THE ENERGY COUNCIL
NATIONAL ENERGY STRATEGY
AND
BACKGROUND PAPER - 2001

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Introduction

The United States of America faces an overwhelming demand for energy. The growth of the nation's economy, especially in the cyber-technology sector, has highlighted our dependence on energy and power. Our society and our economy require reliable power, at stable prices, with ever decreasing environmental impacts.

The good news is that the U.S. has an incredible wealth of varied energy resources. To fully benefit from these resources we must overcome fuel constraints and solve environmental challenges. To do this as a society, we must focus our policy efforts on conservation (maximizing the value of energy), access (to develop energy resources, improve transmission and assure generation of power) and energy technology (to improve efficiencies and lessen environmental impacts).

We are strengthened by an integrated North American energy market but diminished by our society's lack of understanding of energy economics and technology. Just as we move to improve efficiency through technology, our political leaders and regulators must be working to improve regulatory efficiencies. Energy education represents a significant challenge for both the public and private sectors.


We hope both the Strategy and the Background Paper are helpful in a thoughtful and thorough national consideration of energy policy.
NATIONAL ENERGY STRATEGY

Goal

It shall be the goal of the United States' energy strategy to provide a stable supply of reasonably-priced energy in an efficient and environmentally-sound manner to meet the needs of its citizens, economy and national security interests. The U.S. shall assure access, improve efficiency and minimize environmental impacts of energy production, transmission and consumption by emphasizing technology and education. Energy independence shall be the long term goal of the United States.

Conservation

It shall be the energy strategy of the United States to promote energy conservation, improving energy efficiency. Conservation measures shall build upon previous efforts including Corporate Average Fuel Efficiency Standards for automobiles; energy efficiency provisions in building codes (including lighting efficiency standards); home appliance, heating and cooling unit efficiency standards; waste recycling or reduction standards for industrial manufacturing and energy conservation education.

The Federal government should provide direct tax-related incentives to consumers making energy efficiency housing or vehicular investments.

The development of economically competitive, energy efficient technology in the power, transportation, industry and building sectors should be a top priority of the federal government, as a partner with industry, states and academia. Partnerships with industries are particularly important if the resulting conservation technology is to be commercially viable. The national laboratories should play a leading role in this technological effort.
Subsequently developed energy conservation technology will not only help domestic productivity but may become a valuable export commodity, as well. Basic energy conservation research funded by the government shall include superconductivity studies.

**Crude Oil**

It shall be the strategy of the United States to promote the environmentally sound production of domestic energy resources, to ensure the conservation and efficient use of energy resources, and to diversify sources of energy imports.

It shall be the policy of the United States to support and encourage domestic production of crude oil in an environmentally sound manner in order to supply U.S. consumers with a secure source of petroleum, and to provide a stabilizing influence on the world price of crude oil. In this regard, taking the lead of the states, the federal government shall provide tax and tax accounting incentives to oil producers for domestic exploration and development efforts and institute a specific National Marginal Oil and Gas Well Security Program.

Regulatory coordination between state and federal governments is critical and such cooperation shall extend to the management of public lands. An enhanced offshore federal revenue sharing program for coastal states is recommended to assist state and local governments in offsetting the infrastructure demands of offshore development. The federal government is urged to undertake simplification of federal regulations affecting oil and gas exploration and production. Additionally, a comprehensive federal royalty-in-kind program shall be implemented to apply to offshore areas. Further, a federal royalty-in-kind program shall be implemented onshore, to allow states at their option to assume marketing and administrative functions from the federal government.
It shall be the policy of the United States to assure that energy resources are utilized in a manner that recovers the most energy value possible. Similarly, it shall be the strategy of the United States to fund research and development to diversify its source of energy supplies, particularly for the transportation sector and primary modes of personal transportation. Enhanced oil and gas recovery from known reserves shall be promoted, and a research, development, demonstration and commercialization program for unconventional sources of crude oil shall be pursued through a cooperative effort among industry, higher education and the national laboratories.

It shall be the policy of the federal government to encourage diversification of import suppliers, to pursue a Pan American Energy Alliance with Western Hemispheric producing nations, and to open a dialogue with suppliers worldwide. It shall also be the policy of the United States to maintain the Strategic Petroleum Reserve, at least to its present capacity of about 570 million barrels. Any additions to the SPR should be purchased from domestic suppliers.

It shall be the strategy of the United States to support active management for the development of federal lands, public trust lands and Outer Continental Shelf areas in accordance with principles of multiple use and to recognize the potential that public lands hold, particularly in Alaska, for environmentally-sound development of all energy resources.

**Natural Gas**

It shall be part of the strategy of the United States to promote energy security through the use of clean, efficient natural gas in residential, commercial, industrial, utility and transportation applications. Such use shall include the use of natural gas with other fuels for efficiency and environmental purposes.

