

# A HISTORY OF

**T**HROUGHOUT ITS HISTORY, THE OIL and gas industry has been shaped by the vision and initiative of technologists. Today's innovators and entrepreneurs can be found in service companies, engineering and consulting firms, small independent producers, multinational integrated oil and gas companies, government, and academia. They are responding to current challenges with the same driving focus on opportunity that characterized the industry's earliest days.

## A New Generation of Pioneers for a New Millennium

FROM THE MOMENT THAT THE FIRST U.S. OIL well was drilled in 1859, the progress of the oil and gas industry has been a chronicle of technological advancement. In the early "oil boom" decades, explorers joined forces with entrepreneurs, engineers, and skilled craft workers to invent a dynamic industry. Through experimentation, hard work, and simple necessity, these pioneers rapidly developed the fundamental tools and systems for finding, extracting, transporting, and processing oil. As the industry matured, its scientists and technologists led the way in improving our understanding of earth sciences, geology, geophysics, and chemistry.

Now, another wave of technological innovation is transforming the oil and gas industry. The focus this time is on finding economically viable ways to continue discovering and producing oil and gas from an increasingly challenging and more



*The petroleum industry has progressed from Colonel Drake's shallow 1859 well to satellite and computer-guided technology operating miles above and below the earth's surface.*

Photo: Pennsylvania Historical & Museum Commission, Drake Well Museum Collection, Titusville, Pennsylvania

remote U.S. resource base. Without new solutions to extend their productive life, more U.S. oil and gas fields will have to be abandoned. Complex environmental protection standards add to the costs and challenges. The industry seeks ways to cost-effectively meet Federal and State requirements, and to produce from sensitive environments in wetlands, in coastal and offshore waters, or under the frozen tundra of Alaska.

More resource-efficient and less intrusive E&P approaches are key to meeting these challenges. This report highlights the dramatic progress of the past two decades in enhancing the power, productivity, safety, and environmental performance of oil and gas technology. It is a record of achievement that would have seemed a fantasy to the wildcatters in the industry's early days.

# INNOVATION

## Milestones

- '59 Drake well dug by hand
- '70 First cable tool rig
- '90 Rotary drilling developed
- 1933 First whipstock for directional drilling
- '35 First tri-cone bit
- '39 First horizontal well drilled (Havener Run field in Morgan County, OH)
- '47 First offshore directional wells drilled (Gulf of Mexico)
- '53 First truly multilateral well drilled
- '54 First hydraulic rotary rig
- First directional drilling assembly
- '55 Craig-Geffen-Morse waterflooding model developed
- '61 First use of dynamic positioning
- '66 Computerized well data monitoring
- '69 First coiled tubing rig job
- '71 Polycrystalline diamond compact bit introduced
- 2-D seismic prevalent, computers convert drill velocity data into geological information
- '72 Landsat satellite becomes available for remote sensing
- '74 3-D seismic data acquisition tested in Gulf of Mexico
- '75 First floating production system begins operation
- First commercial 3-D seismic survey recorded
- '78 First measurement-while-drilling (MWD) system
- '80 Cost of 3-D post time depth migration (PTDM) estimated at \$8 million for 50 square miles
- '81 First offshore horizontal well (Rospo Mare field, offshore Italy)
- '83 Horizontal wells drilled from vertical shaft (Kern River, CA)
- '84 First steerable drilling system
- New resistivity measurement devices
- '85 3-D vertical seismic profiling developed
- '86 Metal sealed-bearing roller cone bits
- Neutron porosity measurement capability added to MWD
- '87 First logging while drilling (LWD) tool
- '88 Extended-reach drilling exceeds 60-degree radius
- First horizontal well drilled from semisubmersible drill rig
- '89 Only 5% of Gulf of Mexico wells based on 3-D seismic data
- '90 Horizontal well achieves 14,585 linear feet
- '91 15,000-foot horizontal well drilled with directionally controlled coiled tubing
- '92 Slimhole horizontal well (3<sup>3/8</sup>" ) drilled 801 feet
- '93 3-D surveys worldwide cost \$1 million for 50 square miles
- MWD tools advance—smaller, broader temperature range, pressure detection, geosteering
- '94 Digital image processing of 3-D
- '95 3-D seismic used for 75% of U.S. onshore surveys
- 4-D seismic emerges
- '96 80% of Gulf of Mexico wells based on 3-D seismic data
- 4-D seismic characterization methodology applied to previously recorded seismic surveys
- '97 Extended-reach drilling achieves 26,450 feet horizontal displacement in South China Sea
- Magnetic resonance imaging begins on MWD
- 3-D PTDM cost reduced to \$90,000 for 50 square miles by the year 2000



# E&P TRENDS: SMARTER, FARTHER, DEEPER, CLEANER

## Exploring Frontiers and Embracing Change

ON THE THRESHOLD OF THE NEW millennium, the oil and gas industry has transformed every phase of exploration and production operations, from initial prospect identification to final project closure and site restoration. Today's advanced exploration and production operations are models of high technology and resource efficiency. They incorporate high-speed computing, remote sensing and imaging, geologic interpretation, and visualization technology. They use global positioning systems, the latest geographical information systems, and 3-D seismic and 4-D imaging capabilities.

