

**"Will Shale Crowd Out Coal and Green Energy?" EnergyBiz, Ken Silverstein, January 4, 2012**

"Now that France's Total and China's Sinopec have invested \$4.5 billion in two of [America's] premier natural gas developers, common wisdom is suggesting that the fate of shale gas here will outshine all competing energy forms. But is that logic well considered? Estimates are that at least a century's worth of shale-gas is now recoverable from underneath America's feet. Some are betting that such volume will drive down the cost of that fuel, making the alternatives unattractive..."

Shale will not just become a U.S. phenomenon. But it will also have a great impact around the globe. Global proven reserves are estimated to be at 6,600 trillion cubic feet, according to the U.S. Energy Information Administration. China and the United States have the most supplies at 1,275 and 862 trillion cubic feet, respectively. In [the U.S] shale gas has grown 48 percent a year from 2006 to 2010. It now makes up a third of all natural gas supplies."

[EnergyBiz: Will Shale Crowd Out Coal and Green Energy?](#)

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**"Natural Gas Falls To Two-Year Low," The Wall Street Journal, Dan Strumpf and Ryan Dezember, December 31, 2011 - January 1, 2012**

"U.S. natural gas prices fell to their lowest point in more than two years, underscoring how the nation's booming energy business is becoming a victim of its own success... But in the last two months, the steady price decline has turned into a free-fall, as unusually mild temperatures across much of the U.S. have damped demand for gas to heat homes and offices. Natural gas for February settled Friday at \$2.989 per million British thermal units... It closed below \$4 in the winter for the first time in nearly a decade. 'The sub-\$3 levels for gas prices in the winter really point to the incredible amount of non-conventional gas that has come onto the market the last two years,' said Gene McGillian, analyst at Tradition Energy in Stamford, Conn... Natural gas traded as high as \$13 per million British thermal units in July 2008. But in recent years... natural gas production in the lower 48 states hit a record 71.4 billion cubic feet a day in October, the U.S. Department of Energy said this week."

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**"The EPA's Fracking Scare," The Wall Street Journal, Editorial, December 19, 2011**

[In early December, 2010, the EPA issued a report looking at fracking in Wyoming, and wrote that "when considered together with other lines of evidence, the data indicates likely impact to groundwater that can be explained by hydraulic fracturing."]

"More than one-third of all natural gas drilling now uses fracking, and that percentage is rising. If the EPA Wyoming study holds up under scrutiny, an industry that employs tens of thousands could be in peril. But does it stand up? This is the first major study to have

detected linkage between fracking and groundwater pollution, and the EPA draft hasn't been peer reviewed by independent scientific analysts...

What [the draft report] doesn't say is that:

- The U.S. Geological Survey has detected organic chemicals in the well water in Pavillion (population 175) for at least 50 years - long before fracking...
- The EPA study concedes that 'detections in drinking water wells are generally below [i.e., in compliance with] established health and safety standards.'
- The dangerous compound the EPA says it found isn't an oil and gas chemical but is a common fire retardant used in association with plastics and plastics components used in drinking wells...
- The deep water wells that EPA drilled are located near a natural gas reservoir. Encana Corp, which owns more than 100 wells around Pavillion says it didn't 'put the natural gas at the bottom of the EPA's monitoring wells. Nature did.'
- To the extent that drilling chemicals have been detected in monitoring wells, the EPA admits this may result from 'legacy pits' which are old wells that were drilled many years before fracking was employed... Safer well construction of the kind normally practiced today might have prevented any contaminants from leaking into the water supply.
- The fracking in Pavillion takes place in unusually shallow wells of fewer than 1,000 to 1,500 feet deep. Most fracking today occurs 10,000 feet deep or more, far below drinking water wells, which are normally less than 500 feet deep...

This calls into question the relevance of the Wyoming finding to newer and more sophisticated fracking operations in more than 20 states... Natural gas carries a smaller carbon footprint than coal or oil, and greens once endorsed it as an alternative to coal and nuclear power. But as the shale gas revolution has advanced, greens are worried that plentiful natural gas will price wind and solar even further out of the market."

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**"Shale-Gas Boom Spurs Race," The Wall Street Journal, James R. Hagerty, December 27, 2011**

"The boom in low-cost natural gas obtained from shale is driving investment in plants that use gas for fuel or as a raw material, setting off a race by states to attract such factories and the jobs they create. Shale-gas production is spurring construction of plants that make chemicals, plastics, fertilizer, steel and other products. A report issued earlier this month by PricewaterhouseCoopers LLC estimated that such investments could create a million U.S. manufacturing jobs over the next 15 years."

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**"The Underground Solution," Bloomberg BusinessWeek, Paul M. Barrett, November 7 - 13, 2011**

"Vast unlocked reserves of shale [natural] gas could reignite the U.S. economy... Encouraged by the availability of inexpensive and cleaner domestic [natural] gas, some electric utilities are replacing their coal-burning capacity with gas-fired units. Energy-intensive manufacturers of chemicals, plastics, and steel are beginning to bring home operations that they exported years ago...

"This thing could be a game-changer," says Fred Krupp, president of the New York-based Environmental Defense Fund (EDF). Shale production in the U.S. has increased from practically nothing in 2000 to more than 13 billion cubic feet per day, or about 30 percent of the country's natural gas supply. That proportion is heading toward more than 50 percent in coming years. The U.S. passed Russia in 2009 to become the world's largest producer of natural gas...

"Natural gas burns cleaner than coal, emits less in the way of greenhouse gases, and avoids mercury and other pollutants from coal," Krupp points out. "So this could be a win-win, if - and this is a big if - we do it the right way."

Read the entire article: [Could Shale Gas Reignite the U.S. Economy?](#)

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**"Oil-Rich but Gas-Poor in the Middle East", Bloomberg BusinessWeek, Stanley Reed, Ben Farey, and Anthony Diaola, with Sarah Abdullah, October 17-23, 2011**

The [Middle East] may have the world's largest oil reserves, but it's facing a shortage of [natural] gas. Long viewed as a nuisance that hampered production of crude, [natural] gas was typically injected back into the ground or flared off... Those attitudes are changing. As the region's population climbs and developers build grand, air-conditioned homes and sleek glass towers, electricity consumption is climbing - fueling strong demand for [natural] gas... The [natural gas] shortages are forcing big oil producers to use crude to generate electricity, which cuts into exports and is more polluting than [natural] gas."

