2007

Energy Production

Education Partner & Economic Perspective

A Publication of the Independent Petroleum Association of New Mexico

$2.83 Billion Contributed to New Mexico in 2006

INDEPENDENT PETROLEUM ASSOCIATION OF NEW MEXICO

New Mexico: 4th in U.S. Natural Gas Production

OIL is the Lifeblood of the **Modern World**

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Wildlife are very good at adapting to habitat changes due to oil and gas production. Many animals find ways to use equipment to their advantage. (See "Wildife in the Oil Field" section, page 26.)

INDEPENDENT PETROLEUM ASSOCIATION OF NEW MEXICO

This infozine is distributed as a service of the Independent Petroleum Association of New Mexico

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"The Severance Tax Permanent Fund is now worth $4 billion. More than 99 percent of the fund, which retires government bonds, has been built by the oil and gas industry."

We Are the Independents!

The Independent Petroleum Association of New Mexico

A Message from the 2007 Executive Committee

Has there ever been a time to be more proud of what Independent oil and natural gas producers do for the state of New Mexico? The total financial contribution our industry made to the Land of Enchantment in fiscal year 2006 is a mind-boggling $2.83 billion! (Most of that money comes from Independents.) That's not an "economic impact" number. This $2.83 billion is tax, royalty, lease and investment revenue that flowed directly into state bank accounts.

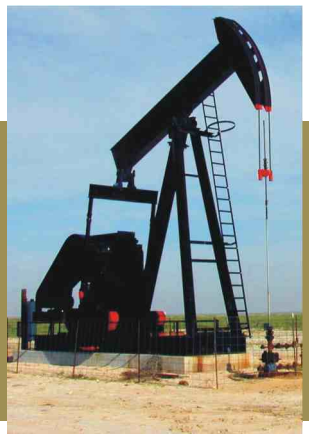
It can be difficult to even imagine such an enormous pile of cash. So, consider that $2.83 billion is the equivalent of a staggering $7.75 million pouring into state coffers each and every day, or $5,382 every minute! And that doesn't even include the one-and-a-half million dollars New Mexico producers send to the federal government on a daily basis.

We're proud to make this important contribution to our state and nation. Independent producers are especially gratified that our work makes such a large contribution to the education of our state's children. With 60 percent of the state's 2007 general fund of $5.1 billion slated to be spent on public schools and higher education, it could be argued that our industry funds 88% of New Mexico's education needs, with every other economic activity funding the last 12 percent and the other general fund obligations. No matter how you slice it, oil and gas make up the biggest piece of New Mexico's economic pie.

"The Permanent Fund has distributed $6.8 billion to New Mexico school children."

Independent producers aren't just a strong economic force in New Mexico, we're also pretty important nationally. Contrary to public perception, most of the oil and gas production in America is not done by "Big Oil." According to the Department of Energy, Independent oil and natural gas companies currently drill 85 percent of the domestic wells, producing 82 percent of our homegrown natural gas, and 68 percent of our crude oil.

The Independent Petroleum Association of New Mexico is pleased to provide you with this publication. Our more than 200 members and the thousands of people they employ want you to have a greater understanding of our industry and the tremendously positive impact it has on the quality of life of all New Mexicans.



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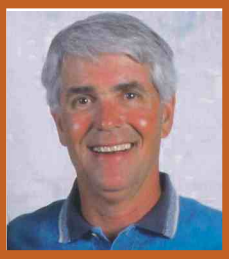


Johnny Knorr

Paul Thompson

John Byrom

Larry Scott

Bruce Ritter

SUMMARY

> “The only thing more important than oil to your survival is oxygen.”

Oil: The Master Resource

What do you need to stay alive in this world? Oxygen, water, food, shelter, and clothing have long been considered the top five essentials for survival. However, this list has been inaccurate for decades. When man chose to weave petroleum energy into the fabric of his existence, oil entered the top five, and higher than you might think. The only thing more important than oil to your survival is oxygen.

Yes, you would perish within several days without water and in a couple of weeks or so without food, but in today's world how do you get food or water without oil? Food cannot be grown, fertilized, protected from pests and predators, packaged, transported, stored, or refrigerated without oil. Water can't be pumped, cleaned, and delivered without petroleum either. That's only the beginning. As explained in the following section, “Oil Makes the World Go 'Round,” oil is essential to every aspect of modern living. Natural gas is important beyond measure as well.

New Mexico is fortunate to be a major player in the nation's energy market. Our state is the fourth largest natural gas producer in the continental U.S. and possesses the third most proven reserves.[1]

The Land of Enchantment is ranked sixth in oil production and fourth in oil reserves.[2] Production is concentrated in two areas–the San Juan Basin in the northwest region of the state and the Permian Basin in the southeast.

In New Mexico, oil and natural gas are critically important because they are the biggest drivers of the state's economy. Take away petroleum production and the Land of Enchantment would suffer profound economic hardship. In FY 2006, the oil and natural gas industry generated approximately $2.83 billion in direct revenue to the state, as well as nearly $539.9 million to the federal government.[3] That $2.83 billion is a big number, especially when you consider the state's entire 2006 general fund was 5.36 billion.

SUMMARY

Put another way, the oil and natural gas industry deposits $7.75 million into state bank accounts every day of the year. That's in addition to the $1.48 million the industry deposits into the federal treasury day in and day out.

New Mexico's school children are the primary beneficiaries of the oil and natural gas industry, and they will be for generations to come. Since the 1920s New Mexico has been depositing money from oil and natural gas production into the Land Grant Permanent Fund. That fund, which is valued at $9 billion (2006), continues to grow while also greatly supporting today's educational system as well as public facilities and government projects. The payout from the Permanent Fund in FY 2006 was $4.26 million.[4]

Over its life, the Permanent Fund has distributed $8.23 billion to the General Fund. Of that, $6.8 billion has gone to New Mexico's public schools.[5] Other beneficiaries include the New Mexico School for the Deaf, New Mexico School for the Blind and Visually Impaired, the University of New Mexico, New Mexico State University and other institutions of higher education.

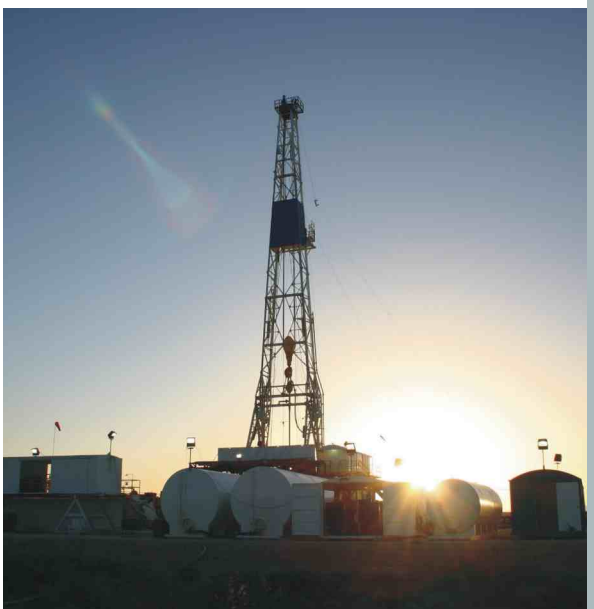
By contrast, the New Mexico State Lottery has raised $291 million in the past 10 years to send New Mexicans to college. That's an average of $29 million a year.

“The oil and natural gas industry deposits $7.75 million into the state's bank account every day of the year.”

While oil and natural gas producers drill for the lifeblood of our economy, educational system, and modern way of life, they do so with great care taken to protect and preserve the environment. Today's wells are drilled with far less impact to the land's surface than the wells of a generation ago.

Technological advances have made oil production cleaner, safer, and more efficient. When a well has given up all the vital energy it can produce, the equipment is removed, and the land is reclaimed. Within a few years the terrain returns to its natural state with no indication (aside from a dry hole marker) that a well had ever been there. Producers follow strict federal and state regulations that ensure the proper use and protection of the land. More than this, those who make a living by providing you with oil and natural gas have an even greater motivation to use the land responsibly–it's their home.

In spite of the incalculable benefits to using oil and natural gas as energy sources, there are those who feel compelled to attack the industry that gives everyone–including them–such a high quality of life. This is one of the great challenges faced by petroleum companies and those they serve (i.e. all of us).



Every day distortions, mischaracterizations, and even outright lies about the industry and its impact on the environment are forced on an unsuspecting public. Historically producers have simply ignored these attacks. However, in recent years industry leaders have realized that this harassment must be countered with a determined effort to debunk the misconceptions while educating the public about the many positive contributions oil and natural gas make to their everyday lives. This publication is part of that effort.

Petroleum Makes the WORLD GO ROUND!

> "It was oil that saved the whales, and it was oil that ended a human history dominated by slavery. It is oil that replaces the vast majority of our hard, physical labor, and it is oil that has given us the ability to create every modern necessity and convenience."

INDEPENDENT PETROLEUM ASSOCIATION OF NEW MEXICO

> "It can be argued that the preciousness of gold can in no way compare to the worth of petroleum."

More Important Than You Know

It is almost impossible to overstate the importance of oil and its powerful brother, natural gas. Without them our world would be completely different, more different than any of us can possibly imagine.

Look around and try to spot a single item that would still be there if oil were not. When people think of oil and natural gas, they typically consider its obvious uses–gasoline for the car, a lubricant for the engine, and a power source for electricity generation and the heating of homes. What about rubber for tires, shoes, and seals on refrigerators, ovens, and car doors? Consider the importance of asphalt, fertilizers, pesticides, and glue. What would life be like without magic markers, lipstick, pantyhose, credit cards, dental floss, toothpaste, baby bottles, telephones, TVs, computers, soccer balls, paint, and synthetic fibers for today's clothing?

The large quantity of everyday items that contain some byproduct of petroleum is astonishing. Take these products away and our world would come to a sudden and catastrophic halt. If somehow we could instantly remove the contribution of petroleum to our world, you would find yourself standing naked and unsheltered in an open landscape among millions of other naked and unsheltered souls.

It's a little unnerving just to think about it. There's only one thing more important to our survival than oil and natural gas, and that's oxygen. Yes, water, food, clothing, and shelter are essential, but in today's world the vast majority of the population cannot get these life-sustaining necessities without petroleum.

Source: National Geographic

The Foster family displays all of their belongings made mostly from oil based polymers.

The Foster family displays all of their belongings made mostly from oil based polymers

The only way to truly appreciate the importance of oil to the modern world would be to turn the clock back to about the mid-19th century before the influence of petroleum began to take hold. At that time, people got their lighting from vegetable and animal oils, especially whale oil. The high demand for these lubricants and illumination sources had driven the earth's whale population to the brink of extinction.

While whales were having a tough go of it as a species, life wasn't all that pleasant for the man who hunted the beast and coveted its blubber. Most people made their living through punishing physical labor. The average life expectancy was about 35 years. Infant mortality was high. Plagues and diseases were common. Death was a frequent visitor.

Life was hard, and there just weren't enough workers available to get the job done. As a result, the great need for human labor had created one of the biggest economic markets known to man–the slave trade. Indeed, slavery had been a fixture in most of the world throughout all of human history. Mankind has always had an energy/labor problem.

The slaves weren't the only ones working up a sweat. Most free men, women, and children were lifting, shoveling, cutting, bailing, plowing, and shucking as well. Even as late as the end of the 19th century, nearly 40 years after slavery had been abolished in the United States, human labor made up 94 percent of all industrial work.[6]

Once the influence of oil had a chance to take hold with the introduction of automobiles, farm equipment, and thousands of other modern machines, the need for physical human labor plummeted. Today, it constitutes only eight percent of industrial work in the U.S.[7]

The invention of the steam engine in 1698 brought significant progress to man's need for energy. So did the discovery in 1853 that kerosene could be produced from coal. Of course, there were many other inventions and discoveries that propelled man toward a less labor-intensive life. However, no single energy source can be compared to petroleum.

