NEBRASKA COMMUNITY ENERGY MANAGEMENT PROGRAM

Allen Energy Study 1984

STATE OF NEBRASKA

NEBRASKA ENERGY OFFICE, BOX 95085, LINCOLN, NEBRASKA 68509 PHONE (402) 471-2867

TABLE OF CONTENTS

ALLEN ENERGY STUDY

PREFACE

The Nebraska Energy Office is committed to assisting local communities plan for their own energy futures. Lasting energy conservation and planning must happen in city halls, churches, and in civic group meetings all across Nebraska. The Nebraska Energy Office will be there--organizing, researching, and supporting Nebraskans along their way towards energy independence.

During 1983, the Nebraska Energy Office worked in Fremont, Lexington and Bayard to develop the Nebraska Community Energy Management Program. In 1984, Governor Kerrey announced the competition and seven more communities were selected to participate in the program. Those communities are: Allen, Burwell, Ravenna, Schuyler, South Sioux City, West Point, and Wood River.

This community energy planning and action program starts with a Community Specialist working with local people to form an Energy Committee. The Nebraska Energy Office then returns a report to those people on how energy is used in their area and what that use means to the local economy. In a subsequent town energy meeting, the Energy Office provides an opportunity for people to take the facts and make decisions about better ways to use energy in their own community. An energy management action plan is developed and the Energy Office stands by the community to turn their decisions into reality. Then state government will get out, expecting that it has left behind information, resources and leaders who understand how energy works as an economic part of the community. It also leaves a successful project that will inspire more local initiatives to realize even more community benefits.

This Energy Study was prepared by the Nebraska Energy Office with information provided by the Allen Energy Committee.

The Nebraska Energy Office acknowledges the support and cooperation of the Allen Energy Committee for their commitment and cooperation in the Nebraska Community Energy Management Program. Voluntarily serving on the Allen Energy Committee are:

Rob Bock	K.P Mitchell
Jim Decker	Diane O'Connor
Bob Heckathorn	Joanne Rahn
Kevin Hill	Jerry Schroeder
Wayne Jones	Pearl Snyder
Glenn Kumm	Tom Wilmes

-- December 1, 1984

EXECUTIVE SUMMARY

Energy is essential for a healthy economy, but higher prices for energy resources can spell trouble for communities such as yours. People typically think of energy costs only when their monthly utility bills arrive or when they pull into a local filling station to fill up the gas tank. Few realize, however, just how much energy "costs" their community in terms of lost economic development. As energy costs grab more and more investment capital or take a bigger bite out of disposable income, many people find that local energy management strategies not only ease the budgetary pressures confronting families and businesses, but they also become the cornerstone of renewed economic development.

Experts differ on the degree to which energy prices have contributed to present economic problems. But all agree that the cumulative impact is pervasive:

■-Farmers, for instance, see the effect directly in the higher prices they pay for diesel fuel or propane, and indirectly in the higher prices for such items as pesticides and fertilizers. With each dollar increase in the wholesale price of a thousand cubic feet (MCF) of natural gas, the price of anhydrous ammonia may climb another $40 per ton--almost 20 percent more than is now paid.

■-Senior citizens and low-income families see the effects not only in their heating bills, but in their food and medicine costs as well. Eighty percent of pharmaceuticals are petroleum-based which means that as oil prices jump, retail prices for medicines must also increase.

■-Since money spent on energy tends to produce fewer jobs than money spent on other goods and services, diverting money from agricultural and manufacturing sectors to pay for higher energy bills creates or maintains high unemployment levels. Officials with the Treasury Department see the effect of energy costs in the form of fewer tax receipts since the unemployed are no longer paying taxes.

Finally, as the massive utility and oil company construction programs soak up available capital, interest rates are escalated in response to a demand for money that exceeds the supply. This is an indirect cost of energy that threatens the stability of innumerable businesses who already flirt with bankruptcy.

Although Allen is not an especially energy-intensive community compared to other parts of the country, the impact of rising energy prices is significant nonetheless. It is estimated that the 390 people living in Allen consumed a total of 37.2 billion Btus in 1983. This is approximately 95.5 million Btus for each man, woman and child in the town. This total includes energy purchased for transportation, business, and the home.