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**"Agency to Set Standards On Fracking Waste Water," The Wall Street Journal, Deborah Solomon, October 21, 2011**

The Environmental Protection Agency, responding to concerns about potential water contamination from natural-gas drilling, said it would develop standards for disposing of waste water from the process... Some waste water is reused or injected into underground wells, and some is sent to wastewater treatment plants. In a statement, the EPA said many treatment plants 'are not properly equipped to treat this type of waste water,' and said it would consider standards that must be met before can be sent to a treatment facility...'

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**U.S. Energy Information Administration ("EIA") image of natural gas opportunities in the lower 48 U.S. States**



**"Deal to Create Pipeline Giant, The Wall Street Journal, October 17, 2011**

"U.S. natural-gas production has surged in recent years as energy companies have combined horizontal drilling with hydraulic fracturing, or fracking, which involves shooting water and chemicals deep underground to blast open gas-bearing rocks... [S]urging future supplies have pushed U.S. gas to below \$4 per million British thermal units, down from a peak of more than \$1 in July 2008..."

While companies that produce natural gas have struggled to turn a profit with such low prices, the companies that transport it are facing huge demand to build new pipelines. The Interstate Natural Gas Association, a trade group, estimates that companies will need to build 35,600 miles of big, high-pressure natural-gas pipelines between 2011 and 2035 to meet market demand, at a cost of \$178 billion."

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**"Gas Turbine Tweaks," EnergyBiz, Salvatore Salamone, Sept-Oct 2011**

"A recent study by the Massachusetts Institute of Technology Energy Initiative noted that there is an abundant supply of natural gas, and taking into account its environmental benefits, natural gas is 'one of the most cost-effective means by which to maintain energy supplies while reducing CO2 emissions.'"

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**"Oceans of Gas," EnergyBiz, Thomas Armistead, Sept-Oct 2011**

"[Natural] gas prices became highly volatile during the last decade [the 2000s], choking off a boom in gas-fired power plant construction. Since summer 2008, however, gas has competed consistently with coal on price, prompting an unprecedented run of fuel-switching that analysts expect to last until at least 2015... The Electric Power Research Institute recently released a report on generation technology options that cites 'the profound impact of the shale gas boom on present and future natural gas prices' as one of the five trends affecting planning for new power generation.

[EPRI] Researchers modeled scenarios to determine the effects of climate policy, environmental regulations that apply to coal plants, and advances in other technologies to determine the economically most-attractive fuel, said John Hutchinson, senior energy strategist. He said what he found was 'there's more certainty around gas, associated with capital cost.'..

Technological advances have greatly improved production of shale gas, inflating gas reserves. From 2000 to 2006, shale gas production averaged 17 percent per year. Since then, it has averaged 48 percent growth, and it has been recognized as a 'game-changer' for the U.S. natural gas market in an [Energy Information Administration] report."

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**"The Reign of Cheap Gas," EnergyBiz, Martin Rosenberg, Sept-Oct 2011**

"I'm not going to say [natural gas] will be \$4 per thousand cubic feet for 10 years, but will it be under \$6 for 10 years? I'm afraid so. Exelon would have made a lot more money if it were \$7." John Rowe, Chairman & CEO of Exelon Energy (serving Illinois, Maryland, and Pennsylvania

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**"The Lessons of the Shale Gas Revolution," The Wall Street Journal, Lucian Pugliaresi, September 30, 2011**

"In response to a 2009 request from Secretary of Energy Steven Chu, the National Petroleum Council (NPC) reported earlier this month that oil production in North America could double by 2035 - to 20 million barrels per day. Where did all this oil come from? For one, the hydraulic fracturing (fracking) technique used in shale gas production is now being used to extract oil... Those proponents of 'peak oil' who claim the NPC report is unrealistic need only revisit our recent history with shale gas. Natural gas production has surged by more than 25% in the last four years. Yet just a few years ago, government reports and long hours of expert testimony on Capitol Hill outlined the need for the U.S. to take action to address a growing shortage of natural gas.

A crash program was called for to build receiving facilities to import foreign liquefied natural gas (LNG). Many receiving facilities were built at a cost of billions of dollars... Today these facilities are operating at less than 10% capacity... The good news is that unlike the bankrupt Solyndra solar plant that received over \$500 million in federal loans, losses at the LNG receiving facilities will not be picked up by the taxpayers."

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**"U.K. Gets Big Shale Find," The Wall Street Journal, Guy Chazan, September 22, 2011**

"An area in northwest England may contain 200 trillion cubic feet of shale gas, putting it in the same league as some of the vast shale-gas plays that have transformed the U.S. energy industry... The discovery of such vast resources - 200 trillion cubic feet would be enough to meet U.K. gas demand for 64 years - comes at a time when the U.K.'s conventional gas fields are in steep decline and it is becoming increasingly dependent on imports such as liquefied natural gas from Qatar and piped gas from Norway.

The exploitation of shale gas has revolutionized American energy markets, helping the U.S. in 2009 to overtake Russia as the world's largest gas producer. Shale now accounts for about 20% of U.S. gas production, but total output is expected to quadruple in coming years... Now the shale boom is beginning to spread to Europe."

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**"Flood of U.S. Shale to Drown Out LNG," Energy Biz, Ken Silverstein, September 20, 2011**

"The emergence of shale gas here has literally bumped [Liquefied Natural Gas, "LNG"] to the back burner. Now that the unconventional gas found a mile beneath the earth's surface can be drilled out using hydraulic fracturing, it has changed America's energy picture. Estimates are that 100 years of the stuff now exists, which has put a damper on LNG imports that were once thought to be the future darling of natural gas...

If more natural gas is demanded to fuel transportation or to firm up wind and solar facilities that are intermittent, the country does have the capacity to store and re-gasify

that [LNG] energy source... Moreover, this country has undergone an expansion of its import facilities - 11 now exist - and with contracts signed in 2005 about to expire, such terminals would be underutilized. Those assets would be especially valuable if the pipeline infrastructure could not accommodate shale gas expectations.

