Energy and Regional Economics

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International instability and possible war affect the overall US economy, and economic conditions in different regions, in a variety of ways. Changes in energy prices and supplies will account for a significant part of the overall impact, and will create differential impacts among regions.

U.S. recessions in recent decades have generally been preceded by, and arguably precipitated by, energy price shocks. Higher energy prices mean lower real incomes and create uncertainty in business planning. The effects of energy shocks may be even greater for many of our trading partners, adversely affecting demand for U.S. exports. With the U.S. economy is somewhat fragile condition anyway, an energy shock could upset the prospects for recovery. On the other hand, the U.S. economy is not as energy-intensive as in the past, and energy prices in real terms are far below where they were 20 years ago.

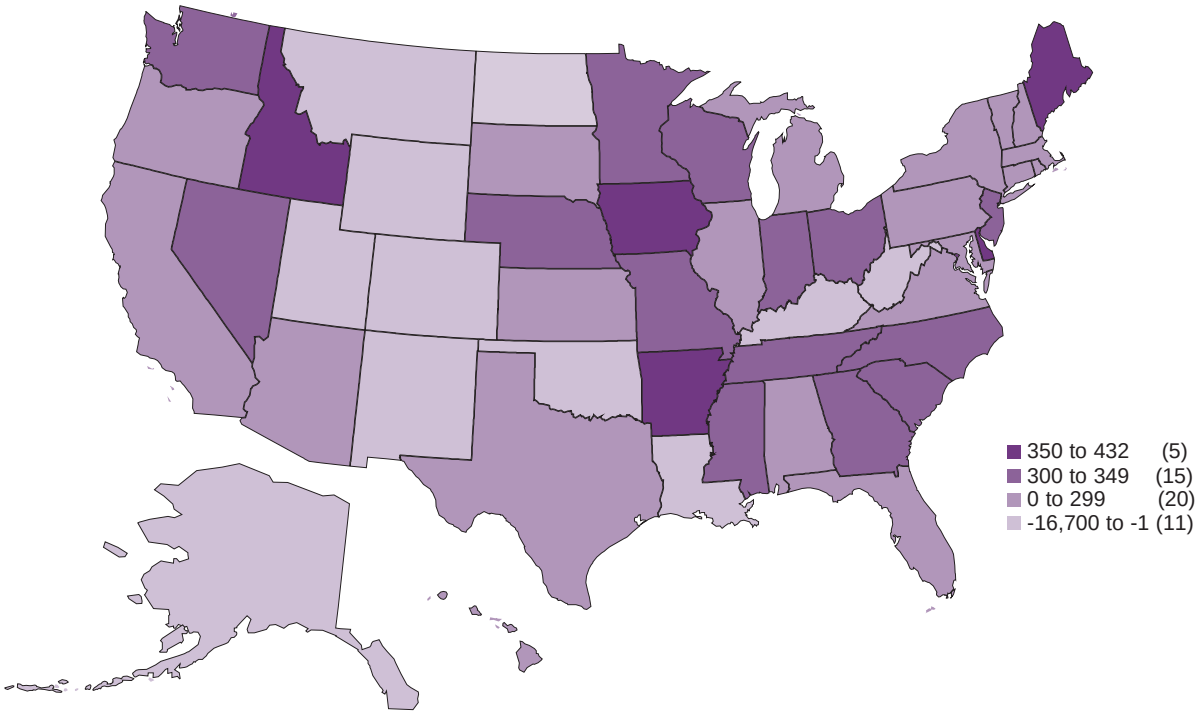
Although some of the materials used in home building, such as cement, are very energy-intensive, the overall energy intensity of home building (within the construction industry and embedded in materials) is below the average for the economy. Higher energy prices could hurt demand for housing, however, and energy accounts for a significant part of the cost of operating homes.

The risks to energy supplies and prices reflect the heavy U.S. reliance on energy imports. Overall, net imports account for a quarter of U.S. energy consumption. For petroleum, the net import share is about 60 percent.