The United States shall promote and encourage domestic production of natural gas in an environmentally sound manner by providing tax and tax accounting incentives to producers of natural gas.
The United States government shall join with states and stakeholders to raise public awareness of the benefits of natural gas. Congress and the Administration shall work with the states to resolve access issues for exploration and development, as well as transmission and distribution. Efforts to weigh the advantages of gas use, the specific resource potential, the environmental sensitivities of affected lands and the applicability of high tech/low impact solutions should be encouraged.

The United States shall continue to support and expand research and development efforts to transfer and commercialize technology and expertise to the natural gas workforce through education and training programs coordinated with the private sector.

Federal agencies shall work with state governments, universities, national laboratories, and international partners, as well as the private sector to establish and support long term research goals, including basic and developmental research. Such research shall seek to promote efficiency, safety and environmental stewardship in the exploration, production, transmission, storage, distribution, consumption, and other infrastructure needs of natural gas. Part of this program will be to assure the integrity, safety, protection and efficiency of the nation’s natural gas storage and delivery systems.

Coal

Coal is the most plentiful fossil energy resource in the U.S. Coal generates well over half the nation’s electricity. It is economically, as well as environmentally, imperative that technology continues to be developed to address coal combustion efficiency, emission concerns and the viability of this resource.
Renewable Energy

Renewable energy sources are characterized by a broad range of technologies, costs, efficiencies and environmental concerns. Recognizing this spectrum of resources, it shall be the strategy of the United States to institute a long range, stable Renewable Energy Development Program that identifies and assists renewable energy sources from research and development through demonstration projects and commercialization in a cooperative effort among industry, higher education and the national laboratories.

Renewable energy resource development must be ranked and funded on the basis of factors including energy efficiency, economic competitiveness, environmental impacts, and technological adaptability. Part of this program, and critical to its success, is federal development of alternative technologies that improve renewable energy efficiencies, cut costs, and assist in integrating renewable energy into existing energy systems.

Electricity

The U.S. electricity sector today is marked by tremendous diversity; for instance, there are differences in existing electrical networks, the number and types of customers, access to the interstate grid, rates, environmental considerations and fuel usage.

State and local governing bodies are close to consumers, utilities, industries, and are concerned for the economic well being of their states and local communities. They are in the best position to evaluate consumer needs, questions relative to fuel choice, economic development implications, the best manner in which to implement competition, and system reliability. Therefore, implementation of federal legislation that fails to maintain diversity and overrides state legislative or regulatory directives will harm consumers and the economy.
Electricity research and development efforts shall be intensified with regard to energy efficiency, superconductivity, advanced and reasonable environmental controls in power generation, distributed generation, fuel cells and the development of cost-effective renewable supply technologies. The development of safe and efficient electric vehicles shall also continue to be pursued.

Nuclear power must continue as an essential component of the nation’s electricity system, providing reliable, clean-air base load power. Neither deregulation policies nor relicensing regulatory delays should be allowed to impair the ability of domestic nuclear plants to continue to provide the nation with emission-free base load power. Further, the federal tax code should be updated to maintain deductibility of decommissioning expenses.

The Department of Energy shall continue to characterize a repository for the disposal of used nuclear fuel and begin to operate such a repository as quickly as is safely possible. The federal government has a legal responsibility to manage commercial reactor fuel. Congress must assure that payments made by law into the Nuclear Waste Fund for construction and operation of a repository under current Department of Energy milestones be available for such purpose.

Responsibility for reliability and long range planning shall be established. Aging infrastructure and access for construction of new infrastructure shall be addressed. Maintaining reliability of the U.S. electricity system shall be a primary goal of policy makers and industry participants, alike.
Energy conservation is an essential part of any energy strategy. The efficient use of energy saves money, prevents waste, stretches the resource base, and reduces emissions associated with the use of energy.

Energy conservation has been a success story in the United States over the last few decades and the nation is poised to make further progress. Figure 1.1, "Energy consumption and GDP, 1970-1999", illustrates recent efficiency gains by comparing energy use to significant increases in U.S. gross domestic product (GDP).

Figure 1.1
Energy Consumption and GDP, 1970-1999

Source: Annual Energy Review 1999, DOE/EIA-0384/99 (pg. 12)
However, in terms of total energy usage, a growing population and robust economy have overwhelmed the productivity improvements so that both total consumption and per capita consumption of energy have increased. Overall, the U.S. spends a half trillion dollars a-year on energy; consequently, even small increments of conservation amount to large financial savings for consumers and taxpayers.

The U.S. energy efficiency program focuses on four major areas of energy use: transportation, buildings, industry and the federal government.

The energy efficiency challenge in terms of transportation is not only to make vehicles more fuel-efficient but also to find ways to decrease demand for travel. Relative to fuel efficiency, the nation's Corporate Average Fuel Efficiency (CAFE) standards have led the country to more efficient automobiles. However, changing consumer preferences for light trucks and sports utility vehicles, which are not held to the same efficiency standard as automobiles, have meant increasing fuel consumption overall in the U.S. transportation sector.

