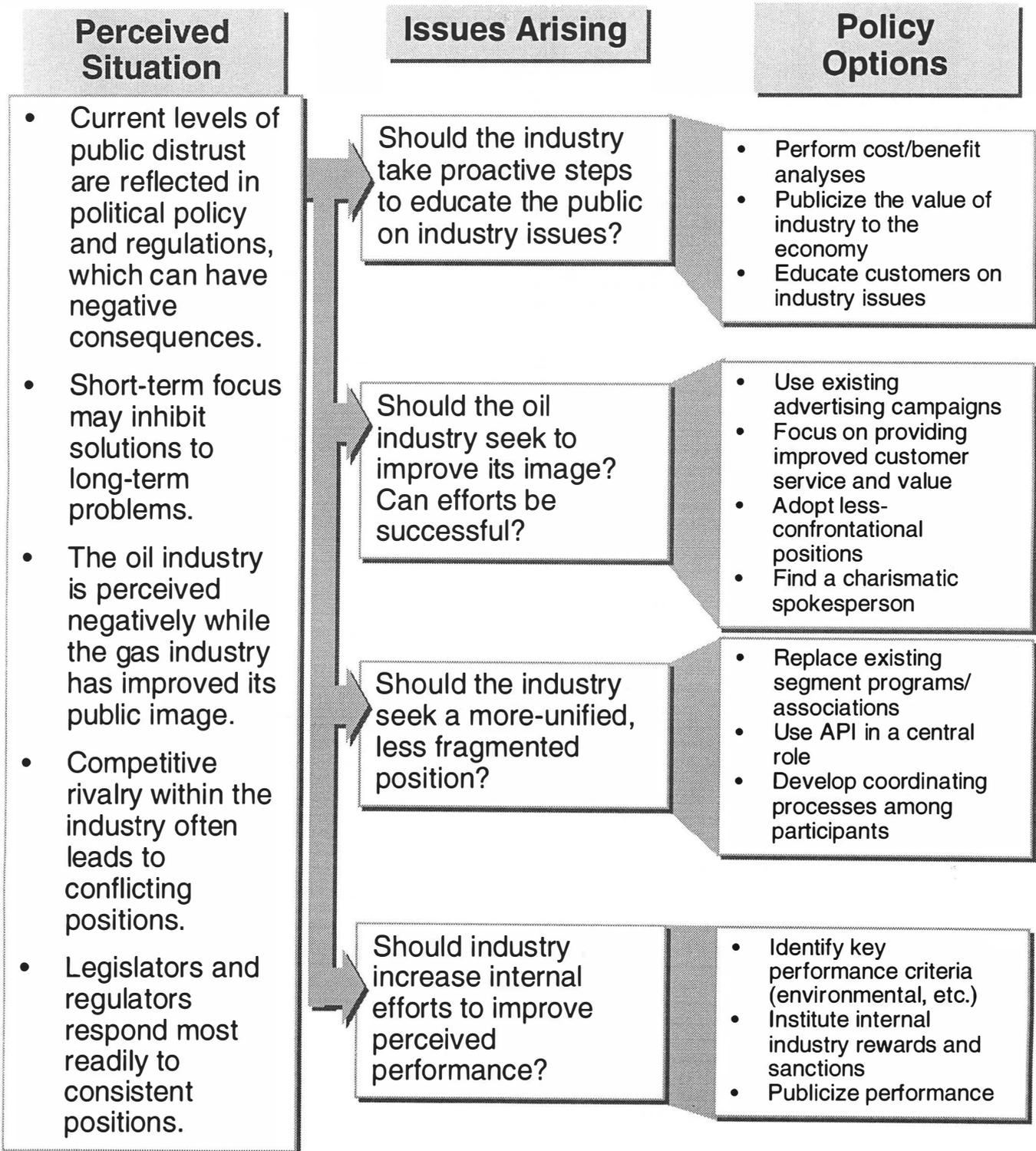
The Administration should work with all Federal agencies to balance regulations, improve consistency from agency to agency, eliminate random, punitive fines when companies report and clean their own spills. (Industry)

The key issue for regulatory pragmatism is to focus on goals, and to ensure that those goals are compatible with national goals. (Observer)

The availability of PRI toxic emissions data provides a vehicle that could be used as a taxable base. By charging for emissions, this would drive industrials to be more efficient. (Environmentalist)

Develop suggested set of guidelines for environmental regulation/legislation at all levels which includes key principles (standards vs. common control). (Public Interest/Environmental Workshop)

# How should the industry relate to the public?



### III. Likely Future Issues

#### E. Public Perception

##### *How should the petroleum industry relate to the public? (Chart III-6)*

The interview and workshop respondents generally believe that the public has a negative perception of the industry which is deep-seated and rooted in historical problems. Furthermore, the public is seen as holding a short-term focus, which may inhibit solutions to long-term problems. These public attitudes are reflected in public policy, laws and regulations that may have negative consequences for the industry.

The gas industry is believed to have a relatively better image than oil. Perhaps this is partly a result of the proactive public relations campaign.

The industry is composed of large numbers of individual segments and companies. For a given policy issue, different groups may find financial benefit or harm; this is often reflected in the lobbying positions taken by the diverse groups. However, legislators and regulators can respond most easily to a united voice.

*Issue: Should the industry take proactive steps to educate the public on industry issues?*

Increased public awareness of industry issues could result in more-favorable public policy. However, education is costly.

Industry could use its existing interaction with customers to include general education on industry issues.

Oil companies could put out flyers to customers who buy RFG, explaining the product.... Analyze and publicize negative implications of new policies, i.e. RFG. (Government/Regulator Workshop)

Industry should educate the public... Industry can educate the public at gas stations (handouts, etc.). (Public Interest/Environmental Workshop)

Industry will have to continue to educate the public and decision makers on the global nature of the oil market, and point out that notions of oil independence are crazy. (Government/Regulator)

If we don't speak, someone else speaks for you... If not explained, people assume the worst. (Government/Regulator Workshop)

Public utility commissions need to be educated regarding the specific issues related to natural gas. Industry should do this. (Observer)

### III. Likely Future Issues

*Issue: Should the industry seek to improve its image? Can it be successful?*

A negative image may result in punitive laws and regulations. But, changing the industry image will require considerable cost and time, and may not even be feasible.

I almost despair of changing public perceptions of the industry. (Industry)

It is unclear whether oil companies can change their image. They have for a long time been big contributors to charitable causes, but seem to have achieved no benefits from this. (Government/Regulator)

The oil industry image problem is deeply rooted and probably nothing can be done to improve it. (Industry)

The industry may adopt a number of useful options to improve its image, including advertising campaigns, a focus on customer service and value, less confrontational public positions, and new, charismatic spokespeople.

The industry must work to improve its image. Ultimately, we must recognize that politics controls everything, and the industry has to be political. Current industry behavior plays into the hands of its adversaries. (Industry)

We should consider industry as well as individual company commercials. The lean beef campaign worked for the beef producers, who charged a tithe on all members to fund a media campaign.... Conoco and Phillips have had good ads to improve industry's public image. (Industry)

AGA [American Gas Association] commercials are quite effective, and the gas industry was seen to perform well. (Customer)

Companies will be looking for growth opportunities in a flat market and will concentrate on learning more about their customers and creating new services. (Industry)

Senior management in oil companies will become much more market-oriented. The marketing staffs in company organizations will improve, develop better experience, and become much more sophisticated. Successful companies in the future will focus much more strongly on the marketing arena. (Observer)

Companies will make a stronger connection to the market place and to their customers. (Observer)

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. (Environmentalist)

### III. Likely Future Issues

The leaders within the oil industry today, have no vision and unlike other major U.S. industries, there is no one in the oil industry who has come forward as a national leader. (Observer)

We have to find credible people in the industry to convey any message we may develop. (Industry)

*Issue: Should the industry seek a more unified, less fragmented position?*

The industry is not monolithic. Many segments have opposing competitive interests. Trends which suggest de-integration of some companies are likely to increase divergence of interests. However, despite these trends, the industry has renewed internal cooperation. Increased cooperation could yield a united voice on certain issues, which could improve influence with government policy makers.

