Agriculture and Rural Communities Are Resilient to High Energy Costs

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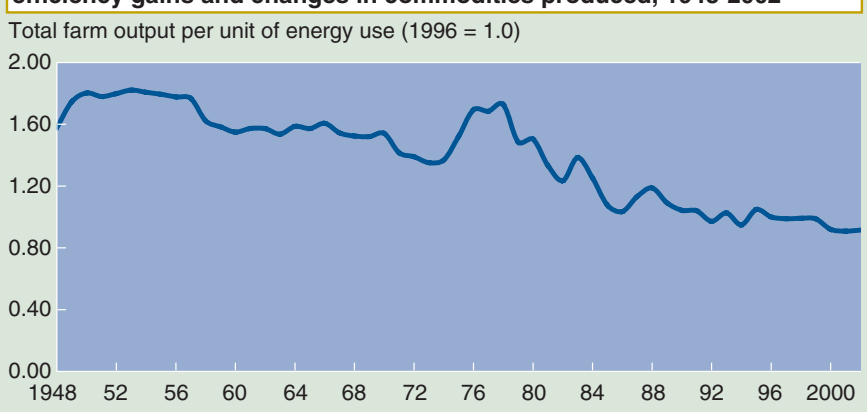
- Farm and rural households may need to make certain tradeoffs to adjust to higher energy prices. Farmers may need to grow commodities that use less energy.
- Farmers may be induced to adopt farming practices that use less energy. And when farming is only one source of household income, additional household members may seek off-farm employment.
- Rural communities may see changes in settlement patterns in more remote rural areas. Commuting patterns may also change in terms of type of vehicle used and distance traveled to work

Higher energy costs in the 1970s prompted all sectors of the U.S. economy to increase energy efficiency. Agricultural producers responded by making tradeoffs—replacing more expensive fuels with less expensive fuels, shifting to less energy-intensive crops, and employing energy-conserving production practices where possible. Energy intensity—defined as energy consumed per unit of total output—has steadily declined over time due to gains in energy efficiency in the agricultural sector.

Nominal energy prices have been steadily increasing, although inflation-adjusted energy prices have remained largely unchanged until recently. In the agricultural sector, energy expenditures for gas, diesel, electricity, and other inputs have increased over time and vary by major commodity produced. Producers of feed grains and wheat, for example, derive a larger share of operating costs from energy inputs than producers of soybeans.

Rural communities face somewhat different issues associated with increases in petroleum and natural gas costs. As energy prices rise, so do household costs for transportation and home heating. Rising fuel costs also could discourage people from vacationing in or moving to rural areas, particularly remote areas far from major services and employment centers. Because rural households tend to have higher travel expenses—simply because they travel longer distances—they are more likely to be affected by increases in gas prices than urban households.

Energy intensity in U.S. agriculture has declined over time due to energy efficiency gains and changes in commodities produced, 1948-2002



Source: USDA, Economic Research Service.