It was oil that saved the whales, and it was oil that ended a human history dominated by slavery. It is oil that replaces the vast majority of our hard, physical labor, and it is oil that has given us the ability to create every modern necessity and convenience. It is oil that has provided the foundation for progress in healthcare, enabling us to more than double our life expectancy in less than a century. It is oil that has fueled not just the industrial revolution but also the technologic and information revolutions as well.

In a true sense of the word, oil is our servant. It's estimated that the energy we use today (which comes directly from oil or is impossible to generate without oil) has given every American access to the equivalent of 300 human servants. Western Europeans are served by 150, and even the people in the developing world, such as India, have a comparable 15 energy-based servants each to help them with all of their physical needs.[8]

> **“ If somehow we could instantly remove the contribution of petroleum to our world, you would find yourself standing naked and unsheltered in an open landscape among millions of other naked and unsheltered souls.**

Not long after people discovered the great power and utility of oil they began calling it “Black Gold” because of its tremendous value. Today that term is a quaint expression with very little meaning. It can be argued that the preciousness of gold can in no way compare to the worth of petroleum.

The World Drinks A Lot of Oil

It takes an enormous amount of oil to run modern civilization. The world consumes more than 83.8 million barrels of oil per day–20.8 million in the U.S. alone. That's 873.6 million American gallons! We only have five percent of earth's population, yet we consume 25 percent of its petroleum (guzzling 384.7 million gallons of gasoline per day).[9] Other nations have been critical of our voracious thirst for oil. However, America is also the world's most productive and innovative country, blessing all other nations with most life-improving advancements.

Oil fuels our freedom.

As you might have guessed, petroleum production and distribution make up the world's largest industry, employing 1.3 million workers in the United States alone. Comprising 1.6 percent of global gross domestic product (GDP), oil is the most important and valuable commodity in international trade.[10]

It takes more than 280 gallons of oil to raise a single 1,250-pound steer. Fuel usage includes everything from fertilizer for the corn that fed the cow to fuel that runs the farm equipment. To get to the final product, every pound of beef in your supermarket requires three-quarters of a gallon of gasoline to produce.[11] Petroleum is everywhere and in one form or another plays a role in everything.

Thirty-one U.S. states possess petroleum reserves as well as the federal offshore coastline. U.S. production as of 2005 was 5.178 million barrels a day. Imports equal 12.5 million barrels daily, with 5.58 million of those barrels, or about 27 percent of our supply, coming from countries that are members of OPEC.[12]

> “Without adequate fuel supplies for fighter jets, battleships, tanks, and other armored vehicles America would be vulnerable to any nation that wished to take what we have, and that includes our liberty.”

Lest We Forget: Oil & National Defense

Oil as well as all other energy sources is directly tied to the success and survival of the United States of America. The same can be said of any other country. Fundamentally, no society can endure–let alone prosper–without two things: an adequate and affordable food supply and the availability of affordable energy. Because our food supply is almost completely dependent on oil, petroleum is the most important commodity we have.

While it's quite clear that our economy and standard of living are completely dependent upon oil, it may be less clear that petroleum is a key ingredient in our freedom, too. Without adequate fuel supplies for fighter jets, battleships, tanks, and other armored vehicles America would be vulnerable to any nation that wished to take what we have as its own, and that includes our liberty.

Allied forces defeated the Axis powers in World War II because of a variety of reasons–brave men and women, intelligent military leaders, and a home-front that made great sacrifices to give the military all that it needed while still running a nation. However, no level of bravery or sacrifice would have mattered if the United States hadn't had sufficient oil supplies to fuel victory.

Freedom isn't free. It takes bravery, skill, passion, human ingenuity, and the fuel to make it all work.

Agriculture

In America, most everyone has access to abundant supplies of food–amounts that often shock people in other parts of the world, and quantities that would have been unheard of just a few generations ago. Stop in any grocery or warehouse store and you'll be astounded at the vast quantities of food that are available, especially in the produce and meat aisles. For all that food, we have oil to thank.

Petroleum is used to make fertilizers and pesticides that nourish plants and keep them pest free. Gasoline and diesel run the tractors, planters, cultivators, hay balers, threshers, reapers, and other machines that plant, cultivate and harvest our crops. Food processing plants are heated with oil and natural gas. The trucks, trains, planes, ships, and barges that get the food from the processing plants to the warehouses and then to grocery stores are fueled with oil. Just stop and think where we would be food-wise if there was no oil and if farmers had to work their fields with horses and oxen instead of with tractors and modern, labor-saving machines.

Here's a little perspective. In colonial days, when they did use horses and oxen to work fields, nine out of ten working people were employed on farms. Today, just three percent of our labor force supplies all the food we need, plus ten percent of overseas consumption.[13] By the early 1900s, tractors were becoming available that could do the work of 17 men and 50 horses.[14] It wasn't until 1953 that there were more tractors than horses on U.S. farms.

That mechanization, along with better fertilizers, pesticides, and plant varieties, produced great increases in crop yields. In 1930, the average yield per acre of corn in the U.S. was 20 bushels. By 1970 that had increased to 70 bushels, and by the mid-1990s, to 140 bushels. In 1930, the average soybean yield was 13 bushels per acre. By the mid-1990s that number had grown to 40 bushels per acre.[15]

Cheap and abundant oil and gas has helped make those productivity increases possible. In 2003, agricultural energy costs in the U.S. totaled $28.8 billion, or 14.4 percent of total production costs of nearly $200 billion.[16] It's imperative that we keep those energy costs low. According to a report by the Congressional Research Service, “unexpected changes in energy prices or availability can substantially alter farm net revenues, particularly for major field crop production.”

The good news is that agriculture uses very little energy compared to other U.S. industries. In 2002, agriculture's share of total U.S. energy use was one percent. And total agricultural use of energy has fallen by 28 percent since the late 1970s, thanks to improved machinery, equipment, and production practices.[17]

The next time you bite into that fresh pineapple from Hawaii, or into out-of-season fruits and vegetables from other parts of the world, know that oil is responsible for growing and getting them to you cheaply.

Photo Courtesy of Juliana Halvorson

Benefits to New Mexico

Enchanting Petroleum

When New Mexico became the 47th state in the union in 1912, it was appropriately proclaimed the Land of Enchantment. With the state's gorgeous mountains, expansive plains, dramatic skyline, and hospitable tri-cultural population, New Mexico has captured the hearts of many an outsider. Predictably, thousands upon thousands of those visitors have been so moved by our state's uniqueness that they've decided to come back–permanently.

What these new residents discover is that New Mexico is one of the poorest states in the union. It's a fact of life many citizens have come to accept as a tradeoff for wonderful weather, excellent views, and a high quality of life. What many transplant and native citizens don't know is how big a role the oil and natural gas industry plays in making the state an enchanting place to live, in spite of its economic shortcomings. In fact, without the tremendous contribution oil and natural gas make to the financial well being of New Mexico, a more appropriate state motto would be "Pretty… but also Pretty Desperate."

Source: New Mexico Department of Labor

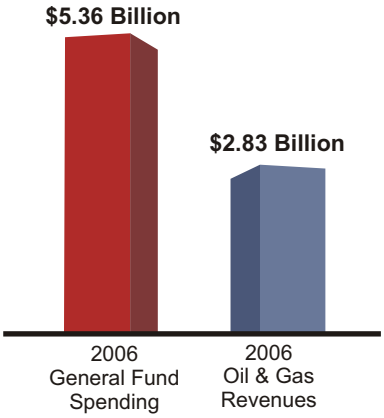
Economic Muscle

Oil and natural gas production is the single biggest horse in New Mexico's economy. Direct revenue is more than half of what the state spends on general fund obligations.[18] Add in other factors such as the impact of thousands of high-paying jobs and the significant amount of money brought into New Mexico from outside our borders, and it's easy to see that the state's well being is directly tied to that of the oil and natural gas industry.

Taxable sales on oil and natural gas were $12.7 billion in fiscal year (FY)2006.[19] All of that production translates into a very large chunk of revenue for state government. The total in tax, royalty, lease, rent, and investment collections for the state in FY2006 was $2.83 billion, which is $7.75 million a day. Size that up against the state's entire 2006 general fund of $5.36 billion.

> "The state's well being is directly tied to that of the oil and natural gas industry."

This enormous contribution to the state's economy is, of course, nothing new. Oil and natural gas producers have been New Mexico's dependable revenue generator for many decades. Production of these valuable resources in just nine of the state's 33 counties pumps hundreds of millions of dollars into education, roads, public facilities construction, and into the operation of our state government.



State Revenues from Oil & Gas Production

State general fund:	2003	2004	2005	2006
Oil and gas emergency school tax	$229,638,624	$297,070,343	$386,785,907	$491,657,374
Oil and gas conservation tax	$10,888,867	$14,931,771	$19,514,983	$24,819,553
Natural gas processors tax	$21,077,023	$13,477,994	$24,321,786	$27,268,027
Federal mineral leasing royalties	$258,365,730	$308,108,000	$391,000,000	$544,880,000
State land office rents, bonuses, etc.	$18,727,187	$22,060,805	$42,044,343	$52,695,563
Gross receipts tax	$36,474,526	$42,941,465	$55,867,203	$124,794,894
Corporate income tax	Data N/A	$27,084,876	$74,632,310	$153,300,956
Subtotal–revenue from current prod.	**$575,171,956**	**$725,675,254**	**$994,166,532**	**$1,420,416,367**
Earnings on land grant permanent fund	$259,142,844	$274,700,492	$339,791,000	$343,380,000
Earnings on severance tax permanent	$136,763,894	$137,947,286	$166,272,000	$168,384,000
Total–general fund revenue	**$971,078,695**	**$1,138,323,032**	**$1,500,229,532**	**$1,932,180,367**
Severance tax bonding fund:				
Oil and gas severance tax	$221,446,421	$293,087,714	$384,561,385	$488,952,323
Land grant permanent fund:				
State land office royalties	$218,385,341	$236,277,777	$312,251,910	$405,343,063
Grand total all funds	**$1,410,910,457**	**$1,667,688,254**	**$2,197,042,827**	**$2,826,475,753**

Source: NM Taxation & Revenue Department and State Land Office

Jobs

The oil and natural gas industry is a large contributor to the state's employment base. According to the New Mexico Department of Labor, approximately 14,300 people work in the areas of exploration and production, and another 12,000 to 14,000 people are employed in service companies, transportation, retail, and other related work. The exploration and production jobs are particularly valuable to the state because they pay very well by New Mexico standards.

In 2006, the average private sector wage in the state was $30,628, while the average income for a worker in the petroleum industry was $52,468.[20] It's also significant to note that these jobs are in predominantly rural counties that would otherwise have a difficult time attracting industry from another sector.

Without question the oil and natural gas industry shoulders a significant majority of the economic burden in the nine counties where production takes place. Equally as important, these rural counties provide a big economic boost to the state rather than a drain, which is common for non-resource producing rural areas.

Steve Dunn, Merrion Oil & Gas. One of more than 14,300 people employed by New Mexico's Oil and Gas Industry.

Benefits to New Mexico

A Taxing Equation

It's impossible to know what would happen to New Mexico's economy if oil and natural gas production suddenly came to a halt. There's no good way to calculate the severity of the waves of impact resulting from the loss of thousands of industry jobs that would in turn eliminate thousands more non-related service-sector jobs, or the loss of millions of dollars flowing into New Mexico from outside the state.

In 2005 officials from the New Mexico Taxation & Revenue Department calculated what it would take to simply replace the tax dollars generated from oil and natural gas production. At that time they estimated that in order to reproduce oil and natural gas revenue the state would have had to raise its gross receipts tax by three percent or to double the state income tax rate, effectively increasing the average taxpayer's bill by $2,000. (This calculation took into account that a large number of New Mexicans don't pay state income tax and therefore would still pay nothing under this scenario.)