Industry should consolidate [its] outward approach to public (consistent view). (Public Interest/Environmental Workshop)

The way industry deals with the public seems to be parochial, greedy, and defensive. (Observer)

*Issue: Should the industry increase internal efforts to improve perceived performance?*

Changing public perceptions will likely require an improvement in underlying performance. The chemical industry has adopted a strong, centralized program—Responsible Care—which includes a performance improvement section. The petroleum industry may need to overcome its concerns about loss of control in order to improve overall performance and public perception.

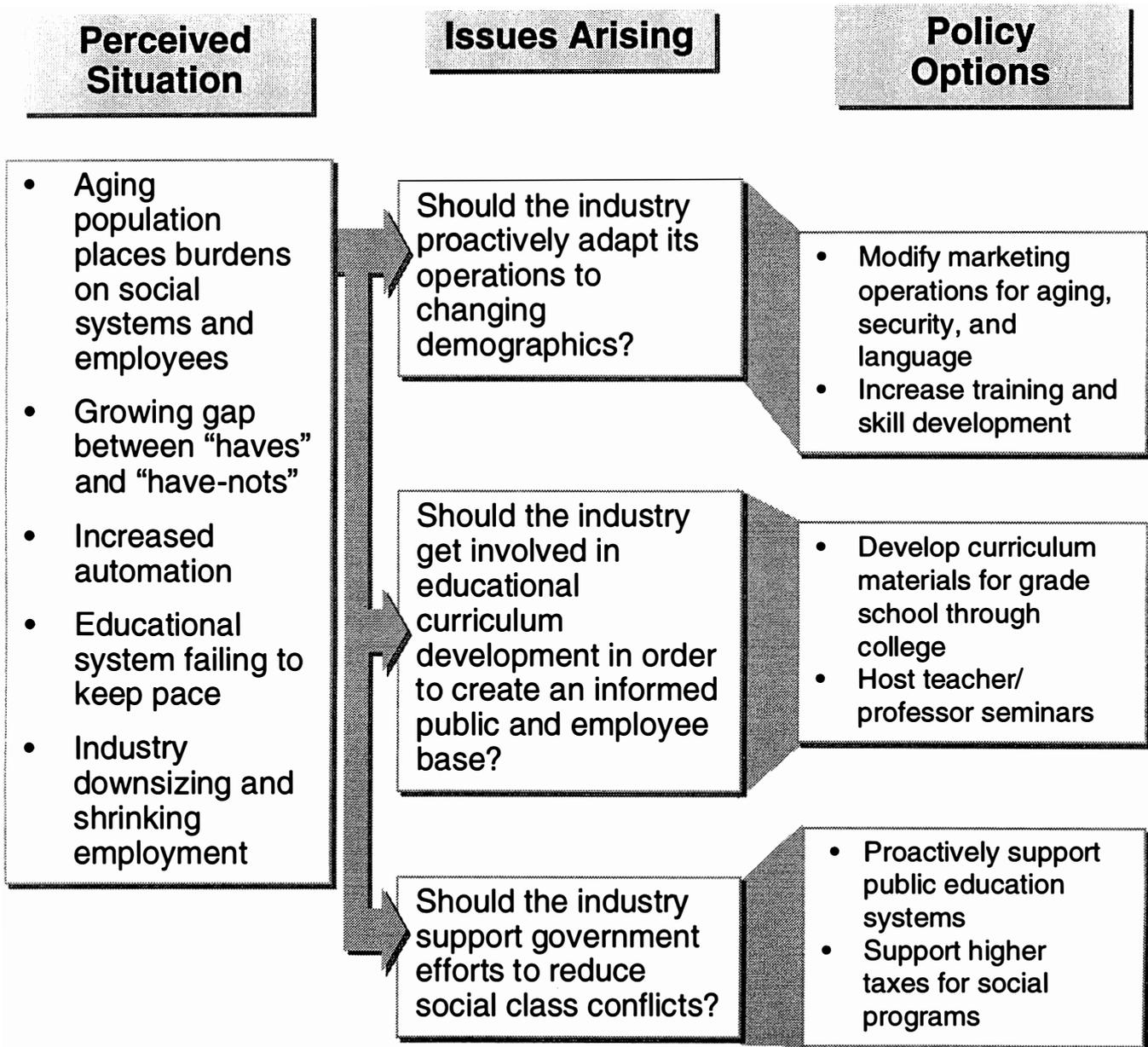
A centralized program, somewhat similar to API's STEP program, could identify performance criteria, institute internal industry rewards and sanctions and then publicize performance improvements. API's publication of SARA emissions data is one example of possible actions.

The energy industry will be challenged to achieve a positive public perception (particularly if energy companies become bigger and more powerful). Taking a proactive position on the environment is the key. (Industry)

Companies should provide more environmental performance information to consumers, allowing them to choose to reward better performers. (Environmentalist)

Government may move towards setting performance standards and measuring results rather than specifying operational detail, but this will depend ultimately on the oil industry showing that it can be trusted with the detail. (Government/Regulator)

# How should industry respond to social and demographic changes?



### III. Likely Future Issues

#### F. Societal Change

##### ***How should the petroleum industry respond to social and demographic changes? (Chart III-7)***

Several trends will continue to pressure social institutions, including an aging population, the influx of new immigrants and the growth of new technology which displaces workers from familiar jobs. Industry downsizing is viewed as likely to continue, and, as in other industries, downsizing may contribute to some of these social pressures.

Many respondents were concerned that the U.S. education system was severely dysfunctional, and incapable of maintaining the skilled workforce necessary to support our economic growth.

*Issue: Should the industry proactively adapt its operations to changing demographics?*

Changing demographics are likely to impact the industry by changing the customer base and the employee pool. Proactive adaptation may lead to competitive advantage, as well as improved social benefits.

Industry could modify its marketing operations to specifically care for the needs of aging customers, customers who speak different languages, or customers who have an increasing fear of crime.

Every company in every industry must understand every nuance about their customers and help the customer manage his risk. (Customer)

Petroleum companies will develop flexibility and innovation in marketing. (Customer)

Future retail marketing facilities will be specifically tailored to local community and consumer demand requirements. (Observer)

Language is a key issue. It is difficult to create a cohesive, effective society with multiple languages. (Industry)

Demographic changes will eliminate many of the current minority and gender issues. White males will be a minority in the future. (Customer)

Convenience must be marketed to new demographic groups as the 18-40 year old males population of customers shrinks, relative to other demographic groups. (Observer)

The population will be aging. Retirement at 65 will no longer be the norm. People will have to work longer because social security cannot cope. (Industry)

### III. Likely Future Issues

*Issue: Should the industry get involved with educational curriculum development to provide for an informed public and employee base?*

A highly skilled workforce is needed to ensure global competitiveness. However, the existing education system does not seem to be coping well with the need to teach technology skills. The system will be further stressed by increasing numbers of workers who are displaced by automation. These events will influence every industry in America. The petroleum industry has considerable skills and resources. These could be used to improve the situation. However, a dramatically increased program would be very costly.

Our current education system is totally irrelevant to future needs. Children are still being trained to be good factory workers - not information workers. (Industry)

Cultural adaptation to available technology is likely to be a challenge to society as whole. The education system is not helping - teachers are uncomfortable with technology. (Observer)

Our educational system is becoming obsolete more rapidly than is generally appreciated. (Customer)

[We should have an] industry commitment to long-term education at all levels (a serious credible role)... Industry Actions — Do more than complain that people are not being educated. (Public Interest/Environmental Workshop)

Education should focus on providing citizens with basic skills. More specific training can be left to the industry or to private training initiatives. (Industry)

Schools must develop comprehensive and on-going energy education in partnership with the industry. (Public Interest/Environmental Workshop)

*Issue: Should the industry support government efforts to reduce social class conflicts?*

Many respondents believe that the middle class is coming under greater pressure. The widening split between haves and have-nots will create increasing social pressures, such as crime and poverty. These events will influence every industry in America. The petroleum industry has considerable skills and resources. These could be used to improve the situation. However, a dramatically increased program would be very costly. The industry may be viewed as a special target for taxation to fund programs to mitigate these problems.