By converting the different energy resources into a common unit of measurement - a gallon of gasoline - we find that each resident consumed the equivalent of 764 gallons of gasoline to maintain the 1983 standard of living in the community. The total energy bill for is pegged at $380,243, most of which is exported from Nebraska in order to import the needed energy supplies.

Including only real cost increases (in other words, eliminating the effects of inflation), and assuming little or no growth in overall energy consumption with only moderate price increases, the annual costs of retail energy purchases will jump perhaps 3.3 percent each year the community delays implementation of an aggressive energy management program. If there are no dramatic shifts in costs caused by events such as another oil price shock or the accelerated decontrol of natural gas prices at the wellhead, this means that by the year 2000 local businesses and residents would be paying $660,000 for energy under a "business-as-usual" scenario. As measured in 1983 dollars, the net economic benefits to the community would be $171,000 less than if the total energy bill remained at the present level as a result of a successful energy management effort that could offset the effect of higher prices. This is about $180 less each year per resident in Allen. Thus, improved efficiency in energy use has the potential of reducing these energy costs in a way that can provide an economic stimulus to the community.

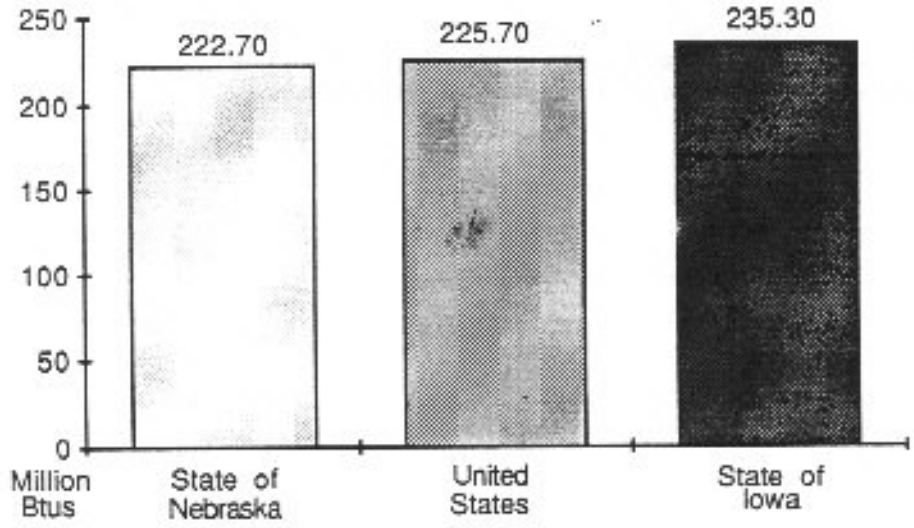
* A Btu is a measure of heat contained in a fuel. It is roughly equal to the amount of heat generated by the complete burning of an ordinary wooden kitchen match. For reference, there are 3,413 Btus in each kilowatt-hour of electricity that is purchased; 124,950 Btus in a gallon of gasoline; and 91,500 Btus in each gallon of propane.

ENERGY AND NEBRASKA

In order to evaluate fully the energy consumption patterns in a community such as Allen, it helps to develop a framework for the reader. This discussion, then, begins with a brief look at the Nebraska energy situation. As Chart I illustrates, the state purchases about five percent less retail energy per capita than neighboring Iowa and one percent less than the United States as a whole. Table A provides a snapshot of where Nebraska uses its energy and in what form the energy is supplied to the state's ultimate users.*

CHART I

COMPARISON OF PER CAPITA RETAIL ENERGY CONSUMPTION
PURCHASED IN THE U.S., NEBRASKA AND IOWA



Source: Calculated from data provided by the U.S. Department of Energy, the Nebraska Energy Office and the Iowa Energy Policy Council, (1984).

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*Energy consumption patterns are generally divided into two categories: End-use consumption, which refers to the retail purchases of consumers indicating whether they are residential or industrial users; and gross consumption which reflects total energy used including energy that is lost in the generation and transmission of electricity. Table A illustrates this difference. Nebraska's 1983 gross consumption, including electrical losses, was 476.4 trillion Btus. The end-use purchases totaled only 355.6 trillion Btus, however. Since economic impacts concern us in this analysis, it is the latter figure which interests us, especially the price paid for purchased energy. As with any cost of doing business, expenses such as energy losses are incorporated in the retail prices and so are implicit in the discussion of end-use consumption.