Since that time, however, oil and natural gas revenues have increased by a staggering 70 percent! The numbers are now so large they defy any sort of economic replacement modeling. To put it simply, if the oil and natural gas industry suddenly disappeared from New Mexico, the state's economy would be so devastated that the federal government would have to support us as an orphan state for a very long time.

Land Grant Permanent Fund

The Land Grant Permanent Fund (LGPF) has been in existence since 1898. It came about when the U.S. government transferred 13.4 million acres of federal land to New Mexico. The state leases that land and sells its mineral rights. Proceeds from those sales and leases go into the Permanent Fund.

The interest earnings and royalties from oil, natural gas, and minerals and the proceeds from land sales are held in trust for the benefit of public entities such as public schools, universities, hospitals, the capitol buildings, water reservoirs, the state penitentiary, public roads, buildings and state parks, and the function of state government. The state earns interest on the fund's principal, and distributes a portion of that interest every year to the 21 entities.

As of October, 2006, the market value of the fund was $9 billion. The State Land Office reports that $494 million (more than 84 percent of which was generated by oil and natural gas development) flowed into the fund in FY 2006. The total distribution to the beneficiaries in 2006 was $422 million.[21]

Severance Tax Permanent Fund

The Severance Tax Permanent Fund (STPF), a second permanent endowment trust, is funded by the Oil and Gas Severance Tax. Funds from the STPF are used to retire bonds that pay for government projects. More than 99 percent of the money going into the STPF comes from oil and natural gas exploration and production. Add the STPF to the LGPF, and the money generated by oil and gas operations on public lands create the third-largest educational endowment in the world. The STPF assets of slightly less than one billion dollars tripled between 1984 and 1998 to more than $3.3 billion. In October 2006, the fund had grown to $4 billion.[22]

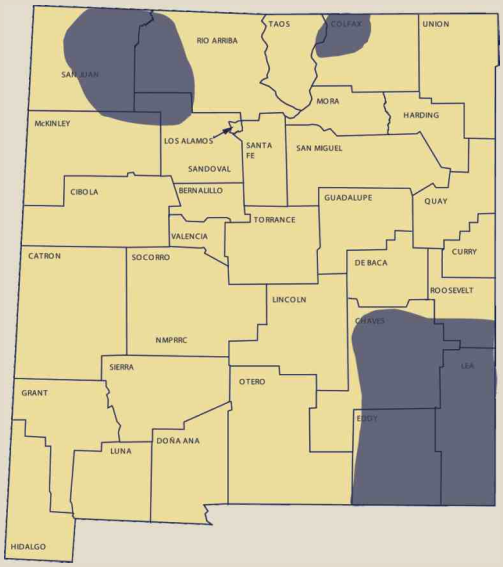
Benefits

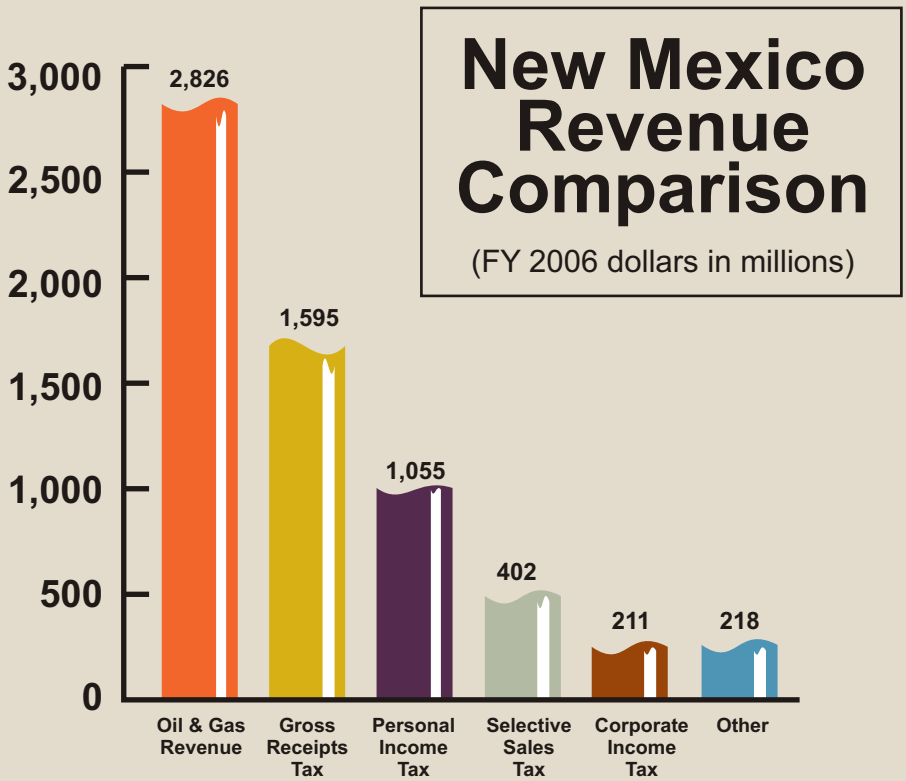
New Mexico Oil & Natural Gas: Northwest and Southeast

Land of Discovery

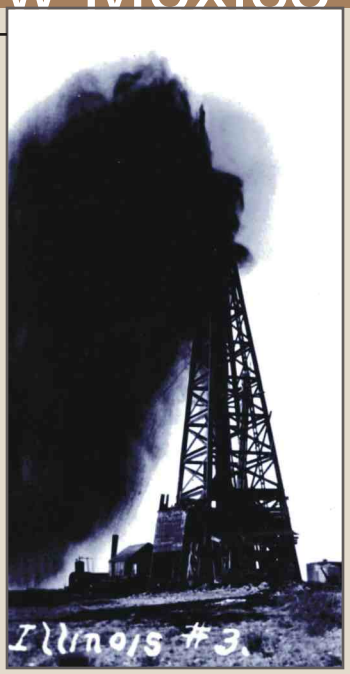
The great economic benefits New Mexico reaps from the oil and natural gas industry were created hundreds of millions of years ago when the sea that covered and withdrew from North America deposited marine plants and animals, minerals, and marine sedimentary rocks. Then the collision of massive tectonic plates forced the Rocky Mountains to rise thousands of feet. The basins that remained captured the decaying organic matter and eventually became hydrocarbon source rocks.

New Mexico has more than 50,000 active oil and natural gas wells in its basins in the northwestern and southeastern sections of the state. An additional 4,500 have already been plugged and abandoned. The San Juan and Permian Basins are by far the most productive. (The Permian Basin has two sub-basins, the Pecos Slope and the Delaware Basin.) The Raton Basin, which encompasses 2,200 square miles in Colfax and Taos counties and southeastern Colorado, is another small, but important contributor of coal bed methane.





Benefits to New Mexico



Illinois #3 hit oil in 1924. It was the first commercial well in New Mexico drilled on state land by Martin Yates, Van Welch, William Dooley, and Tom Flynn.

Permian Basin

The Permian Basin is an ancient seabed underlying an area approximately 250 miles wide and 300 miles long that New Mexico shares with Texas. In 1924, New Mexico hit the petroleum jackpot in the Dayton-Artesia field, about eight miles south of Artesia. Not long after its discovery, the Permian Basin quickly became one of the major oil-producing areas of the world.

The Permian produces oil and natural gas from approximately 53,500 wells (including Texas). Based on recent trends, it's expected that another 10,000 wells will be drilled in southeast New Mexico over the next decade.[23] There are 27 major formations producing in the Permian Basin at depths from as shallow as 200 feet to more than 20,000 feet.[24]

San Juan Basin

Natural gas was discovered in two wells drilled in Eddy County in 1908 and 1909, but it wasn't until 1921 that New Mexico's largest store of the clean-burning fuel was discovered in San Juan County, just south of Aztec.

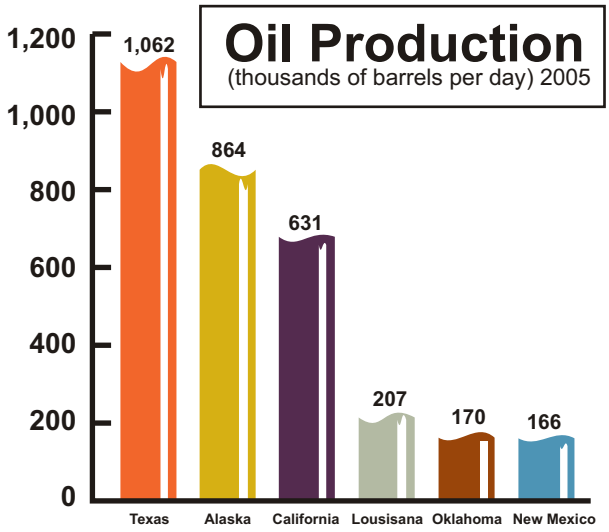
As natural gas advanced as an energy commodity through the mid-20th century, the San Juan Basin became increasingly important to the nation's economy. San Juan overtook the Permian Basin as the lead producer of natural gas in the 1990s due to the production of coal bed methane. There are currently 20,000 producing wells in the San Juan Basin extracting mostly natural gas. Approximately 10,000 more wells are slated to be drilled in the next two decades. The new wells will produce as the existing wells do, primarily from five sandstone formations that range in depth from 200 to 8,000 feet.

The San Juan Basin has produced more than 370 million barrels of oil and nearly 38 Tcf, or trillions of cubic feet, of natural gas. Giant Industries purchases almost all of the basin's oil, refining it into gasoline and diesel at facilities in Bloomfield and Thoreau. Most of the natural gas is gathered and transported via pipeline to California.

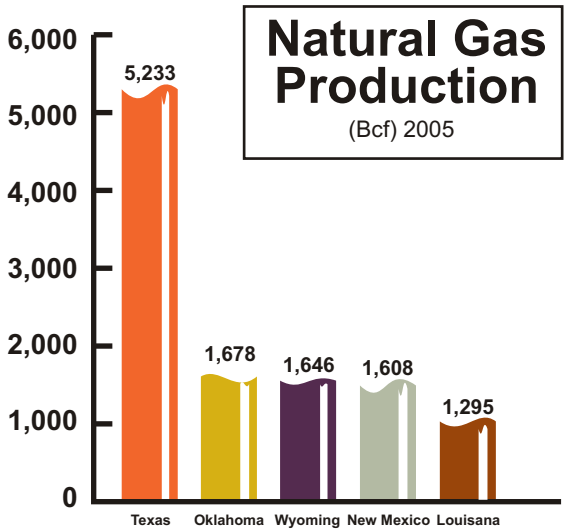
The newest U.S. Geological Survey projections for the San Juan Basin calculate possible natural gas reserves (not to be confused with "proved" reserves) at more than 50 Tcf of unconventional natural gas, 148 million barrels of natural gas liquids, and 19 million barrels of oil. The nation uses about 20 Tcf of gas a year, so that means the reserves of the San Juan Basin would supply about two and one-half years of natural gas for the entire nation.

With such reserves available, New Mexico will be a major player in the oil and natural gas industry for decades to come.