**"The oil industry still produces oil, but it has been infused by so many new technologies that it should be thought of as one of the new manmade, brain-power industries like biotechnology."**

LESTER THUROW  
*Economist*

Source: Price Waterhouse World Energy Conference, November 1997



***Today's optical and radar satellites cost-effectively pinpoint promising geological formations.***

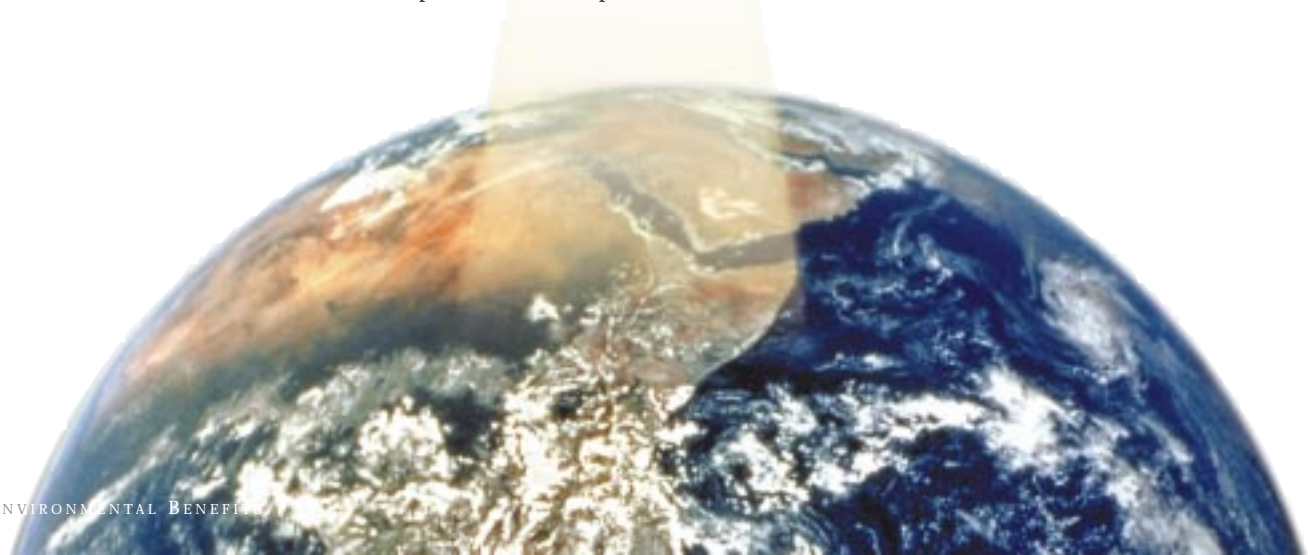
*Photos: Corbis Images*

## Higher Success Rates, Enhanced Productivity, Reduced Impacts


THANKS TO PRODUCTIVITY GAINS from advanced E&P technology, the oil and gas industry has dramatically increased the ultimate recovery of resources from existing fields and become progressively more successful in pinpointing promising new reservoirs. In turn, higher productivity means less impact on the environment and better protection of our precious resources.

## Technology Leadership for a Strong U.S. Economy

THE UNITED STATES HAS BEEN THE proving ground for developments on all these fronts, as market-based drivers have fostered flexibility and innovation. In striving to reduce costs and remain competitive, the E&P industry has embraced new technology at a rapid pace. Simultaneously, a sizeable number of smaller companies have come on the scene, carving out profitable niches based on specialized technological capabilities. Recent trends toward more alliances and mergers in the oil and gas industry—created largely to fill gaps in technological strengths—may further accelerate the rate of future innovation. The domestic industry's aggressive application of new technology positions U.S. companies to remain world leaders in E&P technology.







## OIL AND GAS OPERATIONS

### EXPLORATION

Techniques have progressed from surface observation and divining rods to the use of satellites, microprocessors, remote sensing, and super computers to generate three-dimensional and four-dimensional time-lapse imaging of subsurface reservoirs. Sharply increased drilling success rates have cut the number of both wells drilled and dry holes.

### DRILLING AND COMPLETION

Technology has advanced from gravity-driven cable tools in vertical wells to top-drive rotary rigs, coiled tubing units, advanced drilling fluids, and systems that monitor wellbore conditions during drilling operations. Current technology allows directional and horizontal drilling to reach previously inaccessible resources as well as to drill in deeper offshore waters. Durable forged alloys and polycrystalline diamond have replaced brittle cast iron bits, boosting drilling productivity and efficiency. Enhanced worker safety, habitat protection, lower and less-toxic waste volumes, and increased well productivity are the results.

### PRODUCTION

Techniques have evolved from collecting crude oil in wooden barrels from open gushers, which recovered less than 10 percent of the oil-in-place, to gas, thermal, and chemical injection techniques that can recover, in some cases, up to 50 percent or more of the original oil-in-place without spilling a drop. Today's techniques for reducing emissions of methane (natural gas) have allowed operators to recover an ever-increasing proportion of this valuable resource. These recovery

techniques, which are enhanced with 4-D time-lapse imaging, are directly transferable to other industries, such as groundwater resource management and industrial pollution remediation.

### SITE RESTORATION

Despite the continued advance of technology, mature oil fields eventually cease being economic, must be shut down, and the production site restored to near-original conditions or conditions appropriate for alternative uses. Once capped at the surface and abandoned, wells are now plugged below ground and restored, leaving little or no visible evidence they ever existed. Rigs toppled offshore in "rigs-to-reefs" programs actually improve the habitat for marine life, yielding benefits to oil and gas producers, commercial and recreational fishing industries, and the marine environment.