The problem of increasing energy use despite energy conservation gains is demonstrated in Figure 1.2, "Motor Vehicle Efficiency." Although the fuel rate (miles per gallon) has increased remarkably since the 1970s and fuel consumption (gallons per vehicle) has decreased, mileage (miles per vehicle) has increased, as has the total number of vehicles (not illustrated).
Motor Vehicle Efficiency

Figure 1.2

Source: Annual Energy Review 1999; DOE/EIA-0384(99) (pg. 12)

Mileage per vehicle has increased at a steady rate of more than 3 percent per year over the last 40 years. Factors affecting vehicular mileage include population growth, regional population switches, declining costs of driving and declining use of alternatives to driving.

One bright spot is change in work patterns attributable to the telecommunications revolution, which permits an increasing number of people to office at home. However, traffic congestion in urban areas continues to cause inefficient consumption of energy.
The U.S. Department of Energy's Partnership for a New Generation of Vehicles (PNGV) is a government-industry cooperative research effort to develop more efficient, commercially viable vehicle technology. Such a partnership approach assures that industry concerns about commercial viability may be answered as the project proceeds rather than requiring a separate dissemination process to "sell" the new technology after it has been developed. Government participation in other cooperative agreements like the U.S. Advanced Battery Consortium have allowed companies to pool technical knowledge and funding in addressing industry-wide challenges to energy efficiency technologies.

Government-directed industry energy conservation efforts have focused on nine industries which account for 75 percent of the energy used in industry. (The nine industries are forest products, steel, aluminum, metal casting, chemicals, petroleum refining, agriculture, mining and glass.) The federal program, "Industries of the Future", is focused on developing technologies that assist these sectors in becoming more resource efficient and economically competitive, while producing less waste.

Energy conservation efforts for buildings focus on construction, renovation and operation efficiencies. Federal and state governments work together with the building industry on building code projects, as well as research and development projects to improve lighting, heating, cooling and ventilation processes.

Weatherization programs for low-income residential energy consumers promote energy conservation through state administered programs. Appliance standards for energy efficiency, federally promulgated in the 1980s have also proved successful in promoting energy conservation at the consumer level.
The nation's largest energy user, the U.S. government, has made some impressive strides in energy efficiency over the last decade. Between fiscal year (FY) 1985 and FY 1996, the overall real cost of energy consumption of the Federal government has fallen from $14.6 billion to $7.7 billion. In terms of building efficiency, the Federal Energy Management Program (FEMP) expects to reach a 20 percent reduction in energy consumption in federal buildings in 2000, on a per square foot basis, from a 1985 baseline.

Recently emerging energy management technologies have led to the development of an energy service industry. Consumers are provided tools to manage energy consumption in a more efficient and cost effective manner. Consequently, consumers are positively impacted and energy providers are better able to utilize existing energy infrastructure.
CONSERVATION STRATEGY STATEMENT

It shall be the energy strategy of the United States to promote energy conservation, improving energy efficiency. Conservation measures shall build upon previous efforts including: Corporate Average Fuel Efficiency Standards for automobiles; energy efficiency provisions in building codes (including lighting efficiency standards); home appliance, heating and cooling unit efficiency standards; waste recycling or reduction standards for industrial manufacturing and energy conservation education.

The Federal government should provide direct tax-related incentives to consumers making energy efficiency housing or vehicular investments.

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Subsequently developed energy conservation technology will not only help domestic productivity but may become a valuable export commodity, as well.

Basic energy conservation research funded by the government shall include superconductivity studies.
National Energy Strategy  
Background Paper - 2001  
Crude Oil

Crude oil occupies a special place in U.S. energy policy. In the 1970s, the connection between oil and the U.S. economy was clearly illustrated. The Arab oil embargo and the Iranian revolution dramatically increased world oil prices and the U.S. economy went into recessionary tailspins. The strategic importance of oil was demonstrated dramatically early in this decade when Middle Eastern oil supplies were threatened and the U.S. went to war in Operation Desert Storm/Desert Shield in 1991.

Crude oil accounts for about 40 percent of the U.S. energy supply. Nearly 58 percent of that amount is imported and the sources of those imports are becoming increasingly diverse. However, it is the nation's extraordinary dependence on petroleum to fuel the U.S. transportation sector (97 percent) which makes crude oil a resource which significantly affects national security.

Table 2.1 illustrates trends in U.S. crude oil reserve, production, import and consumption levels since 1972. The level of proven reserves in the U.S. has dropped by 38 percent over the last 26 years.