In the early 2000s, LNG was thought to be golden... Estimates at that time were that U.S. LNG imports would become 23% of the natural gas market, all of which led to the build-out of re-gasification terminals here... But now that the technologies to drill for shale gas have progressed, all that has changed. LNG makes up about 2% of all natural gas consumed in this country and that is projected to remain flat, and possibly even decline...

2,000 trillion cubic feet of recoverable natural gas exists today. Shale gas makes up 700 trillion cubic feet of that."

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### **"A Pregnant Moment", July/August 2011, Energy Biz**

"In America, we are increasingly reliant on deep shale deposits of natural gas. Efforts to tap and develop that resource have attracted \$250 billion in investments. That dwarfs the financial resources directed to other forms of energy in the country. So increasingly, the United States will be placing its bets on natural gas as its go-to fuel for electricity generation... Americans will continue to perfect shale gas extraction technologies that will be used predominantly in this country - assuming concerns about the impact of the process on our water supply do not spark opposition to using the resource.

But how will the United States remain competitive in nuclear energy, solar power and wind power industries when the boldest growth in those sectors will take place off our shores... if China and India are the hothouses where new nuclear technology is pioneered in the next two decades, what will be the Chinese reaction if the U.S. Nuclear Regulatory Commission imposes costly, 11th-hour design changes on a Chinese nuclear plant under construction in Texas? A regulatory dispute could morph into a trade flap with much broader implications. Energy companies and their customers may be nicked in the crossfire."

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### **"Shale Gas and the Putin Puzzle", Holman W. Jenkins, Jr., The Wall Street Journal, June 22, 2011**

"[T]hanks to the unexpected shale gas boom in the U.S., liquefied natural gas cargoes once planned for the U.S. have gone looking for new buyers. Result: European customers have been able to shake off Russian long-term contracts linked to the price of oil. Russia insists the gas glut is temporary. It has tried to fight back by pushing gas sales to China. But now those talks are stalled over price thanks to - guess what - China back home may have the biggest shale potential of all...

A 'land grab' is under way in Europe, says a new study by the European Center for Energy and Resource Security. Having missed the shale boom in the U.S., ExxonMobil has been

drilling in Germany since 2008. In France, Treador Resources and its partner Hess Corp., are prepared to seek oil and gas under the Eiffel Tower. Poland - a country whose energy captivity to Russia is especially irksome - may be sitting on 300 years worth of shale energy. Chevron and ConocoPhillips are among the companies already drilling there.

Though none of this gas, produced by a method known as hydraulic fracturing, or fracking, will likely find its way to market before 2025, shale is already shaping global energy politics. But what the Lord giveth, European politics may now fritter away...

France in May passed a ban on fracking. Poland is the anti-France, set to take the European's rotating presidency next month and determined to move ahead on fracking... Polls show a solid majority of French voters in favor of development that will lower energy prices."

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**"European Shale Gas Is Still Hot Air for Now", Andrew Peale, The Wall Street Journal, June 1, 2011**

"Shale Gas has been a game-changer in the U.S. Following an estimated \$250 billion of investment, 23% of U.S. gas production now comes from dense rocks thousands of feet underground, from 1% a decade ago. Could Europe see a similar shale-gas revolution?

That seems unlikely for now. Europe may have 639 trillion cubic feet of shale gas, only 25% less than the U.S., says the Energy Information Administration. But Europe's is likely to be far costlier to tap... Production costs could be as high as \$16.20 a thousand cubic feet, according to the Oxford Institute. That compares with the \$8.70 a thousand cubic feet that Gazprom, Europe's main supplier, charged for contracted gas in 2010. U.S. shale-gas production costs are about \$3 per thousand cubic feet."

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**"Chevron Expands In Marcellus Shale," The Wall Street Journal, May 5, 2011**

"Chevron Corp. is doubling down on a big natural-gas bet by expanding its reach into a large swath of Pennsylvania... The rapid emergence of shale gas has sent gas prices plummeting in North America, which currently doesn't have many facilities to export the gas in liquid form via seaborne shipments. Pressured by prices that average about \$4 per million British thermal units, smaller companies are taking advantage of the major's interest and selling to pay debt and avoid funding expensive capital projects. For companies like Chevron, low gas prices aren't the only risk. Shale-gas drilling has come under increased scrutiny amid clashes with environmentalists and regulators over the chemicals used in the fracturing process, called 'fracking' in industry parlance."

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**"Coal Generation Outlook: The End of an Era", Dean Oskvig, EnergyBiz, March/April 2011**

[Dean Oskvig is President and CEO of Black & Veatch's Global Energy Business]

"Natural gas will be our 'new coal.' The Marcellus Shale alone is estimated to have enough gas to power the entire Northeast for nearly 50 years. And, with plentiful supply, conventional wisdom suggests fuel costs will remain stable and low - similar to our country's vast coal resources. Power generation demand for natural gas will grow 2.6 percent per year through 2035, when it will account for approximately 40 percent of the nation's energy mix. During the same time frame, coal's contribution will fall and represent just one quarter of the power generation fuel source. Signs of this new era in fuel supply are already apparent. The U.S. Energy Information Administration projects 80 percent of all new added generation between now and 2013 will be from natural gas-fired facilities... There is no question that coal's reign as our leading fuel source for electric generation will come to an end... The debate now centers on how much and how fast the U.S energy mix will change."

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**"The Great Shale Gas Rush," Jim Estathiou, Jr., and Kim Chipman, Bloomberg BusinessWeek, March 7 - March 13, 2011**

"President Barack Obama enthusiastically backs gas drilling, and these days 90% of it is done by fracking, which involves forcing below ground, chemically treated water under high pressure to smash through layers of rock, thus freeing the gas to flow upward... Obama is 'evaluating the need for new safeguards for drilling', says White House spokesman Clark W. Stephens...

The Marcellus Shale [located in Pennsylvania, West Virginia, and New York] may contain 490 trillion cubic feet of gas - enough to heat U.S. homes and power electric plants for two decades... That makes it the world's second largest gas field behind South Pars, shared by Iran and Qatar... While there have been no documented cases of fracking fluids flowing underground into drinking water, there have been spills above ground...