Farm Energy Costs Vary by Commodity and Region

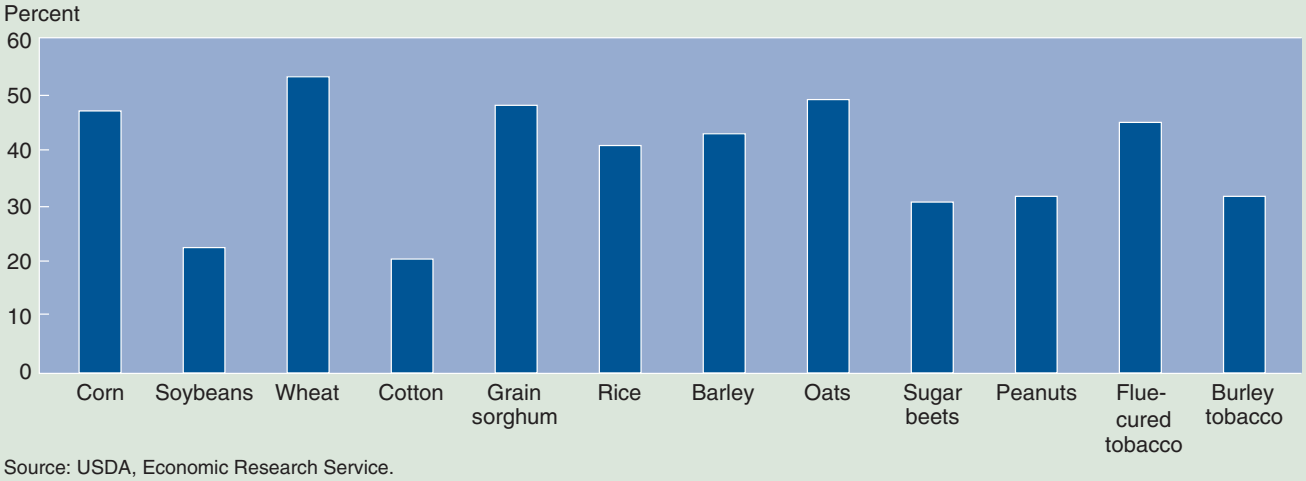
Direct energy consumption in the agricultural sector includes use of gas, diesel, liquid petroleum (LP), natural gas, and electricity. Indirect energy use involves agricultural inputs, such as nitrogen fertilizer, which have a significant energy component associated with their production. Since 1992, direct fuel and electricity expenses for U.S. farms have averaged around 7 percent of total operating costs. Diesel fuel and gasoline are widely used for tillage, planting, transportation, and harvesting. Electricity, LP, gas, and natural gas are primarily used in drying; irrigation; operation of livestock, poultry, and dairy facilities; and onfarm processing and storage of perishable commodities. Expenses from indirect energy use increase total energy expenditures to 15 percent of operating costs. Fertilizers embody the most energy among production inputs because natural gas is the primary input (70-90 percent of the cost of producing nitrogen fertilizer).

The impact of energy cost changes on producers depends on both overall energy expenditures and, more importantly, energy's share of production costs. Even if farms spend a lot on energy, the impact of cost changes on farm profits depends on the extent to which energy is a significant share of total costs.

The potential impacts on farm profits from changes in energy prices are greatest for feed grain and wheat producers. Beef cattle operations consume large amounts of fuel nationally but have small energy expenses per farm. Crops with the highest energy input costs per acre generally do not have the highest share of operating costs from energy inputs. For example, the high energy costs for rice producers accounted for 42 percent of total operating costs. In contrast, energy input costs for wheat production accounted for 52 percent of total operating costs in 2004. Other commodities with a high share (44 percent or more) of operating costs from energy inputs are wheat, corn, grain sorghum, and oats.

Rising energy prices make cotton and soybeans more attractive alternatives to other crops for which energy represents a higher share of total operating costs. Per-acre energy input costs are lowest for soybean production ($18), which comprised 22 percent of total operating costs in 2004. Energy input costs for cotton, at $64 per acre, were among the highest of major field crops but made up just one-fifth of the total operating costs of cotton production. In areas where feed grain and wheat

Energy costs as a share of total operating costs, 2004



Source: USDA, Economic Research Service.

Costs of energy inputs used on field crops, by region, 2004

Energy inputs	Heartland	Northern Crescent	Northern Great Plains	Prairie Gateway	Eastern Uplands	Southern Seaboard	Fruitful Rim	Basin and Range	Mississippi Portal
Soybeans									
Per-acre costs (dollars):									
Fertilizer	8.20	14.28	7.96	5.12	15.54	14.06	na	na	8.26
Fuel, lubrication, and electricity	7.72	10.73	8.47	23.03	7.66	6.26	na	na	12.26
Total energy input costs	15.92	25.01	16.43	28.15	23.20	20.32	na	na	20.52
Operating costs (percent):									
Fertilizer	11	15	11	6	19	16	na	na	9
Fuel, lubrication, and electricity	10	12	11	25	9	7	na	na	13
Total energy input costs	20	27	22	30	28	23	na	na	21
Wheat									
Per-acre costs (dollars):									
Fertilizer	45.47	42.03	20.28	19.29	na	55.57	37.01	35.40	32.66
Fuel, lubrication, and electricity	11.53	21.49	7.32	14.23	na	9.36	22.06	12.21	9.77
Total energy input costs	57.00	63.52	27.60	33.52	na	64.93	59.07	47.61	42.43
Operating costs (percent):									
Fertilizer	50	41	34	32	na	48	3	37	35
Fuel, lubrication, and electricity	13	21	12	24	na	8	17	13	10
Total energy input costs	62	62	46	55	na	56	47	49	45

