

Illinois in the Global Energy Marketplace

Energy Resources in Our Daily Lives

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Energy Supply and Prices: Oil

Energy Supply and Prices: Natural Gas

ISGS Response to Illinois' Energy Needs

Energy Resources in Our Daily Lives

Sunlight, wind, biofuels, fossil fuels, and nuclear fuel are all energy sources, some of which Illinois citizens commonly use every day. Coal and nuclear fuels generate electricity; natural gas heats buildings and supplies energy for industry; petroleum fuels cars, trucks, and airplanes; and electricity lights, heats, and cools homes, offices, factories, and other modern buildings. The United States has one of the most sophisticated energy production and distribution systems in the world. This dynamic system has undergone important changes in recent decades.

A Profile of Illinois Energy Production and Consumption

With 12.1 million residents (1999), Illinois nationally ranks fifth in population. Illinois ranks seventh in coal production and fourteenth in oil production. Although it has a history of important coal production, moderate oil production, and minor natural gas production, Illinois currently consumes more energy than it produces. Thus, Illinois' energy supplies and prices are determined by many interconnected factors extending across the world. **Illinois is part of the global energy marketplace.**

Illinois' energy resource consumption is roughly in line with its fifth place population ranking. Illinois ranks (1997) sixth in coal consumption, fifth in natural gas consumption, seventh in electricity usage, and eighth in petroleum consumption (on a btu equivalent basis). Illinois' capacity to generate electricity ranks fifth. Illinois is a net exporter of electricity (1998) and uses a diverse mix of fuels to generate electricity, including coal, nuclear, and, increasingly, natural gas.

Coal Illinois coal production peaked in the late 1910s at almost 90 million tons per year (Figure 1). Today, Illinois annually produces 40.4 million tons (1999) and consumes about 44.6 million tons (1998), but only about 42 percent, or 17 million tons, of Illinois coal is consumed in-state. Most of the balance of coal used in the state, about 21 million tons in 1998, comes from Wyoming's Powder River

