# TESTIMONY OF BURTON C. ENGLISH BEFORE THE HOUSE FOSSIL AND SYNTHETIC FUELS SUBCOMMITTEE IN CEDAR RAPIDS ON MAY 16, 1983

by

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Good morning, ladies and gentlemen. My name is Burton C. English. I am a staff economist with the Center for Agricultural and Rural Development. My area of expertise is in agricultural economics and policy. I wish to thank Congressmen Tom Tauke and Billy Tauzin for inviting me here.

My testimony here today will focus on how agriculture is affected by changes in natural gas prices. In addition, the testimony will focus on supply disruptions such as those that took place in the 1970s and their potential impacts on the nation's agricultural sector. First, however, I will discuss how natural gas is used in the production of crops and livestock.

## Natural Gas Use in Agriculture

Agricultural production is affected both directly and indirectly by changes in natural gas prices. Natural gas is used as a direct input in such farm operations as irrigation, waste disposal, space heating, crop drying, and brooding. Indirectly, it is a major input in the production of fertilizers (especially ammonia, an important ingredient in the production of nitrogenous fertilizers). Additionally, the manufacture of most agriculturally related products (i.e. machinery, pesticides) are heavily dependent upon natural gas, as well as the food-processing industry.

According to the 1978 Census of Agriculture [Bureau of the Census, 1981], 78,705 farms reported spending $235.6 million on natural gas in 1978. This was approximately 4 percent of the total on-farm fuel costs reported in this census. The majority of natural gas expenditures occur in the West South Central (Arkansas, Louisiana, Oklahoma, and Texas spent $95.2 million with Texas spending $82.8 million) and the West North Central (Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, and Kansas spent $41.0 million with Kansas spending $21.6 million).

The majority of natural gas used directly by the United States' agricultural production sector (96 percent) is consumed by large irrigation pumps [Bureau of the Census, 1982]. The Great Plains obtains much of its irrigation water from deep wells overlying large aquifers, particularly the Ogallala aquifer. This formation stretches from the Texas Panhandle area north into southern Wyoming, encompassing large western portions of Oklahoma, Kansas, and Nebraska, and smaller eastern portions of New Mexico, Colorado, and Wyoming. The southern portion of the Ogallala; including Texas, Oklahoma, Kansas, and New Mexico are characterized by excessive pumping depths--a result of over 20 years of extensive and intensive irrigation. Many producers there are already adjusting to dryland or limited irrigation crop rotations. Coincidentally, the southern Ogallala formation contains the majority of natural gas irrigation pumps because of these state's intrastate markets (Table 1). Any proposed change in the Natural Gas Policy Act of 1978 (NGPA), then may not have a large effect here because of the existing decontrolled intrastate market and the other serious problem of declining water tables. Rising gas prices will no doubt be critical to local

Table 1. Power sources for irrigation pumps overlying the Ogallala aquifer, 1981

| State | Fuel type | | | | |
|---|---|---|---|---|---|
| | Natural gas | Electricity | Diesel | LP gas | Other |
| | (percent) | | | | |
| Colorado | 9 | 74 | 5 | 11 | 1 |
| Kansas | 60 | 23 | 11 | 6 | 0 |
| Nebraska | 21 | 33 | 30 | 15 | 1 |
| New Mexico | 55 | 30 | 10 | 3 | 2 |
| Oklahoma | 56 | 16 | 9 | 17 | 2 |
| Texas | 55 | 35 | 6 | 2 | 0 |
| Wyoming | 8 | 80 | 10 | 1 | 1 |

SOURCE: (Anonymous, 1981)

economies dependent on irrigated agriculture powered by natural gas pumps, but it will be only one of several problems faced by these economics.

Producers in the northern Ogallala formation also will be adversely affected by higher gas costs, but production changes attributed singularly to rising gas costs may not be as great as in the southern area. States in the northern formation, Colorado, Nebraska, and Wyoming are on interstate pipelines. Gas for irrigation pumps has always been scarce here and, as a result, there are few natural gas irrigation pumps. In Colorado, 9 percent of the pumps are natural gas powered; Nebraska, 21 percent; and Wyoming, 8 percent. Electricity is the dominant pump power source. In addition, natural gas here has historically been cheaper than electricity on a per BTU basis. If gas costs do increase, then, the production effects (caused by the gas price increase) may not be noticeable until its relative price exceeds the price of electricity.