**TABLE 2.1**

U.S. Crude Oil Reserves, Production, Net Imports, and Consumption*, 1972-1999

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</thead>
<tbody>
<tr>
<td>Crude Oil Reserves (Billion Bbls)</td>
<td>36.3</td>
<td>27.9</td>
<td>23.7</td>
<td>22.5</td>
<td>22.5</td>
</tr>
<tr>
<td>Crude Oil and Condensate Production (MMBbl/day)</td>
<td>11.9</td>
<td>11.0</td>
<td>10.1</td>
<td>9.4</td>
<td>9.6</td>
</tr>
<tr>
<td>Net Imports (Crude oil and Products) (MMBbl/day)</td>
<td>4.5</td>
<td>4.3</td>
<td>6.9</td>
<td>9.2</td>
<td>9.9</td>
</tr>
<tr>
<td>Petroleum Consumption (MMBbl/day)</td>
<td>16.4</td>
<td>15.3</td>
<td>17.0</td>
<td>18.6</td>
<td>19.5</td>
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*Includes refinery volume gains and stock draws.


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In the midst of falling U.S. reserves and declining production, it is easy to forget that the U.S. is the number two producer of crude oil in the world, second only to Saudi Arabia. Table 2.2 presents the top crude oil producers of 1998.

**TABLE 2.2**

Top Crude Oil Producers, 1998
(Millions Barrels per Day)

<table>
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<tr>
<th>Country</th>
<th>MMBU/d</th>
<th>Percent</th>
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<tr>
<td>Saudia Arabia</td>
<td>8.4</td>
<td>12.5</td>
</tr>
<tr>
<td>United States</td>
<td>6.4</td>
<td>9.5</td>
</tr>
<tr>
<td>Russia</td>
<td>5.9</td>
<td>8.8</td>
</tr>
<tr>
<td>Iran</td>
<td>3.6</td>
<td>5.3</td>
</tr>
<tr>
<td>Venezuela</td>
<td>3.2</td>
<td>4.8</td>
</tr>
<tr>
<td>China</td>
<td>3.2</td>
<td>4.8</td>
</tr>
<tr>
<td>Mexico</td>
<td>3.0</td>
<td>4.5</td>
</tr>
<tr>
<td>Norway</td>
<td>3.1</td>
<td>4.6</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>2.6</td>
<td>3.9</td>
</tr>
<tr>
<td>United Arab Emirates</td>
<td>2.2</td>
<td>3.3</td>
</tr>
<tr>
<td>Nigeria</td>
<td>2.4</td>
<td>3.6</td>
</tr>
<tr>
<td>Kuwait</td>
<td>2.1</td>
<td>3.1</td>
</tr>
<tr>
<td>Canada</td>
<td>2.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Indonesia</td>
<td>1.5</td>
<td>2.3</td>
</tr>
<tr>
<td>All Others</td>
<td>17.4</td>
<td>26.0</td>
</tr>
<tr>
<td></td>
<td>67.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: US DOE, Energy Information Administration, 2000

However, while U.S. production is declining, global oil production is increasing. By 2010, world production is expected to increase by almost 20 percent, while U.S. production is forecast to drop seven percent. In fact, U.S. production has dropped 20 percent over the last 25 years.

Although U.S. production has declined, exploration productivity has improved dramatically, especially in the last ten years. The exploration productivity (additions to proven reserves divided by the total number of exploratory wells) has increased from a 1987 average of 100,000 barrels a day to about 400,000 barrels a day in 1997. Moreover, a new barrel of reserves in the U.S. that cost about $15 to find in 1977 (inflation adjusted price) costs less than $5 to find today.
Advanced computer-based technology, often supported by government-assisted research, as well as increasing corporate efficiency efforts, are major factors in this trend.

In fact, new technologies have impacted drilling outcomes in every producing area of the U.S. However, nowhere is the impact of changing technology more evident than in the Deep Water U.S. Outer Continental Shelf. In terms of oil, projects in the Deep Water Gulf of Mexico, together with onshore projects in Alaska dominated new field discoveries in the U.S. in 1999. Over 80 percent of new field discoveries came from the Gulf of Mexico and, overall, 95 percent of total new discoveries were made in the Gulf of Mexico and Alaska. As exciting as they are, even these technologies are not enough to overcome the low exploration and production (E&P) cost advantage of some areas of the globe like the Middle East.

Although it is the bright spot for U.S. production, the boom in the Deep Water Gulf of Mexico is straining the infrastructure of coastal areas adjacent to the Gulf. New or improved roads and other government services are necessary. Coastal areas are often environmentally fragile and require special care in their development in order to protect other uses like fisheries and recreation. Federal royalty revenues may be the key to providing much needed revenue to assure protection of these valuable coastal environments.

Federal-state revenue sharing formulas related to energy production from federal lands vary. Onshore states generally receive royalties from production on federal lands within their boundaries. Coastal states receive significantly less federal royalties on offshore production three miles beyond the state/federal boundary. Beyond this three-mile royalty-sharing zone, the states currently receive no part of the federal royalties.