The workforce will be ill-educated for the remaining jobs. Society is likely to be bifurcated between the haves and the have-nots. (Industry)

### III. Likely Future Issues

Under-educated workers will be unable to compete for higher paying jobs, and government will focus on how to improve their living standards. (Customer)

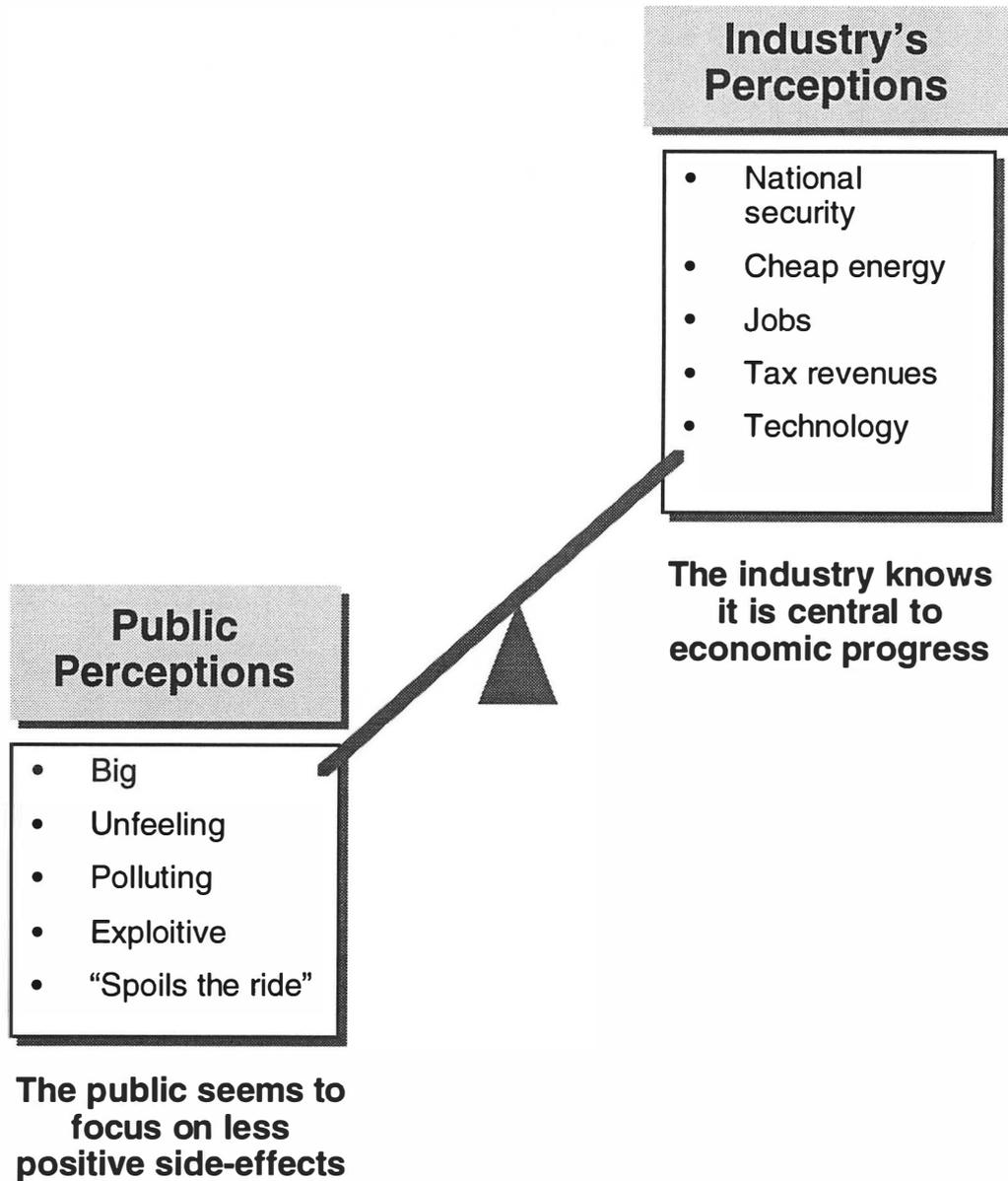
Changing demographics as the baby boom generation begins to retire will place much more pressure on government resources and the social security system. There is some expectation that social security will be bankrupt. (Government/Regulator)

One of the key roles of the federal government will be to ensure that people have jobs and that there is an adequate standard of living. (Observer)

How can we weave back together the haves and have-nots? Currently, the United States practices a winner-takes-all economy where there is a very large skew in income distribution. If income inequities continue, we can expect to see increasing levels of conflict between social classes. (Observer)

The oil industry in 2020 will be more heavily taxed. That will be the main political impact. (Observer)

**The domestic oil industry has found it difficult to present a persuasive positive image to the public for many years.**



## IV. An Opportunity for New Industry Leadership

“In the past few years, the industry has devoted much attention to internal reinvention with impressive results,” said one industry member. “Is it now timely to seriously consider reinventing our external relationships?” Based on the responses gathered from this study, as well as our interactions and experience with energy clients worldwide, Arthur D. Little believes that it is. By proactively working to improve its relations with other constituencies, the industry will have taken a first strong step toward developing processes to address issues as they arise over the next 25 years.

Working from the material gathered in our interviews and workshops, we have identified four themes that may help guide the industry in its relations with non-industry constituents:

- *Shaping Environmental Policies.* There is a rare opportunity for the industry to provide leadership in developing more broadly based environmental policies.
- *Interacting Effectively on Global, National, and Local Levels.* There is a common view that global and local issues may grow in importance relative to national issues, which were dominant in the past. The challenge for the industry will be to engage and influence other stakeholders on all these levels as part of a coordinated overall strategy.
- *Understanding Differing Worldviews and Building on Similarities.* It is essential for industry to recognize how its views differ from those of other constituencies, and to build on common ground.
- *Planning for Risk and Uncertainty.* The industry should work to develop effective crisis management responses.

This proactive approach to improved relations will need to account for potentially conflicting opinions and differing positions taken within the industry’s own diverse membership. Both industry and other constituencies may need to challenge long-held beliefs and practices and to consider new processes for communicating with each other. New organization structures, such as joint forums, may be needed to bridge existing industry, public interest, and government structures. Finally, the process is likely to require a considerable expenditure of resources—both money and talent.

### A. Industry Image -- The Current Situation

The U.S. petroleum industry is perceived by many today to be its own worst enemy. Despite its development of advanced technology and its central position in the economy, perceptions of the industry have turned decidedly negative since 1970, partly as a result of environmental performance and supply security concerns of the general public (Chart IV-1). Whatever the reasons, the industry must take responsibility for its image. Some of our participants noted that the petroleum industry is regarded more positively in countries other than the U.S.

#### IV. An Opportunity for Industry Leadership

People expect and take for granted the good things that happen and react very negatively to the bad things. (Observer)

The trust that was lost during the 1970s, as a result of price and supply shocks, has still not been regained today. (Observer)

The industry's contribution to the economy and the pervasive use of oil and gas products is well understood by all stakeholders. However, these fundamental understandings may in fact contribute to frustrations. In other industries, consumers perceive they have choices to select alternate suppliers or products, or even to go without using the product. Consumers cannot easily function without oil and gas. Feelings of helplessness and frustration may be redirected at the industry as negative perceptions.