na = Not available
Note: Fertilizer and fuel, lubrication, and electricity are the primary energy-related inputs. Fertilizer includes commercial fertilizers, soil conditioners, and manure. Costs of other inputs, such as chemicals, custom operations, and purchased water, would, to a lesser extent, also be affected by changes in energy prices.

Source: 2004 Agricultural Resource Management Survey, USDA.

compete for acreage with soybeans, higher energy prices may induce a switch to soybean production.

Variation in the regional distribution of energy input costs suggests that changes in energy prices would most affect producers in regions where irrigation is indispensable for crop production. Corn, soybean, wheat, cotton, grain sorghum, and peanut producers in the Prairie Gateway have a higher share of total operating costs from direct energy costs than do producers in other regions, partly due to irrigation expenses. The higher energy input costs in this region are mainly due to additional fuel costs associated with irrigation. High energy prices could reduce production of these crops in the Prairie Gateway if less acreage is planted or if reduced irrigation lowers yields.

Changes in energy prices may have a greater effect on producers of major field crops in the Southeast—the Southern Seaboard and Eastern Uplands. Fertilizer costs as a share of total operating costs were highest for corn and cotton producers in these regions. Higher energy prices could result in a reduction of these crops in the Southeast if fewer acres are planted or if reduced fertilizer use cuts yields.

Direct energy costs make up a small share of total operating costs on livestock operations, comprising 3-7 percent of the operating costs for hogs, dairy, and cow-calf operations in 2004. However, these operations can experience higher energy costs indirectly through higher feed production costs. Feed costs make up roughly 60 percent of total livestock production costs, so livestock producers could expect to see cost increases through either purchased feed or feed produced onfarm.

Some Agricultural Production Practices Save More Energy

Certain production practices provide important means of energy conservation. For example, conservation tillage provides key opportunities for both direct and indirect energy conservation. Reduced tillage involves less fuel consumption when a tractor runs over the field fewer times and saves indirectly by reducing fertilizer requirements. Drip irrigation methods involve lower water-pumping costs and can also use nutrients more effectively. But, additional gains in agricultural energy efficiency could still be captured, especially in the areas of tillage, pest,

nutrient, machine, irrigation, and drying management for crops. ERS researchers used the most recent (2001) production practice survey for corn (one of the most widely planted and input-intensive crops) to examine the extent of adoption and use of selected energy-reducing practices:

- *Conservation tillage:* Acres devoted to conservation tillage could increase. In 2001, 70 percent of corn acres used some form of conservation tillage, while 26 percent still tilled conventionally, and 4 percent were moldboard plowed.
- *Low-water-use irrigation:* More irrigated acres could use energy-reducing low-pressure systems. Only about one-third of irrigated corn acres use a low-pressure system. Of the 14 percent of the acreage irrigated, over two-thirds used a high-pressure system.
- *Nitrogen management:* Commercial nitrogen use could be reduced through soil testing and more efficient application methods. While commercial nitrogen fertilizer was applied to nearly all corn acreage, less than 30 percent reported using a nitrogen soil test. Over 20 percent of the acreage received a fall nitrogen application; less than 10 percent received a nitrogen inhibitor; and less than 30 percent received a split nitrogen application. Manure was applied to less than 15 percent of the acreage.

The above examples indicate areas where energy use can be reduced. However, at the time this information was gathered, the higher energy-using practices may have been economically efficient. The current increases in energy prices may result in changes to such practices.