Benefits



Source: Energy Information Administration

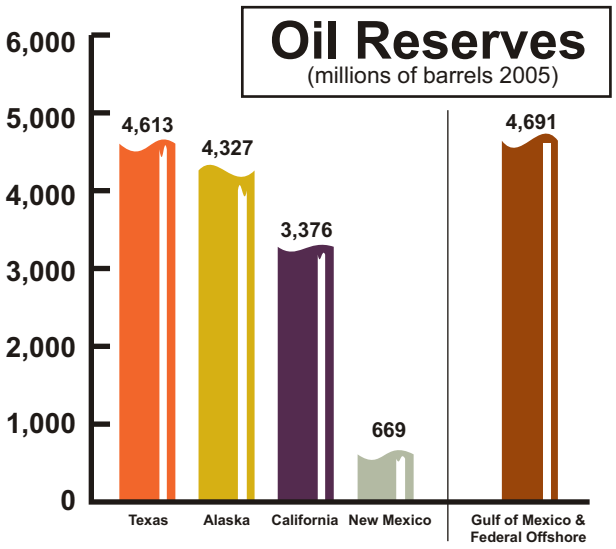


Source: Energy Information Administration

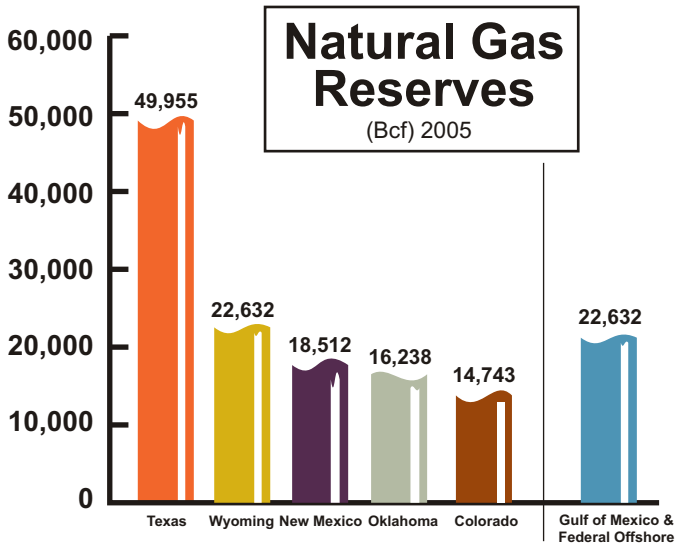
New Mexico: A National Player

Because New Mexico is a relatively small (by population) and poor state, the lament can often be heard, “We're always near the bottom in every national ranking.” Oil and natural gas production is one area where New Mexicans can hold their heads high and declare to the nation, “We're a player!”

New Mexico is currently the fourth largest producer of natural gas in the United States (very close in production behind Oklahoma and Wyoming) and has the third largest amount of proven natural gas reserves. The state is ranked sixth in oil production and fourth in oil reserves. Finally, New Mexico leads the nation in the production and reserves of coal bed methane.



Source: Energy Information Administration



Source: Energy Information Administration

Oil & Water

Environmental Stewardship

Anyone who listens to the constant rhetoric of environmental activist groups would likely be convinced that oil companies only care about making a profit and that "destroying" the environment is simply a necessary casualty to get there. Nothing could be further from the truth. The men and women who are dedicated to producing oil and natural gas for an energy-thirsty nation take their jobs very seriously. Safely producing the fuels that power our state and nation is only part of their job. Protecting the land that gives us these valuable fuels is equally important.

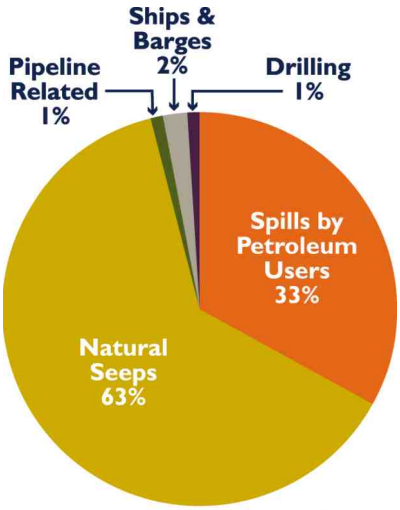
These producers live in the communities where they work and therefore have a strong pride and natural incentive to care for the land. It's worth noting that a significant majority of the people who are dedicated to stopping oil and natural gas production don't live in places such as Artesia, Hobbs, or Farmington; instead, these people typically live in cities such as Santa Fe, New York, and Boston.

New Mexico oil and natural gas producers are continually developing and implementing advanced technologies that improve both efficiency and environmental benefit. Their record for safe, clean production of energy is excellent, and it must stay that way. Strict federal, state, and local environmental regulations require that producers protect the environment from groundwater contamination, air pollution, and unnecessary surface damages. The Oil Conservation Division Rule Book on the state Energy, Minerals and Natural Resources website lists 1,304 sections of rules, definitions and procedures. The book is 157 pages thick, including amendments to the rules.[25]

Naturally Occurring Water Contamination

Today there is a tendency for people to blame humans for any kind of environmental pollution. What they don't realize is that nature can be pretty messy, even without help from us.

While oil and natural gas (along with a lot of water) are typically contained within rock formations well below fresh water reserves, it's not uncommon for hydrocarbons to naturally find their way into fresh water supplies. In fact, in the early days of oil production, petroleum was sometimes discovered following the drilling of water wells. A sheen of oil on the surface of the water would sometimes mean the land in that location was better suited for oil production.



Source: National Research Council

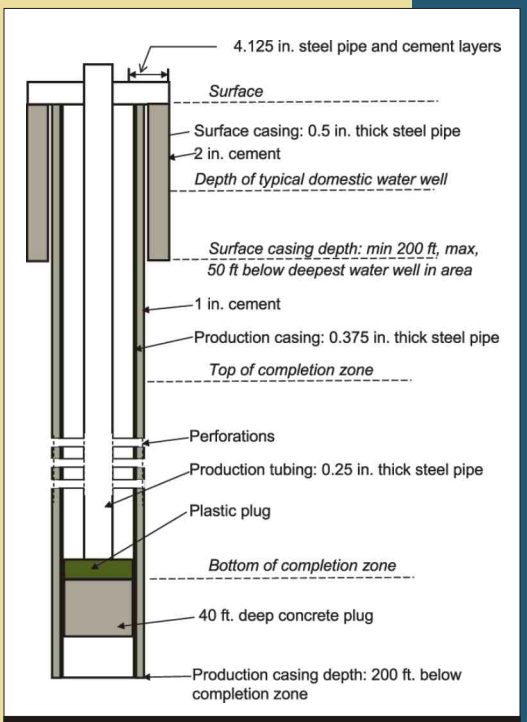
Other forms of naturally occurring contamination are also well known to scientists. Mexico's largest oil reserve was discovered when a fisherman noticed oil in the water around his dinghy and reported the "problem." Seabed oil seeps are not a problem because microbes use them as a food source. (Land-based microbes also feast on oil when it is spilled on the ground.) Surprisingly, 63 percent of oil that finds its way into U.S. waterways does so through natural seeps.[26]

There is natural contamination of hydrocarbons and other matter that filters into groundwater. In New Mexico, naturally occurring methane seeps into groundwater supplies in wells from Aztec to Durango, Colorado.

> “Drillers take a multitude of safety precautions to protect groundwater, which include standard procedures for drilling the well.”

Nationally, fully two-thirds of the methane gas found in domestic water wells has nothing to do with natural gas development. The methane in domestic wells is two-thirds biogenic gas, caused by bacteria, and one-third thermogenic, which can be related to natural conditions, development, or both. Other contaminants found in producing areas include selenium, fluorine, sulfate, or iron.

The tendency to assume man's activities are to blame for environmental impacts is common. Oil and natural gas producers have grown accustomed to occasionally taking blame for damage not of their doing. In one case, the City of Carlsbad accused the industry of polluting a water well with hydrocarbons. The New Mexico Oil Conservation Division (NMOCD) investigated and discovered the city was actually drilling beyond its aquifer. Unbeknownst to city officials, they were drilling in an adjacent oil field.



There are many ways to complete wells with various sizes of tubing and casing. This diagram is a basic configuration.

Multiple Protections for Ground Water

When any oil or natural gas well is drilled, great care is taken to protect groundwater that lies between the surface and the minerals below. Groundwater is an issue only some of the time because it is not always present where minerals are found.

Since the first commercially viable oil well was drilled by Edwin Drake in 1859 (Titusville, Penn.), many technological advancements have made the drilling process more efficient and safer for humans as well as the environment, especially where groundwater is concerned. During the drilling process, multiple steps are taken to ensure that fresh groundwater reserves are not compromised by mineral deposits that lie below.

Drillers take a multitude of safety precautions to protect groundwater, which include standard procedures for drilling the well. First, a hole is drilled to a minimum depth of 200 feet or 50 feet below the deepest registered domestic water well in the area. A steel pipe is inserted into the hole. Then, a two-inch barrier of cement is pumped between the hole and the steel casing all the way up the surface.

The next step is to drill a production hole typically 200 feet below the target formation, also known as the “completion zone.” Production casing is then inserted into the hole. Once again, cement is placed between the hole and the steel casing, measuring about one inch thick, all the way up to the surface. Approximately 40 feet of cement is left inside the bottom of the casing.

Casings are checked for integrity before the well construction process continues. In the completion zone, the production casing is perforated so that oil or natural gas can flow into the production tubing. When the well is operational the oil or natural gas flow through the production tubing to the surface.

The cement barrier is an essential part of well safety because it seals off formations to prevent fluids from migrating. In other words, the oil or natural gas can only come to the surface through the production tubing, where there are multiple barriers of protection for groundwater. Additionally, the cement seal also protects the steel casing from the corrosive effects of other formation fluids.

> “Entrepreneurs and government agencies are currently working on processes to clean produced water to such a degree that it can be used for agricultural or other purposes.”

Produced Water: Hope for the Future

Along with oil or natural gas, water also is produced from a well. For each barrel of oil extracted, an average of eight barrels of typically saline water is also produced. This water can be nearly six times as salty as seawater. Dissolved hydrocarbons in this water make it difficult to clean and desalinate. However, entrepreneurs and government agencies are currently working on processes to clean produced water to such a degree that it can be used for agricultural or other purposes.

Produced water is separated from the oil or natural gas at the well site and then transported by pipeline or truck to an injection well. Injection wells are drilled into deep formations, often below 10,000 feet or an existing well is converted to an injection well. The Environmental Protection Agency (EPA) has regulations for injection wells, which are overseen by the NMOCD. These regulations are specifically designed to prevent contamination of underground sources of drinking water.

Sometimes water is pumped into holding tanks and later trucked to a disposal facility. Although most water is disposed of by injection in New Mexico, some is allowed to evaporate in regulated pits, permitted and checked by the NMOCD. In other cases, water from varying sources is injected underground through injection wells, to help force oil out of the reservoir rock. This process is known as secondary recovery or waterflooding.

Currently, produced water is a financial liability to the industry because of the disposal expense. However, this problem will actually become a solution if entrepreneurs are successful in perfecting the technology to adequately clean the water at a cost that is cheaper than the disposal expense. When this happens (and we believe it will), there will be a windfall of untold millions of gallons of water. In an arid state such as New Mexico, this technology could provide an extraordinary economic and environmental benefit. Not only would the state be awash in a new source of water, but it would also cash in on improved recovery of oil and natural gas resources. The increased costs of disposing of produced water (as a well ages the ratio of water to oil or natural gas often increases) is typically what makes a well more costly to operate than its worth. Turning produced water into an asset instead of a liability will increase the lifecycle of the well.

Roughnecks in the process off drilling a well.

A land farm in the San Juan Basin.

Soil Protection

If there is a significant oil spill or leak, naturally there is immediate cause for concern. However, cleaning up the vast majority of spills does not take a hazardous materials crew. It takes a “Land Farm.” Keep in mind, oil is simply an advanced form of compost. It is completely organic. When oil is spilled on the ground, producers clean it up by–believe it or not–cultivating it.

The contaminated soil is spread out in a thin layer over a plot of ground and mixed with the native soil, minerals, nutrients, and oil-eating microbes. The microbial activity is stimulated and bio-remediation begins. The result? The oil is “eaten” or degraded into its organic compounds and, thus, disappears.

Larger spills are cultivated by using the soil much like a farmer uses his land by creating rows of furrows for crops. The furrows are tilled at regular intervals to keep the soil oxygenated so the microbes can do their work. Proper pH levels are also maintained. When the process is complete, rich, productive soil remains–soil that can be used in parks, gardens, flowerbeds, or any other useful purpose. Nature is the original inventor of recycling.