Even if the U.S. EPA stepped in [to regulate], its authority would be limited. A clause in the 2005 Energy Law - dubbed the 'Halliburton loophole' for the company that helped pioneer fracking and is a supplier of fracking fluids - exempts fracking from parts of the Safe Drinking Water Act... So far, the EPA has begun a study of fracking's effect on drinking water. In February the agency said final results will come in 2014, two years after its initial target - and the 2012 elections."

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**"This Is No Time to Discourage U.S. Oil and Gas Production," Robert Bryce, The Wall Street Journal, February 26-27, 2011**

"The President's 2012 budget, released earlier this month, calls for eliminating a dozen tax incentives that benefit producers of coal, oil and natural gas... Two tax deductions for the oil and gas sector are most important: percentage depletion (part of the tax code since 1926) and intangible drilling costs (part of the tax code since 1913). According to Mr. Obama's

budget, those two items will cost taxpayers about \$2.4 billion per year over the next decade. A handful of other oil- and gas- related tax policies, including an increase in the amortization period for geological and geophysical expenses, cost taxpayers and additional \$2 billion per year. So the sector's total annual tax advantages amount to about \$4.4 billion.

Percentage depletion allows well owners to deduct a certain amount of the value of their production in a given year. It's significant, but the really important tax rule is the deduction for intangible drilling costs, or IDC. That allows drillers to immediately expense, rather than capitalize over years, many of the costs associated with drilling a well, including labor, supplies and fuel... Even if we assume that the IDC deduction is in fact a subsidy, are consumers getting a tangible benefit?

Consider natural gas. Thanks to the increasing use of horizontal drilling and hydraulic fracturing, U.S. gas production has soared over the past few years. The result: Methane prices are now about half what they were in 2008. Various studies... predict that eliminating the deduction for intangible drilling costs could increase natural gas prices by 50 cents per thousand cubic feet... Give that the U.S. burns about 23 trillion cubic feet of gas per year, simple arithmetic shows that eliminating the deduction could mean an increased cost to consumers of \$11.5 billion per year in the form of higher natural gas prices."

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**"Listening to the Shale Revolution," Holman Jenkins, Jr., *The Wall Street Journal*, February 5-6, 2011**

"Just a few years ago, Russian leaders talked up the inevitability of a natural gas cartel more powerful than OPEC. Never mind. The U.S. last year topped Russia in natural gas production for the first time since 2001. The U.S. shale boom has ignited a search elsewhere, from China to Central Europe. Poland alone is estimated to hold shale gas reserves equal to half or Europe's existing conventional reserves - a fact already altering the strategic balance between Europe and its soon-to-be-former energy overlord, Russia."

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**"The Marvelous Marcellus," *EnergyBiz*, January/February 2011**

"[T]he Marcellus shale is the mother lode of natural gas in the United States, now estimated to be the second-largest gas reserve in the world with more than 500 trillion cubic gas feet of estimated recoverable reserves... The economic and environmental benefits of natural gas as a primary source of energy are compelling. Gas emits half of coal's carbon-based pollutants. At \$4 per thousand cubic feet, gas sells for the energy equivalent of about \$26 per barrel of oil - at a time when oil is selling for more than \$80 per barrel.

Aubrey McClendon of Chesapeake Energy stated in a *60 Minutes* segment that we have recently proved up the equivalent of twice the oil reserves in Saudi Arabia with U.S. natural gas shale formations - led by the Marcellus shale."

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## "Pipeline Proliferation," EnergyBiz, January/February 2011

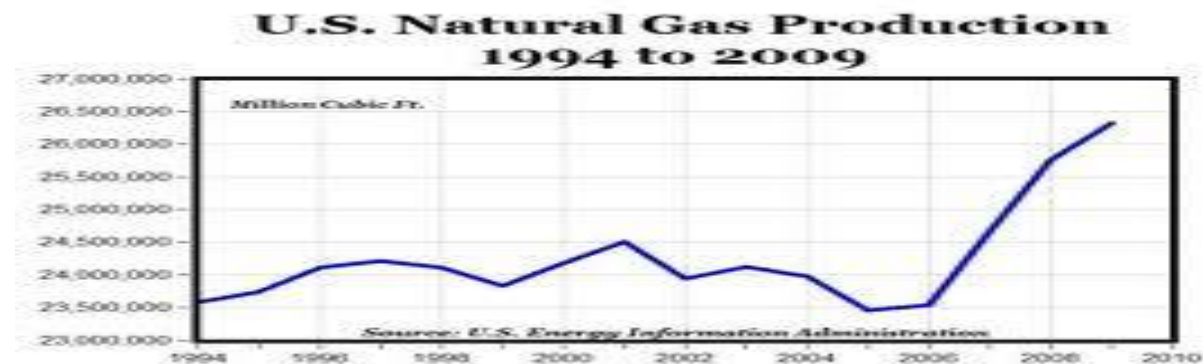
"Marcellus shale gas production has doubled in the past 12 months to around 700 million cubic feet per day. New pipelines and expansions now being completed should add an additional 725 million cubic feet per day, making a grand total of 1.2 billion cubic feet per day in the past year alone. [U.S. Energy Information Administration economist Damien] Gaul predicts Marcellus shale gas production will double again over the next few years."

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## "Exxon Bulks Up on Natural-Gas Assets," The Wall Street Journal, December 24, 2010

"ExxonMobil Corp. continued a year-long buying spree for U.S. natural-gas assets, paying \$575 million for wells and reserves in Arkansas... Exxon became the largest gas producer in the U.S. after it bought XTO Energy Inc. in June for \$25 billion. In July, Exxon paid \$695 million for Denver-based Ellora Energy Inc.

Exxon said it produced 3.726 billion cubic feet of natural gas a day in the U.S. in the third quarter, about 16% of the nation's total consumption... While oil prices have been climbing, closing above \$90 a barrel on Wednesday, natural gas has been trading around \$4 per million British thermal units, far below the \$13 fetched in 2008... But the purchase by Exxon... shows that Exxon is bullish about the long-term prospects for natural gas. The Irving, Texas company says [natural] gas will be the fastest-growing fuel through 2030."