In Rural Economies, Rising Energy Costs Have Direct Effects . . .

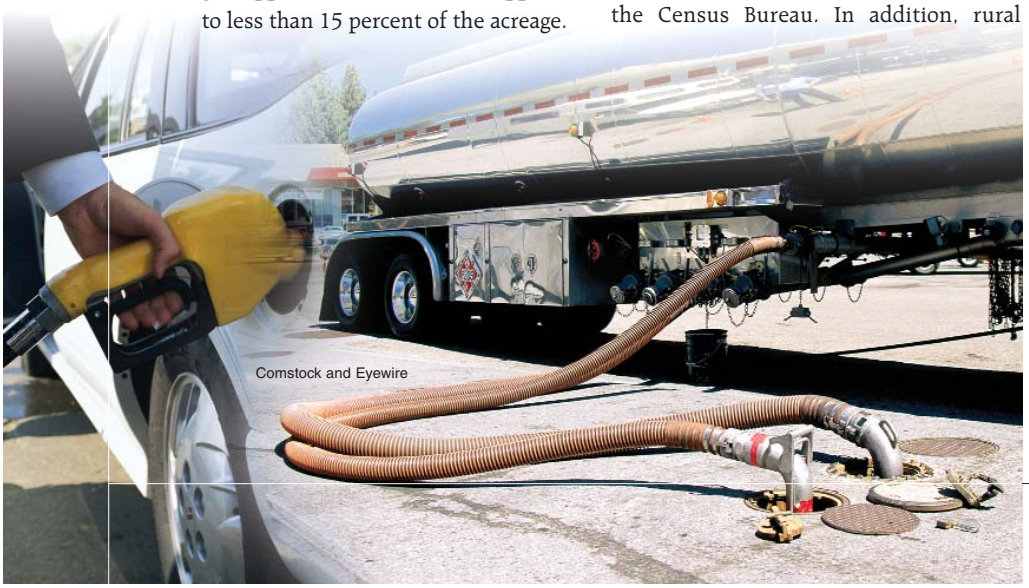
Increases in petroleum and natural gas costs directly affect rural communities and their residents through higher transportation and home heating costs. A secondary effect of rising fuel costs is to discourage people from vacationing in or moving to rural areas, particularly remote areas far from major services and employment centers, thereby reducing revenues to businesses that provide services to these people.

Rural Households. Because of higher personal transportation expenditures, rural households are more likely than urban households to feel the pinch of increased gas prices. Rural residents depend more on cars and trucks than on public transit, driving 17 percent more miles each year per household than urban residents do. Less than 1 percent of nonmetropolitan (nonmetro) residents use public transportation, compared with 6 percent of metro residents, according to the Census Bureau. In addition, rural drivers are more likely to use SUVs or trucks as personal transportation (35 percent in 1991) than are metro residents (20 percent), another factor raising rural fuel costs.

Estimates based on recent surveys of vehicle use and projected fuel prices suggest that the average rural household with at least one driver will spend about 30 percent more on fuel in 2006 than in 2004, unless driving patterns change. Because urban households drive less and are less likely to drive small trucks, their fuel costs will increase less—$680 compared with $850 for nonmetro drivers.

Rural communities with persistent poverty may be hit hardest by energy cost increases. The poverty threshold for a family of four in 2004 was $19,157. Assuming that their driving level is the rural average, their projected increase in household fuel costs would represent over 4 percent of income. While poor families may not drive as much as other families, workers in persistent-poverty counties tend to travel longer (25 minutes) to their jobs than do workers in other rural counties (21 minutes). Commuting time increased 24 percent between 1990 and 2000, a period of declining poverty in these counties. Adjustments to rising fuel costs in poverty counties are likely to be difficult because residents are already more likely to carpool (17 percent) than are workers in other nonmetro counties (13 percent), and public transport, as in other nonmetro counties, is virtually nonexistent.