A recent report of the Outer Continental Shelf Policy Committee presented recommendations for federal OCS revenue sharing with thirty states and five territories (including those on the Great Lakes) as an entitlement program utilizing existing Department of Interior administrative mechanisms. This report is the basis of legislation proposed in Congress. The Coastal Assistance legislation is the kind of program that makes domestic oil and gas production a win-win proposition for the U.S.
Another proposed form of federal/state cooperation is a royalty-in-kind program. The valuation of crude oil production from federal lands for royalty purposes has proven to be a contentious matter, involving costly litigation and causing ill will among producers, states and the federal government. A federal royalty-in-kind program could eliminate valuation disputes, significantly decrease federal administrative costs and provide an opportunity for enhanced value from the marketing of oil. It could also reduce producer costs and risks of litigation, making production from federal lands a more attractive investment. Alberta's program is one example of a successful royalty-in-kind program.

Development of oil and gas resources from federal lands is a critical component of U.S. energy policy. Indeed, any discussion of domestic energy production must consider federal lands and the potential for future discoveries and development. There are more than 700 million acres in the U.S. that are owned by the federal government. That is approximately one in three acres or 32 percent of the nation's land mass.

Much of that land is in Alaska, as are much of the nation's oil, natural gas and coal reserves. In fact, 87 percent of the state of Alaska is owned by the federal or state governments. Recently, progress has been made on leasing limited areas of the National Petroleum Reserve - Alaska (NPR-Alaska) for exploration, subject to detailed environmental restrictions.

Renewed leasing of the NPR - Alaska holds great promise for sustaining domestic energy production from Alaska. This is significant since in 1999 Alaska produced 22 percent of the nation's oil. However, federal exploration and development moratoria, onshore and offshore, hobble the search for domestic energy resources from Alaska to the Atlantic offshore.

Finally, a discussion of domestic oil production would be incomplete without recognition of the role that marginal production plays in this nation. The United States has more than 500,000 marginal oil wells that produce almost one-third of the lower 48 states' onshore production. All wells are subject to depletion and may eventually be designated as marginal on the basis of economics or as stripper wells on the basis of low production (generally less than 10 barrels a day).
In Oklahoma, a state with a high number of marginal wells, the average daily production is 2.3 barrels per well per day. Marginal well activity (employment, royalties and tax revenues) plays an important role in the economies of many oil and gas producing states. The positive impact is particularly felt in rural communities that provide workforce and maintenance for mature production.

As marginal wells are plugged and abandoned, the reserves accessed by those wells may be counted as lost, since it is unlikely that partially depleted reservoirs will be re-drilled. On the other hand, dramatic advances have been made in low cost enhanced recovery technologies, which are extending the productive lives and economic benefits of marginal wells. The Petroleum Technology Transfer Council, a public/private cooperative effort, and state programs like Oklahoma's Commission on Marginally Producing Oil and Gas Wells, assure that technological, administrative, and well servicing information is made available to smaller operators throughout the country.

States have also taken an active role in regulating the plugging and abandonment of wells that have ceased operation. Many states have programs that provide for the proper closure of orphaned wells and the clean up of the surrounding well sites, as well. These activities are generally funded by an assessment on current oil and gas activity.

Since neither state governments, the federal government, nor the oil and gas industry set worldwide oil prices, the solution to preserving marginal wells involves close attention to production costs including taxes, royalties and other costs controlled by the public sector.

Because of declining production in the U.S., imported oil plays an important role in the nation's energy mix. Oil is the only energy resource imported in significant amounts. The amount of oil imported to the United States has more than doubled in the last 25 years. Imported oil as a percentage of total U.S. consumption has risen from 28 percent in 1972 to 58 percent of consumption today.
The big change over the last decade has been in the mix of import sources. In the early 1970s, Middle Eastern members of the Organization of Petroleum Exporting Countries (OPEC) dominated as suppliers of foreign crude to the U.S. Today the import mix is decidedly Western Hemispheric. Termed "short-haul" crude, imports from Canada, Mexico and Venezuela dominate today. The only Middle Eastern country among the top four foreign suppliers is Saudi Arabia.

The U.S. Canadian Free Trade Agreement and the subsequent North American Free Trade Agreement (NAFTA) have played a significant role in assuring the integration of the North American energy market. Consumers in the U.S. are now assured secure access to Canadian energy supplies. Efforts to support cross border energy trade with Mexico are being encouraged.

In the Energy Council's 1988 National Energy Strategy proposal, the Council recommended a Pan American Energy Alliance. Later, in 1991, the Council welcomed Alberta, Canada's principal energy province, as an international affiliate. In 1997, Venezuela became the second international member of the Energy Council. These relationships have forged an informal alliance among energy producing interests in the Western Hemisphere, allowing for dialogue and better understanding with our important energy trade partners.

Another notable trend over the previous ten years has been the globalization of energy markets. U.S. companies have moved in unprecedented numbers to explore for and produce oil overseas. Concurrently, foreign companies have increasingly become involved in the U.S. internationally integrating the oil industry.