## The Wall Street Journal, Op-Ed, "The Madness of New York", December 26, 2010

"New York has imposed a de facto drilling moratorium [on natural gas] because of dubious environmental fears. Shale drilling relies on hydraulic fracturing, the process of blasting a solution that is 99% water and sand (less than 1% chemicals) into rock to release gas deposits. Fracking has been commercially viable since 1949 and is responsible for 30% of domestic oil and gas production.

The recent advances in shale gas have come from combining fracking with 'horizontal'

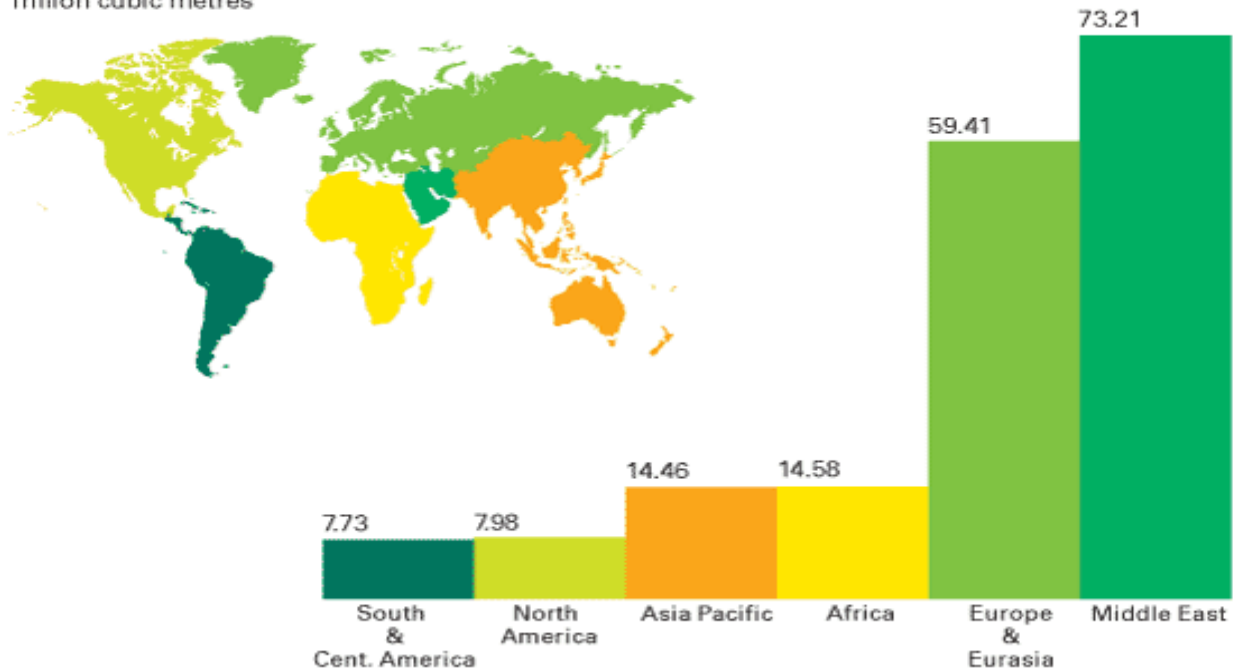
drilling, which permits wells to move laterally under the surface. Horizontal fracking lets the industry get much more energy out of one well. The industry uses steel casing and cement to prevent fracking fluid from polluting wells and underground reservoirs. The EPA and the Ground Water Protection Council, a nonprofit made up of state regulatory agencies, have published studies concluding that fracking is safe. While energy exploration is never risk-free, the Ground Water Council hasn't found a single documented case of fracking having polluted local ground water...

Between July 2009 and June 2010, Pennsylvania's 632 Marcellus wells released 180 billion cubic feet of gas, doubling state production. The Keystone State has used this development to attract more investment in company headquarters, training facilities and service sites - brick-and-mortar capital lost to the Empire State."

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"Beyond the [Exploration & Production] sector, low gas prices spell trouble for merchant electricity generators: Witness Dynegy's decision to sell out to Blackstone Group on Friday. Because gas-fired generation sets the electricity price in most U.S. regions, electricity revenues follow gas prices down even as costs of fuel like coal remain stable.. It is of little comfort to E&P companies right now, but their predicament has a silver lining for an important constituency: their customers."

Proved reserves at end 2007  
Trillion cubic metres



**"Energy Under Our Feet," Ken Fisher's column, Forbes, July 19, 2010**

"Despite its many critics, hydraulic fracturing will change the nature of energy production. Your investments in the energy sector should reflect that fact. Fracking, as it is called by insiders, means injecting fluid at very high pressure into a well used to produce oil, water or natural gas. The most important application is in natural gas production. The injections produce tiny fissures in underground rock, allowing the gas (or whatever you are trying to extract) to seep out.

While fracking is a decades-old process, it has made great technological strides in the past few years. It will make and keep natural gas cheap for a long, long time. Gas that now costs \$5 per thousand cubic feet at the wellhead could come down in price to \$2. The consequence will be a large-scale displacement of competing energy sources by gas.

The losers in this technological shift will be energy sources that are either dirtier than natural gas (coal, especially) or much more expensive (wind and solar). The winners will be the suppliers of fracking technology...

Windmills and solar cells are carbon-free sources of electricity. But they are costly. If you've been investing in these, give it up. That game is effectively over."

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**"The Natural Gas Revolution," editorial opinion by John Deutch MIT professor and board member of Cheniere Energy, The Wall Street Journal, July 16, 2010**

"According to the Energy Information Agency (EIA), natural gas could become a much more important fuel for the U.S. in the coming decades. In its 2010 International Energy Outlook, the EIA predicts growth in natural gas production principally from shale in Latin America, China, Australia, North Africa, and the former Soviet Union.

Global unconventional gas production is projected to increase to 7.9 trillion cubic feet in 2035 (1/3 of total natural gas production) from its 2008 level of 3.5 trillion cubic feet (about 1/6 of total production).