While most states consume more energy than they produce, there are 11 states, most of which are sparsely-populated, where energy production exceeds energy consumption. Figure 1 shows 1999 per capita energy consumption, net of production, by state. Texas, notably, no longer is among the states where production exceeds consumption, although that state would still probably see a net benefit from higher energy prices, particularly if higher prices stimulate higher demand for equipment and services used in energy exploration and production.

U.S. per capita energy consumption increased from 215 million

Figure 1. Per Capita Energy Consumption, Net of Production 1999 Million BTU



Source: Energy Information Administration, "State Energy Production and Consumption."

BTUs in 1949 to 359 million in 1973, but since then there has been no upward trend, with per capita consumption in 2001 equal to 340 million BTUs.[1] Relative to the size of the economy (i.e., BTUs per dollar of real GDP) energy use was falling even in the 1950s and 1960s, and in 2001 it was only 55 percent as great as in 1971. Energy expenditures as a share of GDP fell from a peak of 13.7 percent in 1981 to 6.0 percent in 1998 and 1999, before rising to a little over 7 percent as a result of higher prices. In 1999, national spending on energy totaled about $559 billion. In 2000 and 2001, total energy expenditures increased to over $700 billion, or about $2,500 per person. Spending on energy is still a large chunk of GDP, and any supply disruptions or price spikes threaten the economy.

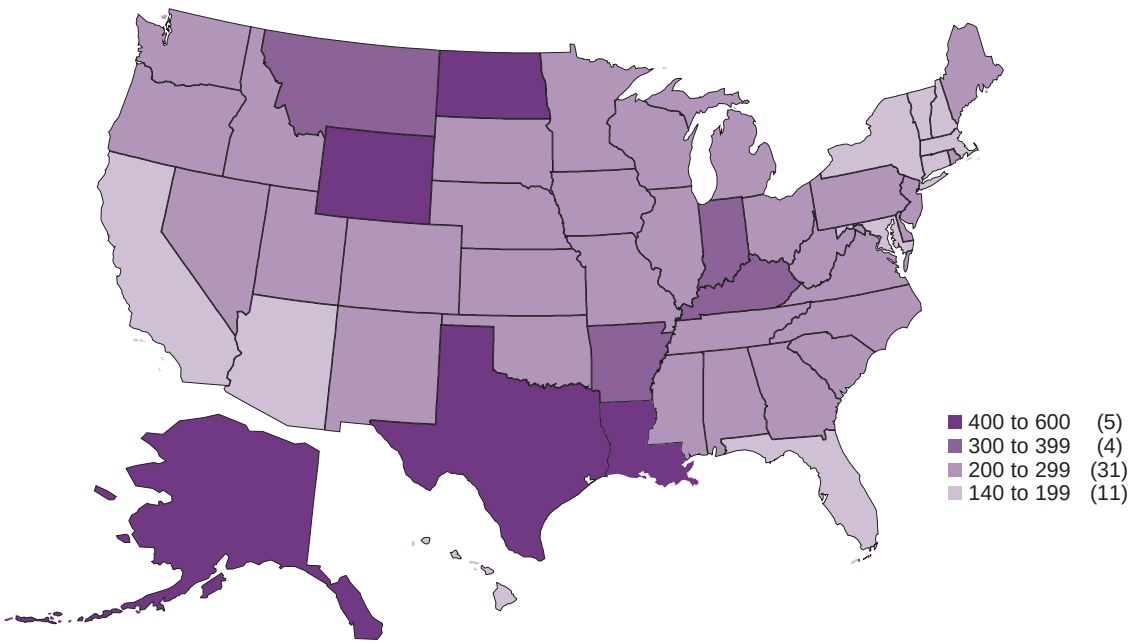
For the nation as a whole, and particularly for energy producing states, a large share of energy use is consumed in energy production. This includes energy lost in transforming fossil fuels into electricity, as well as energy used in processing and distributing oil, gas, and other primary fuels. At the national level, the net supply of energy to non-energy industries and end users represents only about 70 percent of total consumption, with adjusted per capita energy consumption equal to about 254 million BTUs in 2000. Figure 2 shows 1999 per capita consumption by state, after eliminating energy consumed in the production, processing, and distribution of energy.