Since we consider the economic rather than the engineering impacts of energy in this report, all references will be in terms of retail purchases.

In reviewing Table A, we find that transportation is Nebraska's most energy-intensive sector. This is not so surprising when you consider two interesting statistics. First, Nebraska has 16 percent more registered motor vehicles per capita than the United States as a whole; and second, reflecting its rural nature, the state has more than three times the total highway miles per capita as the United States.

TABLE A

COMPARISON OF NEBRASKA END USE
ENERGY CONSUMPTION BY SECTOR AND FUEL TYPE

(in 1983, trillion BTUs)

	Residential	Commercial	Industrial	Agricultural	Transportation	Total
Coal	0	0	7.8	0	0	7.8
Natural Gas	40.8	33.4	37.7	9.2	0	121.1
Gasoline	0	0	0	4.0	9.2	96.1
Aviation Fuel	0	0	0	0	4.5	4.5
Propane LP	4.6	3.1	0.8	4.9	0	13.4
Distillates	1.8	6.3	5.4	21.4	26.7	61.6
Electricity	22.1	14.0	10.7	4.3	0	51.1
End-use Total	69.3	56.8	62.4	43.8	123.3	355.6
Losses in transmission and distribution of electricity	52.2	33.1	25.3	10.2	-0-	120.8
TOTAL	121.5	89.9	87.7	54.0	123.3	476.4

As further noted in Table A, retail sales of energy in Nebraska consist mainly of natural gas, gasoline, distillate fuels such as home heating oil and diesel fuel, and electricity. Refined petroleum products are the single largest contributor of energy consumed in Nebraska and accounted for 49 percent of the end-use energy consumed in the state in 1983. Natural gas was the second largest source of energy comprising 34 percent of the total energy consumed, and electricity was the third largest energy source, providing approximately 14 percent of the 1983 demand for energy.

Only small amounts of the above natural resources are available in Nebraska for energy production. This means that most of Nebraska's energy must be imported, which in turn means that dollars must be exported to pay for the energy. Alternate energy sources hold promise for the future, although in 1983 alternatives such as solar, wind, biomass and alcohol fuels provided less

than one percent of the energy consumed in the state. Among these alternatives, the ethanol portion of gasohol accounted for approximately one percent of the fuel used by motor vehicles.

With this information, census data and other demographic data, we can build an energy usage profile for Allen. The results of this profile are illustrated in Table B.

TABLE B
VILLAGE OF ALLEN

1983 RETAIL ENERGY PURCHASES BY SECTOR

(in billion Btus)

Residential/Commercial	25.46
Transportation	11.77
TOTAL	37.23

Estimated 1983 Allen Energy Bill: $380,243

Source: Totals calculated from various demographic data provided by the U.S. Census, the Nebraska Energy Office and the Nebraska Department of Economic Development (see text of report for full information).

AN ENERGY PROFILE OF ALLEN

When we speak of an energy profile for Allen, Nebraska, we are referring to the amount of energy purchased by end-users who live or do business within the city limits of. However, since many energy transactions and users are not strictly confined to the community--for instance, many persons who purchase gasoline in the town may not actually live or do business within the city limits -- the resulting profile is only an approximation of consumption for the community.

Another point to keep in mind is that this profile has been constructed from a combination of actual use data and from estimates derived from a statistical analysis based upon demographic data such as population, income, automobile registrations, retail sales, industrial activities and so forth. This information was obtained from sources including the U.S. Census data for Allen and Dixon County, the Nebraska Energy Office and the Nebraska Department of Economic Development.