The 2010 EIA projection of world-wide production of unconventional gas increases at 5.2% per year between 2008 and 2035, compared to 1.4% for total gas production.

What will this mean? In the short run, natural gas will displace coal in the electricity sector. This will significantly lower carbon emissions. In terms of renewable energy, low-cost natural gas will make hybrid solar plants that use both sunlight and natural gas to make electricity more economically attractive.

As oil gets more expensive and natural gas cheaper, there will also be an enormous incentive to use far more natural gas in the transportation sector... The continued expansion of gas pipelines around the world, as well as the expanding trade of liquefied natural gas, indicate a movement toward a global market for natural gas similar to oil, and ultimately with a single world price."

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**The Wall Street Journal, "How Shale Gas is Going to Rock the World", by Amy Myers Jaffe, May 10, 2010**

"Over the past decade, a wave of drilling around the world has uncovered giant supplies of natural gas in shale rock. By some estimates, there's 1,000 trillion cubic feet recoverable in North America alone - enough to supply the nation's natural-gas needs for the next 45 years. Europe may have nearly 200 trillion cubic feet of its own... shale gas will revolutionize the industry - and change the world - in the coming decades. It will prevent the rise of any new cartels. It will alter geopolitics. And it will slow the transition to renewable energy...

The shale boom is also likely to upend the economics of renewable energy. It may be a lot harder to adopt green power that needs heavy subsidies when there's a cheap, plentiful fuel out there that's a lot cleaner than coal, even if gas isn't as politically popular as wind or solar."

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**Money.ninemsn.com, "Investors Too Optimistic on US Nat Gas", January 25, 2010**

"It is a sentence heard more and more often these days: have investors overestimated actual demand for commodities? Sector analysts at Barclays Capital remain confident this will prove not to be the case, for most resources. However, when it comes to natural gas they believe the answer is a firm yes.

Natural gas prices in the US have been able to withstand the fall in prices for crude oil and Barclays analysts believe this is due to investors hoping that a cold winter will assist in working through the remaining surplus inventory that continues to hang over the market (been there for 18 months now).

[Barclays] believes that US producers have slashed drilling, but they have not cut supply by enough.... Producers were able to significantly boost rig productivity during the drilling downturn of 2009, with most independent producers growing... production even with large drilling cuts. To make matters worse: exacerbating the less-than-expected slide in US production should be growth in LNG imports, at 1.9 Bcf/d over 2009 levels, almost completely offsetting the US production decline.

Finally, US demand is expected to fall for a second straight year in 2010... it has all to do with US utilities which are no longer replacing coal with gas as aggressively as they did in 2009... In terms of price forecasts, Barclays expects Henry Hub... to average US \$5.25/MMBtu this year. This is lower than what NYSE futures are currently trading (US\$5.82)."

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**The Deal, "The Year in Review - Energy", December 24, 2009 - January 10, 2010**

"A year ago, it was all gloom and doom in the natural gas industry. The credit crunch and severe drop in prices - from \$14 per million BTU in May to \$4.76 recently - hit companies hard, and many were expected to shed assets, sell out to competitors or file for bankruptcy...

Natural gas companies have been able to get through the cycle by cutting jobs, capital expenditures and production and by doing joint ventures to bring in cash-rich partners... Wall Street has also been willing to raise money for them through debt and secondary offerings. Banks have been more forgiving during redetermination season, since they didn't want to sell foreclosed assets in a down market. As for M&A, there's been a severe disconnect between bid and ask and a cautiousness toward doing deals...

However, there are more troubling signs on the horizon for natural gas players. Observers worry about how U.S natural gas supply can continue to grow at an exponential rate while the price fails to respond negatively to nonexistent positive demand signals.

'Essentially, the only thing that's saved the market from a horrendously oversupplied state and an early full-storage scenarios a big increase in natural gas used for power generation, surprising strength in industrial gas demand, a collapse in Canadian imports and the fact that [liquefied natural gas] continues to be missing in action. All of these factors are likely to be less important going forward,' a private equity investor wrote as part of a recent survey by Tudor Pickering Holt & Co. Securities Inc....

[According to Allen Brooks, an analyst at energy investment banking boutique Parks Paton Hoepfl & Brown] 'If gas demand falls again in 2010 as the EIA forecasts, then one has to wonder whether we are watching an impending train wreck in slow motion.'

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### **Energy Biz Insider, "Natural Gas' Fortunes", December 23, 2009**

"Energy's future may have come to light with Exxon Mobil Corp.'s proposed purchase of XTO Energy. If Exxon Mobil's predictions are right, unconventional formations such as shale would provide significantly more of [the United States] generation and transportation fuels.

Texas-based XTO, which has the resource equivalent of 45 trillion cubic feet of shale gas, shale oil, and coal-bed methane, might be the perfect fit for Exxon Mobil - or any deep-pocketed oil partner... By betting on natural gas, Exxon Mobil is saying that fossil fuels will remain paramount but that tighter air quality restrictions are coming... [Exxon Mobil, in fact, says in its annual energy outlook that it anticipates natural gas to grow faster over the next 20 years than either oil or coal.]

The \$31 billion deal... comes atop earlier estimates this year from the Potential Gas Committee that said the country's natural gas reserves are 35% greater than two years ago.

Reserve levels now stand at more than 2,000 trillion cubic feet... the most they have been in

44 years... [The U.S. Energy Information Administration is predicting that total domestic natural gas production will grow from 20.6 trillion cubic feet in 2008 to 23.3 trillion cubic feet in 2035, with shale accounting for a quarter of that expansion.]

The increase is because of shale... it has only been in recent years that retrieving [natural gas from shale] has been geologically possible. With horizontal drilling, producers can move laterally beneath cities and neighborhoods to extract the product... To produce gas from shale, tons of water and chemicals must be pumped deep down into the wells to loosen it. And that has created concerns among many communities and environmental groups that say the process contaminates the groundwater."