Energy prices per BTU in 1999 were more than 30 percent above the national average in Hawaii, Connecticut, Vermont, Arizona, and New Hampshire. In Lousiana, Alaska, North Dakota, Wyoming, Texas, and Indiana, however, average prices were more than 15 percent below average. The six states with the lowest average prices, however, were the highest in per capita energy expenditures for that year, as their higher levels of consumption offset lower prices. Many states with high average prices, on the other hand, were below average in per capita expenditures.

The high per capita energy expenditures in the states with the cheapest energy, and relatively low expenditures where energy was expensive, largely reflected the concentration of energy-intensive industries in states with cheap energy. Per capita residential use, however, also tends to reflect energy prices.

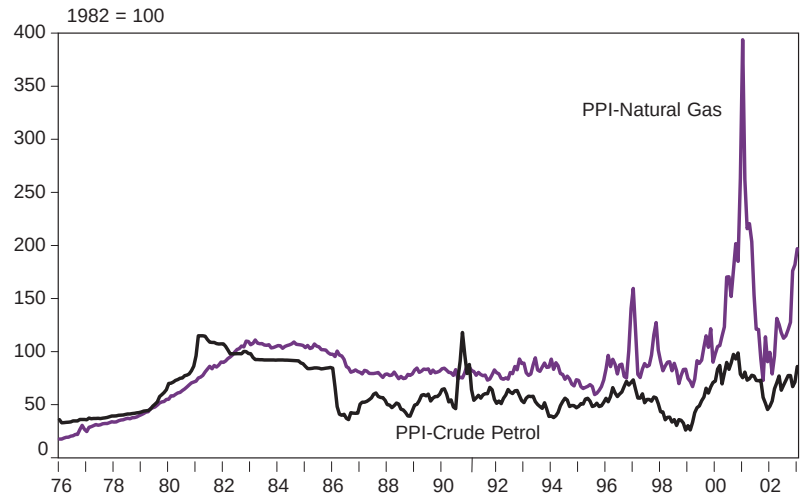
The vulnerability of different states or localities to energy shocks depends not only on net energy consumption per capita, but also on the types of energy used and the uses for that energy. Oil and gas accounted for 39 percent and 24 percent, respectively, of US energy consumption in 2001. Oil and gas

Figure 2. Adjusted Per Capita Energy Consumption, 1999 Million BTU



Source: Energy Information Administration, "State Energy Price and Expenditure Report, 1999."

Figure 3. Oil Versus Gas Price



Source: U.S. Bureau of Labor Statistics, Producer Price Index.

supplies are much more dependent on imports, and more subject to price swings, than coal, nuclear, hydro, or other energy sources. Many of the states that rely heavily on oil and gas for their energy consumption, such as Alaska, Louisiana, and Texas, are oil and gas producers. An increase in oil and gas prices would tend to benefit those states, as a whole, even though home owners and many businesses may be adversely affected. States such as Delaware, Hawaii, New Jersey, and Rhode Island lack energy resources, but rely on oil and gas for more than 70 percent of their energy needs. Those states could be subject to substantial adverse impacts from an energy price spike, even though they are not especially big users of energy.

End Users

About 21 percent of U.S. energy use in 2001 was residential.[2] The largest users of energy were industrial (manufacturing, agriculture, mining, and construction), accounting for 34 percent of the total, while 18 percent was used in commercial operations and 28 percent for transportation. Those shares of total energy use include the energy used by electric utilities to generate the electricity used by each sector. Since it takes about 3 BTUs worth of fuels such as coal, oil, or gas to generate 1 BTU of electricity, the actual energy going to commercial or residential customers is less than the ultimate energy use attributed to them. Electricity accounts for about 36 percent of net residential energy consumption and nearly half of commercial net energy consumption. For industrial users, electricity is only about 13 percent of net energy use, and electricity provides less than 0.1 percent of energy for transportation.