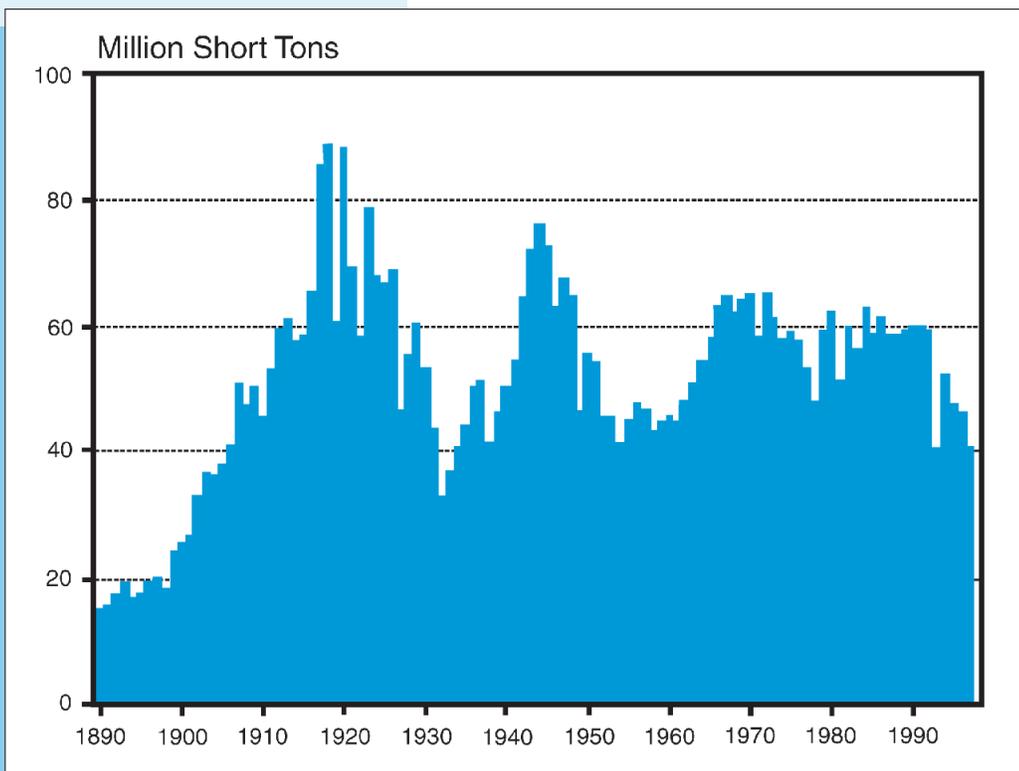


Figure 1. History of Illinois coal production. Source: Energy Information Administration.

Basin. Compared with that coal, Illinois coal generally contains more sulfur, which must be removed from power plant emissions; thus, the future production of Illinois coal will depend on mining efficiency relative to the costs of sulfur removal, among other factors.

Natural Gas Illinois produced minimal quantities of natural gas, 195 million cubic feet in 1999, but consumed 980.6 billion cubic feet that same year. Thus, Illinois produces only 0.02% of its natural gas consumption. However, Illinois is an important natural gas distribution and storage state, ranking second in the nation in natural gas storage capacity, primarily underground storage of gas used to meet peak winter heating demand in the Midwest and Northeast. Illinois receives substantial natural gas supplies from traditional U.S. source regions along the Gulf Coast and in the Midcontinent as well as from Canada.

Petroleum Illinois produced an estimated 9 million barrels of petroleum in 1999, which is substantially lower than the estimated 22 million barrels produced in 1989, but consumed 242.1 million barrels in 1997. Thus, Illinois produces only 3.7% of its petroleum consumption. Petroleum production in the Illinois Basin is now in a mature stage, as it is for the forty-eight contiguous states onshore as a whole. However, despite cumulative production of 4.3 billion barrels in the Illinois Basin, as many as 4.1 billion barrels of unrecovered movable oil may remain in the Basin's reservoirs.

Electricity Illinois has a substantial utility generating capacity of about 30,400 megawatts (MW) and ranked fifth in the nation in 1998. That year, of the five largest plants in the state, one was gas-fired, three were nuclear, and one was coal-fired. Overall generating capacity is dominated by coal with 44 percent coal-fired and 32 percent nuclear plants. Recent sales by utilities have moved more capacity into the non-utility sector; new construction is almost entirely by non-utility "merchant" generators using natural gas-fired turbine technology. Most of these new and currently proposed plants are designated for peak-load capacity, an application for which natural gas turbines are well suited.

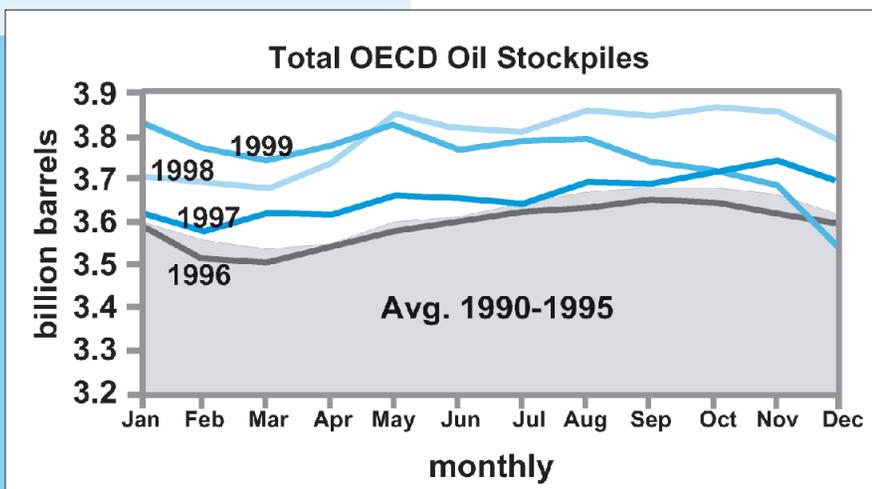
Energy Supply and Prices: Oil

One of the most visible barometers of U.S. energy prices is the price of motor gasoline. Usage in the U.S. amounts to 8.4 million barrels (42 U.S. gallons per barrel) per day (1999). In June 2000, gasoline prices climbed to well over \$2.00 per gallon in the Midwest, reaching the highest prices ever (in nominal dollars) in the region. As a result, Illinois dropped its sales tax on gasoline for the remainder of 2000 to lessen the impact on consumers and began investigating industry pricing.