### OPERATIONS IN SENSITIVE ENVIRONMENTS

Resources underlying arctic regions, coastal and deep offshore waters, sensitive wetlands and wildlife habitats, public lands, and even cities and airports can now be contacted and produced without disrupting surface features above them. Wildlife preserves and conservation easements are created and managed jointly by industry, environmental, and government stakeholders. In Alaska, such new approaches as ice pads and roads, multilateral completions, and annular injection of drilling wastes minimize environmental impacts while also reducing costs.

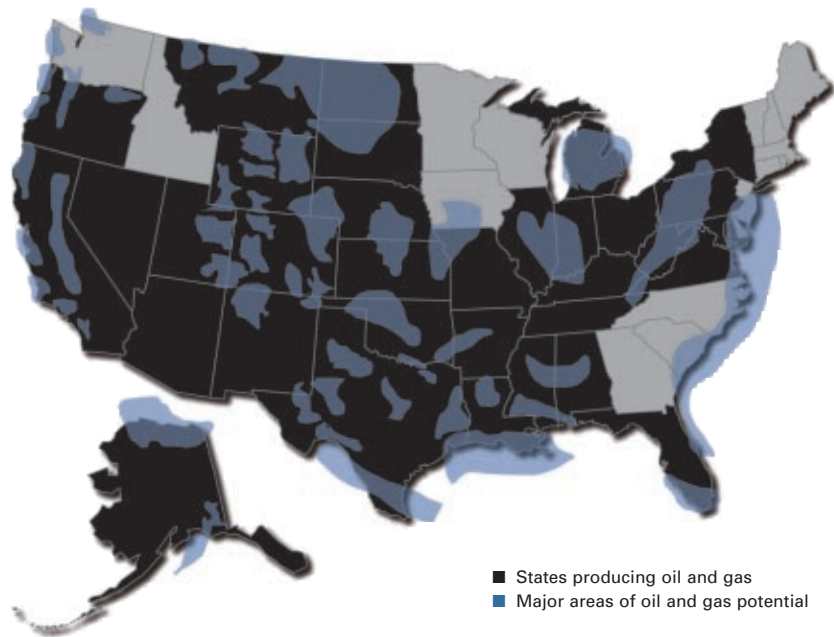


# MEETING THE CHALLENGES OF A MATURE RESOURCE BASE

## Mature Resource Base: Perception vs. Reality

THE UNITED STATES IS THE MOST mature petroleum-producing province in the world—much of our easy-to-find resource base has been depleted. So should we be concerned that the United States will soon stop producing oil and gas? Not if the past two decades are any indication.

With our easily recoverable resources largely depleted, it would be logical to expect resource development opportunities in the United States, relative to the rest of the world, to continue to diminish. Conventional wisdom would predict a relentless drop in U.S. reserve additions and well productivity and a continued increase in finding costs. In fact, quite the opposite has been the case.



Source: U.S. Geological Survey, modified by ICF Resources Incorporated

## E&P Successes Defy Conventional Wisdom

DESPITE THE FACT THAT THE United States is the most mature hydrocarbon region of the world, 11 percent of all the petroleum reserves ever added in the United States (since 1859) have been added in just the last eight years. Over these eight years, the United States has replaced 100 percent of the gas it has produced, 104 percent of the natural gas liquids, and 79 percent of the