From Table 2, crop drying is illustrated as another major use of natural gas power. Many agricultural commodities need to have some moisture removed after they are harvested in order that they may be safely stored. Corn requires approximately one-half of the fuel used to dry agricultural commodities. Other major crops that may be dried before storage include grain sorghum, peanuts, rice, soybeans, and tobacco. Drying is conducted both on-farm and off-farm with nearly 70 percent of the energy used in crop drying being done on-farm. Table 2 lists only on-farm crop drying. Few farms are near natural gas pipelines and, as a result, LP gas is used for drying. Large cooperative and commercial elevators could face considerable cost increases attributable to increasing natural gas prices. Although many cooperative members will not pay for the gas directly, all members will be affected by this through decreased dividends.

The industry feeling the largest influence from a natural gas price increase could be the fertilizer industry. Fertilizer is an essential input in modern, highly intensive agriculture and nitrogen derivatives account for nearly half of the fertilizer produced. Most nitrogenous fertilizers are derived from ammonia with approximately 90

Table 2. Breakdown of energy uses in the agricultural production sector for the United States in 1978

| Operations - crops | Gals of gasoline | Gals of diesel | Gals of fuel oil | Gals of LP gas | Cu ft of nat gas | Tons of coal | KWH's of elect | Invested BTU's[a] | BTU total |
|---|---|---|---|---|---|---|---|---|---|
| | (1000) C/ | (1000) C/ | (1000) | (1000) | (million) | | (million) | (billion) | (billion) |
| Preplant | 45,949 | 1,212,328 | --- | 17,214 | --- | --- | --- | --- | 175,537 |
| Plant | 31,178 | 315,600 | --- | 2,076 | --- | --- | --- | --- | 47,870 |
| Cultivate | 20,310 | 338,682 | --- | 5,406 | --- | --- | --- | --- | 50,031 |
| Harvest | 523,994 | 582,510 | --- | 88,593 | --- | --- | --- | --- | 154,755 |
| Farm pickup | 1,018,323 | 1,057 | --- | 22,234 | --- | --- | --- | --- | 129,559 |
| Fertilizer applic. | 24,251 | 70,084 | --- | 2,567 | --- | --- | --- | --- | 12,996 |
| Pesticide applic. | 25,271 | 92,764 | --- | 9,535 | --- | --- | --- | --- | 16,937 |
| Farm truck | 535,485 | 5,747 | --- | --- | --- | --- | --- | --- | 67,732 |
| Farm auto-crops | 486,159 | --- | --- | --- | --- | --- | --- | --- | 60,767 |
| Grain hndlng (vehs) | 15,253 | --- | --- | --- | --- | --- | --- | --- | 1,905 |
| Grain hndlng (mach) | --- | --- | --- | --- | --- | --- | 34 | --- | 114 |
| Crop drying (on-fm) | --- | --- | 62,102 | 629,396 | 700 | --- | 565 | --- | 71,364 |
| Irrigation | 73,622 | 136,894 | --- | 242,512 | 134,222 | --- | 19,453 | --- | 254,766 |
| Frost protection | 38,866 | 27,634 | 218,548 | 1,458 | --- | --- | 200 | --- | 39,824 |
| Fertilizer | --- | --- | --- | --- | --- | --- | --- | 652,532 | 652,532 |
| Pesticides | --- | --- | --- | --- | --- | --- | --- | 68,130 | 68,130 |
| Electricity | --- | --- | --- | --- | --- | --- | 1,696 | --- | 5,783 |
| Miscellaneous | 72,633 | 37,162 | --- | --- | --- | --- | --- | --- | 14,232 |
| Total - crops[b] | 2,911,293 | 2,820,464 | 280,651 | 1,020,990 | 134,922 | --- | 21,948 | 720,662 | 1,824,843 |

Table 2. (Continued)