The residential share of national energy consumption has been fairly constant over the past 30 years, while the commercial and transportation shares have grown and the industrial share of total energy use has fallen, partly because the industrial share of the total economy has declined. Energy-intensive industries such as primary metals, paper, and chemicals, in particular, account for smaller shares of GDP than in the past. All sectors, however, have taken steps to use energy more efficiently.

From 1970 to 2000, average gross energy use per household for residential purposes fell from 218 million BTUs to 195 million. Net energy consumption (excluding losses in electricity production) fell from 157 million BTUs to 106 million per household. The greater relative decline in net energy use compared to gross energy use reflects an increased share of residential energy use consisting of electricity. By either measure, however, energy use per household fell substantially, even though houses have gotten larger, the share with air conditioning (especially central air) has grown dramatically, and households have more appliances and other equipment, including computers. Energy savings were achieved largely through better insulation, and more efficient equipment.[3]

Oil

The 39 percent of US energy consumption in 2001 that came from petroleum represented about 7 billion barrels. Of that, about 150 million barrels were used to produce electricity. Of all electricity produced in the nation, less than 3 percent was generated using petroleum, but for Hawaii virtually all electric power comes from oil, and oil accounts for 20 percent or more of electricity in Connecticut, Delaware, and Florida.

Of the 7 billion barrels of oil consumed, about 1 billion barrels were not actually burned for energy, but were converted into asphalt, chemicals, plastics, and other non-fuel products, many of which are used as building materials. The potential energy from these products was counted in the estimates of total energy consumed. The large industrial-sector use of energy from petroleum

in states like Delaware, Kansas, Kentucky, Louisiana, and Texas is partly due to such non-fuel uses.

Much of the fluctuation in oil prices has been due to speculative reactions to the international uncertainty, as well as to fundamental demand and supply factors. The situation in the middle east was juxtaposed against the strike in Venezuela. Although the Venezuelan state-owned oil company has been restarted using replacement workers, production will not fully recover for some time. There is also a possible political problem in Nigeria. On the other hand, the announced willingness to tap the U.S. strategic petroleum reserve to avoid supply disruptions, and the willingness of OPEC members to provide oil (rather than impose an embargo, as in the 1970s) should help limit short-term disruptions. Prices should drop once the situation in Iraq stabilizes. Recent price fluctuations could rekindle proposals for changes in energy policy, however, possibly involving regulations or incentives for changes in new home energy features, as well as new supply initiatives.

Natural Gas

Imports account for about one-sixth of U.S. natural gas consumption, a much smaller share than for oil. Nearly all the imports come from Canada, which is somewhat more stable politically and economically than most foreign oil suppliers. Only about one percent of consumption comes from liquefied gas imported from offshore sources. The price of natural gas, however, has been more volatile than the price of oil, due partly to the difficulty in transporting and storing gas. A big price spike in 2001 was reversed in 2002, but prices have soared again.