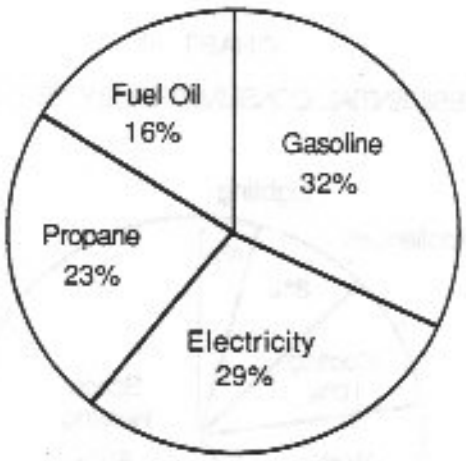
While a more accurate profile could be generated by conducting an extensive end-use survey of each of the major sectors, such an effort would cost far more than funds presently allow. Nonetheless, the methodology used to generate this profile provides a sufficient statistical base to illustrate the adverse economic impacts resulting from a "business-as-usual" energy consumption approach, and to conclude that there is a major opportunity to improve the community economic well-being through an energy management program.

In 1983, Allen's energy consumption was approximately 37.2 billion Btus. To provide a more meaningful illustration, we can put this number in the context of how much equivalent gasoline it represents for each of the 390 residents. Since one billion Btus is comparable to the energy contained in about eight thousand gallons of gasoline, we might say that local residents and businesses consumed the equivalent of 298,000 gallons of gasoline for all 1983 end-use energy needs--approximately 764 gallons per person. The total energy bill for the community is pegged at $380,243 in Allen, about $975 per capita.

As the pie chart indicates (Chart II), the transportation sector is the most energy-intensive area of the 1983 economy when compared on a Btu basis. This is consistent with the state profile.

CHART II

RETAIL ENERGY PURCHASES BY FUEL TYPE - ALLEN
AS A PERCENTAGE OF TOTAL BTU CONSUMPTION (1983)



Gasoline products are the community's largest energy resource, providing about 32 percent of total energy needs when compared to an equivalent Btu basis. This is followed by electricity at 29 percent propane at 23 percent, and fuel oil products at 16 percent.

In terms of actual consumption measures, these percentages are broken down into the following estimated annual purchases:

* Fuel Oil	42,000 gallons
* Propane	95,000 gallons
* Gasoline	94,200 gallons
* Electricity	3,215,442 kilowatt-hours

To better understand how use affects the local economy such as Allen's, it is helpful to break the consumption pattern into a sector-by-sector analysis.

Residential Use

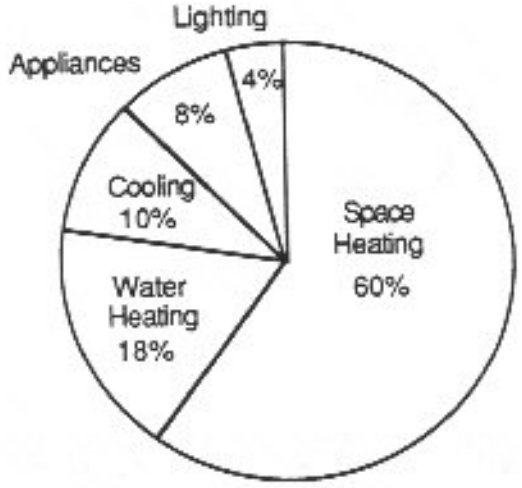
There are 157 year-round residential dwelling units which house the 390 residents of Allen*. The majority of these were constructed prior to 1960 and can be considered to have been constructed below current energy standards. Because of market demand and state adoption of minimal energy standards, most new homes are insulated and more energy efficient than older housing, although still more energy consuming than need be the case if building designs approached the levels that are technically feasible today.

Energy use in the residential sector can be divided into four major categories: space heating, water heating, space cooling, and other appliance use. In Nebraska, space heating typically accounts for about 60 percent or more of the home energy bill (Chart III). Unlike the rest of the State, Allen uses no natural gas for either the residential or commercial sector. Space heating is provided by a combination of electricity, propane and fuel oil.

*According to 1980 census data and city utility data.

CHART III

END-USE RESIDENTIAL CONSUMPTION BY PERCENT IN NEBRASKA



PERCENT BY END USE

There is an enormous potential for reducing the space heating requirements in residential buildings. For example, a new 1,500 square foot home (typical of the new dwellings being constructed now in Nebraska) can reduce its thermal needs by 60 percent or more, compared to pre-1978 units, through improved building design. A well-designed new home might be able to lower its annual heating demand from 1,000 gallons of fuel to 400; a new home that incorporates either some carefully designed solar or super-insulating features can cut that demand even further, to as low as 100 gallons per year. By the year 2000 such a household might save $1,200 to $1,700 a year in avoided heating bills.