| Operations-livestock | Gals of gasoline | Gals of diesel | Gals of fuel oil | Gals of LP gas | Cu ft of nat gas | Tons of coal | KWH's of elect | Invested BTU's[a] | BTU total |
|---|---|---|---|---|---|---|---|---|---|
| | (1000) C/ | (1000) C/ | (1000) | (1000) | (million) | | (million) | (billion) | (billion) |
| Lighting | --- | --- | --- | --- | --- | --- | 1,734 | N/A | 5,914 |
| Feed handling | 120,284 | 316,904 | --- | 29,606 | --- | --- | 1,110 | N/A | 65,606 |
| Waste disp (vehs) | 91,665 | 79,759 | --- | 12,931 | --- | --- | --- | N/A | 23,756 |
| Waste disp (mach) | --- | --- | 679 | 6,983 | 461 | --- | 119 | N/A | 1,639 |
| Water supply | --- | 13,923 | --- | --- | --- | --- | 1,537 | N/A | 7,174 |
| Livestock handling | 13,763 | 1,942 | --- | 5,719 | --- | --- | --- | N/A | 2,536 |
| Space heating | --- | 1 | --- | 54,357 | 11 | --- | 164 | N/A | 5,761 |
| Ventilation | --- | --- | --- | --- | --- | --- | 2,020 | N/A | 6,892 |
| Water heating | --- | --- | --- | 68,220 | --- | --- | 946 | N/A | 9,745 |
| Milking | --- | --- | --- | --- | --- | --- | 794 | N/A | 2,708 |
| Milk cooling | --- | --- | --- | --- | --- | --- | 1,301 | N/A | 4,438 |
| Egg handling | --- | --- | --- | --- | --- | --- | 31 | N/A | 106 |
| Brooding | --- | --- | 9,539 | 215,600 | 4,669 | 36,522 | --- | N/A | 27,512 |
| Farm vehicles | 214,474 | 62,225 | --- | 8,777 | --- | --- | --- | N/A | 36,278 |
| Farm auto-lvstk | 68,891 | --- | --- | --- | --- | --- | --- | N/A | 8,611 |
| Other | 95,283 | 12,527 | --- | 1,659 | --- | --- | 205 | N/A | 14,505 |
| Total-livestock[b] | 604,363 | 487,283 | 10,218 | 403,845 | 5,141 | 36,522 | 9,961 | N/A | 223,179 |
| Total-agriculture[b] | 3,515,656 | 3,307,747 | 290,869 | 1,424,835 | 140,063 | 36,522 | 31,909 | 720,662 | 2,048,022 |

[a] Invested energy includes the energy required to manufacture fertilizers and pesticides.

[b] May not sum due to rounding errors.

SOURCE: (Economics Statistics and Cooperatives Service, 1980) percent of this ammonia using natural gas as a basic input. Thus, price changes of natural gas would affect the cost of producing ammonia. Presently, the ammonia price is set by world markets containing significant amounts of Middle East and Soviet Union gas. The question as to whether these higher U.S. costs could be passed on to U.S. producers, then, remains unanswered. An examination of the past fertilizer cost data as published by the U.S. Department of Agriculture indicates that these costs have not been passed on. In 1975, the cost per ton of anhydrous ammonia was $265; in 1981 this same ton cost $243. Ammonium nitrate cost $186/ton in 1975 and $185/ton in 1981 [Crop Reporting Board, 1976, 1982].[1] During the same period domestic natural gas prices were rising rapidly. Currently, domestic producers who cannot compete with the world prices have been forced to shut down either permanently or at the very least temporarily. In addition, most ammonia plants are operating in the west Gulf coast area (an area characterized by intrastate gas use).

Commercial fertilizer use in agriculture has increased from 12,079 tons in 1940 [The Bureau of the Census, 1961] to nearly 2 million tons in 1974 [The Bureau of the Census, 1977]. Corresponding to this

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[1]In 1973-1974 there was a perceived fertilizer shortage which drove prices up. However, even if you took the 1976 price for Anhydrous Ammonia ($191 per ton) and adjusted this to 1981 dollars ($305 per ton), there would be a real price decrease.

increase in fertilizer use, corn yields, for example, increased 71 percent [USDA, 1969, 1981]. Fertilizer was an important input in the package of inputs that created this yield increase. Impacts on the fertilizer industry caused by fertilizer shortages resulting from decreased U.S. capacity and other world phenomena could result in substantial U.S. agricultural impacts.

## Analysis of Energy Cost Increases and Their Impacts on the Agricultural Producing Sector

I have been involved in analyzing the impacts of rising energy costs on the Agricultural Sector since 1976 and the Center for Agricultural and Rural Development has analyzed these impacts since 1974. These studies involve large interregional, national programming models as well as national econometric models. Crop and livestock production and their inputs including the invested energy in fertilizer and pesticide production are included in these models. The programming models are divided into 105 homogenous producing regions endogenously producing barley, corn, cotton, legume hay, non-legume hay, oats, silage, sorghum, soybeans, and wheat; and in some of the studies livestock commodities fed and non-fed beef, dairy, and pork.