Regardless of the outcome of the investigations, it is important to recognize that this price event took place against a background of international and national petroleum supply trends favoring higher prices.

World Oil Overview In 1999, world oil production relative to consumption showed an average daily deficit of about 0.8 to 1.3 million barrels per day. Average world production was about 71.9 million barrels per day, while average world consumption was about 73.2 million barrels per day. Oil stockpiles provided the remaining needed oil. Saudi Arabia is the world's leading producer, accounting for 8.6 million barrels per day, or about 11.9 percent of production. As the world's leading consumer, the U.S. accounted for 18.5 million barrels per day, or about

Figure 2. Oil stockpiles of the twenty-nine countries within the Organization for Economic Cooperation and Development (most of western Europe, the U.S., Canada, Mexico, Australia, and Japan, among others). Note the decline in stocks at the end of 1999 below the three preceding years and below the 1990–1995 average. Source: Energy Information Administration.



25.5 percent, of consumption. As 1999 closed, oil stockpiles in major consuming nations were below historical trends (Figure 2). At the end of the first quarter of 2000, world demand was 75.62 million barrels a day, but world supply was only 75.05 million barrels per day, indicating a continuing world deficit.

U.S. Oil Overview Most people are aware that U.S. oil production is down and oil imports are up. The magnitude of these trends may not be widely known. Lower 48 reserves peaked in 1959; production peaked in 1970 (Figure 3) and has declined irregularly since then. In 1970, the U.S. produced 9.2 million barrels of oil per day and imported about 1.3 million barrels per day, accounting for 12 percent of its supply. In 1999, the U.S. produced 5.9 million barrels per day but imported about 8.6 million barrels per day, or about 56 percent of supply. Oil imports have been steadily growing, up by 46 percent since 1990. These imports come from the Organization of Petroleum Exporting Countries (OPEC), which supplied about 4.2 million barrels a day to the U.S. in 1999, and from non-OPEC sources, which supplied the U.S. with about 4.5 million barrels per day. Saudi Arabia and Venezuela are the leading OPEC suppliers, and Mexico and Canada are the leading non-OPEC suppliers.

Recent OPEC Actions The 11 members of OPEC provide 40 percent of world oil production and control 78 percent of the world's proven oil reserves. In response to slumping oil prices, in part brought on by the economic downturn in Asia in 1997–1998, OPEC and several non-OPEC countries cut production in March 1999 by 2.1 million barrels per day. As a result, prices rebounded from \$12.30 (March 1999) to \$29.57 per barrel (June 2000) with prices continuing above \$30.00 through most of summer and fall 2000. The OPEC production cuts, economic rebound in Asia, and robust U.S. demand into mid-2000 helped set the stage for some well-publicized motor gasoline price spikes, as occurred in Illinois.

Impacts on Illinois Gasoline Supplies The motor gasoline price increases that affected the Midwest, including Illinois, in June and July 2000 were the result of both the world oil supply situation and the result of factors affecting the Midwest at that particular time. Six factors can be specifically cited as supporting higher Illinois gasoline prices this past summer: (1) world petroleum consumption was again growing, (2) U.S. petroleum import dependence was at record-high levels, (3) OPEC has worked effectively as a group since early 1999 to control oil supply, (4) petroleum and petroleum product stockpiles were at low levels, (5) U.S. refinery utilization was at record-high rates, and (6) new reformulated gasoline requirements were introduced in the Chicago area in May 2000, complicating the gasoline supply and distribution network. In addition, certain blending components were apparently in short supply as a result of pipeline supply interruptions affecting the region, which may have made production of the new Phase II reformulated gasoline by refiners even more difficult. Multiple market forces were operating, many of which were international and national rather than strictly regional in scope.