A number of studies suggest that existing building stock can improve its energy efficiency by 40 percent to 60 percent. However, it is expected that without new programs to promote conservation in the residential sector, overall consumption will increase slightly as more homes are built. Their increased efficiency will be offset by a move from the present 1300 square feet unit to new homes averaging 1500 square feet or more.

Commercial Use

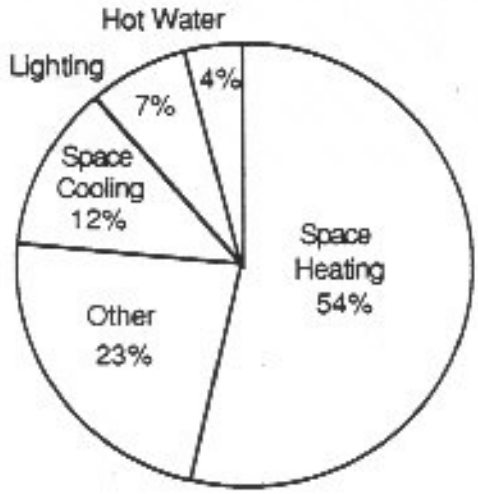
Not only does Allen have no manufacturing operations in the town but it has a smaller per capita retail sales than the state as a whole. As a result, energy use in the commercial sector, when measured per capita, is considerably smaller than the state as well. Nonetheless, the commercial sector, including local government operations, employs about one of every four persons in the labor force. Thus, rising energy prices not only affect the sales of goods and services, but local employment opportunities are threatened as well.

Activity in the commercial sector takes place in a variety of settings such as stores, offices, hotels and restaurants. The needs for energy vary widely among these facilities, but they all have common requirements for heating and cooling, lighting, and other requirements such as office equipment, cooking and communications systems.

Energy consumption in a typical commercial building is illustrated in Chart IV.

CHART IV

ILLUSTRATION OF ENERGY CONSUMPTION
IN A TYPICAL COMMERCIAL BUILDING IN NEBRASKA



PERCENT BY END USE

Space heating typically accounts for 54 percent of the total energy budget for the commercial sector; space cooling, 12 percent; lighting, 7 percent; water heating, 4 percent; and other uses mentioned above, 23 percent.

The primary energy sources used in the commercial sector are electricity and propane.

The U.S. Department of Energy and the U.S. Department of Commerce estimate that savings of 20 percent to 50 percent in commercial buildings is possible. Many retail trade associations publish energy guide books that claim 10 percent to 30 percent energy savings if their suggestions are implemented. The Nebraska Commercial Conservation Program has found the greatest savings to businesses are achieved simply by properly operating and maintaining existing mechanical systems.

Transportation Use

Most energy for transportation in the state is supplied by gasoline, oil, and diesel fuels. Supplemental amounts are provided by super-unleaded with ethanol (gasohol) and propane. Mileage driven in Nebraska peaked in 1978 and

then decreased in 1979-80. Since 1981, mileage has again been gradually increasing although total fuel use continues to decline since improved efficiency in miles per gallon has more than offset any driving increases.

Allen has an estimated 308 trucks and automobiles, about one for every 0.8 persons.* Despite the small number of motor vehicles, transportation fuels represent approximately 32 percent of the overall energy consumed in Allen and 29 percent of the total cost of energy purchased by local residents and businesses in 1983. Reducing gasoline or diesel fuel consumption by only 20 percent in 1983 would have increased personal disposable income by $23,000. This would have generated a sizeable stimulus for the local community.

*Based on census data.