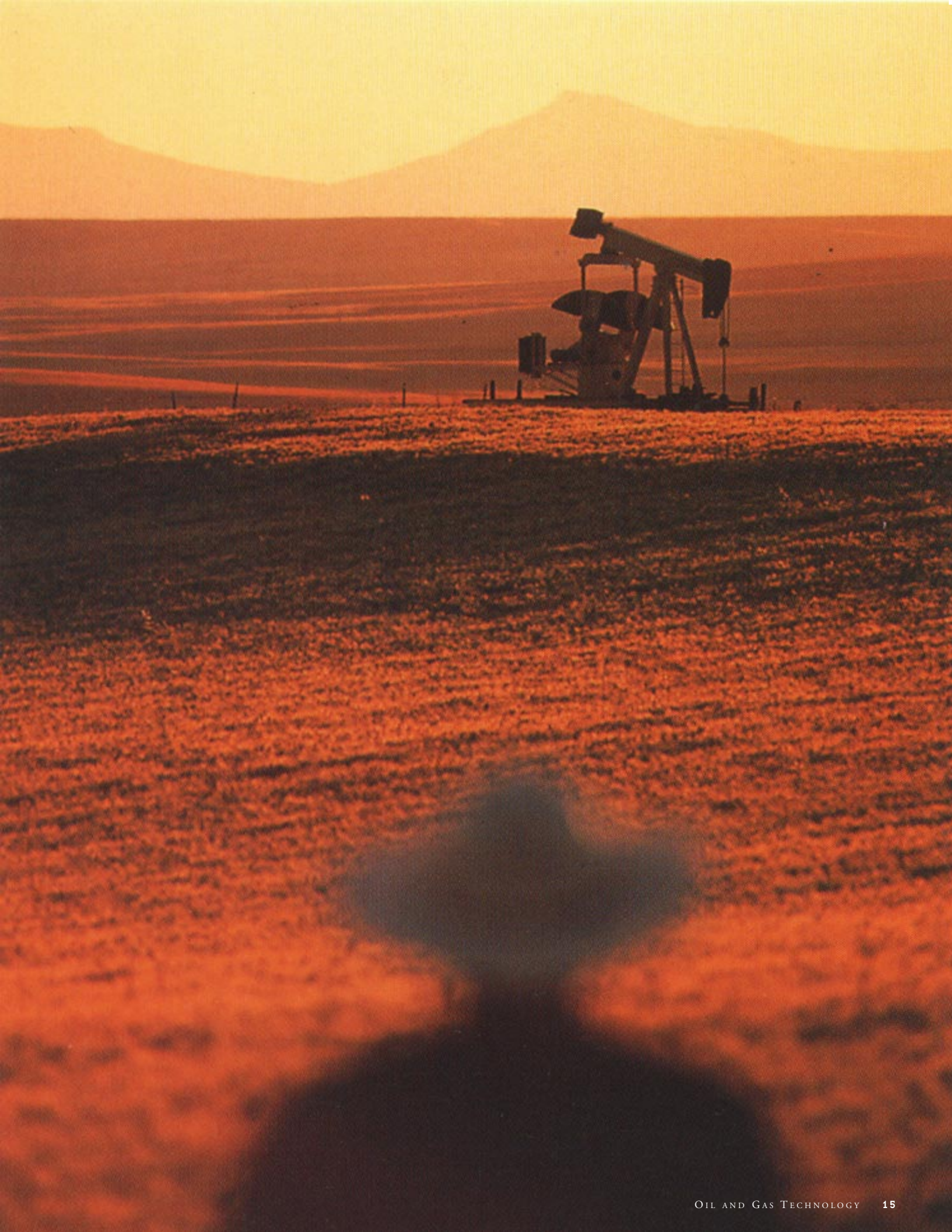
crude oil. The overall replacement rate for hydrocarbons in the United States over the last eight years is 92 percent, despite high rates of production. And in the past three years, total hydrocarbon reserve additions have exceeded production by 8 percent. Advanced technologies have been behind the logic-defying trends in E&P, allowing economic access to domestic resources that are concentrated in deeper formations, tighter zones, deeper water, more sensitive environments, and increasingly more unconventional settings.

**"This industry...can, at \$15 or \$16 a barrel, do things that it thought it couldn't do at \$30 a barrel a decade ago. It's an industry that's being transformed by technology and computers. It's an industry that can do much better at lower prices. It's an industry that's surprised itself."**

DANIEL YERGIN  
Chairman  
Cambridge Energy Research Associates

Source: *New York Times*, August 16, 1998







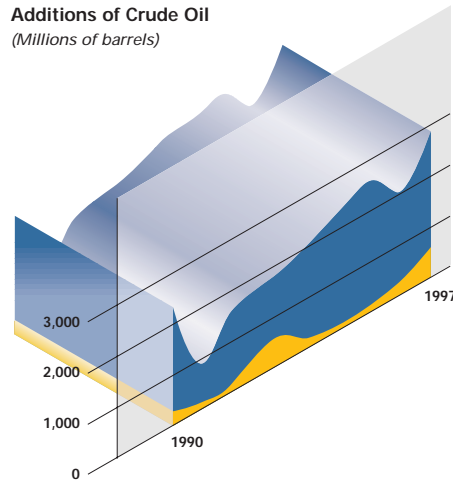
## Tapping Resources Once Thought Unreachable

CONTINUAL INNOVATION OVER THE last three decades has enabled the E&P industry to drill ever deeper, with fewer dry holes, and to recover more reserves per well drilled. When onshore production in the lower-48 States began to decline in the 1970s, for example, waterflooding and gas pressure maintenance practices helped to increase U.S. crude oil production. Enhanced oil recovery technologies were used as early as 1967 and gained serious attention when the price and import supply shocks of 1973, the Iranian revolution, and the Iran / Iraq war stimulated significant research and development investments by industry and the U.S. Department of Energy. More recently, sophisticated imaging technologies, including 3-D seismic and 4-D time-lapse systems, have provided oil and gas professionals with detailed pictures of reservoirs and formations, enabling more accurate and productive exploration and development efforts.

## E&P Capabilities Spell Opportunity

THESE AND MANY OTHER ADVANCED E&P technologies have literally redefined reserves. Oil and gas at depths recently considered unreachable can now be tapped. Smaller accumulations once thought to be uneconomic can now be produced profitably. Fields under wetlands or cities can be accessed without disruption of the surface.

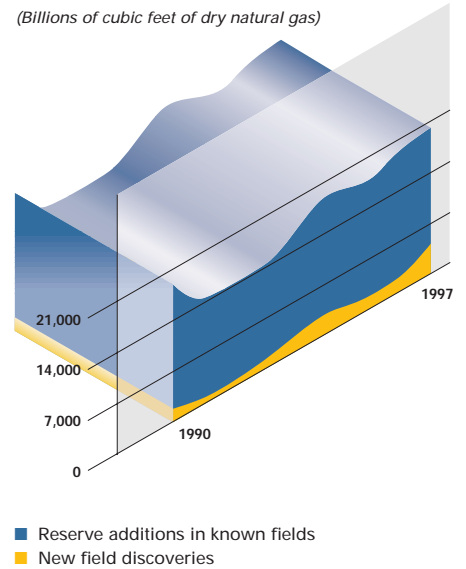
**Annual Reserve Additions of Crude Oil**  
(Millions of barrels)