Consumers have a love/hate relationship - they love the product, but hate the companies who provide it. (Customer/Observer Workshop)

The industry is viewed as difficult to deal with, in part because of inconsistent positions among segments and insensitivity to its scale advantages in dealing with smaller groups. From the industry point of view, its scale advantage is not apparent. For example, when 220 million environmentalists are on one side, and the industry on another, the advantage doesn't seem very large. However, the industry does command tremendous resources, and when it deals one-on-one with other organizations, resources tend to be mismatched.

Industry should consolidate its outward approach to the public (provide a consistent view). (Public Interest/Environmental Workshop)

There is the perception that oil companies are politically powerful that far exceeds the reality. (Government/Regulator)

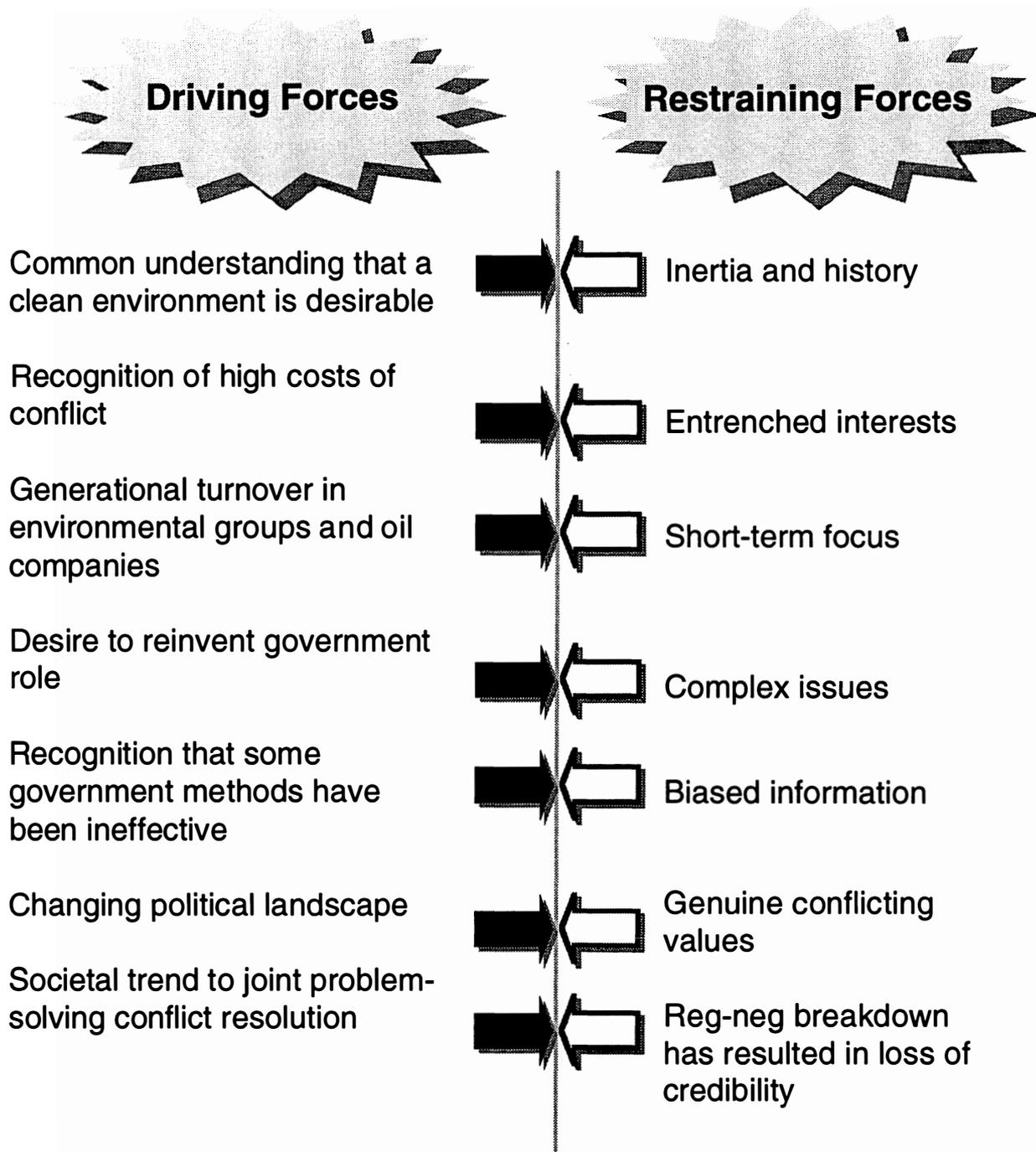
Environmentalists firmly believe that the oil industry has been the most difficult industry to deal with. Obviously, some companies have been exceptions, but mainly the industry has fought the environmentalists all the way. (Environmentalist)

Finally, the industry is perceived as almost willfully neglecting its image. In part, this may stem from a belief within the industry that virtually nothing can be done about the problem. Financial performance expectations have developed a culture in many companies that demands clear returns from efforts and expenditures—including those for public communication. Unfortunately, it is difficult to justify significant expenses for communication and education when the return is not certain.

#### **IV. An Opportunity for Industry Leadership**

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**The industry has a rare opportunity to provide leadership in developing more broadly based environmental policies.**



## IV. An Opportunity for Industry Leadership

### B. Industry Challenges

#### *Shaping Environmental Policies*

In our conversations, we believe we have identified a rare opportunity for the industry to provide leadership in developing more broadly-based environmental policies (Chart IV-2). We have heard encouraging statements, as well as cautionary ones, that suggest the opportunity can be converted into success only through proactive industry leadership.

[We have] support for the process of (regulatory) change through involvement of interested parties. (Customer/Observer Workshop)

We may not be at a point of reconciliation - there is still a lot of work to do. (Public Interest/Environmental Workshop)

Changing trends, attitudes, and performance may have opened an opportunity for greater cooperation and leadership on environmental issues. The recent elections may reflect these changing trends, or may merely be another symptom of a growing disenchantment with traditional approaches which fail to resolve issues, fail to bring about sought-after improvements, and are very costly. Many people believe that these changes are often cyclical, and the pendulum is likely to swing back again. If this opportunity is not seized, another opportunity may not presents itself for a long time.

We have identified several driving forces for improved cooperation that appear to have strengthened in recent times:

- Industry members as well as environmentalists appear to hold a common understanding that a clean environment is desirable. However, there are still differences of opinion about how to define “clean” and how to go about ensuring compliance.
- There is a recognition that conflict leads to high costs. In addition to protracted litigation costs, conflict can result in delays, missed opportunities, and onerous conditions—for both the winning and losing sides.
- We are experiencing generational turnover in both the oil and gas companies and the environmental organizations. Some of the originating zealots in the environmental groups have been replaced by more pragmatic people. Similarly, people in the industry have developed an increasing interest in dialogue. Many large companies have created senior management positions, such as Vice President, Environment. These senior managers can talk with the new pragmatic environmental people from a position of shared common ground.
- There is increasing recognition that some government methods have been ineffective, coupled with a greater desire to reinvent the government role.
- This desire to reinvent government has been articulated by both political parties, and we have seen a changing political landscape that is more conducive to change.

#### IV. An Opportunity for Industry Leadership

- American society as a whole has trended toward greater joint problem solving and conflict resolution. In part, this has been driven by Total Quality Management team-driven approaches, as these techniques have moved out of companies into general society.