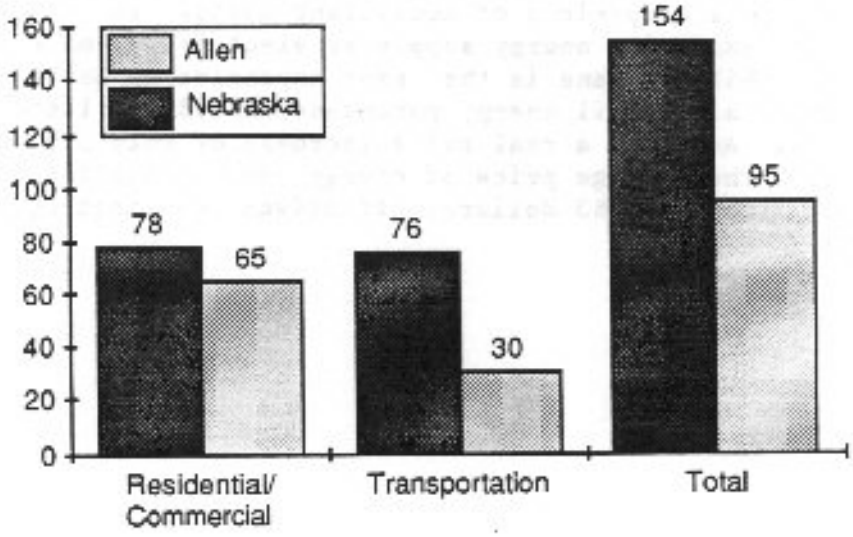
Summary

Chart V provides a summary comparison of per capita energy consumption in 1983 with per capita consumption in the state. Since there is very little, if any, energy directly consumed for primary farm production within the city limits and no industrial activity in the community, industrial and agricultural use of energy have been omitted from the state total. Corrected in this manner, it appears that the community is considered less energy-intensive than the state as a whole.

CHART V

COMPATISON OF NEBRASKA AND ALLEN
PER CAPITA ENERGY CONSUMPTION BY SECTOR

(In million Btus/person, excluding industrial and agricultural consumption)



When the figures are totaled, local residential and business consumers use more than 95.5 million Btus per capita, equivalent to 764 gallons of gasoline for all end uses annually.

According to the Nebraska Energy Office data, the annual increase in energy consumption during the 1970's was approximately three percent, down from the nearly six percent rate in the preceding decade. After peaking in 1979, energy use in the state declined about five percent in both 1980 and 1981; this was followed by a four percent increase in 1982. The Energy Office estimates further increases will follow a more moderate course through the year 2000.

Given present levels of price increases, it is reasonable to expect that, absent any major community conservation programs, the local retail energy bill will increase at a rate of about three percent annually. As noted in the following section, Allen will, nonetheless, be greatly affected by rising energy prices.

ECONOMIC IMPACTS--THE YEAR 2000

Several factors should be explored in a review of the future impacts of rising energy costs upon a local economy. The first is to explore the costs to the average household for its direct consumption. The second is to evaluate the community's annual energy bill for all sectors in terms of local per capita incomes. The last approach is to look at how rising energy prices affect the local economy's productivity.

To begin our analysis we need to look at typical 1983 energy costs in the community. This is presented in Table C, both in dollars per conventional measure (e.g., gallons and kilowatt-hours) and in dollars per million Btu. This will allow a comparison of equivalent costs. It is interesting to note that our most expensive energy supply is electricity, more than $15 per million Btus while propane is the least expensive at $6.78 per million Btus. The average of all retail energy purchases in 1983 is listed at $10.21 per million Btus. Assuming a real price increase of only 3.3 percent per year, by the year 2000 the average price of energy can be expected to climb to $17.73 per million Btus (in 1983 dollars, effectively eliminating the impact of inflation).

TABLE C

AVERAGE 1983 RETAIL ENERGY PRICES IN ALLEN

Fuel Source	$/Unit	$/Million Btu
Gasoline	$1.20/gallon	$ 9.60
Propane	$ .62/gallon	$ 6.78
Fuel Oil	$ .98/gallon	$ 7.10
Electricity	$ .052/kwh	$10.21
1982 average energy price for all sources:		$10.21/mmBtu
Projected year 2000 average energy price for all sources (in 1983 dollars) at 3.3 percent real increase per year:		$17.73/mmBtu

The average prices listed on Table C understate the cost to the residential consumer since, typically, residential electrical and natural gas rates are higher than commercial and industrial rates. Table D identifies these costs in terms of the 1983 consumption of a typical Allen household and projects the costs of a similar household in the year 2000, assuming 3-4 persons in each household.