Source: Energy Information Administration, 1998

Particularly impressive is the industry's track record in effectively extracting additional resources from previously discovered, older fields. Since 1990, the vast majority of reserve additions in the United States—89 percent of oil reserve additions and 92 percent of gas reserve additions—have come from finding new reserves in old fields. Recent studies found that about half of these additions are from development-dominated growth (growth from more intensive development within the limits of known reservoirs), with the other half coming from more exploration-

**Annual Reserve Additions of Natural Gas**  
(Billions of cubic feet of dry natural gas)

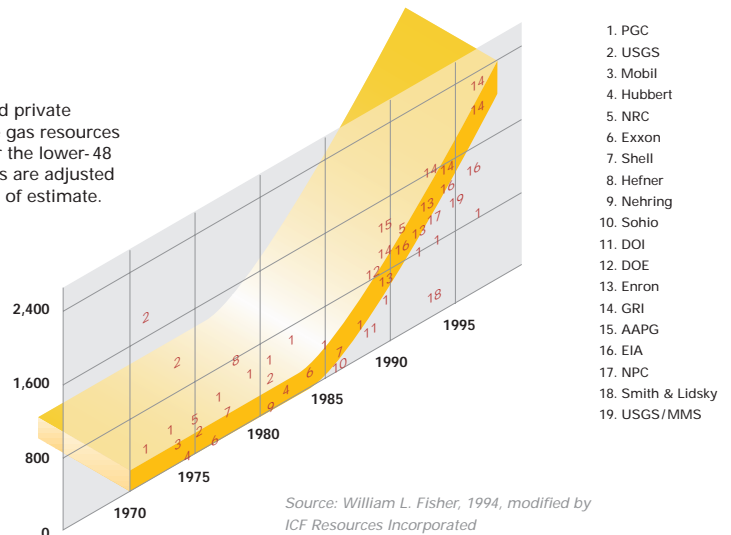


dominated growth (growth from finding new reservoirs in old fields and in extending the boundaries of oil fields).

As E&P capabilities continue to grow, so does the consensus of estimates of recoverable U.S. oil and gas resources. For example, in the 1970s, the consensus of estimates of ultimately recoverable gas resources was on the order of 400 trillion cubic feet (Tcf). Today, adjusting for what has already been produced, estimates range from 1,200 to over 2,000 Tcf.

**Estimated Recoverable Gas Resources (Tcf)**

Range of government and private estimates on recoverable gas resources (several estimates are for the lower-48 States only). All estimates are adjusted for production since date of estimate.



Source: William L. Fisher, 1994, modified by ICF Resources Incorporated



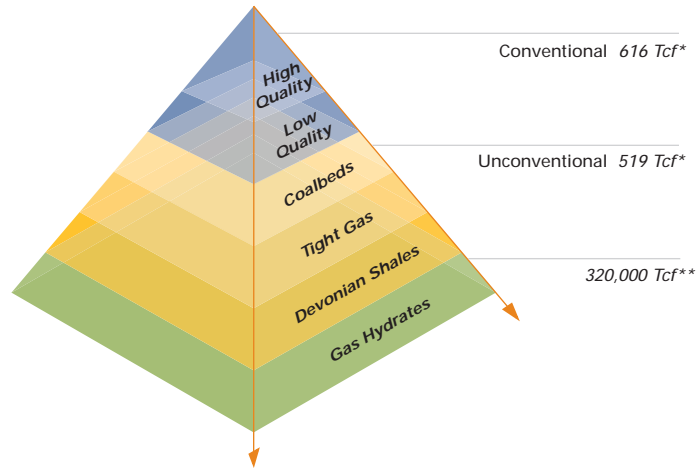


## High Stakes in Unconventional Settings

TODAY, THE E&P INDUSTRY IS confronting formidable new technology challenges. Both the stakes and the potential rewards are great. Among the opportunities? Finding cost-effective ways to tap plentiful, less conventional resources that could potentially extend the world's oil and gas supplies for hundreds of years. Less conventional oil resources are found in heavy oil deposits, oil shales, and tar sands. Gas is now found in coal seams, large shale deposits, and gas hydrates. All told, the world's unconventional resources contain energy deposits many times larger than the world's remaining conventional resources. In fact, a fundamental characteristic of the world's hydrocarbon resources is that the more challenging and technically difficult the resource is to exploit, the more of that resource there is to pursue.

If these resources can be successfully extracted and refined, we may well need to change the definition of a "nature" resource base. When unconventional resources are factored into the U.S. resource base, our Nation does not seem to be such a mature province after all. With more than a century of oil production behind us, more than two-thirds of the over 600 billion barrels of the Nation's known oil resources remain untapped.