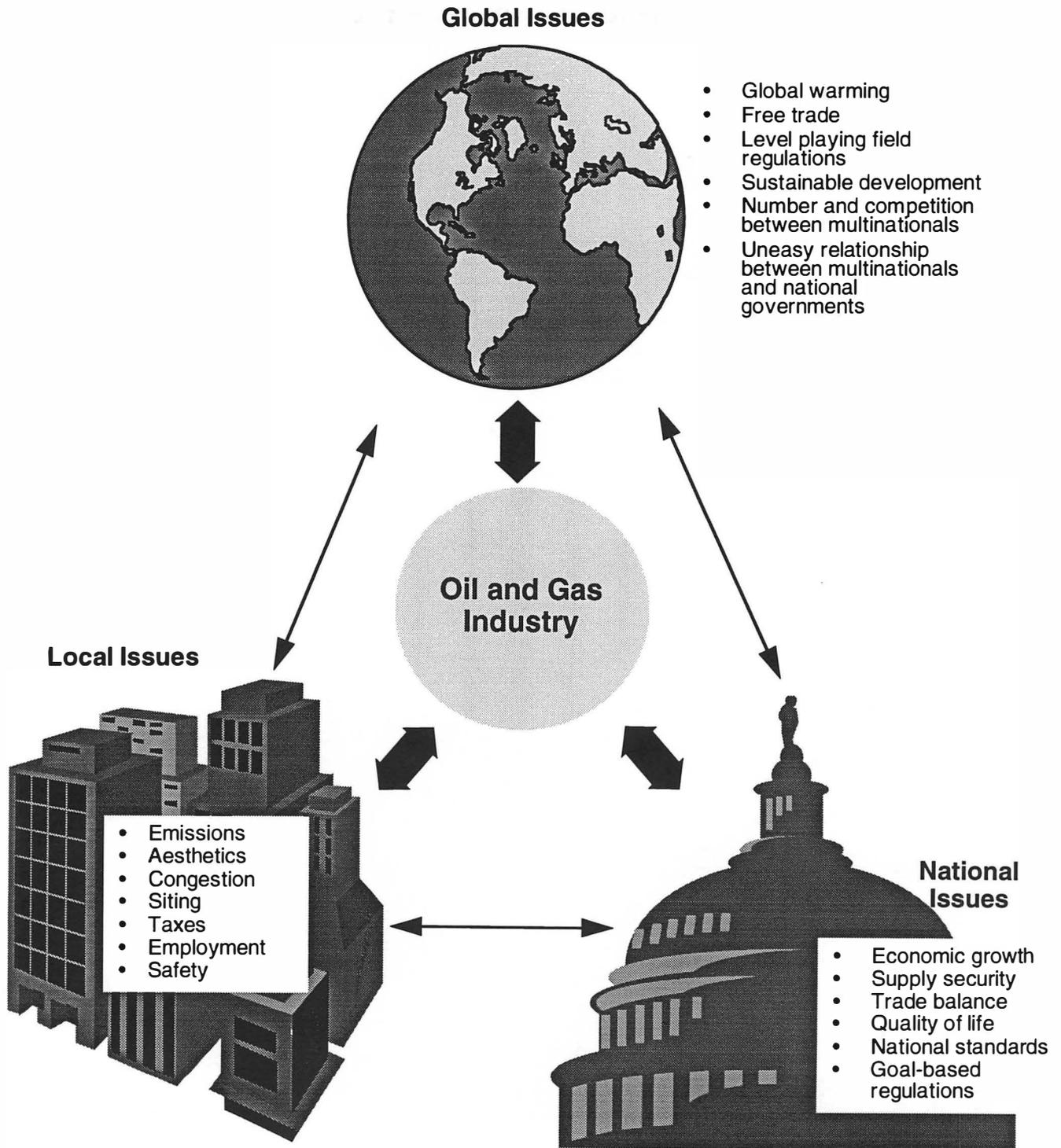
At the same time, significant restraining forces, while perhaps weakening, still exist:

- There is inertia and history. Our past is littered with many confrontations. However, there is also a history of improved environmental performance, and some limited cases where cooperation has led to win-win agreements.
- Some entrenched interests may continue to seek conflict. For example, some cynics believe that strident environmental groups seek conflict to ensure continued media attention and contributions from their supporters. Others believe industry will continue to do battle to further their economic self-interests.
- Because of other pressing and proximate issues, many groups have a tendency to focus on the short term. A short-term win arising from conflict is often viewed as good, even when it poisons relationships and makes future interactions worse. A longer-term view is more likely to consider previous wins and losses, and seek a balanced approach. Extensive game theory research suggests that, when players adopt strategies which consider a longer view of interaction, cooperation occurs spontaneously to maximize overall benefit.
- The underlying environmental issues are highly complex, with major uncertainties in science, technology, impacts, and efficacy. For example, we may never understand global warming. Even a limited understanding of the issue takes time and effort, and information may be biased (or perceived as biased) because of its association with a particular advocacy group. Good science is cynically viewed as “that science which supports my view.” Yet to resolve issues, we need a common understanding of underlying physical phenomena and without this understanding agreements will be difficult to reach.
- Often, conflicts grow out of genuinely conflicting values where no reconciliation is possible. The key here is to build on common ground. Industry and environmental groups should ensure that the value-driven, irreconcilable conflicts do not eliminate the potential for cooperation in other areas.
- Reg-Neg (regulation-negotiation) was being used successfully to develop common approaches, but suffered a breakdown late in the RFG regulation process. Many in the industry felt betrayed, encouraging cynics to resist future efforts to seek consensus. Since then however, some limited success has been gained in other areas. Reg-Neg participants may regain their credibility through continued consistent performance according to the agreements. At the least, the Reg-Neg breakdown should be viewed as a learning opportunity.

#### **IV. An Opportunity for Industry Leadership**

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**There is a common view that global and local issues may grow in importance relative to national issues.**



## IV. An Opportunity for Industry Leadership

### *Interacting Effectively on Global, National, and Local Levels*

In the past, conflicts between constituents have tended to focus at the national level, with more limited involvement at state or local levels. In the future, many people believe that the focus will shift to global and local levels, with the national level being reduced in importance (Chart IV-3). The national level may focus on assuring common standards across the nation, while taking account of regional differences in environmental conditions.

Expect some tensions between national governments and global companies.  
(Industry)

Multinational corporations will have a far greater role in the government of the globe, and will take on additional power relative to national governments.  
(Environmentalist)

Environmental issues will be local issues, and the expectation will be local answers. People will not accept as answers, environmental regulations that are of a national nature, unless they deal with their local concerns. (Observer)

The environmental movement is recognizing that the action will increasingly be at the local grass roots level. The central organizations are not necessarily popular among the local groups. (Environmentalist)

The industry will face a challenge in dealing with these multiple levels. The opportunity for conflicts is likely to increase, as more constituencies are drawn into the issues, and more complexity is created. Communication will be made more difficult and expensive; even monitoring efforts will become resource-intensive.

At the global level, issues such as global warming, free trade, and sustainable development will require international cooperation on an unprecedented scale. The industry will need to learn to inform and influence these multiple governmental and non-governmental groups. In many cases, there will be an uneasy relationship between the national governments and the interests of multinational corporations. We live in a very complex and interlocking world, and industry will have to adjust. At the same time, U.S. companies are likely to face increasing competition from an increasing number of strong, new multinational competitors. A global management focus may be required to compete effectively, as resources, scale, and speed increase.

On the local level, communities are likely to become the centers for conflict on environmental issues, such as emissions, aesthetics, congestion, and siting. In addition, they will have great concern about local tax revenues, employment, and public safety. The nature of the industry requires it to routinely operate in local communities. For example, oil and gas can be produced only where geological deposits exist; if these sites conflict with other desired uses, the industry cannot “set up shop” elsewhere—it must either resolve the local conflict or abandon the prospect. Similarly, distribution and sale of petroleum products, including natural gas, are also local businesses. The industry

**To resolve issues over the next 25 years, it will be important for the various stakeholders to consider each other's worldviews and seek common ground.**

**The industry** generally believes the global economy will expand rapidly, fired by the Far East, supported by incremental changes to technology and the capital stock. Free trade, open markets, and light-handed government regulations will enable oil companies to fuel the growth with abundant supplies of moderately priced oil and gas.

**For environmental and consumer groups,** risks in the more distant future take on a present reality, and risks of low probability are taken very seriously. They seek solutions mainly in a combination of demand management and quantum technological advance.