For instance, Venezuela's wholly owned subsidiary, Citgo, has significant refining interests in the U.S. Citgo's marketing agreements with Seven-11 also give it a tremendous number of retail gasoline outlets throughout the country. Saudi Arabia's arrangement with Texaco gives that nation a refining position in the U.S., and Shell, whose parent company is Royal Dutch Shell, has been a long-term player in this country. BP (formerly British Petroleum) continues to expand its presence in the U.S. by acquiring companies like Amoco and the non-Alaskan assets of Arco.
In addition to relying on the global integration of the oil industry to lend stability to world markets, the U.S. has an oil "insurance policy". It was the interruption of oil imports during the 1973 Arab oil embargo, which led to the creation of the U.S. Strategic Petroleum Reserve (SPR). Filled between 1977 and 1994, the SPR is at its current fill level of 570 million barrels, which is roughly the equivalent of 57 days of imports. Reserves from the SPR were sold in 1991 to stabilize oil prices during the Gulf War. However, questions about the role of the SPR remain (e.g. Is it an insurance policy against supply disruptions? Against price changes?).

Another insurance policy is the International Energy Agency's (IEA) multi-national agreements to address global oil disruptions. In fact, the IEA was founded in the 1970s as consumer nations sought to mitigate the effects of oil embargoes.

Petroleum consumption in the U.S. has varied over the last 25 years in response to price and legislated efficiency efforts. Consumption reached 18.9 million barrels per day (MMbld) in 1978, prior to the Iranian revolution, which led to price increases in 1979.

Subsequently during the early 1980s, the consumption rate fell to 15.2 MMbld, a decline of 20 percent. However, since then, consumption has slowly risen to 19.5 MMbld. At this level, U.S. oil consumption is roughly 26 percent of the world total.

The U.S. outlook for oil through the year 2010, according to the DOE, is for decreasing production, increasing consumption, relatively stable prices, and an increase in imports. Crude oil production declines in the U.S. will be mitigated, but not offset, by technological advances in exploration and production, as well as increases in natural gas liquids production.

Consumption of petroleum products is expected to increase by 19 percent from 1998 to 2010. Efficiency gains will be offset by economic growth and increases in travel. The DOE outlook calls for oil prices to increase by only about five percent by 2010. Price increases are expected to be moderated by production increases by OPEC and non-OPEC countries alike.
Consequently, given declines in domestic production and increases in consumption, oil imports to the U.S. will increase. The DOE forecast is for a 16 percent increase in imports of crude oil and petroleum products to the U.S. by 2010. This increase would place imports at about 53 percent of U.S. consumption.

The security risk that this higher level of imports implies may be mitigated to some extent by the integration of the global market, increasing diversity of imported supplies and energy supply diversity, as well as the SPR and the IEA. For instance, risk has been mitigated by the secure energy relationship between the U.S. and Canada. As more Canadian oil production comes online, the U.S. will have the opportunity to seek contracts for additional amounts on a non-discriminatory basis.
CRUDE OIL STRATEGY STATEMENT

It shall be the strategy of the United States to promote the environmentally sound production of domestic energy resources, to ensure the conservation and efficient use of energy resources, and to diversify sources of energy imports.

It shall be the policy of the United States to support and encourage domestic production of crude oil in an environmentally sound manner in order to supply U.S. consumers with a secure source of petroleum, and to provide a stabilizing influence on the world price of crude oil. In this regard, taking the lead of the states, the federal government shall provide tax and tax accounting incentives to oil producers for domestic exploration and development efforts and institute a specific National Marginal Oil and Gas Well Security Program.

Regulatory coordination between state and federal governments is critical and such cooperation shall extend to the management of public lands. An enhanced offshore federal revenue sharing program for coastal states is recommended to assist state and local governments in offsetting the infrastructure demands of offshore development. The federal government is urged to undertake simplification of federal regulations affecting oil and gas exploration and production. Additionally, a comprehensive federal royalty-in-kind program shall be implemented to apply to offshore areas. Further, a federal royalty-in-kind program shall be implemented onshore, to allow states at their option to assume marketing and administrative functions from the federal government.

It shall be the policy of the United States to assure that energy resources are utilized in a manner that recovers the most energy value possible. Similarly, it shall be the strategy of the United States to fund research and development to diversify its source of energy supplies, particularly for the transportation sector and primary modes of personal transportation. Enhanced oil and gas recovery from known reserves shall be promoted, and a research, development, demonstration and commercialization program for unconventional sources of crude oil shall be pursued through a cooperative effort among industry, higher education and the national laboratories.
It shall be the policy of the federal government to encourage diversification of import suppliers, to pursue a Pan American Energy Alliance with Western Hemispheric producing nations, and to open a dialogue with suppliers worldwide. It shall also be the policy of the United States to maintain the Strategic Petroleum Reserve, at least to its present capacity of about 570 million barrels. Any additions to the SPR should be purchased from domestic suppliers.