### Natural Gas Resource Base



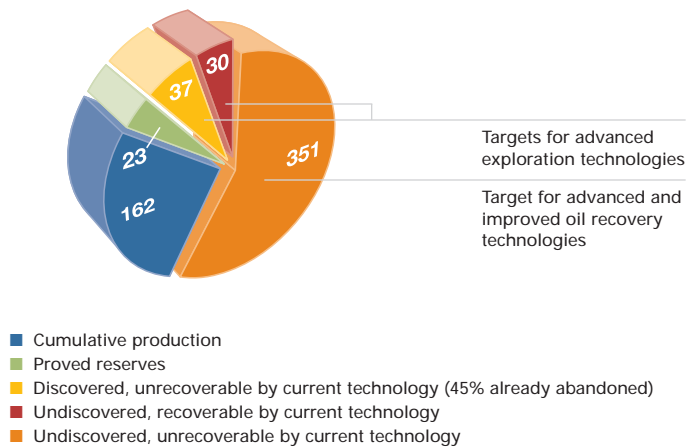
\*Technically recoverable domestic resource base  
 \*\*Mean estimate of U.S. hydrate resource base

Source: U.S. Department of Energy and U.S. Geological Survey

### Targets for Advanced Exploration and Production Technology

(In billions of barrels)

Of the approximately 603 billion barrels of the United States' known oil resources, over two-thirds remain untapped. Advanced exploration and recovery technologies are key to reaching these undiscovered or currently unrecoverable resources.



Source: U.S. Department of Energy, 1998





# MORE EFFICIENT, MORE EFFECTIVE, MORE PROTECTIVE OF THE ENVIRONMENT

## Environmental Awareness, Commitment, and Results

AS SCIENCE AND TECHNOLOGY HAVE evolved, so too has our awareness of the impacts of human activity on the environment. In the past 30 years we have begun to more fully understand the effects of human activities on soils and vegetation, air and water quality, wildlife, and health. A heightened respect for the environment has become pervasive in our society in education, industry, and government.

In the petroleum sector, oil and natural gas must be discovered, produced, processed, and consumed in a manner that respects and protects the environment. This has become the standard to which both government and the industry are committed.

## Government Has Responded to Environmental Concerns

PROTECTION OF THE ENVIRONMENT began in the early years of the industry. While many early regulations were designed to conserve oil and gas resources, these mandates served the environment at the same time. Later, as understanding grew of the potential risks associated with E&P operations, regulations to protect public health and the environment were implemented.

Before World War I, States began implementing requirements to case and cement wellbores to prevent possible contamination of freshwater aquifers. Based on new technology and operational techniques developed



*Industry and government are working to protect the environment for future generations.*

by the industry, States continued to advance new standards of protection or restricted the use of less protective alternative practices.

Since 1970, State and Federal governments have passed legislation and promulgated regulations to ensure higher levels of environmental protection. Federal legislation cuts across the spectrum of environmental concerns. Among others, these statutes include the Clean Air Act, Safe Drinking Water Act, Clean Water Act, Coastal Zone Management Act, Resource Conservation and Recovery Act, Endangered Species Act, and Occupational Safety and Health Act. Many of these statutes are implemented primarily by State agencies, which have developed programs that apply to unique and diverse environmental settings. These programs must meet or exceed the Federal requirements.

The Environmental Protection Agency has acknowledged a need for individually tailored regulations for waste management at the State and local levels that take into

account differences in environmental conditions, geology, and production economics. Most States base the protective measures they require on site-specific conditions. This approach allows the State the flexibility to require additional protection where needed without unnecessarily adding requirements and costs on operations by imposing a uniform statewide standard. Although Federal regulations sometimes restrict this State flexibility, site-specific regulations appear to be an appropriate tool to assist the States in balancing the dual goals of environmental protection and oil and gas production.

## A Fundamental of Effective Business Management

INDUSTRY POLICIES AND FIELD practices have changed dramatically in recent decades, often leading or defining new regulatory requirements. The oil and gas industry's environmental orientation has become part and parcel of its business operations, domestic and worldwide. Companies have recognized that sound environmental practices are a prerequisite for society's consent to conduct their operations.

Operators are becoming increasingly involved in the regulatory development process at both State and Federal levels to assist in finding a balance between oil and gas production and environmental protection. Many operators have developed innovative approaches to increase environmental protection, and may employ practices that exceed the requirements set forth under State and Federal regulations.



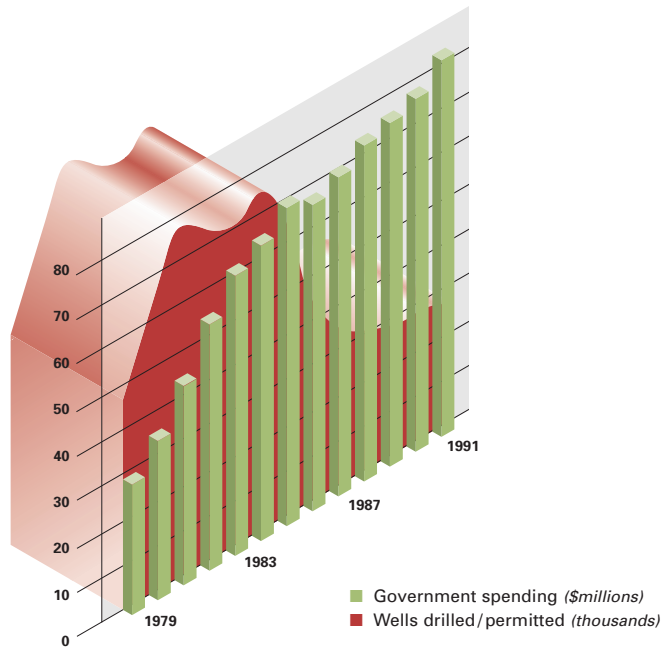






### State Spending on Oil and Gas Regulatory Activities

State spending on oil and gas regulatory activities nearly tripled during the 1980s in the largest oil- and gas-producing States. Spending rose fastest between 1979 and 1985, a period of high industry activity.