Crude oil leakage or spills can damage soil and vegetation, and as such, federal and state agencies monitor and test wells and oil storage. Should produced water spill onto the ground or common lube oil used with compressors drip off the machine, Oil Conservation Division rules regulate its cleanup and removal.

“Nature is the inventor of recycling.”

Directional Drilling

Directional drilling allows producers to drill more than one well from a location and disturb less surface area. It protects environmentally sensitive areas and makes drilling more feasible in areas with multiple-use regulations.

It has its limits, however, and it doesn't always prove to be less intrusive overall. There's only so far a drill can deviate from vertical, and it often requires more time for construction, drilling, and longer-term maintenance. Additional equipment may be required to complete the task. The cost of drilling a directional well is often considerably more expensive and presents additional risks. Therefore, use of this technology is only suitable and economically viable in a limited number of cases.

Land Use

For every inch of surface property that is disturbed in the process of oil or natural gas development, more money must be invested for construction and later reclamation. Companies try to disturb as little area as possible to reduce the impact on the land, to maintain good neighborly relationships, and to save on long-term costs.

The well pad is the surface area upon which the drilling rig sits. One to three acres is the optimal size, providing enough room for the heavy equipment needed for drilling, maintenance, construction, and safety. The pad also provides a buffer between the wellhead and surrounding wildlife, vegetation, and neighbors. When drilling is complete, the pad may be reduced to between one-half and one-and-a-half acres.

During the productive life of a well, operators are responsible for various types of maintenance stipulated in the lease or other legal documents and/or required by the state. These regulations cover weed control, safety, and fencing associated with the well site, pipelines, and roads. Wells are also required to be pressure-tested so that potential leaks can be avoided. State and federal law require environmental safeguards during and sometimes after production.

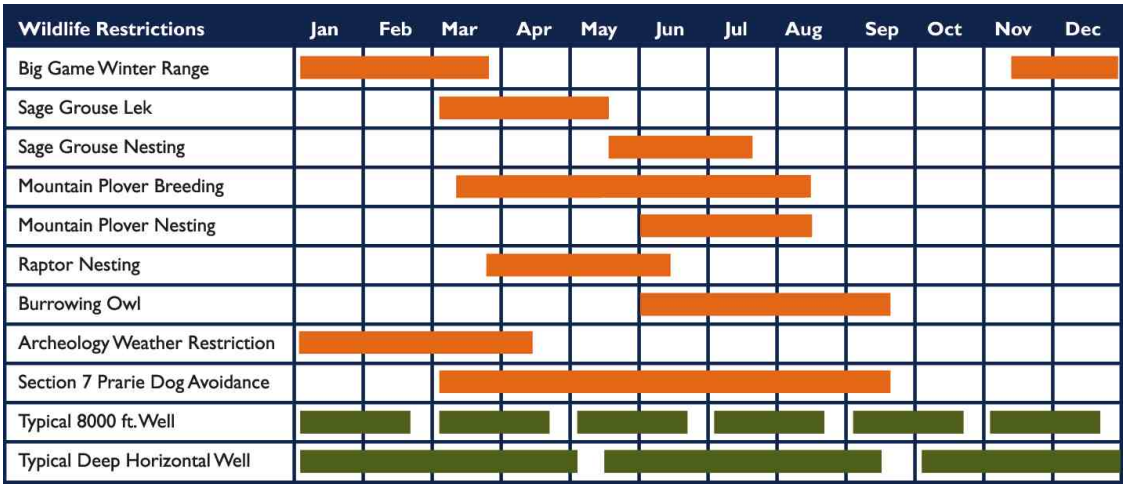
Access Restrictions

Occasionally anti-development groups will prompt members of the press to question why federal and state governments continue to lease land for oil and natural gas exploration when such large quantities of land are already under lease. The question reveals an ignorance of the constraints the industry must work under.

For starters, some leases turn out to be a lot less promising than they were at the time of purchase. Industry executives must distinguish between leases they believe will be good risks and those they fear will become money pits. Therefore, many leases never see the tip of a drill bit.

Another reason oil companies need an abundance of leases is that they must navigate an obstacle course of bureaucratic requirements and delays. State permits are required for all wells in New Mexico, and many wells will probably also require federal and/or tribal permits. During the permitting process, environmental, archaeological, and surface issues are addressed.

A Mosaic of Seasonal Restrictions Source: IPAMS



Operators must adhere to hundreds of regulations and meet a wide range of standards and requirements before the drilling begins. Rules require companies to plan for the entire life of the well, unexpected events, safety, environmental protection, weed control, and final reclamation when the production cycle is completed. Only when all requirements are met and permits are granted can drilling begin.

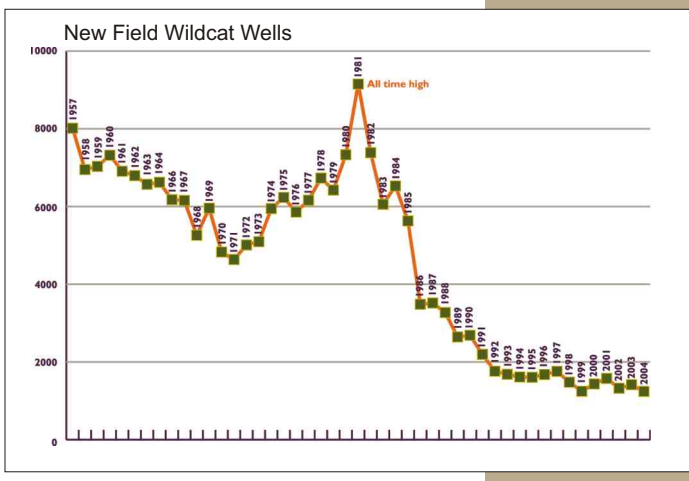
Deer in the San Juan Basin go about their business with a pumpjack nearby.

Restrictions pertaining to wildlife can make the drilling process especially difficult. In many cases companies are restricted from drilling during the mating or migratory seasons of endangered or otherwise vulnerable wildlife. It's not uncommon to have many species restrictions on a single lease. Multiple overlapping limitations leave the oil company with a narrow window in which the drilling of a well is actually allowed. In fact, a 2003 study by the Department of Interior confirmed that nearly 40 percent of the natural gas reserves on federal land in the Intermountain west have some barrier that prevents development.

To complicate matters even more, independent producers do not own their own drilling rigs. They hire drilling companies to do the work, and there are not enough rigs to go around. If no rig is available during the small window of time that a well can be drilled on a given lease, then the drilling of that well will be delayed by as much as a year.

Considering all of these issues–overly risky leases, permit requirements, delays, and restrictions–it's easy to see why oil and natural gas companies need lots of lease options to choose from.

People who are not familiar with how the industry works might confuse a drilling lease with an actual well site. In fact, anti-industry activist groups count on people not understanding the difference so they can convince people that there is too much drilling activity in new areas. However, a glance at the history of drilling rates reveals that the number of new field wildcat wells (1,206) is only about 14 percent of what it was from the all-time high (9,151) in 1981.



Source: Energy Information Administration

Wildlife in the Oilfield

The premise that man and nature cannot co-exist, that where man encroaches, wildlife scatters and dies out, is simply untrue. When the Alaskan pipeline was being built, environmentalists bemoaned the fate of the caribou saying the animals would suffer immensely. The exact opposite happened. In Prudhoe Bay, about 50 miles west of the Arctic National Wildlife Refuge, the number of caribou has quintupled since production began in early 1978.[27] The caribou often use the oil field equipment and the adjoining Alaskan pipeline for a windbreak and warmth. Much of the year the temperature in this region is a frigid 40 degrees below zero.

In New Mexico, wildlife appreciate oil and gas drilling equipment, and they use it well. Birds use elevated surfaces as foundations for nests. Deer, like caribou, use the equipment as windbreaks in their efforts to stay warm. There is so much wildlife in the oilfield that in 2004 IPANM created a contest where oil field workers and others could win cash prizes for the best photo or video demonstrating wildlife adapting to manmade changes in their environment.

"Rockin' Birdies" A bird tends to its chicks inside a pumpjack.

For more information on IPANM's "Wildlife in the Oil Field" contest go to our website at www.ipanm.org.

> “Oil companies generously donate hundreds of thousands of dollars to charities and community projects annually. In addition, many companies donate "in-kind" materials and supplies to community programs.”

Community Support

Hard Hat Generosity

Owners, operators, and employees in the oil and natural gas industry are active supporters of the communities they live in. Every year employees of the industry dedicate hundreds of hours as volunteers involved in government committees and task forces; community boards, business, recreational and agricultural organizations; school activities; scouting, and sports teams. Oil companies generously donate hundreds of thousands of dollars to charities and community projects annually. In addition, many companies donate “in-kind” materials and supplies to community programs.

Northwest
Farmington has an impressive community program to help keep the environment clean. Since 2003, usually during “Energy Week” in April, hundreds of employees of oil companies and service companies donate their time and equipment to pick up illegally discarded trash on public lands that surround the city. It's called The San Juan County Clean Up and Prevention of Illegal Dumping, or CUPID.

The oilfield workers haul off tons of garbage ranging from household trash to appliances to old cars. Since 2004, 200 oil and natural gas businesses sent more than 2,000 employees to join public volunteers to clean up trash from San Juan County's public lands. In those three years the volunteers have picked up 1,000 cubic yards of garbage, 3,000 old tires, 600 appliances and 150 vehicles. Glacia Simms-Montoya, who founded the CUPID effort, says San Juan County's oil and gas companies have donated about $1 million in time and equipment to the cleanup program. “They've donated trucks, trash bags, breakfast, you name it,” Sims Montoya said. “The people are just great. They do it because it needs to be done, and this is the only industry that can do it.”

In 1998, Farmington oil companies began raising funds for an exhibit at the Farmington Museum and Visitor’s Center called “Dinosaurs to Drill Bits.”

“Farmington Museum”

Museum staff and industry executives spent two years designing the display. Once that was complete, they began serious fund-raising, pulling in $600,000 in commitments by the end of 2001.

The Phase I addition of the project was initiated in late 2003 and the grand opening of the $240,000 exhibit took place in May of 2004. The 1,500 square-foot exhibit features displays on history, geology, drilling, completion techniques, refining, end products made from oil and natural gas, and economic impact from the industry. The outstanding exhibit looks like something you would see in a large museum in a major metropolitan area.

Phase II of Dinosaurs to Drill Bits is even more ambitious. Museum and industry leaders have raised another half million dollars and are hoping to raise an additional $1 million in their quest to expand the exhibit to 4,000 square feet.

“Dinosaurs to Drill Bits”
One section of the Farmington Museum's exhibit.

"The Derrick Floor" in Artesia

Southeast

Perhaps the most impressive example of community support and giving can be seen in Artesia's MainStreet project. The project began in 1997 when community members decided to revitalize their downtown area. Artesia MainStreet became a 501(c)(3) non-profit organization in 1998 and quickly began to make a big difference on Artesia's Main Street area. While people across the community and region have made contributions to Artesia MainStreet, a significant majority of the funding for the project has come from the oil and natural gas industry.

Artesia MainStreet has renovated historic buildings, commissioned the painting of a mural, commissioned an artist to create welcome signs at city entrances, created the Heritage Walkway and Plaza, and even planted 300 trees in the downtown area. The tree planting and walkway were part of a seven-block renovation at a cost of $2.6 million.

Most impressive are the bronze sculptures that have been created by renowned artists. One sculpture is that of Sallie Chisum, an active, strong, and influential woman in the early days of the city. The 200 percent life-size sculpture called "First Lady of Artesia" celebrates the importance of women in the city's early history.

"Woman's Intuition"
Artesia sculpture of Mary and Martin Yates.