It shall be the strategy of the United States to support active management for the development of federal lands, public trust lands and Outer Continental Shelf areas in accordance with principles of multiple use and to recognize the potential that public lands hold, particularly in Alaska, for environmentally-sound development of all energy resources.
In the 1988 Energy Council National Energy Strategy background paper, the role of natural gas was characterized as a transition fuel, a bridge to a cleaner fuel future. Over the intervening decade, the growth of the importance of natural gas has been dramatic and it now appears that the "transition fuel" may have a role of its own for a long time to come. The inherent efficiency of gas, its environmental advantages and the removal of regulatory constraints are all important factors in its success.

The U.S. is the world's largest gas producer, followed by the former Soviet Union. Estimates of supplies of gas are increasing due not only to exploration, but better assessment techniques. The demand outlook features gas dominating the burgeoning U.S. electric generation market. Long-term, sophisticated technology and a resource base of conventional and non-conventional sources hold the promise of making gas an important part of the world's energy mix, as well as that of the United States.

While there is a global market for oil and, in the whole, a domestic market for coal, the U.S. market for natural gas is currently dominated by North American resources. Both the supply and demand sides of these markets are growing. The U.S. natural gas resource base has increased an estimated 23 percent since 1992 thanks to new frontier areas and better technology to estimate and recover reserves.

There are two regions that will contribute most to the increase in domestic gas supply over the near to mid term: the Rocky Mountains and the deepwater Gulf of Mexico. Figure 3.1 illustrates Producing and Consuming Regions of the U.S. and Canada.
Figure 3.1

Producing and Consuming Regions

*Alaskan resources were not assessed in the study.

Source: National Petroleum Council - Natural Gas - Volume I - Dec. 99 - (pg. 38)
Table 3.1

Resources by Region

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Source: National Petroleum Council - Natural Gas - Volume I - Dec. 99 - (pg. 38)
The National Petroleum Council (NPC) has recently estimated the U.S. natural gas resource base, excluding Alaska to be 1,466 Trillion cubic feet (Tcf). Add to this 313 Tcf of Alaskan resources and the national supply stands at 1,779 Tcf. Table 3.1 compares U.S. and Canadian natural gas resources from the NPC 1992 and 1999 studies.

This estimate includes unconventional sources that have emerged over the last twenty years to become part of the U.S. gas market. For example, coal bed methane production in 1982 was non-existent. Throughout the year 2000 in Wyoming alone, 2200 wells have been drilled and 1300 permits are outstanding.

The North American nature of the gas market is tied to the significant supplies of Canada's Western Sedimentary Basin (WSB) which covers much of Alberta and parts of British Columbia, Saskatchewan and Manitoba. Recently production has begun in the Scotian Basin offshore eastern Canada. Canada's reserves are estimated by the NPC to be 667 Tcf, but since the WSB and frontier regions of Canada are less mature than traditional U.S. producing regions, upward revisions of supplies may be expected.

Long term, the U.S. gas supply may become more global in character as liquefied natural gas (LNG) becomes more economic. Over the last decade LNG imports have been a small part of the supply picture, contributing 50 to 85 Billion cubic feet (Bcf) a year to U.S. supplies. In 1999, although U.S. LNG consumption was increasing, LNG still accounted for less than one percent of the natural gas used in the U.S., or 163Bcf.

Two previously mothballed LNG terminals, one at Elba Island, South Carolina and one at Cove Point, Maryland are scheduled to be placed back in service by 2005. The combined annual regassification capacity of the four U.S. LNG receiving facilities will exceed 900 Bcf/yr.

Long considered "stranded" on the basis of transport economics, at least three alternatives for Alaska's natural gas resource base are under consideration. Moreover, the three are not mutually exclusive.
The first option is conversion to LNG. Alaska has more than 20 years experience in exporting Cook Inlet LNG to Asian markets. Alternatively, Alaskan North Slope gas could be shipped through a new natural gas pipeline. There are a number of routes under consideration but most would bring the gas to southern Alberta where it would be shipped by existing pipelines to West Coast or Midwest U.S. markets. The market will dictate the actual route.

As a third alternative, Alaska's natural gas may serve environmental goals through conversion to liquid fuel. New gas-to-liquid (GTL) technology has reduced the costs of converting natural gas to an ultra clean, high performing liquid suitable for use as a transportation fuel.

Such a liquid fuel could utilize the existing oil transport infrastructure to move to environmentally sensitive markets. A low emission fuel, suitable for technologically-advanced engines, possibly even fuel cells, GTL fuel could also be blended with existing gasoline fuels to lower emissions or be used as a substitute for distillate fuel. Among the options for Alaskan natural gas, the market is expected to direct the needed financial resources to the option or combination of options that optimizes the value of the natural resource.

An intriguing potential source of supply, long term, that may be characterized as not only non-conventional but even exotic, is gas hydrates. Methane hydrates are ice-like materials formed in conditions of high pressure and low temperatures. Gas hydrates are found in Alaska's Arctic permafrost and in deep ocean environments.