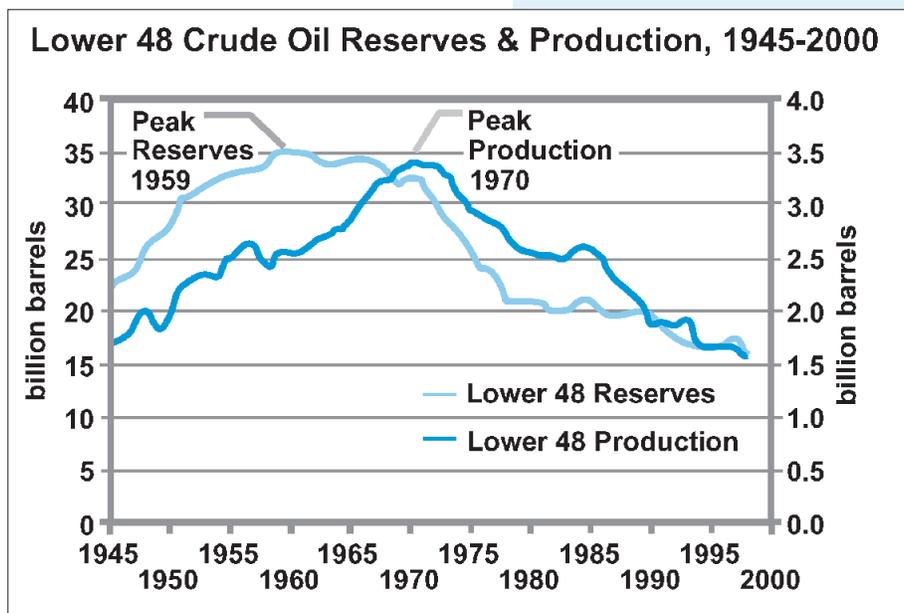


Figure 3. History of U.S. lower forty-eight states crude oil reserves (left scale) and annual production (right scale) (billion barrels). Note the production response in 1984–1985 to high oil prices, over \$31.00 per barrel, in 1981–1982. Source: Energy Information Administration.

Energy Supply and Prices: Natural Gas

A Natural Gas Overview In contrast to the world market for oil, natural gas in the U.S. is a North American market; 87 percent of marketed natural gas is produced in the U.S., and the balance is almost entirely produced in Canada. Natural gas production and marketing are deregulated; federal oversight of interstate pipelines is the major remaining component of regulation. Natural gas production peaked in the U.S. in 1973 at 21.73 trillion cubic feet (Tcf), dropped to 16.17 Tcf in 1986, and recovered to 18.79 Tcf in 1999. Consumption totaled 21.3 Tcf in 1999 and is expected to increase to 29 Tcf by 2010.

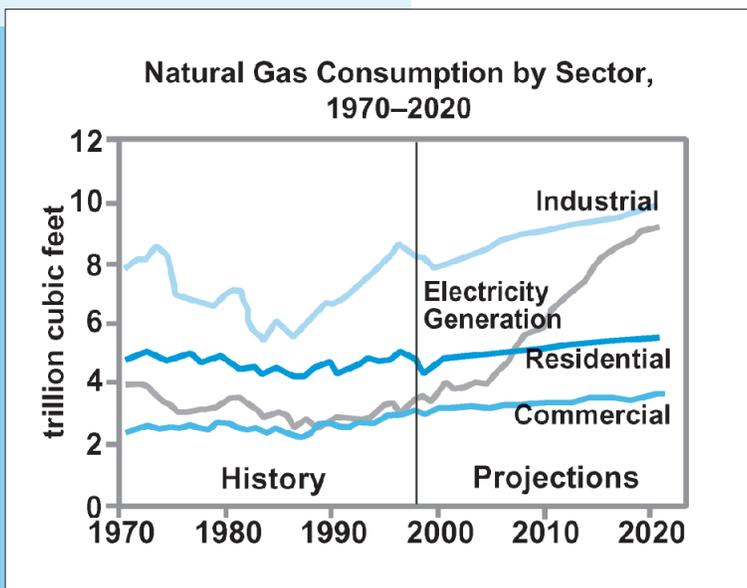
Illinois ranks first in the nation in per capita annual residential natural gas demand, second in total residential consumption, and third in total commercial consumption of natural gas among the states. Thus, natural gas supply and price trends are of major concern to Illinois residents, especially as the winter 2000–2001 price outlook for natural gas indicates winter gas costs will be 30 to 50 percent higher than last year because of higher gas prices and the expectation of a colder winter than any of the previous three years.