The crown jewel of the Artesia MainStreet project is "The Derrick Floor" sculpture, which is accompanied by "Pioneers of the Oil Industry" sculptures. The $1.64 million Derrick Floor is a life-size bronze of a four-man crew. The roughnecks who are "making a connection" of drilling pipe are represented at 125 percent to put the emphasis on the people who built the oil patch in southeast New Mexico. The drilling rig is 34 feet in height with a floor approximately 35 feet in length by 25 feet in width. It is truly one of the most impressive sculptures in the state. Ninety percent of the funding for The Derrick Floor came from oil and natural gas companies. Those companies also contributed $65,000 in in-kind services. A total of 135 businesses and individuals made contributions to the project.

"First Lady of Artesia"
A sculpture off Sally Chisum.

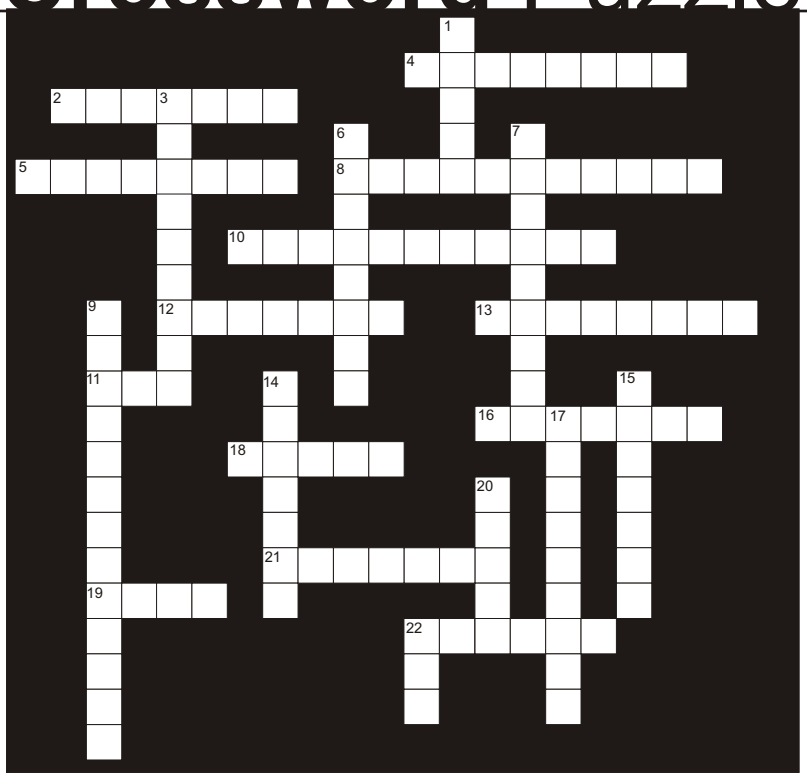
Community Support

Artesia MainStreet worked with three families on the Pioneer sculptures. The first is of oilfield pioneers Mary and Martin Yates, called “Woman's Intuition” (the west side of Main and 6th). The name comes from the story of when Martin relied on Mary to help him stake the third location of a well after the first two failed. That well, the Illinois #3, struck oil in 1924, and became the first commercial oil well on New Mexico state lands and the first commercial production in the southeast region (pg. 13). Illinois #3 generated the first royalty check to the state in the amount of $135.

The second sculpture is of Mack Chase and John R. Gray. It's called “Partners” because Mack and John formed a highly successful company, Marbob (named after their wives Marilyn and Bobbi), before going on to create two separate and highly successful companies. A third pioneer sculpture of Van Welch was dedicated in July, 2005. All of these families have played major roles in the formation and success of the city and the industry and continue to be significant supporters of the community today. From 1997 to mid-2006 Artesia MainStreet raised and invested a stunning $6.8 million.

INDEPENDENT PETROLEUM ASSOCIATION OF NEW MEXICO

Crossword Puzzle



Across
2. Produces electrical power
4. Power measurement
5. Fuel for future?
8. Little oil
10. Stored energy
11. Lifeblood of the modern world
12. 4 Corners gas
13. Location for cleaning spills
16. Ancient SE New Mexico seabed
18. Secondary recovery fluid
19. Propeller pusher
21. Iowa fuel
22. Measurement of oil

Down
1. Contract granting rights to explore
3. Renewable oil fuel
6. Richly keragen-veined rock
7. Not finite
9. Mixed with oil and gas
14. Non-traditional gas
15. Gutsy speculations
17. Hardworking driller
20. From our star
22. Measurement of natural gas

See page 33 for answers

What do you **know** about Oil & Gas?

1. Which is an untrue statement about oil?
- A. A naturally-occurring organic compound
- B. A man-made chemical poison
- C. Comprised of the remains of tiny fish, plants and animals
- D. Something that breaks down into organic matter

2. How much money, through distributions from the Land Grand Permanent Fund, has the oil and gas industry contributed to public education in New Mexico since the 1920s?
- A. Not a stinking penny
- B. $6.8 billion
- C. $2.6 billion
- D. $973 million

3. What is **t**he **v**alue of New Mexico's Land Grand Permanent Fund, which gets most of its money from the oil and gas industry, as of October, 2006?
- A. $2.2 billion
- B. $11 billion
- C. $4.3 billion
- D. $9 billion

4. Since the Alaskan pipeline was built in 1978, the caribou population in that region:
- A. Went on strike
- B. Quintupled
- C. Joined the Sierra Club
- D. Decreased by nearly half

5. Which of the necessities of daily life do not depend on oil in order for us to be able to use them?
- A. Food
- B. Water
- C. Plastics
- D. Oxygen

6. Which one of the following major accomplishments did not depend on the power of oil?
- A. Ending slavery in America
- B. Doubling our life expectancy in the last 100 years
- C. Restoring the bald eagle population
- D. Saving the whales

7. A career in the oil and gas industry:
- A. Pays nearly double New Mexico average annual salary
- B. Is rewarding work that contributes mightily to the state economy
- C. Helps keep America free
- D. All of the above

8. How much oil does the United States use every day?
- A. 20.8 million barrels
- B. 873,600,000 gallons
- C. More than Canada and Mexico
- D. All of the above

9. How much oil does it take to raise a 1,250-pound steer?
- A. None. Steers don eat oil
- B. 7 barrels
- C. 175 gallons
- D. 280 gallons

10. Where does New Mexico rank in oil production compared to other U.S. states?
- A. 23rd
- B. 5th
- C. 6th
- D. 14th

11. Not counting the oil found in the federal offshore coastline, how many U.S. states have oil reserves?
- A. Ten
- B. Forty-seven
- C. Thirty-one
- D. Seventeen

12. Cellulosic ethanol is:
- A. The answer to all of our energy needs
- B. A fuel that needs more research and development to be viable
- C. Found in underground deposits
- D. Easily made from the stalks of corn plants

13. Independent oil producers:
- A. Have no money
- B. Produce 82 percent of America's natural gas
- C. Contribute minimally to America's energy supply
- D. Are a small part of the Big Oil family

14. Which are not made with oil?
- A. Lipstick
- B. Computers
- C. Salsa
- D. Tires

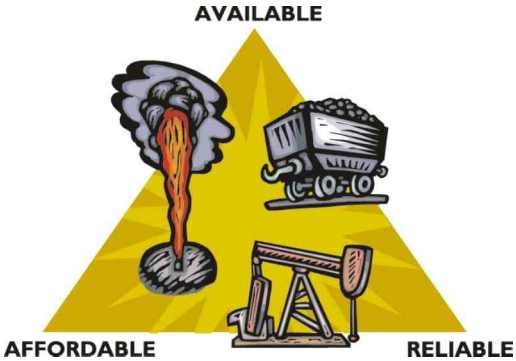
15. Sixty-three percent of the oil in American waterways:
- A. Was put there by environmentalists trying to give oil companies a black eye
- B. Leaked from poorly maintained oil wells
- C. Comes from natural ground seepages
- D. Leaked from poorly maintained pipelines

Drilling equipment trucks leave a location after drilling a well in southeast NM.

Answers:
1. B, 2. B, 3. D, 4. B, 5. D, 6. C, 7. D, 8. A, 9. D, 10. C, 11. C, 12. B, 13. B, 14. C, 15. C

Renewables: Promise and Problems

Fossil Fuels Still Rule



In spite of all our technological progress, the United States remains heavily dependent on fossil fuels for our energy needs. Power from coal, oil, and natural gas currently provide more than 79 percent of all the energy consumed in the United States. According to the Department of Energy, more than two-thirds of our electricity, and more than 99 percent of our transportation fuels come from the valuable carbon-based commodities we extract from beneath the surface of our planet. Most of the rest is supplied by nuclear power.

The simple reason that we remain so reliant on fossil fuels is that they complete the "Energy Triangle" of the modern age. Fossil fuels are Available, Affordable, and Reliable. In other words, we know where to get them, we can get them at a reasonable cost, and we know how to make them serve us with great consistency. That continues to be the case even though the world consumes oil, natural gas, and other fossil fuels in massive quantities every day. How can this be? Technological progress has enabled the industry to continue to find more petroleum, to extract more per well, and to use oil and natural gas in innumerable ways.

However, that's not the whole story. There is another fundamental quality to fossil fuels that gives them a tremendous advantage over other forms of energy. Fossil fuels represent stored energy that, without too much effort, can be turned into energy to power things. All you need to do with a lump of coal is throw it into a fire, and it burns and gives off its energy. Renewables, however, need to be captured. Wind can't be pumped out of the ground and refined into an energy source. A windmill must be built to harness the power of nature, and if the wind doesn't blow there is no energy. Sunshine can't be poured into a gas tank to make your car go. It has to be captured by a photovoltaic cell, which produces no power at night.

Fossil fuels don't have these problems. They are self-contained energy units that, once taken out of the ground, need only be touched with a spark to generate power or heat. They are easily and safely transported to be used whenever and wherever we want. Refining and processing, of course, enable us to efficiently use these fuels in countless ways.

The difficulty, expense, and inherent inefficiency of having to build equipment to capture the energy (wind turbines, solar panels, dams, etc.) are factors that make renewables less efficient than fossil fuels. They are also less practical because once the energy is captured it must instantly be used. Renewables are generally available (with the exception of hydro-power because there are few possibilities for new dams). However, to date, they have not been affordable. Even today, nearly all renewable energy projects have been constructed using public funding and tax rebates.[28]

The third side of the Energy Triangle is reliability. Nearly all renewable sources have challenges in this area, especially wind and solar power. Wind is, by its very nature, inconsistent. The electrical grid requires consistency. Therefore, expensive compensating and backup systems are required. Solar power's obvious problem is that the sun doesn't shine at night, produces less energy on cloudy days, and is only viable in specific geographical regions. To get a sense of the reliability problem consider that a single new 555-megawatt natural gas-fired power plant produces more energy in one year than all of California's 13,000 wind turbines.[29]

> “The United States is estimated to have 62 percent of the world's potentially recoverable oil shale resources at two trillion barrels.”

Wind power has the additional environmental problems that must be addressed. Every year windmills kill significant numbers of bats (very important for pollination of plants and trees) and large birds of prey such as eagles and hawks. The tall towers can be an eyesore and are most problematic when located near populated areas because of the strobe effect that occurs when sunlight or moonlight reflects off the blades. Noise and ice thrown by the blades are other problems.

Our intent is not to malign the important efforts being made in the renewable energy industry. However, it's necessary to note that at this point in time, energy generation outside of fossil fuels and nuclear power is extremely limited, and there are great challenges ahead.

The United States government and many state governments, including New Mexico, have put highly aggressive programs in place to promote the research and development of renewable energy. Even so, the Department of Energy (DOE) predicts our reliance on both oil and natural gas will greatly increase during the next two decades–oil by 34 percent, and natural gas by 20 percent.[30]

Independents Strongly Support Renewable Energy

The oil and natural gas industry is a big supporter of the rapid advancement of renewable energy. The United States and the rest of the world are going to continue to demand more and more power, and it will be impossible for fossil fuels and nuclear power to meet the demand.

Some of the biggest investors in wind and solar power are oil companies. That's because we view ourselves not only as producers of oil and natural gas, but also as producers of energy. Generating electricity from the wind and the sun is another business opportunity with a lot of potential for future growth and profits, especially in New Mexico.