Table 1. State Energy Consumption and Production

State	1999 Million BTU Per Capita			2000 Energy Expense	End-Use Sectors 1999			
	Production	Consumption	Adjusted Consumption	Per Capita	Res.	Comm.	Ind.	Trans.
Alabama	282	459	295	$2,707	17%	11%	49%	23%
Alaska	4,476	1,121	550	$4,440	7%	9%	56%	29%
Arizona	82	255	168	$2,059	23%	22%	18%	37%
Arkansas	40	472	317	$2,740	16%	10%	49%	25%
California	71	253	180	$2,098	17%	15%	34%	35%
Colorado	387	285	200	$2,020	23%	22%	24%	32%
Connecticut	16	256	186	$2,430	29%	23%	19%	28%
Delaware	0	370	240	$2,644	20%	16%	39%	25%
Dist. Of Columbia	0	327	191	$2,675	20%	63%	2%	16%
Florida	11	255	163	$1,951	26%	21%	18%	35%
Georgia	17	359	243	$2,416	20%	15%	34%	31%
Hawaii	3	204	146	$2,174	10%	10%	30%	51%
Idaho	38	414	269	$2,441	19%	17%	40%	24%
Illinois	100	320	229	$2,425	23%	19%	33%	26%
Indiana	124	460	334	$2,801	18%	11%	48%	24%
Iowa	6	391	293	$2,841	20%	14%	41%	25%
Kansas	310	396	270	$2,749	19%	16%	37%	27%
Kentucky	755	462	307	$2,810	17%	12%	47%	24%
Louisiana	1,538	827	532	$4,638	9%	7%	62%	22%
Maine	18	422	278	$2,959	18%	11%	49%	21%
Maryland	26	267	185	$2,227	26%	24%	20%	29%
Massachusetts	4	254	194	$2,435	26%	21%	25%	28%
Michigan	42	328	245	$2,284	23%	18%	33%	26%
Minnesota	12	351	248	$2,485	20%	13%	37%	30%
Mississippi	95	437	275	$2,623	17%	12%	37%	34%
Missouri	8	323	236	$2,373	24%	19%	21%	35%
Montana	1,209	467	300	$3,162	15%	12%	48%	26%
Nebraska	34	361	266	$2,526	22%	18%	28%	32%
Nevada	10	340	221	$2,419	20%	16%	32%	32%
New Hampshire	32	279	198	$2,611	24%	17%	29%	30%
New Jersey	13	318	244	$2,572	21%	21%	25%	33%
New Mexico	1,536	365	221	$2,259	15%	17%	32%	37%
New York	12	235	176	$2,243	26%	28%	23%	23%
North Carolina	19	320	210	$2,404	23%	18%	31%	28%
North Dakota	1,451	577	435	$3,233	15%	12%	51%	23%
Ohio	51	384	263	$2,611	20%	15%	43%	22%
Oklahoma	656	410	272	$2,706	19%	14%	38%	29%
Oregon	48	335	227	$2,234	21%	17%	32%	30%
Pennsylvania	157	310	220	$2,482	23%	16%	35%	26%
Rhode Island	0	264	239	$2,271	25%	20%	29%	25%
South Carolina	46	384	239	$2,536	19%	14%	41%	25%
South Dakota	40	326	242	$2,585	22%	16%	26%	35%
Tennessee	34	378	248	$2,424	21%	16%	34%	29%
Texas	532	574	406	$3,551	12%	10%	56%	22%
Utah	446	326	232	$2,042	18%	17%	34%	30%
Vermont	32	278	196	$2,675	26%	18%	24%	32%
Virginia	115	324	220	$2,372	22%	21%	28%	29%
Washington	77	389	251	$2,236	19%	15%	38%	28%
West Virginia	1,862	407	276	$2,452	19%	14%	42%	25%
Wisconsin	10	345	246	$2,435	21%	16%	40%	24%
Wyoming	17,574	880	591	$4,541	9%	10%	53%	28%
US Total	**225**	**351**	**244**	**$2,499**	**19%**	**16%**	**38%**	**28%**

Note: Adjusted consumption excludes losses in electric generation and other energy production.
Source: U.S. Department of Energy, Energy Information Administration, State Energy Data Report, 1999.