**Government** is concerned with responding to current issues (such as regulatory reform, competitiveness and near-term economic growth), and developing pragmatic policies within the constrained realities of politics.

#### IV. An Opportunity for Industry Leadership

must find ways to manage local issues by providing information and coaching, within a context of global issues that may not be well understood at the local level.

##### ***Understanding Differing Worldviews and Building on Similarities***

Each person, each member of a constituency group, including the industry, generally operates in a consistent and rational way. However, opinions and behavior of these individuals and groups are often quite at odds since they are based on differing views of the world. In resolving issues over the next 25 years, it will be important for the industry to consider the underlying worldviews of other constituencies. The key will be to identify useful commonality, while avoiding prejudice. Although the different constituencies are highly diverse within themselves (there are few monolithic groups), there are some common threads in their worldviews (Chart IV-4).

##### ***Industry***

The industry generally believes we are entering a period of rapid global economic expansion, fired by the Far East, supported by abundant supplies of moderately priced oil and gas, with continuing incremental changes in technology and capital. It further believes in limited intervention by government, and expects free market forces to result in strong and constructive competition between an ever changing set of companies of differing sizes and business focuses.

Developing 'tigers', such as India, China, and Brazil, will grow at 3-4 percent per capita GDP (6 percent overall GDP annual growth). These will achieve development equivalent to the U.S. current standard of living by 2020. (Industry)

Plan on flat prices. Though the potential for price spikes exists, sustained growth in real terms would likely trigger creative responses in both supply and demand. Prices could be lower [in the future] than today in real terms. (Industry)

##### ***Public Interest Groups***

Environmental and consumer groups do not necessarily disagree with the industry view. However, they believe that future risks and low-probability risks should be taken very seriously. Something that could change the world dramatically in 50 years time may be as important in their value systems as something that happens tomorrow. Furthermore, they strongly recognize that unfortunate incidents can occur even with low-risk activities and perceive that the consequences can be dire and alarming.

The views of individuals within public interest groups are often infused with spiritual overtones. Some individuals may find an element of spiritual satisfaction in a reduced-consumption lifestyle. For them, traditional measures of economic growth, such as gross aggregate consumption or GDP, are not a key driving force. Environmental groups tend to identify oil and gas demand management and quantum technology advance as solutions to their concerns.

The euphoric consumption levels of American consumerism are deadly to global resources and are not sustainable... People must adopt better personal ethics and

#### IV. An Opportunity for Industry Leadership

base their personal behavior on facts coupled with ethics. A spiritual change is needed to maintain the behavioral changes. (Environmentalist)

The oil industry has been resistant in acknowledging the threat of global climate change. (Environmentalist)

Rather than being the cheapest, most economic form of energy, petroleum is actually a high-cost method of providing the end-use services desired by consumers. Government should focus on least-cost solutions—conservation. (Environmentalist)

The US should increase gasoline taxes by \$1-2 per gallon and possibly add CAFE standards which would require 45 miles per gallon to be achieved by new vehicles. (Observer)

##### *Government*

Government is concerned with current, pragmatic policies and issues, such as regulatory reform, competitiveness, and near-term economic growth, within the constrained realities of political policies. Government is often tightly constrained within its framework, and, especially with ongoing budget cuts, has limits at any time on what it can do.

[We have concern about] devolution of regulations from the federal to state and local jurisdictions such that the latter become more burdensome than the national standards. (Government/Regulator)

[The U.S. should] develop regional decision systems for federal energy policy [and apply them] to prospects like California's Outer Continental Shelf - [We should] use different arrangements [and] a variety of approaches. [It's] OK if you have different regulations in different regions. (Government/Regulator Workshop)

#### **IV. An Opportunity for Industry Leadership**

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**Industry should expect and plan for the unexpected.**

**Geopolitical**

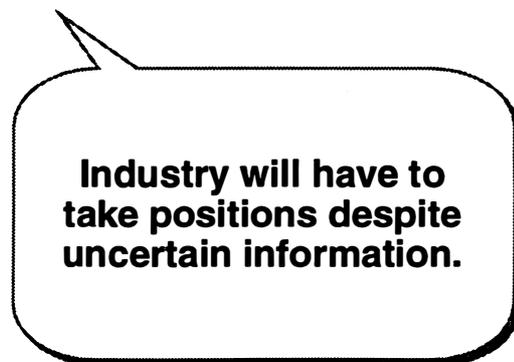
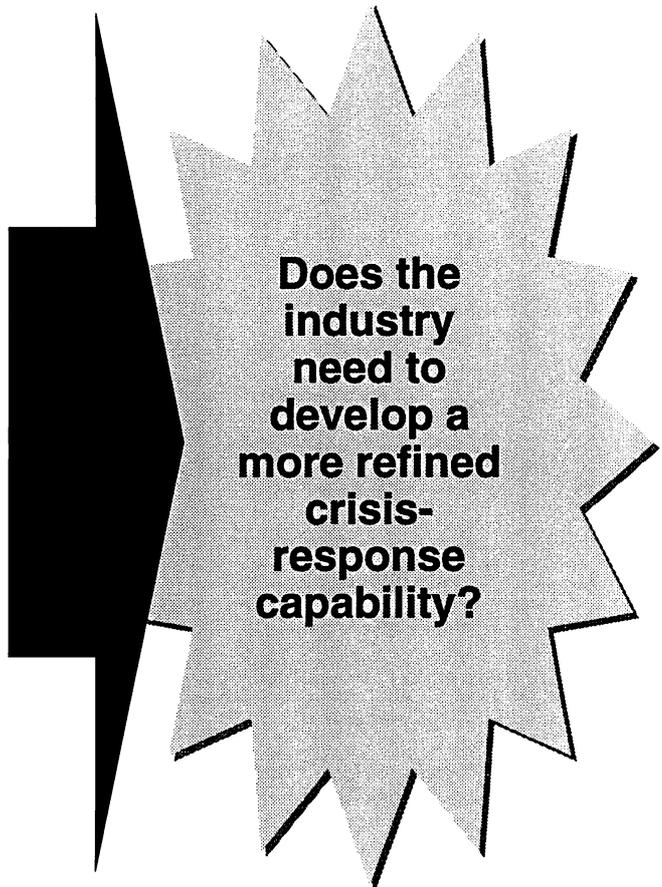
- Rearrangement of political borders
- Instability erupting unpredictably around the world
- OPEC behavior

**Environmental**

- Continuing uncertainty in the science
- Future incidents
- Diminishing tolerance for incidents

**Technology**

- Increasing substitutability of energy forms
- Possibility of the 300 mpg car
- Impact of telecommunications on workplace and travel patterns



## IV. An Opportunity for Industry Leadership

### *Planning for Risk and Uncertainty*

Industry should expect and plan for the unexpected. Key uncertainties arise from geopolitical instability, environmental impacts, and technology change (Chart IV-5). Industry may need to develop a more refined crisis response capability to deal with inevitable crises. In addition, industry will need to adopt policy positions despite uncertain information.

Uncertainty about the future is unavoidable. As one industry observer said, “Whatever we think is going to happen, isn’t.” Together, we can develop educated opinions about future scenarios—but we can be 100% certain only that some elements of those scenarios will ultimately be wrong. Nevertheless, we can identify key uncertainties in three major areas: geopolitics, the environment, and technology.

In geopolitics, we can expect continued change. We will likely see rearrangements of political borders—some candidates include Russia, the Middle East, Canada, and even the U.S. There will be continued instability in international relations and national governments’ policies. Sometimes these instabilities will erupt with dramatic effect on the oil and gas industry. Lastly, we should expect international trade to exert a greater influence on world affairs. Market forces could dramatically change some institutions, such as OPEC.

China has annexed Siberia. (Customer/Observer Workshop)

International politics and especially international trade will have major impacts on the oil industry in the year 2020. (Observer)

In the environmental area, high public concern will be coupled with future uncertainties. In global environmental issues, such as climate change and sustainable development, there are major uncertainties about the fundamental physical phenomena, as well as the efficacy of solutions. The industry will also experience local environmental incidents, such as spills. These incidents will take on greater significance, since the public tolerance for them appears to be dropping.