The Short-Term Outlook for Natural Gas The current (November 2000) market prices for natural gas are over \$5.00 per thousand cubic feet (Mcf) compared with about \$2.50/Mcf at the same time last year. Current prices are driven by limitations in supply in the face of continuing gas demand growth, including the use of natural gas to generate electricity. In 1998–1999, low world oil prices and limited prices for natural gas meant that many oil and natural gas producers (often the same companies) were not drilling extensively for new supplies. Natural gas supplies decreased. In April 1999, only 371 drilling rigs were seeking new gas supplies, which was 34 percent below an average of 564 rigs operating the previous year. Although the number of drilling rigs seeking new natural gas supplies has averaged 832 for November 2000, new supplies from these wells will generally not be available until late winter-early spring of 2001.

An underlying cause for the limited gas supplies of the 2000–2001 winter would again be the Asian economic crisis of 1997–1998 that drove down world oil prices, cut income to oil and gas producers, and thus resulted in less drilling for both oil and gas in the U.S. Although less coupled to world events than are oil prices, natural gas prices and domestic supply are nevertheless linked to the global economy, particularly with increased use of natural gas as a fossil fuel with low environmental impact. The exact price path that natural gas will take this winter, however, depends on weather, electricity demand, and world oil prices. The mid-term outlook for natural gas price impacts on consumers looks less severe.

Mid-term Outlook for Natural Gas According to many analysts, beginning in spring 2001, gas prices should moderate from \$5.00/Mcf levels, but a new gas price floor is likely to be established at \$2.50 to \$3.00. If gas prices descend much below \$2.50, the new drilling and other infrastructure necessary to satisfy expected U.S. demand will be discouraged. Gas prices will always fluctuate with electricity demand, weather, and, to some extent, oil prices (which affect producers of both oil and natural gas). Gas-fired electricity generation, particularly

Figure 4. Past and projected U.S. natural gas consumption. Source: Energy Information Administration.



for peak load power plants that operate half time or less, is predicted to continue to grow as one effect of electricity market deregulation (Figure 4). This factor alone provides significant support to natural gas prices. However, Illinois will see good, even increasing, availability of natural gas supplies and should not be the victim of regional gas supply shortages.

The Midwest, including Illinois, is capable of receiving the highest level of gas supplies of any region in the U.S. during peak consumption. Average daily flows into the Midwest increased 28 percent during 1990–1997. In addition to supplies from the long-term producing areas such as the Gulf Coast and the Midcontinent, the Chicago area is becoming a major hub for increasing Canadian natural gas imports. For example, the new Alliance Pipeline from Alberta, Canada, has started delivering up to 1.3 billion cubic feet of gas per day to a point near Joliet, Illinois. With an excellent gas supply infrastructure and accessible supplies from Canada and within the U.S., Illinois is not likely to see a state-based gas supply shortage. A widespread, extreme cold-weather event would test gas deliverability regionally, but impacts would not be limited to Illinois. These available gas supplies are in part why Illinois has seen construction of numerous gas-fired electricity generation facilities in the last 18 months with applications pending for many more.