Table 2. Energy Use By Fuel, 1999

	Coal	Natural Gas	Petrol	Other	Electric Interstate Purchases		Coal	Natural Gas	Petrol	Other	Electric Interstate Purchases
Alabama	43%	17%	27%	30%	-18%	Montana	42%	15%	42%	39%	-38%
Alaska	2%	60%	36%	2%	0%	Nebraska	33%	20%	41%	21%	-15%
Arizona	33%	13%	41%	36%	-24%	Nevada	29%	25%	36%	11%	-1%
Arkansas	22%	22%	32%	29%	-5%	New Hampshire	11%	6%	56%	45%	-19%
California	1%	26%	40%	16%	17%	New Jersey	3%	25%	48%	13%	12%
Colorado	31%	28%	37%	2%	3%	New Mexico	47%	35%	41%	1%	-24%
Connecticut	0%	16%	52%	23%	8%	New York	4%	29%	39%	19%	9%
Delaware	13%	21%	51%	1%	15%	North Carolina	29%	9%	38%	21%	2%
Dist. of Col.	0%	19%	20%	0%	60%	North Dakota	113%	16%	34%	8%	-70%
Florida	17%	14%	50%	14%	5%	Ohio	32%	20%	31%	12%	5%
Georgia	28%	12%	37%	22%	0%	Oklahoma	24%	39%	36%	4%	-4%
Hawaii	1%	1%	89%	9%	0%	Oregon	3%	20%	35%	46%	-5%
Idaho	2%	14%	33%	33%	19%	Pennsylvania	31%	19%	37%	23%	-10%
Illinois	22%	27%	35%	23%	-7%	Rhode Island	0%	33%	38%	5%	22%
Indiana	53%	21%	33%	1%	-8%	South Carolina	27%	11%	31%	42%	-11%
Iowa	37%	21%	37%	6%	-1%	South Dakota	19%	15%	48%	31%	-13%
Kansas	31%	29%	42%	10%	-12%	Tennessee	30%	14%	34%	20%	2%
Kentucky	48%	12%	40%	2%	-2%	Texas	13%	35%	48%	4%	0%
Louisiana	6%	43%	40%	8%	2%	Utah	55%	24%	38%	3%	-20%
Maine	1%	1%	47%	38%	9%	Vermont	1%	5%	51%	69%	-42%
Maryland	22%	15%	42%	14%	7%	Virginia	18%	12%	39%	18%	12%
Massachusetts	1%	23%	41%	8%	28%	Washington	4%	12%	39%	51%	-8%
Michigan	25%	29%	34%	8%	4%	West Virginia	133%	20%	30%	2%	-85%
Minnesota	20%	21%	39%	16%	3%	Wisconsin	26%	21%	37%	13%	3%
Mississippi	11%	29%	40%	13%	7%	Wyoming	117%	24%	37%	3%	-82%
Missouri	39%	15%	44%	7%	-5%	**United States**	**21%**	**23%**	**40%**	**15%**	**0%**

Note: Fuel use includes direct use and use in generating electricity. "Other" includes nuclear, hydro, wood, waste, geothermal, etc.
Source: U.S. Department of Energy, Energy Information Administration, State Energy Data Report, 1999.

Moreover, while the current factors causing oil prices to rise may be temporary, gas prices may be higher and more volatile for a much longer time.

The pressures on gas supplies are partly due to greater use in generating electricity. Natural gas used to be relied upon only for marginal peak load electricity. Coal, and perhaps hydro or nuclear power, used to provide the predominant base supplies, and still account for the majority of power generated. Those sources involve higher capital costs, but lower fuel costs.

New electricity capacity added in recent years has been largely gas-powered, particularly for non-utility electricity producers, reflecting low prices for gas after about 1985, along with environmental and safety concerns. Gas still only provides only about 15 percent of electricity, but its use makes electricity much more vulnerable to fuel price shocks, and perhaps also makes gas prices more vulnerable to demand shocks. The lack of excess generating capacity in some areas has also contributed to the risk of electricity shortages and price spikes.

Although there is some talk about a lack of potential for increasing natural gas supplies, such warnings have occurred in the past, only to have gas reserves magically appear when prices increased and regulations were relaxed. But unlike the situation with oil, where resolution of political issues will quickly increase supplies and produce lower prices, new investments will be needed to provide additional supplies of natural gas, and prices may not fall back to the levels of the 1990s.

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[1] U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 2001* (November 2002).

[2] Based on *Annual Energy Review 2001,* Table 2.19. Other EIA data, such as the values by state in Table 1, indicate slightly different shares, but similar trends.

[3] See Paul Emrath, "Home Vintage and Operating Costs, *Housing Economics,* November 1997.