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**The New York Times, "A Bid to Cut Emissions Looks Away from Coal", Nov. 1, 2009**

"As Congress debates legislation to slow global warming...engineers are tinkering with ways to capture and store carbon dioxide...coal-fired power plants, commonly identified as the nation's biggest emissions villain, may not be the best focus. Rather, engineers and policymakers say, it may be easier and less costly to capture the carbon dioxide at oil refineries, chemical plants, cement factories and ethanol plants, which emit a far purer stream of it... [CO<sub>2</sub>] typically makes up only 10% to 12% of a coal plant's emissions, they note, and the gas is so mixed up with pollutants that it is difficult to separate...

[CO<sub>2</sub>] makes up 20% of the gas resulting from hydrogen production...

In the oil industry, drillers have for years tapped underground reservoirs of [CO<sub>2</sub>]... they inject it into [oil] fields to help force oil to the surface in a process called 'enhanced oil recovery'... What oil drillers pay for [CO<sub>2</sub>] depends on the value of the oil it helps produce. When oil is at \$70 a barrel, [CO<sub>2</sub>] goes for \$10 or \$11 a ton...

For now, no one is sure what it will cost to capture and sequester [CO<sub>2</sub>] from coal plants because the first such project in the nation, [Mountaineer] at American Electric Power [in West Virginia] got under way only last month. At the moment, the process consumes 30% of the coal plant's energy, but engineers are working to cut that in half.

Even so, experts expect the price to run to \$60 a ton or more. But pure streams could be captured [from the other emitting sources for] perhaps \$10 to \$15 a ton."

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**Business Week, October 19, 2009, "Bettying Big on a Boom in Natural Gas"**

"U.S. gas producers, capitalizing on a technological breakthrough, have in recent years unlocked an enormous volume of natural gas in the shale rock under Colorado, Oklahoma, Pennsylvania, Texas, and other states. According to a July report by the Colorado School of Mines, the U.S. now holds 1,800 trillion cubic feet of natural gas, one third of it in shale, the equivalent of some 320 billion barrels of oil. That's more than Saudi Arabia's 264 billion barrels.

Of course, natural gas isn't interchangeable with oil and won't solve America's energy woes by itself. While natural gas can be used to heat homes and power vehicles, it's mostly used, like coal, to generate electricity...

While natural gas producers say they're sitting on the greatest volumes ever, they also face considerable barriers to getting their commodity to market. Prices are so low that many producers have closed their wells...

In Raleigh, [N.C.] Progress Energy's [CEO] made his decision to shift [from putting scrubbers on coal-fired generation] to [converting those plants to run on] natural gas in the face of a state requirement to cut the utility's sulfur dioxide emissions in half... If Washington [D.C.] puts a cap on carbon emissions, [Progress Energy] will likely face another decision on how to modernize [its] three other 1950s- and '60s-era coal-fired plants...

A few other utilities are making the shift to gas or considering doing so.

- Tampa Electric has transformed its coal-fired Gannon Power Station into a natural gas unit at a cost of \$750 million.
- In April, developers of the Highwood Generating Station near Great Falls, Mont., dropped plans to burn coal and chose natural gas for a new plant.
- Portland (Ore.) General Electric is proposing to build two new natural gas plants.

Most utilities, however, remain on the sidelines. Natural gas prices have been so volatile over the years that executives are unwilling to make a long-term commitment...Oddly enough, natural gas is finding more popularity among utilities that embrace renewable energy. Fears that cheap natural gas might take investment from costlier solar and wind power have proven overblown; instead, utilities are building both. Because gas turbines can vary their output with precision, they complement wind farms and solar fields that generate irregular power flows. The result is a more stable and reliable energy supply.

Florida Power & Light, the nation's largest renewable energy developer, is building a solar thermal power plant that will be the nation's second largest. The Juno-Beach (Fla.) company put its new facility next to an existing gas-fired plant so that when a cloud passes in front of the sun, the gas plant can keep the power flow steady.

- Public Service Enterprise Group, a major mid-Atlantic utility, is developing gas and renewable projects simultaneously...
- General Electric has targeted a line of fast-start gas turbines at renewable projects...
- Topeka (Kan.) based Westar Energy has paired four of those turbines with 300 megawatts' worth of wind capacity spread around the region."

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**The New York Times, September 22, 2009, "Refitted To Bury Emissions, Plant Draws Attention"**

"NEW HAVEN, W. Va. - Poking out of the ground near the smokestacks of the Mountaineer Power Plant are two wells that look much like those that draw natural gas to the surface. But these are about to do something new: inject a power plant's carbon dioxide into the earth... Mountaineer is the world's first electricity plant to capture and store carbon dioxide.

The hope is that the gas will stay deep underground for millennia rather than entering the atmosphere as a heat-trapping pollutant. The experiment... is riveting the world's coal-fired electricity sector... visitors from as far as China and India, which are struggling with their own coal-related pollution, have been trooping through the plant. The United States still depends on coal-fired plants, many built decades ago, to meet half its electricity needs. Yet the economic viability of Mountaineer's new technology, known as carbon capture and sequestration, remains uncertain. The technology is certain to devour a substantial amount of the plant's energy output - optimists say 15%, and skeptics say 30%.

Environmentalists who oppose coal mining and coal energy of any kind worry that sequestration could simply trade one problem, global warming, for another one, the pollution of water supplies. Should the CO<sub>2</sub> mix with water underground and form carbonic acid, they say, it could leach poisonous materials from rock deep underground that could then seep out.

[E]ngineers will begin pumping carbon dioxide, converted to a fluid, into a layer of sandstone 7,800 feet below the rolling countryside here, and then into a layer of dolomite 400 feet below that. [The plan] is to inject about 100,000 tons annually for two to five years, about 1.5% of Mountaineer's yearly emissions of carbon dioxide. Should Congress pass a law controlling carbon dioxide emissions and the new technology proves economically feasible, the company says, it could then move to capture as much as 90% of the gas.

For energy planners, a crucial question is how much this technology would cost if refined and installed on a bigger scale. The answer remains elusive.

[Experts are focused on Mountaineer because] it is far easier to corral several million tons [of emissions] flowing from a single chimney than a comparable amount coming from tens of millions of car tailpipes or home heating systems".