It is highly plausible to expect to see a major climatic disaster over the next 25 years. (Observer)

Today’s children have been educated to see environmental protection as a key element of quality of life. (Customer)

In the technology area, the continuing development and commercialization of new technologies could have a significant impact on demand for oil and gas products. We may see increasing fungibility of energy sources, where electricity, gas, and oil can be increasingly substituted in end uses. This would have a tremendous impact on existing production and distribution infrastructure for oil and gas products. Distributed electricity generation, electric or natural gas vehicles, hyper-efficient cars, and other technology advances could also have significant effects on industry size and structure.

#### **IV. An Opportunity for Industry Leadership**

Technology advances in telecommunications could have a dramatic effect. Will we sit at home doing our work, and not travel at all? Or will we put our office in our pocket and travel everywhere?

**It is difficult to predict how technology will impact oil, but we can be sure that the impact will be large. (Industry)**

The only way to deal with the inevitable uncertainty is to expect and plan for it. As in the past, the industry must continue to provide the flexibility to respond to a changing set of challenges.

There are two areas where industry may need to build the capability to deal more directly with these uncertainties. First, a more refined crisis response capability might be helpful in dealing with the eruptions of geopolitics, as well as with unfortunate environmental incidents. By providing an industry-wide response, more resources could be brought to bear, and industry solidarity might be more reassuring to the public.

Secondly, industry will be forced to adopt policy and strategy positions despite having only uncertain information available. Industry decision processes should deal with the uncertainties of the global environmental and technology change issues and develop sensible positions early on in the debate, or run the risk of having the basis for policy decisions defined by other constituencies.

Ultimately, the lesson that we have learned from this extensive dialogue with intelligent, informed and committed people from a wide variety of backgrounds can be summarized in a simple but important message. The industry has an opportunity to show greater leadership in the next quarter century, and move away from the largely reactive and defensive posture of the past quarter century. If this leadership opportunity is taken responsibly, with appropriate involvement of the other constituencies that have a valid and important interest in the future of the nation's energy and environment, then the outlook for the nation's economic and environmental development will be substantially enhanced.

## Appendix A: The Value of the Industry

At the request of the National Petroleum Council, we provide this section to supplement an economic study of the petroleum sector conducted by a separate contractor. This section reports qualitative statements made by our participants regarding the value of the oil and gas industry to the nation. Comments centered around five major areas:

- The industry is large and growing
- The industry is vital to the economy
- The industry is efficient and technologically advanced
- The industry benefits other stakeholders
- The industry meets consumer needs

*Value: The U.S. oil and gas industry is large and growing.*

Participants generally expect there to be plenty of oil and gas, into 2020 and beyond.

Natural gas resources in North America (Canada, the U.S. and Mexico) are abundant and can support substantially increased consumption in the transport sector as well as its traditional end use sectors. (Industry)

There will be abundant supplies of natural gas available in 2020. Huge reserves in Canada and the United States will be tapped. (Government/Regulator)

Participants generally recognized the large size of the industry.

The oil industry infrastructure is unbelievable with tremendous scale enabling it to deliver tremendous volumes. (Industry)

It is difficult to believe that the public would not be impressed if they understood the full story of the huge and complex network that provides all kinds of comfort in a cost efficient way, by finding and developing oil in the most hostile locations geographically and politically, and bringing it to market in a form that provides environmentally sound fuels. This is currently just taken for granted. (Industry)

There will be a bigger industry with large partnerships between international states and oil companies. (Observer)

There is debate over whether the domestic industry will grow or not, but the international industry is expected to grow strongly.

*Growth:*

The domestic oil industry in 2020 will be very robust. Petroleum products will continue to be strongly demanded for their use as transportation fuels. In addition, fuel oil use may increase for electricity generation. (Government/Regulator)

## Appendix A: Value of the Industry

Global oil consumption is growing rapidly, driven by increasing automobile ownership and increasing miles driven in newly industrializing countries in Asia and South America. (Environmentalist)

### *Non-Growth:*

It is hard to conjure up a scenario with robust [U.S.] demand growth for liquid products. Most scenarios seem to fall in the range of a modest increase to a severe decline in demand. (Industry)

Energy demand will be pretty flat in the OECD countries. Oil demand will be flat, but gas may gain a little. (Industry)

*Value: The U.S. oil and gas industry is vital to the economy.*

Participants recognized that the industry allows the U.S. to compete globally.

The fact is that the world today is an oil economy. Oil is a remarkably versatile fuel and is still the driver of the world economy. (Environmentalist)

Oil is part of a complex international trade web and U.S. companies must be involved. (Industry)

There is no doubt that the oil industry is of the utmost importance to the nation's economic and military security. (Industry)

The oil and gas industry is the single most strategic industry for the future of the United States. (Observer)

Many participants believe that oil will still be the dominant fuel source in 2020.

The energy source mix will strongly favor oil, since it has the best economics and availability. (Observer)

In the United States, transportation fuel demand will continue to rise from current levels near 10 MMBPD. As yet, there are no alternates to oil. (Observer)

The industry financially supports the U.S. Government through large royalties and taxes.

Oil and gas royalties are one of the largest sources of revenue to the federal government (Industry)

*Value: The U.S. oil and gas industry is efficient and technologically advanced.*

The industry promotes efficiency.

## Appendix A: Value of the Industry

The oil industry has made similar progress in efficiency and lowering costs to consumers as Wal-Mart and Eckerd drugs. The customer does not recognize how efficient it has become. (Industry)

There is tremendous environmental value in energy efficiencies associated with natural gas. (Environmentalist)

The industry promotes technological advances.

In the energy business, we have seen tremendous improvements in technology, although the industry has not promoted nor discussed those widely. (Government/Regulator)

We bring the cutting edge of technology, not just for oil but also for telecommunications and information systems. We provide the means for modernization and an end to isolation (e.g., Burma). The industry brings a whole value package. It is efficient and competitive. (Industry)

We are drilling in 7,000 ft of water; size is needed to take such risks; small companies cannot do this; we can use the technology in many places. (Industry)

We have also made tremendous progress in the environmental performance of oil product terminals, and should publicize the improvement. (Industry)

Participants believe that the industry will continue to improve technology and increase efficiency.

The trade-off between environment and economics will not be the same as today - technology will facilitate our ability to have our cake and eat it too! (Customer)

Technology in the future will have shown continued steady progress in reducing exploration and drilling costs. (Observer)

Technological advances will have also resulted in significant breakthroughs in being able to produce oil from locations that currently are not technically feasible. (Observer)

Better technology and increasing use of secondary and tertiary recovery will permit higher domestic production from existing reservoirs. (Government/Regulator)

The industry will continue to get more efficient. (Industry)

*Value: The U.S. oil and gas industry benefits other stakeholders.*

The industry supports the environment and developing countries.

My company spent \$7 billion last year on the environment. (Industry)

## Appendix A: Value of the Industry

Our company has set the environmental standard for the industry with its proposals in Bulgaria. (Industry)

RFG and replacement of the auto stock will have substantially cleaned up auto emissions. (Customer)

We add a lot of value, particularly in the developing countries, and they understand [that] (Industry)

The focus of environmental concern has changed.

The population is fairly comfortable with the current level of environmental cleanliness and are beginning to show concern about costs associated with cleanup. (Government/Regulator)

Lots of the problems that have been highlighted by the environmentalists are now fixed. (Industry)

We have dealt with the big [environmental] things; now [we are] dealing with small benefits for big costs. (Customer/Observer Workshop)

Not everyone believes the industry is doing its share in the environmental effort.

The perception is that the industry must be coerced into environmental compliance, and cannot be trusted to police itself. (Government/Regulator)

Industry should not exploit third world countries lower standards - don't use lesser technology. (Public Interest/Environmental Group Workshop)

*Value: The U.S. oil and gas industry meets consumer needs.*

The industry fulfills American citizens' love of driving.