The U.S. Department of Energy has estimated that one unit of this frozen, pressurized methane is equal to 160 volumes of gas and less than one unit of water at surface pressures and temperatures. The potential resource base of gas hydrates to be found in U.S. permafrost areas and surrounding waters is more than 100 times greater than estimated conventional U.S. gas resources. Some educated estimates put the methane hydrate resource base at 320,000 Tcf, while the U.S. Geological Survey estimates range between 112,000 and 676,000 Tcf. Efforts to research gas hydrates are only just beginning.
In 1999, according to DOE, total natural gas end use consumption was 21.4 Tcf. The industrial sector led the way with 9.9 Tcf or 46 percent of total consumption. The residential market accounted for 4.7 Tcf or 22 percent; electric utilities consumed 3.1 Tcf, about 15 percent; and the commercial sector used 3.1 Tcf or 14 percent. Table 3.2 shows 1999 data with estimates for 2005, 2010 and 2015 consumption data.

Table 3.2
U.S. Natural Gas Consumption
(Tcf)

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*Historical data includes all gas use for industrial cogeneration and independent power producers; all gas for new power plants except cogeneration is included in the electricity generation sector.

Source: U.S. DOE, Energy Information Administration, Natural Gas Monthly, July 1999, DOE communications

In terms of demand for natural gas, the future is promising. The NPC estimates a 32 percent increase in U.S. demand by 2010. This would mean approximately 14 million new gas customers. Electricity generation demand is expected to account for almost 50 percent of the consumption increases. There appears to be a convergence of the gas and electric industries currently underway. Efficiency, environmental advantages with regard to emissions and a favorable regulatory climate are responsible for the increase in gas demand.
According to the NPC, 96 percent of the more than 200 fossil fuel generating plants recently announced for construction in the next five years have specified natural gas for fuel. The price of competing fuels, the number of nuclear plant retirements and the capacity utilization of coal-fired electricity plants, as well as the health of the general economy, will all be factors in the extent to which gas generation expectations are met.

Imports from Canada to the U.S. are expected to increase from 3.3 Tcf in 1999 to over 4 Tcf in 2010. However, given growing U.S. demand overall, Canadian gas is expected to supply the same 13 to 14 percentage share of total U.S. demand that it does today.

Likewise, Canadian gas demand is expected to increase from 2.9 Tcf in 1999 to 3.5 Tcf in 2010 and 3.8 Tcf in 2015. This is an increase in Canada’s demand of 28 percent from 1998 to 2015, all of which is expected to be met by Canadian production.

Currently, Mexico imports a very small amount of U.S. gas, primarily to serve industries along the U.S.-Mexican border. Trade between the two nations in natural gas is not expected to increase dramatically in the near-to-mid term. However, increasingly, pipeline connections and American investments in Mexican local distribution companies and power plants are likely to improve the chances for cross-border gas trade.

How will gas supplies reach the burgeoning demand? Requirements for expansion of transmission and distribution systems to meet the growing demand will be enormous. Figure 3.2 illustrates projects proposed for 1999-2001 that would increase transportation capacity by 10 Tcf a year if all proposed projects are built. However, some projects are likely to be mutually exclusive.

Frontier production areas like the deepwater Gulf of Mexico and offshore eastern Canada and shifting market regions will require new transmission lines. The dynamic customer base for natural gas will drive the expansion of the distribution system. Access issues and regulatory hurdles to permitting new pipelines on a timely basis loom large as considerations affecting this development.
This dramatic increase in the use of gas rests on a regulatory basis that has led to strong increases in gas use in this decade. The Federal Energy Regulatory Commission, building on an order issued in 1985, took a dramatic step in 1992, issuing Order 636 which restructured the natural gas market separating transmission and commodity sales.

Unencumbered by heavy-handed regulation, the natural gas market has developed hubs, as well as secondary transmission capacity trading and futures trading. However, adjustments relative to financial risk are still being made and are raised particularly in discussions of pipeline and distribution expansions.

Overall, the outlook for natural gas is bright but a number of issues require attention. Chief among these is the issue of access, which may stymie exploration and development, as well as transmission and distribution.

For exploration and development, the issue of access relates not only to outright prohibitions, but to limitations and restrictions which cause delays that make project economics unfeasible. For instance, due largely to Federal prohibitions, 10 percent of the promising Rocky Mountain region is strictly off limits to exploration and more than 40 percent is subject to restrictions which may add an average of two years to a project time line.

Impressive advances have been made in reducing the “footprint” of exploration and production activities, making oil and gas operations a reasonable neighbor for many uses of federal land under a multiple use concept. Efforts could be made to prioritize restricted areas, weighing resource potential, environmental sensitivity and the project’s potential for high tech, low impact development.

Transmission and distribution systems similarly face increasing challenges for string facilities in order to bring what many feel is an environmentally-preferred fuel to consumers. Rights-of-way delays in approval for pipelines and other restrictions are stopping some projects and delaying others.