The oil and natural gas sector is one of the solar industry's biggest consumers. Solar power is an excellent energy source for niche uses, such as in remote mineral production areas where no electricity is available and diesel generators are impractical. For this same reason ranchers and farmers have been using solar energy for quite some time.

Even if scientists figure out how to leap the daunting technological hurdles mentioned above, that still only addresses our need for electricity. While electrical power is very important, our most needed energy breakthrough is in the area of transportation fuels. Currently there is no viable substitute on the horizon for oil and the many fuels it produces.

Hydrogen
Hydrogen is often referred to as the ultimate transportation solution. Perhaps one day it will be. However, after reviewing a few pertinent facts you'll see why some experts call it the "Wonder Fuel," because they wonder how it can ever be made viable for mass use.

Hydrogen is not an energy source found in nature, such as oil, natural gas, coal, or wood. It is an energy carrier, similar to a battery that holds an electrical current, only hydrogen is more difficult to generate and transport. Electricity uses wires while hydrogen uses high-pressure pipes.

Like electricity, hydrogen generation requires an energy investment that comes from a primary fuel, i.e. coal, oil, nuclear, etc. Presently, most hydrogen is created using natural gas because it is the least expensive, yet still well beyond being economically viable. Hydrogen can be generated by a process called water electrolysis, but that process consumes a lot of electricity.[31] Beyond the cost of producing the hydrogen there are other significant problems:

> The Department of Energy estimates that hydrogen fuel cell costs will need to come down to $50 per kilowatt for automobile application. The present figure is about $5,000 per kilowatt and scientists have been working on the problem with significant government funding for 40 years.[32]

> Fuel cell production costs must drop by 100 percent and fuel cell durability must improve by a factor of five for automobile application.[33] The Union of Concerned Scientists estimates that a transition to a hydrogen economy is a "trillion dollar class effort." An entire storage and delivery system (hydrogen stations) would have to be constructed.[34]

> Hydrogen safety is a significant concern. Until now, only highly trained professionals have handled this dangerous energy carrier. Opening it up to the general public presents a large number of known and unknown challenges. A hydrogen car or truck must be superior to the alternatives, which continue to improve, most notably with hybrid technology.[35]

> Using hydrogen as a fuel results in a phenomenon known as hydrogen embrittlement. Under high pressure and temperature, hydrogen atoms flow into the intermolecular spaces in steel, which causes metal to become brittle. This problem will have to be fixed before hydrogen-powered engines can be made safe and reliable.[36]

The ablest minds in the field estimate that in a best-case scenario it would take two to four decades before hydrogen has even a chance to play a role in our energy picture. It's possible we could one day have a hydrogen economy, but right now it looks like a long shot. Then again, human ingenuity has a long history of achieving feats that at one time were completely unimaginable.

> “A single new 555-megawatt natural gas-fired power plant produces more energy in one year than all of California's 13,000 wind turbines.”

Ethanol

Ethanol is a fuel source derived primarily from sugarcane or corn. In recent years it has become more widely used as a way to oxygenate gasoline, which helps it to burn cleaner. Another oxygenate, Methyl Tertiary Butyl Ether (MTBE), had been the oxygenation standard, but MTBE is being phased out because of concerns that it may leak out of underground gasoline tanks and then pollute groundwater.

Ethanol is also being marketed as a substitute for gasoline. In the 2005 Energy Bill Congress mandated that 7.5 billion gallons of ethanol be produced annually by 2115, nearly double the amount produced at the time the bill passed. Because of that legislation ethanol has enjoyed an enormous amount of attention and capital investment.

In spite of the excitement about ethanol, it has a lot to prove before it can be accepted as one of the many solutions we need to diversity our energy portfolio.

There is disagreement among scientists and economists about ethanol's potential. Some studies show that ethanol requires more liquid fuels to produce than it provides on combustion.[37] Dr. Michael Economides of the University of Houston says in a worst case scenario it could take as much as 3.6 gallons of fossil energy to produce one gallon of ethanol.[38] Other studies indicate that ethanol has a slightly positive energy balance.[39] However, even if the most optimistic estimates turn out to be true, using a barrel of oil to produce a barrel and a quarter of ethanol doesn't make much economic sense.

To complicate matters further, the landmass required to serve even a small portion of our gasoline requirement with ethanol would be huge. For example, if we tried to replace just ten percent of the gasoline the U.S. will need in the year 2020 with ethanol, we would need to plant cornfields across every inch of Indiana, Ohio, and Illinois just for the feedstock.[40] If we did that, one has to wonder what we would do to replace the food lost on one-sixth of the country's farmland.[41]

Supporters of ethanol as a fuel source advertise it as a cleaner burning fuel than gasoline. On balance, however, it actually produces more and worse pollution. Ethanol emits higher levels of NOx (nitrogen oxide) emissions contributing to smog and it makes gasoline evaporate faster, reducing its value while increasing pollution. It also must be shipped separately for mixing at distribution terminals, which simultaneously drives up costs, fuel usage, and emissions.[42]

However, even with all of ethanol's negatives, it still may be prudent to continue research and development. With a few technological breakthroughs, cellulosic ethanol made from such things as switch grass and bio-waste may become economically and environmentally viable.

Renewables:
Promise and Problems

Biodiesel
Biodiesel is a clean-burning fuel made from field crop oils, usually soybeans. Although it has the word "diesel" in the name, there is no petroleum in the product. It's called biodiesel because it's typically blended with diesel fuel. Like ethanol, it is gaining in popularity, but doesn't have the potential to make more than a tiny contribution to our overall transportation fuel needs. The National Biodiesel Board, a trade group for the industry, reports that 75 million gallons of biodiesel were sold in the United States in 2005.[43] Considering that America uses the equivalent of approximately three gallons of gasoline per person per day (873.6 million), all of the biodiesel sold in 2005 would sustain us for about two hours.

Oil Shale
One of the most promising alternatives to oil is what's called "oil shale." The potential resource is enormous. It's estimated that there is more than 200 times more oil shale than conventional reserves. Better yet, the United States is estimated to have 62 percent of the world's potentially recoverable oil shale resources at two trillion barrels. According to The World Energy Council, the largest of the deposits is found in the 42,700 km2 Eocene Green River formation in northwestern Colorado, northeastern Utah, and southwestern Wyoming.[44]

The name "oil shale" is actually a misnomer because it does not contain oil and it is not often found in shale. The organic material in oil shale is kerogen, and it's contained in a hard rock called marl. When processed, kerogen can be converted into a substance similar to petroleum. During this process the organic material is liquefied and processed into an oil-type substance. The quality of the product is typically better than the lowest grade of oil produced from conventional reserves.

Unfortunately, oil shale poses several challenging problems. Processing of oil shale requires significant amounts of energy and water. It also produces massive amounts of waste product. In the 1970s major oil companies in the U.S. spent billions of dollars in various unsuccessful attempts to commercially extract shale oil. However, as the price of conventional oil rises the economics of shale oil will improve.

Roughnecks making a connection

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Glossary:

"Crossed Swords"

Barrel of oil: Equal to 42 U.S. gallons.

Biodiesel: A renewable fuel that can be manufactured from vegetable oils, animal fats, or recycled restaurant greases.

Coal bed methane: Methane gas found in coal seams. It is sold and used the same as traditional natural gas. Currently, natural gas from coal beds accounts for approximately 7% of total natural gas production in the United States.

Directional drilling: A technique whereby the drilling is intentionally directed away from vertical in order to reach a particular part of a reservoir. This method allows many wells to be drilled from one point lessening surface disturbance.

Ethanol: An alcohol-based fuel produced by fermenting and distilling starch crops that have been converted into simple sugars. Feedstocks for this fuel include sugarcane, corn, barley, and wheat. Scientists are also attempting to create ethanol from "cellulosic biomass" such as trees and grasses, which is called bio-ethanol.

Fossil fuels: Fuels formed in the ground from the remains of dead plants and animals. It's believed that it takes millions of years to form fossil fuels. Oil, natural gas, and coal are fossil fuels.

Hydrogen power: A source of energy that converts hydrogen to electricity to provide heat, light, and power. Though hydrogen is readily available, the production of hydrogen power is expensive and not yet commercially viable.

Independent producers: Small, generally privately-held oil and gas drilling companies. Independent producers develop 90 percent of domestic oil and gas wells, produce 68 percent of domestic oil and produce 82 percent of domestic natural gas.

Land farming: A way of cleaning up oil spills on land. Contaminated soil is spread out, mixed with native soil and oil-eating microbes. The soil is cultivated, and in a matter of weeks the mixture becomes soil that could be used on any farm or garden.

Land Grant Permanent Fund: One of New Mexico's two permanent funds. It was valued at $9 billion in late 2006. Interest from the fund is used to support public schools and other entities. The fund gets most of its money from oil and gas leases on state lands. Since it was formed in the early 1900s, the fund has distributed $6.8 billion to public education in New Mexico.

Megawatt: A measure of a unit of electricity that equals one million watts, which is enough electricity to power 600 to 1,000 homes at any given time.

Natural gas: A naturally occurring mixture of hydrocarbon and non-hydrocarbon gases found in porous geological formations beneath the earth's surface. The principal component is methane, often associated with petroleum.

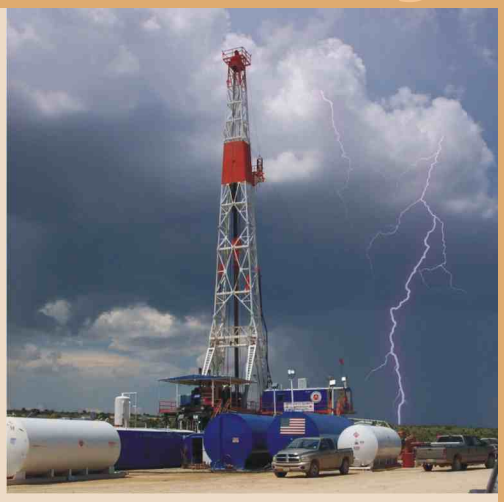
Oil: Petroleum is basically a mix of naturally occurring organic compounds from within the earth that contain primarily hydrogen, carbon and oxygen. Most geologists agree that crude oil forms over million of years from the remains of tiny aquatic plants and animals that are exposed to the combined effects of time and temperature. In other words, oil forms from organic matter that is either "cooked" deep within the earth for long periods of time at low temperatures, or "cooked" for short periods of time at high temperatures.

Oil and gas lease: A contract between a mineral owner, otherwise known as the *lessor* and a company or working interest owner, otherwise known as the *lessee* in which the lessor grants the lessee the right to explore, drill and produce oil, gas and other minerals for a specified primary term and as long thereafter as oil, gas or other minerals are being produced in paying quantities. The oil and gas lease is granted in exchange for royalty payments to the lessor. Oil and gas produced on public lands produce revenue for state or federal governments depending upon which entity owns the land.

Oil shale: Underground formation of a fine-grained sedimentary rock containing varying amounts of kerogen, a solid, waxy mixture of hydrocarbon compounds. Heating the rock to high temperatures converts the kerogen to a vapor, which can be condensed to form a slow-flowing heavy oil called shale oil.

Permian Basin: An oil and natural gas producing area in southeastern New Mexico and northwestern Texas. The basin is an ancient seabed, 300 miles long and 250 miles wide. There are more than 53,000 oil and gas wells in the basin.

Glossary:



Produced water: Underground water that comes to the surface as a result of oil and natural gas drilling. The water can be six times as salty as seawater. Typically, eight barrels of saline water are produced for each barrel of oil. Entrepreneurs are working on ways to clean up produced water so it can be used for agriculture or other purposes.

Renewable energy: Energy obtained from sources that are essentially inexhaustible. Renewable sources of energy include wood, waste, geothermal, wind, photovoltaic, and solar thermal energy.