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### **The New York Times, September 7, 2009, "Natural Gas Hits a Roadblock in the Energy Bill**

"The natural gas industry has enjoyed something of a winning streak in recent years. It found gigantic new reserves, low prices are encouraging utilities to substitute gas for coal, and cities are switching to buses fueled by natural gas. But its luck has run out in Washington... influential lawmakers, from both parties, say that new technologies under development to capture and bury emissions of coal are a better bet than gas for long-term solutions for climate change.

[I]t is not only coal-industry lobbyists and their Congressional supporters who favor the concept of carbon sequestration. David Hawkins, a climate change expert at the Natural Resources Defense Council, said simply replacing coal with natural gas for power generation was "not a viable strategy" because that would merely delay climate change by a few decades. "A coal plant with carbon capture and storage is a cleaner plant than an uncontrolled natural gas plant," he said.

Many legislators believe that carbon capture and sequestration - a largely untested system that would bury carbon at power plants so it does not escape into the atmosphere - can be made to work. Developing the technology was particularly important for any global solution to climate change, since China and India depend on coal for their energy and growing economies, said Paul Bledsoe, director of communications and strategy at the National Commission on Energy Policy, a bipartisan research organization."

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### **Energy Biz insider, August 31, 2009, "Speculating on Higher Natural Gas Prices"**

"The Obama administration wants those commodities that are bought and sold through trading platforms to be subject to even stricter oversight. The administration's Commodity Futures Trading Commission is considering regulations that would diminish the power of those exchanges and set limits on the number of energy positions that traders take. The commission has said it will propose new rules by fall."

Gary Gensler, head of the CFTC explains that in his view, "position limits should enhance liquidity by promoting more market participants rather than having one party that has so much concentration so as to decrease liquidity. Gensler's view is that having concentration (one party with a very large position in the commodity market) drives prices higher, and distorts the economic forces of supply and demand.

The Industrial Energy Consumers of America presented testimony to Congress in August 2009 in which they argue that the natural gas markets demonstrate this effect. From January 2008 to August 2008, the price of natural gas more than doubled:

- During that period, US production of natural gas increased by 8%,
- During that period, US inventories of natural gas were well within the five-year average,
- During that period, US demand was essentially unchanged from the same period in the prior year.
- As a result of the doubling of the price, US consumers paid an additional \$40 billion in higher natural gas costs.

The US Government Accountability Office issued a report in 2007 that appears to support the Energy Consumer (and Mr. Gensler's) view. That report said speculation among futures traders could cause price escalation (without fundamental supply and demand shifts), but

that the lack of transparency in the market makes it difficult to give a precise answer as to the effect of such price escalation."

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**Energy Biz Insider, July 29, 2009, "Resource Planning"**

"According to the Edison Electric Institute, at least nine coal plants representing 6,650 megawatts have been canceled [in the first half of 2009], joining 24 plants that were scuttled in 2008... Climate and energy legislation, as well as a profound shift in environmental policy from the previous eight years, have made power companies that rely on fossil fuel generation to serve their load more reticent to pursue projects that are now deemed risky.

Overlaid on this is an economic recession that has slowed the demand for generation capacity, at least in the short run. According to the Sierra Club, only 59 of the 220 coal-fired plants planned and in various stages of permitting since 2001 remain actively under development, which means trends well under way a year ago have only accelerated in recent months.

Major cancellations include:

- The Navajo Nation in New Mexico planned to build the Desert Rock 1,500 megawatt coal-fired power plant on its reservation in New Mexico but its permit was revoked by the EPA.
- NV Energy is postponing plans for a \$5 billion, 1,500-megawatt Ely Energy Center in eastern Nevada.
- LS Power withdrew its application to build the [1,600 megawatt] White Pine Energy Station in Nevada."

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**The New York Times, June 12, 2009, "Exxon, in Switch, Joins Plan to Build 1,700-Mile Natural Gas Pipeline From Alaska"**

"In a surprising about-face, Exxon Mobil said Thursday that it would work with a Canadian pipeline operator, TransCanada, to build an ambitious natural gas pipeline from Alaska... It also deals a blow to a rival project from BP and ConocoPhillips and introduces more uncertainty into one of Alaska's biggest political and economic debates.

With production for the Prudhoe Bay oil field declining, Alaskans have been hoping for years that natural gas would take over as the state's financial mainstay. Alaska's estimated 35 trillion cubic feet of gas reserves are now being reinjected into oil fields or left in the ground because there is no way to get the fuel to consumers.

With Exxon and TransCanada on one side, and BP and Conoco on the other, there are two contenders for what would be the biggest civil engineering project in North America, and

one of the most challenging. It would dwarf the 800-mile trans-Alaska oil pipeline, a momentous project that was completed in 1977.

TransCanada has estimated that the project would cost \$30 billion. It would stretch roughly 1,700 miles... the pipe would have a daily capacity of six billion cubic feet of natural gas, or about 10% of current domestic consumption. It would begin operation in 2018."

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**Energy Biz insider, December 24, 2008, "New Coal Economics"**

"A perfect storm... Utilities are also facing rapidly escalating railroad transportation contracts as shippers take advantage of their pricing powers... International demand for both coking and thermal coal are rising global electrical demand and coal consumption throughout Asia and India... With the falling dollar, selling [coal] to Asia, Europe or South America is giving coal producers a higher return than selling into the US... In 2007, the US exported almost 60 million tons of coal. [At year-end 2008] many expect that figure to be between 80 and 90 million tons. Estimates for 2009 are even higher at 100 million tons.

Consequently, fuel managers of major utilities are seeing their costs escalate. Mike Hendon, senior manager of coal acquisitions at TVA said he's 'never seen prices as volatile as they are now' ... Like it or not, coal is part of a global economy. The railroads and the producers understand that. And they are looking to the highest bidder, which is increasingly overseas."

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**Energy Biz insider, August 20, 2008, "Russia's Rise"**

"Russia's already the leading natural gas producer globally while some say that its oil production will eventually surpass that of Saudi Arabia. It now exports 6.5 million barrels a day but many expect that to jump to 9 million a day by 2010, which is equal to that of Saudi Arabia. According to the US Energy Information Administration, [Russia] possesses 27.5% of the world's [natural] gas supply. About half of its own needs are met with natural gas while it provides about 23% of Europe's demand."