The Link Between Electricity and Natural Gas: The “Peaker Plant”

New utility power plant construction essentially ceased under electricity market deregulation in most areas of the country. Non-utility, or “merchant,” generators have been filling the demand gap for electricity, particularly summer air-conditioning demand, by building gas-fired turbine electricity generating facilities. Summer represents the peak time for electricity use—hence, the term “peaker plant” applied to these power plants. More than 50 peaker plant permits were granted or pending in Illinois as of August 2000, and, since 1998, 16 plants totaling 5,305 MW of new gas-fired capacity have become operational or are being built. Illinois already was a net exporter of electricity as of the end of 1998. Thirty additional new peaker plants totaling 8,123 MW are permitted by the Illinois Environmental Protection Agency (10 plants) or are in the permit process (20 plants). Not all of these plants will be built since local permits and rapidly changing market conditions (including rapidly escalating natural gas prices) also affect plant construction decisions. As of August 2000, 11 additional electricity generation projects at existing industrial and utility sites have also been permitted or applied for.

Although natural gas supplies are ample in Illinois, gas-fired electricity generation in the state and nationwide will affect natural gas consumption and prices. Natural gas usage has historically been cyclic because of its extensive use in winter months for space heating purposes, resulting in decreased demand in summer. This decreased demand lowered wellhead prices in summer when gas storage reservoirs are filled to meet winter demand. As gas-fired electricity generation for peak summer loads increases, this historical cyclicity will be smoothed out, and higher natural gas prices will be supported during the summer months. Thus, gas used in the winter will consist of seasonally higher priced gas coming from wellheads directly to market plus higher priced summer storage gas.

An additional impact of gas-fired electricity generation, especially that beyond a peaker plant, will be deferral of generation capacity fired by other fuels, such as Illinois coal. This deferral will have a negative impact on the Illinois economy. It is also important to recognize that the gas turbines of peaker plants require substantial water resources for cooling and for boiler loops (in the case of combined cycle plants). Water demand could be on the order of several million gallons per day, depending on the generation capacity of the plant.

Information Sources on the Web:

U.S. Energy Information Administration
<http://www.eia.doe.gov>

American Gas Association
<http://www.aga.org>

National Petroleum Council
<http://www.npc.org>

BP (London) Statistical Review of World Energy
<http://www.bp.com/worldenergy/>

Organization of Petroleum Exporting Countries
<http://www.opec.org>

The Illinois State Geological Survey Response to Illinois' Energy Needs

The Illinois State Geological Survey (ISGS) continues its active program of research and development related to energy resources and their utilization in Illinois. All of these activities have been combined under the Energy Resources and Utilization Laboratory (ERUL) while maintaining research sections in coal, oil and natural gas, and energy-related environmental engineering. The coal and the oil and natural gas sections focus mainly on resource supply issues; the coal group also considers mine subsidence problems. Energy and environmental engineering focuses on diverse issues of coal cleaning, coal by-product utilization, and sorbents for methane adsorption and flue-gas cleaning. Energy resource economics is also included in ERUL. With more than 20 researchers, ERUL is attracting external funding to address Illinois and national energy issues and is developing interdisciplinary projects to investigate current areas of interest in Illinois such as the development of coalbed and coal mine methane resources. **With continued collaboration among ISGS staff, faculty at the University of Illinois at Urbana-Champaign, and other researchers around the country, the ISGS is committed to innovative and ongoing investigations of Illinois energy resources.**

One new aspect of that commitment is the development of an information series called *Illinois in the Global Energy Marketplace*. This is the initial publication of the series. It provides background on two recent energy marketplace events, summer 2000 gasoline prices and winter 2000–2001 natural gas prices, affecting Illinois residents. This print publication will also appear online (<http://www.isgs.uiuc.edu>); online updates will be posted as energy markets change and new trends develop. Because world energy markets are becoming increasingly more integrated, the *Illinois in the Global Energy Marketplace* series will assist Illinois residents, businesses, and government agencies in understanding new trends and will provide background and information links to both domestic and international information resources. For additional information, contact Robert J. Finley, Head, Economic Geology Group (217-244-8389 or finley@isgs.uiuc.edu).

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