Source: Department of Energy and Interstate Oil & Gas Compact Commission, June 1993

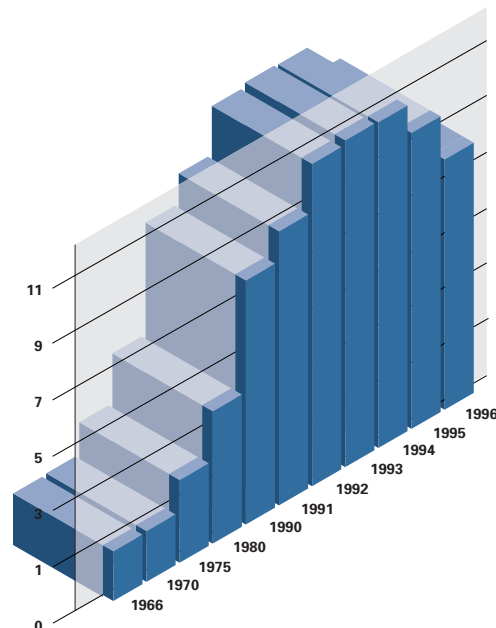
Most companies have integrated environmental issues and activities into their operational planning and management, policies, and education and training. Most conduct extensive internal audits of their impacts on the environment, and many have adopted internal standards for monitoring and continuously improving their environmental performance. In many cases, companies have adopted international environmental performance protocols such as ISO 14000\* as standard business practice for their operations around the world. Meeting or exceeding regulatory requirements and maintaining a high level of environmental performance are recognized as cornerstones of the oil and gas industry.

The industry—both in the United States and worldwide—commits enormous financial resources to specific measures for caring for the environment. In total, the industry spent over \$8 billion on the environment in the United States in 1996—more than the U.S. Environmental Protection Agency’s entire budget and more money than the industry spends annually on exploration for oil and gas in the United States.

### Industry Spending on Environmental Protection, 1966–1996

(Billions of nominal dollars)

From 1966 to 1993, the U.S. petroleum industry’s spending on environmental protection rose steadily, peaking at \$10.6 billion. The decline since 1994 is primarily attributable to the completion of major capital projects in the refining sector.



Source: American Petroleum Institute, 1998

\*The ISO 14000 series, a project of the International Organization for Standardization, is a collection of voluntary consensus standards that have been developed to assist organizations to achieve environmental and economic gains through the implementation of effective environmental management systems.



Photo: Corbis Images

## Recognizing Excellence in Safe Operations

The Minerals Management Service Safety Award for Excellence, the SAFE award, first given in 1983, recognizes and commends Outer Continental Shelf operators that conduct operations in a safe and pollution-free manner. In referring to 1997 SAFE recipients Newfield Exploration Company and Kerr-McGee Corporation, MMS Director Cynthia Quarterman noted: "This prestigious award recognizes these two companies' exemplary performance, as well as their corporate commitment to safety and environmental protection while conducting operations on the Nation's Outer Continental Shelf."

## Voluntary Industry Programs for Environmental Protection

IN 1996, THE PETROLEUM INDUSTRY spent an estimated \$187 million on company environmental departments and voluntary programs to improve environmental quality and to support community and environmental groups.



### Programs include:

#### API Step

The American Petroleum Institute's STEP Program (Strategies for Today's Environmental Partnerships) encourages companies to reflect environmental commitments in their principles and policies, and to develop programs that prevent pollution, promote safe operating practices, and conserve resources in partnership with government, the public, and other key stakeholders.

#### EPA Natural Gas STAR

Nearly 70 exploration, production, transmission, and distribution companies are members of the Environmental Protection Agency's Natural Gas STAR program. Natural Gas STAR seeks to reduce methane emissions by identifying best management practices that reduce emissions and disseminating these advanced technologies to other companies to use when it makes economic sense to do so.

## OSHA Voluntary Protection Programs

Participants are a select group of facilities across all industries with outstanding health and worker safety programs that go beyond compliance with Occupational Safety and Health Act (OSHA) regulations. E&P industry participants include BP Exploration's Endicott Island, Alaska site and Texaco Exploration's operations in Maysville, Oklahoma. The programs establish a cooperative relationship among management, labor, and OSHA to ensure a safe and healthful workplace. Once OSHA verifies that the program meets established criteria, the site is removed from routine scheduled inspection lists. OSHA reassesses periodically to confirm that the site continues to meet the criteria.

## Safety and Environmental Management Program (SEMP)

SEMP is a voluntary, nonregulatory strategy for identifying and reducing risks of accidents, injuries, and oil spills associated with developing oil and natural gas on the Nation's Outer Continental Shelf (OCS). Operators representing over 99 percent of production from the OCS have a SEMP in place or are developing one. The program was developed by the Minerals Management Service (MMS) in partnership with industry. Proper implementation of the program can help operators comply with MMS operating regulations, decrease operational risks, and enhance worker safety.