Most of the material that is presented in the remainder of this report is derived from two of these energy studies. The first study, just recently completed, analyzes the impacts of changing natural gas prices on the agricultural production sector. This study, partially financed by the Natural Gas Supply Association, examines regional impacts of changing natural gas prices. The second study, conducted by Dan Dvoskin, Earl O. Heady, and myself, examined the impacts of natural gas curtailment as well as deregulation. While this study was completed in 1978, I believe that the results of this study are still relevant in today's energy picture.

Changing natural gas prices

Future natural gas prices and their impacts on various sectors of the economy are two of today's popular topics. Hearings such as the one today are being held to discuss deregulation and other methods of natural gas pricing. Projections are being made as to possible future natural gas prices, assuming various regulatory policies and the absence of these policies. Some studies extend beyond the price estimation of natural gas and examine the impacts of price increases on various producing and consuming sectors of the economy. This study takes the latter approach. It determines the likely impacts that occur on the agricultural production sector as natural gas prices change.

In this study, English, Schatzer, Oamek, and Heady, 1983, a range of natural gas prices are used in examining the potential response of the agricultural sector to changing natural gas prices. A range of acquisition costs ($3.10-$4.15 per thousand cubic feet [mcf] in 1982 dollars) is added to estimated regional delivery costs. The low acquisition cost case reflects an increase of 6 percent above the mid- 1982 level. The high case ($4.15/mcf) is equated to a price that would occur with $34 per barrel crude oil and is a 42 percent increase above the mid-1982 cost. A mid point of $3.55/mcf is also used.

Economic model: For the period of analysis, 1982 through 1987, the impacts that result from increasing natural gas prices and the methods used in determining natural gas prices are examined. Two types of models are used in the analysis -- econometric and linear programming; both of which were developed at the Center for Agricultural and Rural Development. These two models are linked together so that a short-run, multiperiod analysis can be conducted. The econometric model represents the demand for agricultural commodities and projects next year's price while the linear programming is an agricultural supply model.

There is a wide divergence of views on the impact of decontrol on natural gas prices with most of the conclusions drawn from studies conducted under an increasing oil price environment which is no longer evident. One of the most recent analysis conducted by the U.S. Department of Energy showed that their decontrol proposal would result in slightly lower natural gas prices [Office of Public Affairs, 1983]. Opponents, on the other hand, maintain that decontrol will increase natural gas prices. Rather than attempt to resolve the issue of whether decontrol will bring higher or lower prices, this study considers a range of prices and evaluates the effects of this range and the impacts of eliminating regional pricing disparities. One impact of decontrol should be the minimization of regional disparities in pipeline acquisition costs. Thus, the decontrolled environment scenario eliminates regional disparities by subtracting the actual acquisition costs from mid-1982 commercial natural gas prices, while the controlled environment scenario uses a U.S. average acquisition cost.

Results of Study: The results of the study indicate that at a national level minimal impacts will occur to the agricultural production sector, under the range of natural gas prices considered. An average per year reduction over the period of analysis of $13 million (0.3 percent) in net returns to land and management occurs as natural gas prices range between an average acquisition cost of $3.10 to $4.15 per mcf. In addition, total land under production increases an average of 400,000 acres during the 1984-1985 period and 1.1 million acres during 1986-1987. However, even though total land use increases, irrigated acreage decreases by 4 percent in the 1986-1987 period. Much of the decrease in irrigated acreage occurs in the South Central Region of the United States. It should be noted that irrigated agriculture in the South Central Region is presently under economic pressure due to declining water tables, increased input costs, and low crop prices. Any further increases in input costs further reduces this region's competitiveness in the production of agricultural commodities.

Direct and indirect natural gas use in the $3.10 acquisition cost case average 426.8 billion cu. ft. a year over the six-year period. In the $4.15 case, this use decreases by 15 percent reflecting the decrease in irrigated acreage in the South Central Region of the United States.

Finally, the solutions that removed the regional disparities that are now included under present policy show little impact on any of the farm indicators analyzed.

Limitations: While natural gas prices will not cause an increase in the price of the raw food commodity, the cost of food preparation may be affected, but examination of this facet in the agri-business and household sectors are not included in the analysis. In addition, it must be pointed out that this study examines the production of feed grains (corn, oats, barley, and sorghum), soybeans, wheat, cotton, hay silage, as well as livestock commodities -- beef, pork, and milk. It does not attempt to incorporate the production of specialty crops such as fruits and vegetables. The study was completed before the announcement of the Payment-In-Kind program. With the participation rate announced in this program and reduced acreage being planted, the demand for fertilizers and energy by the agricultural production sector will be reduced, thus reducing the impacts of changing natural gas prices. Finally, the results of the study are not predictions, rather they are projections made under given assumptions.