People will continue to commute and will select personal automobiles as the transportation method of choice...car pooling has not succeeded and is unlikely to succeed in the future. Automobile traffic will continue to grow with increasing population. (Observer)

Twenty-five years from now people will still be in love with their automobiles, and still unwilling to put up with inconvenience in their use of cars or transportation in general. (Observer)

Driving habits in the U.S. are also likely to remain similar...people like to get out, and cars provide an excellent opportunity to satisfy this desire. (Environmentalist)

## **Appendix B: The Interview/Workshop Methodology**

The NPC hired Arthur D. Little to assist in obtaining a broad base of experiences and perceptions to identify the issues and policies that will most likely affect the oil and gas industry over the next 25 years and to identify potential processes for their resolution. Our independent status allowed us to probe sensitive issues with interview and workshop participants. We then presented the responses as we heard them.

We interviewed 45 people, and 46 others participated in three workshops (please see the Introduction for the list of participants). The workshops each represented a distinct constituency: government policymakers and regulators (16 participants), public interest and environmental organizations (14 participants), and industry customers and observers (16 participants). By holding separate workshops we were able to contrast perceptions of the three groups regarding key issues and policy options.

Throughout the process, we worked side-by-side with the NPC's Coordinating Subcommittee on Future Issues. We worked together to select the participants, agree on interview content, plan the workshops, and synthesize the findings.

### **Selection of Participants**

Participants were selected from a pool of 250 names identified in several joint sessions with members of the NPC's Coordinating Subcommittee on Future Issues. The intent of the selection process was to ensure balanced participation from all stakeholders: members of the petroleum industry, customers, public interest and environmental groups, government policymakers and regulators, and industry observers.

These thought leaders hold responsible and important positions in their constituency groups. As such, they tend to be well progressed in their careers and at a senior level. It should be recognized that tomorrow's new generation of thought leaders, who will have risen to positions of responsibility by 2020, may not be well represented by this participant group.

The participants have access to information and experience which makes them knowledgeable about the industry and its issues. We sought their personal opinions, which may have been based on differing sets of data and analyses. Consequently, there may be contradictions in facts and opinions expressed in this process.

### **Interviews**

Interviews covered five topic areas for both the U.S. in general and the oil and gas industry in particular:

- How have things changed in the last 25 years, since 1970?
- What is your view of the future in the year 2020?
- Why do you believe this will happen?
- In what way might we reach this end-state?

## Appendix B: The Interview/Workshop Methodology

- What are the significant issues we are likely to face in this 25-year period, what warning signs should we look for, and how might the issues best be resolved?

We used a conversational interview style to enable spontaneous responses, enhance creativity and allow exploration of new areas and ideas. A prompt list of scenario drivers (including technology, environmental, consumer, political, supply, societal, and industry structure drivers), and a prompt list of issues (including government policy issues, issues under companies' control, and issues affecting public perception) were used to stimulate the conversations. Because interviews often covered different questions and material differently, this method does not allow for rigorous statistical analysis, but does provide a rich database of qualitative views and opinions.

Members of the NPC Future Issues Subcommittee observed the proceedings so that they could better understand the issues, concerns, and actions discussed in the groups. The Subcommittee members sat behind the participants, took notes, and later reviewed the workshop discussion to identify key learnings.

The workshop process was split into large group and small group sessions. In the large group, participants:

- Reviewed the preliminary results of interviews and voiced their comments;
- Identified critical issues facing the U.S. with respect to its oil and gas industry over the next 25 years;
- In addition, the government policymaker/regulator and the public interest/environmental group workshops analyzed the driving and restraining forces with respect to resolution of selected issues;
- The industry customer/observer workshop visioned the world in 25 years, including American society and specific factors affecting the oil and gas industry.

In the small group sessions, participants:

- Prioritized the issues,
- Further refined selected issues,
- Identified stakeholders, and
- Identified and prioritized specific policies and actions.

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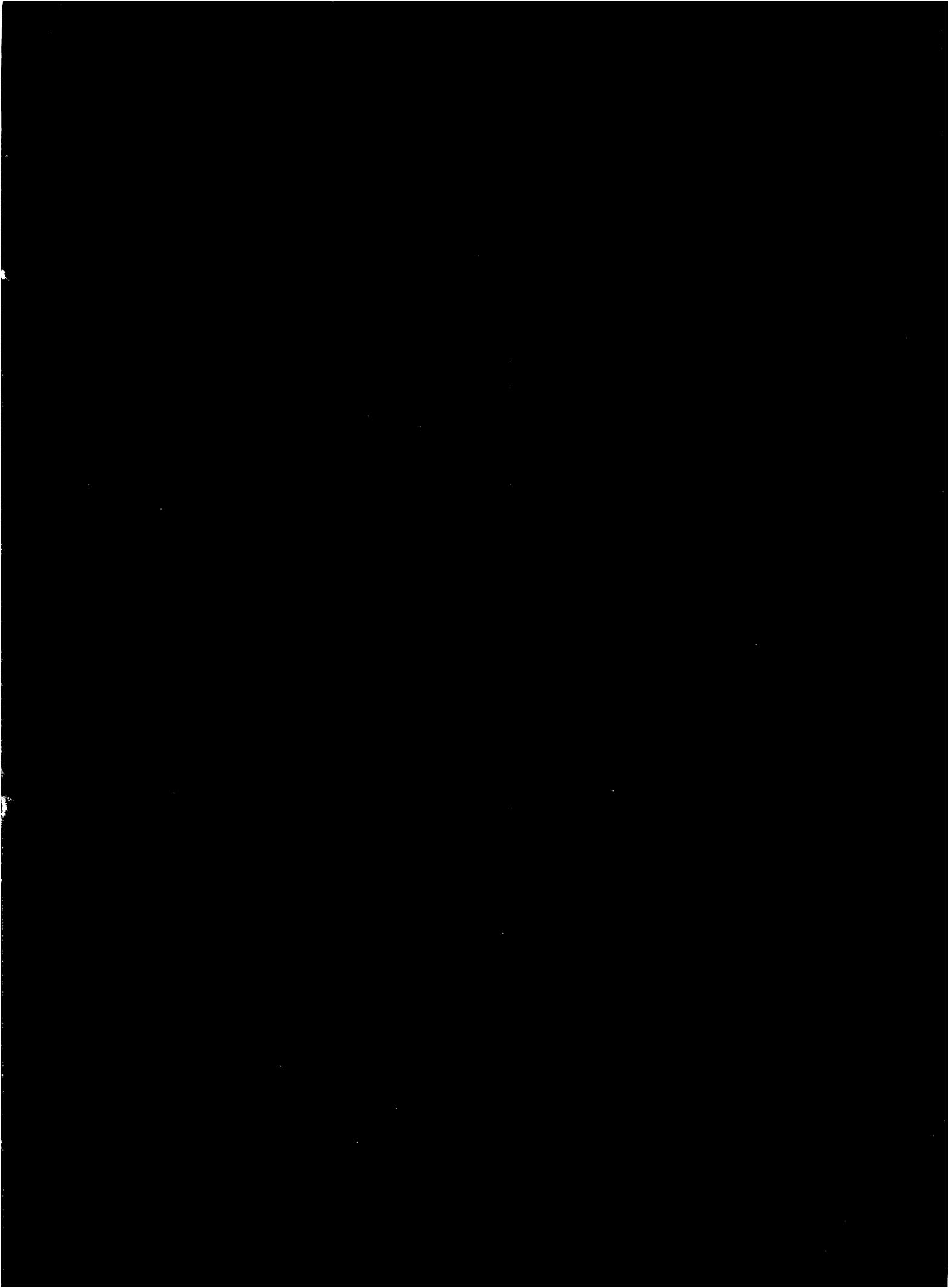
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