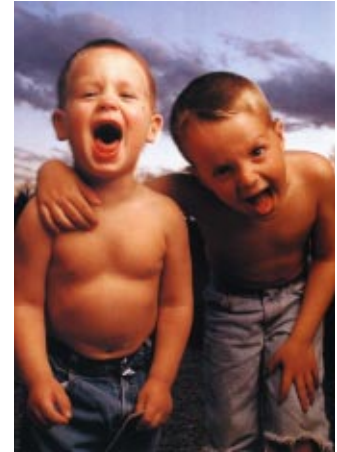
## Myths about the Oil and Gas Industry

**Myth:** The oil and gas industry is frequently characterized as Big Oil.

**Reality:** The Big Oil image is misleading. Independent oil and gas producers—small businesses typically employing 10 full-time and 3 part-time employees—drill 85 percent of the Nation’s wells and produce 65 percent of the natural gas and nearly 40 percent of the oil consumed by Americans. Across America, the owners and employees of these businesses may be your neighbors, serving as a cornerstone of economic activity in smaller rural communities. Accordingly, the Department of Energy has technology transfer programs targeted specifically to small independent producers.

**Myth:** Many Americans believe that the spills from oil and gas E&P are the leading cause of oil pollution in the oceans and in the Nation’s rivers and streams.

**Reality:** To the contrary, the National Academy of Sciences found that offshore oil and gas E&P accounts for only 2 percent of the oil in the marine environment; marine transportation accounts for 45 percent; industrial and municipal discharges, including urban runoff, 36 percent; atmospheric pollution, 9 percent; and natural sources such as oil seeps, 8 percent.



## Steps Toward Reductions in Greenhouse Gas Emissions

Oil and gas companies all over the world are voluntarily reducing emissions of carbon dioxide and other greenhouse gases. Industry giants BP Amoco and Royal Dutch/Shell Group have taken the lead in this area, publicly committing to reduce future greenhouse gas emissions to levels below those set forth in the Kyoto Protocol. In recent years, individual companies have implemented hundreds of emissions reduction initiatives and projects—from the reduction of natural gas flaring and venting, to innovative gas-to-liquids and gas liquefaction technology, to the development of creative, market-based emissions trading programs.

## Wetlands Restoration

In States where a substantial amount of oil and gas operations occur in sensitive wetlands, the oil and gas industry is actively restoring and protecting the fragile ecosystems in which it operates. Louisiana Land and Exploration

## International Protocols

On an international basis, the E&P industry is sharing “best environmental practices” and setting voluntary operating guidelines to improve environmental performance. Key associations include the European-based E&P Forum; the Western Hemisphere Oil and Gas Environmental Forum, a cooperative effort among over 30 private and State-owned oil and gas companies in the United States and Latin America; the International Association of Geophysical Contractors; and the International Petroleum Industry Environmental Conservation Association.

“While fiercely supportive of efforts to preserve and protect the environment, most Americans are using yesterday’s news while making critical decisions about behavior and policy on key environmental issues. This dependence on mythology threatens to block progress on important environmental initiatives . . . it is vital that we debunk these myths so that the public can most effectively address the environmental needs of today.”

KEVIN J. COYLE  
President  
National Environmental Education &  
Training Foundation



## Wildlife Protection Programs

With the help of Shell Oil Company Foundation and Exxon Corporation, the National Fish and Wildlife Foundation (NFWF), a nonprofit organization dedicated to promoting conservation and sustainable use of our natural resources, has been able to significantly enhance its habitat and wildlife protection programs. Multi-million-dollar, multi-year grants from these companies have enabled NFWF to establish two important grant programs: the Shell Marine Habitat Program—dedicated to protecting and enhancing the Gulf of Mexico ecosystem—and the *Save the Tiger Fund*, an international effort launched with Exxon to assist in the long-term survival of Asia’s remaining population of wild tigers.

Company (which merged with Burlington Resources in 1997), for example, began studying wetlands restoration methods as early as the 1950s and later implemented an award-winning wetlands conservation program.

Today, in LaTerre, Louisiana, Fina has undertaken an extensive program to halt erosion on over 7,000 acres of marsh by planting cordgrass and constructing a series of weirs and dams, helping to restore the marsh and its declining alligator population.

### Coastal and Marine Habitat Protection

The industry actively collaborates with private conservation groups to protect sensitive coastal and marine habitats and wildlife. For example, Shell Oil Company Foundation recently provided a 5-year, \$500,000 grant to The Nature Conservancy of Texas for conservation research and field-based environmental educational programs at the

Mad Island Marsh Preserve along the Texas Gulf Coast. On Shamrock Island in Corpus Christi Bay, The Nature Conservancy of Texas and Bristol Resources are collaborating to restore and protect habitats impacted by past oil and gas operations. On Galveston Bay, Mobil Oil recently donated over 2,200 acres of wetlands and grasslands for use as a preserve for the area’s wild prairie chicken, one of North America’s most endangered species.

### Federal Lands Stewardship

Whether tailoring operations to protect Federal lands or assisting the government in enacting sound resource development policies, the domestic petroleum industry plays a vital stewardship role on our



Nation’s Federal lands. For example, a recent exchange of over 18,000 acres of land in North Dakota’s Badlands enabled the Bureau of Land Management to consolidate ownership of prime bighorn sheep habitat, and provided Burlington Resources with access to Federal mineral rights on lands away from these critical habitats.

Equally crucial is the industry’s commitment to environmental excellence when exploring or producing on Federal lands—Unocal Alaska’s award-winning operations in Alaska’s Kenai National Wildlife Refuge and Conoco’s management of its operations in the Aransas National Wildlife Refuge on Texas’ Gulf Coast typify this commitment.