Roughneck: A low-ranking member of the drilling crew. The roughneck usually performs semi-skilled and unskilled manual labor that requires continual hard work in difficult conditions for many hours. After a roughneck understands how a rig operates and demonstrates his work ethic, he may be promoted to other positions in the crew.

San Juan Basin: A prolific natural gas producing area in northwest New Mexico. It covers parts of San Juan, Rio Arriba, Los Alamos and McKinley counties. Natural gas was discovered in the basin in 1921. Currently there are 20,000 producing wells in the basin. Some wells produce oil, but most production is natural gas.

Severance Tax Permanent Fund: One of two of New Mexico's permanent funds. In late 2006 it was valued at $4 billion. Interest from the fund is used to retire bonds that pay for government projects. Ninety-nine percent of the fund's money comes from oil and natural gas exploration and production.

Solar power: Energy from the sun's radiation converted into heat or electricity, generally through the use of photovoltaic panels, or solar cells. The solar cells are placed under direct sunlight. The rays of the sun hit the cells initiating a chemical reaction that creates an electric current.

Wildcat wells: An oil or natural gas well drilled in an area that has not previously produced minerals. Due to the uncertainty of being successful, investors who choose to enter into a wildcat oil and gas limited partnerships are exposed to high risks.

Wind power: Electricity that is generated through the use of a turbine, usually mounted on a tower. Wind turns the turbine blades, which are connected to a shaft and a generator. Windmills do not consistently generate electricity, as the wind is not always blowing.

El Paso Natural Gas Company laying pipeline from Bloomfield to Gallup, circa 1950.

Fast Facts

New Mexico

Production

- Rankings (2005)
  - 4th in natural gas production (1.7 Tcf)
  - 3rd in natural gas proven reserves (68-89 Tcf)
  - 6th in oil production (166,000 barrels a day)
  - 4th in oil proven reserves (677 million barrels)
- Producing Counties
  - **North:** San Juan, McKinley, Rio Arriba, Sandoval, Colfax
  - **South:** Eddy, Lea, Chavez, Roosevelt
  - *Reserves are believed to be in Otero & Sierra counties as well
- Total producing wells: more than 50,000

Economics

- 2005 direct revenue: $2.83 billion
- 2006 taxable sales: $12.7 billion
- The industry provides 14,300 direct jobs with an average salary of $52,468 compared to a state average of $30,628 (Fy2005)
- There are approximately 12,000 to 14,000 service sector jobs connected to the production, distribution, and sale of oil and natural gas
- Land Grant Permanent Fund:
  - $9 billion balance as of October, 2006
  - 2006 payout to 21 public entities of $422 million
  - Oil and natural gas make up 94.5% of revenue going into the fund
- Severance Tax Permanent Fund:
  - $4 billion balance as of October 2006
- The 50 largest operators in New Mexico produced 51,529,535 barrels of oil in the year 2005 or about 141,176 barrels per day
- The 50 largest operators in New Mexico produced 1,516,136,254 Mcf of natural gas in the year 2004 or about 4,153,797 Mcf per day

Miscellaneous

- The first substantial discovery of gas was made in 1921 in San Juan County just south of Aztec
- The San Juan Basin holds at least 50 Tcf of natural gas, enough to run the entire nation for two and one-half years
- The first commercial well in southeast New Mexico was the Illinois #3 drilled in 1924 by Martin Yates, Van Welch, William Dooley, and Tom Flynn. The first royalty check to the state in 1924 was $135
- The Oil & Conservation Rule Book is 157 pages thick and contains 1,304 sections of rules, definitions and procedures
- 3.4 million acres (31% of New Mexico land) are managed by the Bureau of Land Management (BLM)
- The NM Land Office manages state trust lands, including 9 million acres of surface and 13 million acres of sub-surface

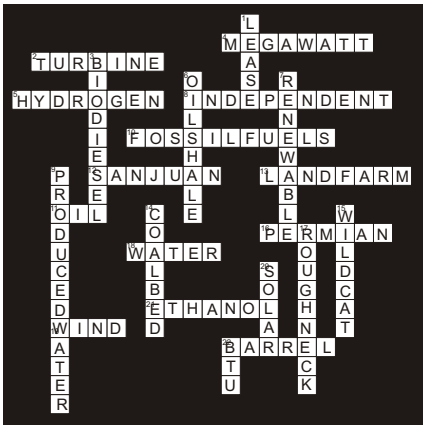
United States

U.S. Consumption

- We consume 20.8 million barrels of oil a day (2005), a 25% increase from 20 years ago
- Our daily consumption is equal to 945 Olympic-sized swimming pools filled with oil
- Annual consumption of oil is approximately 7.5 billion barrels
- 60% of all oil consumed in U.S. is imported, up from 35% in the 1970s
- Overall consumption is up 25% since 1970
- 15% of all natural gas consumed in the U.S. is imported (2005)
- We import 12,549,000 barrels of oil daily with 5,587,000 coming from OPEC members
- Americans use an average of 3.375 gallons of oil per person per day, three of those gallons are used for gasoline
- The American Petroleum Institute reports that the U.S. burns 141 billion gallons of gasoline annually
- A one-cent increase in the retail price of gas takes $1.4 billion out of consumer's pockets
- 99% of transportation fuels come from oil
- Coal, oil, and natural gas provide 85% of all energy consumed in U.S.
- Two-thirds of all electricity is generated by fossil fuels
- The Department of Energy estimates that in the year 2020 80% of our energy will come from fossil fuels
- The U.S. imports more than 8% of its refined product needs (mostly gasoline)
- Imports of energy products make up nearly 11% of all U.S. imports
- Demand for oil is expected to rise by 2% annually

U.S. Production

- The first productive U.S. oil well was drilled by Edwin Drake in 1859 in Titusville, Pennsylvania
- 31 states produce oil and natural gas along with the offshore coastline
- U.S. Production in 1970: 10 million barrels a day
- U.S. Production: 5.1 million barrels a day (2005)
- Projected U.S. production in 2025: 4.7 million barrels a day
- "Big Oil" (fully integrated companies involved in production, transportation and retail sales) drills only 15% of U.S. wells, produces only 18% of natural gas, and 32% of crude oil
- Houston-based Baker Hughes Inc., which has kept an accounting of rigs since 1944, reports that the number of rigs exploring for oil and natural gas peaked in 1981 at 9,151
- Baker Hughes reports that in 1959 2,074 wildcat rigs were exploring for oil and natural gas; in 2005 the number of rigs was 1,400 after a low of 975 in 1971.



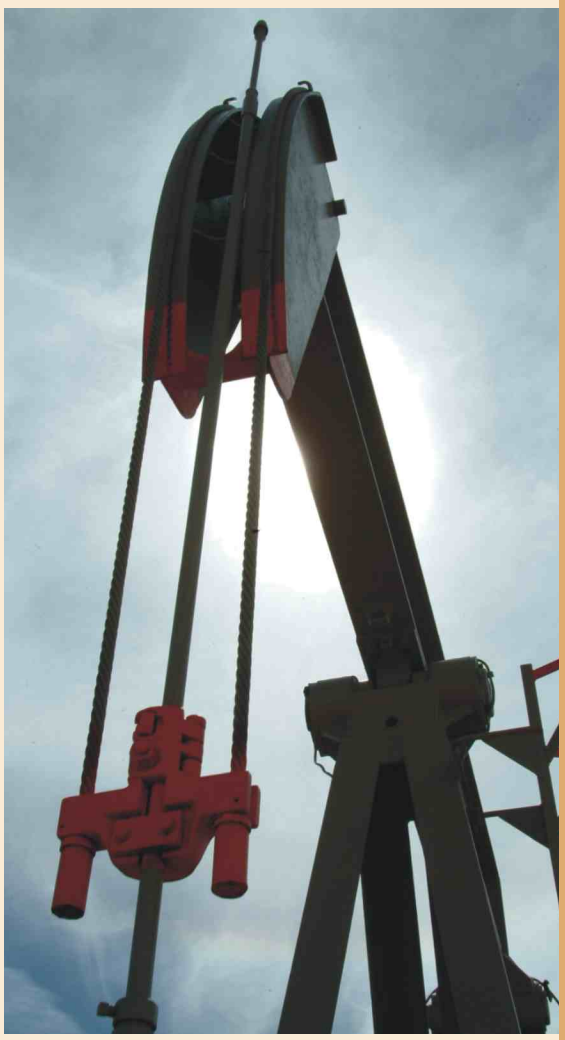
Answers from page 23

Fast Facts

- U.S. oil production peaked in 1970
- Prudhoe Bay on Alaska's North Slope (about 60 miles from the controversial Arctic National Wildlife Refuge, or ANWR) is America's largest oil field
- Oil was discovered in Prudhoe Bay in 1968 and is estimated to hold 12 billion barrels of oil
- Independents (primarily small companies only involved in production) drill 85% of wells, produce 82% of natural gas, and 68% of American crude oil
- 75% of all wells in America (about 450,000) are “stripper wells” (those that produce fewer than 15 barrels of oil per day), but together they produce more than a million barrels a day, 20% of domestic output
- The U.S. has 153 refineries, down from a high of 319 in 1980
- A new refinery hasn't been built in the U.S. for more than a quarter century
- Total drilling costs tripled between 1990 and 2004
- According to the Independent Petroleum Association of America, more than $31 billion was spent on drilling costs in 2001 compared to $11.5 billion in 1991

U.S. General Oil & Natural Gas Stats

- The national trade deficit in 2004 was $725 billion, $251 billion of that was for oil and petroleum goods
- Oil is a “commodity” which means that producers DO NOT set the price
- The price of oil is set on the world market, which mean producers are “price takers” not price makers
- According to the U.S. Geological Survey and the Minerals Management Service, approximately 4.1 billion barrels of oil resources and 167 Tcf of natural gas reserves underlie federal lands in the lower 48 states
- The petroleum industry employs more than 1.3 million workers nationwide
- When adjusted for inflation, a gallon of gasoline in 2006 would need to cost nearly $3.00 a gallon in order to reach the previous all-time high established in 1981, when it was $1.34 a gallon
- If crude oil had kept pace with the general rate of inflation over the past 20 years, the price of a barrel of oil would be about $90
- The Cato Institute estimates that if the price of gasoline relative to wages were comparable today to what they were in 1920, we would be paying almost $10 a gallon
- According former to Exxon Mobil CEO Lee Raymond, if we tried to replace just 10% of the gasoline the U.S. will use in 2020 with corn-based ethanol, we would have to dedicate corn fields across every inch of Illinois, Indiana and Ohio solely to grow the grain needed for feed stock approximately one-sixth of the entire land area we currently use for all crops
- Only one percent of the 262 million acres of public lands managed by the Bureau of Land Management is impacted by oil and natural gas operations
- It typically takes 7 to 10 years to go from discovery of oil/gas to production
- The U.S. has only 4 Liquefied Natural Gas (LNG) terminals. Most experts estimate that 10 to 14 new import terminals will be needed by 2015 to meet projected demand
- The U.S. currently has 18 different regional gasoline standards, making it difficult if not impossible to keep gasoline supplies stable and available in the event of temporary supply disruptions



World

- The world drinks 83.8 million barrels of oil a day (2005), which is the equivalent of 3,690 Olympic-sized swimming pools filled with oil
- Two-thirds of all oil is used to make fuel for transportation
- 50% of all proved oil reserves lie in the Middle East, with Saudi Arabia having one-fifth

For EVERY MINUTE your child is in school, New Mexico's Oil & Gas Industry contributes

to Education

Do the math...

If we assume all state revenue from oil and gas were given to public schools, how much money would the industry give to kids every minute students are in class?

	$2,826,475,753	Oil & Gas Funds
÷	1,080	Hours
=	$2,617,107.18	
÷	60	Minutes
=	$43,618.45	every minute

INDEPENDENT PETROLEUM ASSOCIATION OF NEW MEXICO

A Publication of the Independent Petroleum Association of New Mexico