Heating costs will also be affected, with variations by region. Rural residents tend to use less natural gas, the price of which is expected to increase sharply. However, the rural-urban difference is not as great as one might expect. While the rural average share of homes that heat with utility gas is lower (35 percent) than the urban average (43 percent), it is not much lower. Further, rural households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Potential rises in the cost of driving for urban and rural areas

Item	Metro	Nonmetro
Commuting vehicle: [1]	*Percent*	
Car	63.2	54.8
Van	6.0	6.6
SUV/truck	20.5	34.6
Public	6.6	0.4
Other	3.7	3.7
	100.0	100.0
Vehicle miles per year:[1]	*Number*	
Per driver	13,436	15,195
Per household with driver	24,674	28,397
Vehicle miles per gallon[2]	21	20
Total gallons per household	1,180	1,437
Costs per year:[3]	*Dollars*	
2004 ($1.85/gallon)	2,183	2,658
2005 ($2.29/gallon)	2,702	3,290
2006 ($2.43/gallon)	2,867	3,492
Increase, 2004-06	684	833

[1] Based on National Household Transportation Survey, 2001.
[2] Assumes 24 miles per gallon for cars and 16 miles per gallon for trucks and SUVs.
[3] Prices from U.S. Department of Energy, Energy Information Administration, "Short Term Energy Forecast," November 2005.

tend to rely on utility gas more than the use of electricity, compared with urban households. Price increases have been greater for utility gas than electricity, subjecting rural residents to potentially higher heating costs than urban households.

. . . and Indirect Effects

Rural communities increasingly depend on tourism, second-home ownership, retiree inmigration, and the ability of people to commute long distances to work from rural places with desirable attributes. Substantial rises in transportation costs are likely to reduce these activities, particularly in rural areas that are relatively remote from major urban centers, and to slow rural growth, possibly leading to job and population losses. Earnings from recreation industries have grown considerably faster than overall earnings in rural areas. Also, recreation counties have generally gained population at a much faster rate than have other types of rural counties. The advantage is especially striking in counties not adjacent to metro areas. In 2000-04, recreation counties were the only type of county to gain population in nonadjacent counties. With high rates of growth, construction jobs are plentiful in these counties. Moreover, these counties attract entrepreneurs and retirees, whose incomes are generated by other types of businesses or investments, as well as tourism. While it is difficult to determine the impact rising energy costs may have on these trends, significantly increasing transportation costs may slow some of these growth patterns.

Tradeoffs May Lie Ahead

Farm and rural households may need to make certain tradeoffs to adjust to higher energy prices. Farmers may need to grow commodities that use less energy. High fuel costs may also induce more farmers to adopt farming practices that use less energy. And because farming is only one source of household income, additional members of the farm household may seek off-farm employment.

Because of higher transportation expenses, rural communities may see changes in settlement patterns, especially in more remote rural areas. Commuting patterns may also change in terms of type of vehicle used and distance people drive to work (some could move closer to their employment, usually near urban centers). With greater use of computers and the Internet in rural areas, more rural workers may seek jobs where they could work from home at least part of the week.

This article is drawn from . . .

The ERS Briefing Room on Farm Income, www.ers.usda.gov/briefing/farmIncome/

"Recreation Counties Are the Fastest Growing Nonmetro Counties," by Calvin L. Beale, in *Amber Waves*, Vol. 4, No. 1, USDA, Economic Research Service, February 2006, available at: www.ers.usda.gov/amberwaves/february06/findings/findings_ra3.htm

Recreation, Tourism, and Rural Well-Being, by Richard Reeder and Dennis Brown, ERR-7, USDA, Economic Research Service, August 2005, available at: www.ers.usda.gov/publications/err7

"Nonmetro Recreation Counties: Their Identification and Rapid Growth," by Kenneth M. Johnson and Calvin L. Beale, in *Rural America*, Vol. 17, No. 4, USDA, Economic Research Service, Winter 2002, available at: www.ers.usda.gov/publications/ruralamerica/ra174/ra174b.pdf

You may also be interested in . . .

To help farmers begin to think about how reduced tillage can save energy, USDA has developed an online Energy Estimator for Tillage, available at: //ecat.sc.egov.usda.gov