## Curtailment and deregulation

The second study that I mentioned examined natural gas curtailment and natural gas deregulation [Dvoskin, Heady, and English, 1978]. It must be noted that this study was conducted in 1977 before the 1978 NGPA. However, the study found that prohibiting the use of natural gas for irrigation causes a decline in water use. Many regions shift to electrical power. However, it must be noted that this shift would result only if additional investments in power transmission lines and power generating facilities occurs. Furthermore, the irrigators could not shift instantaneously. In the short run, this curtailment would result in large regional losses to those areas that rely on natural gas powered pumps.

The deregulation portion of the study found that the South Central region receives the brunt of the impact as natural gas prices rise. An estimated increase in crop production costs of 5.3 percent nationally would occur. However, it must be stated that much of the gas price impacts analyzed in this portion of the study have already occurred.

## Comments on Future Natural Gas Legislation

I will begin my comments by reflecting on the past. "The shortage of natural gas in combination with extremely cold weather in January 1977 had a severe impact on the U.S. economy. It contributed heavily to unemployment and further dampened economic recovery. As the pressure in the pipes dropped, lay-offs exceeded one million people and home heating was threatened. The crisis was fully as severe as the 1973 Arab oil embargo." [Dvoskin, Heady, and English, 1978, p. 7] It is important to remember this recent past when developing legislative proposals. I would suggest that H.R. 2164, a bill which extends and expands price controls, may lead to another situation similar to that of 1977. It would make it much more difficult for future inevitable adjustments in prices to occur. The nation has already undergone much of the adjustment process. It would be a shame to force the nation through this again.

Secondly, it would seem that the 1978 NGPA has taken away the U.S. gas producers' incentive to produce the lowest cost gas first and the incentive for gas pipelines and gas distributors to seek the lowest cost supplies. The result of this lack of incentive is what is presently occurring. Prices increase at the same time excess supply exists. The law, as written, was developed in reaction to shortages. It did not adequately take into account the possibility of short-term surpluses. In addition, it was developed in an era of energy price increases. Today, we are experiencing energy price reductions or, at the very least, energy price stability. I agree with Tyner, Doering, and Eidmar [1982] that the NGPA has not resulted in a smooth transition from the low regulated natural gas prices to the higher prices and, in fact, has been a disruptive factor to the U.S. gas markets. It has developed a large gap in prices between regulated "old" gas and unregulated "new" gas. I do not believe that this was the intent of the NGPA as passed by Congress but rather the results of the economic and energy situation that followed the law's passage.

Another question that should be examined when looking at legislative proposals is the impact on natural gas dependent industries such as the Ammonia industry. Our agricultural sector relies on fertilizer which has natural gas as a major input. As already stated, I do not believe that increased natural gas costs can be passed on by the ammonia producers. Thus, as is already happening, ammonia producing plants will close and the U.S. will rely more and more on world supplies. The question of the security of fertilizer supplies must be examined.

Finally, in commenting on H.R. 2154, the Natural Gas Fair Marketing Act of 1983, if the intent of the bill is to solely review contracts between production and pipelines, then I do not believe this bill is the answer. In reviewing contracts, it must be remembered that pipelines need supply assurances. Similar to packing plants and their demands for assured electrical supplies; households, grain elevators, etc. need assurances that natural gas will be available on demand. This does not come free. A cost for assurance of demand must be paid. Furthermore, contract review would create uncertainties. The individuals involved in contract negotiation would not know whether the negotiated contract would "pass inspection." Economic theory suggests that for efficiency, uncertainties must be eliminated or, at the very least, reduced. It seems to me that while the legislative intent of consumer protection is good, the bill would, in the long run, increase negotiation costs and, therefore, consumer costs would increase due to the increase in inefficiency.

A problem exists in the natural gas pricing mechanism. This problem is characterized by a gap between where we are today and where we should be. The intent of a natural gas policy should be to bridge that gap in a least cost or most efficient manner. To achieve this, both consumers and producers costs must be taken into account. The costs due to the possibility of shortages occurring should be included. The impacts of income redistribution must also be examined. While I have not examined these aspects, in total, I feel that a total phased decontrol of natural gas should take place. A phased decontrol of all gas would decrease the gap between old and new gas. It would decrease market disorder. The phased decontrol would have little impact on the farm sector and the impacts that would occur as stated by Gardner [1982] are far less than those caused by weather or international events.

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