TABLE D

ILLUSTRATION OF AVERAGE HOUSEHOLD ENERGY COSTS - ALLEN

1983

electricity	-	7000 kwh at $.047/kwh	= $ 329
propane	-	1600 gallons at $.68	= $1,088
gasoline	-	600 gallons at $1.20/gallon	= $ 720
		Annual Total:	$2,137

2000

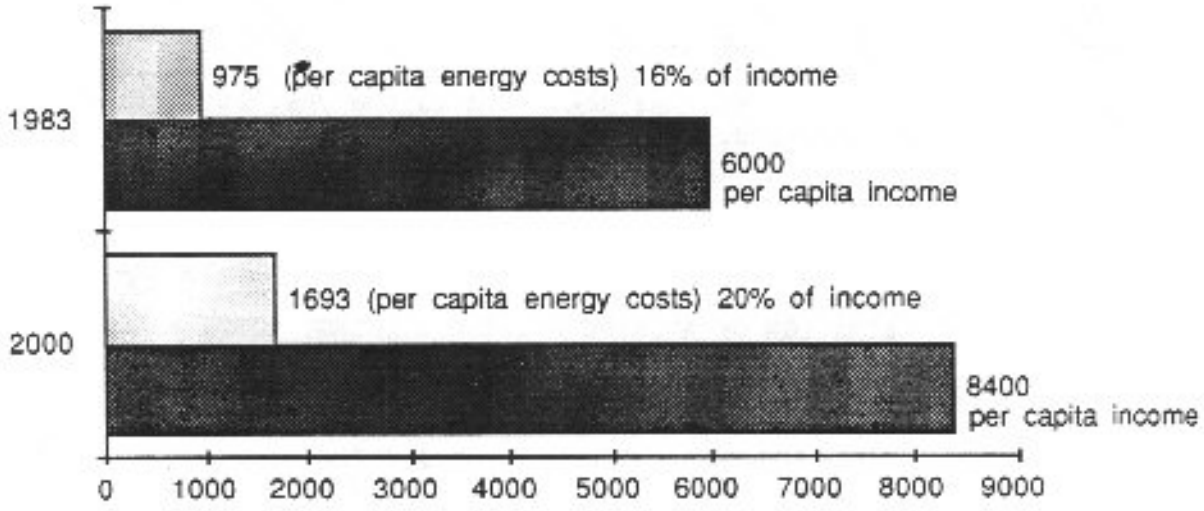
electricity	-	6000 kwh at $.066/kwh	= $ 396
natural gas	-	1200 gallons at $1.56/gallon	= $1,872
gasoline	-	400 gallons at $2.33/gallon	= $ 932
		Annual Total:	$3,200

Should this trend materialize, the implication is clear: Even with a modest conservation effort the household energy costs will experience a 50 percent increase, rising from $2,137 in 1983 to as much as $3,200 in the year 2000.

But this information does not tell us about the household or individual share of industrial or commercial-governmental energy requirements. As previously noted, Allen spends $380,243 a year for all uses of energy. This represents a per capita expenditure of $975. Since the 1983 estimated per capita income approaches $6,000, 16 percent of the village income must go to pay for energy consumption in one form or another. If we assume, after discounting for inflation, that energy prices rise as little as 3.3 percent per year, and if overall usage remains, by the year 2000 each of the Allen residents will be paying $1,693 to purchase the energy needed by the community. Should real incomes rise by as much as two percent per year, the net result will be that in 17 short years, per capita energy costs will jump to 20 percent of the personal income levels. This point is illustrated in Chart VI.

CHART VI

ILLUSTRATION OF ENERGY COSTS AS A PERCENTAGE OF PERSONAL INCOME-ALLEN
(1983 Dollars)



Spending more of our business and family budgets on energy means there will be less money for other goods and services. In short, the productivity of the local economy will be weakened if the village cannot find a way to stem the flow of energy dollars. While these numbers are not absolute forecasts of the future, they do underscore a central theme of this report: Increasing energy costs will be a major factor in determining the quality of future economic development.

Another measure of productivity is to determine the economic benefits that result from spending a dollar on one commodity compared to another. As Table E illustrates, under optimum circumstances, a one dollar expenditure for conventional energy yields a "multiplied" economic benefit of only $1.45 for a state such as Nebraska. This figure reflects a composite of electricity, natural gas and oil expenditures and it reflects the fact that when money is spent for a commodity such as energy, the effect is to generate business activity and tax revenues that, in turn, create a demand for additional manufacturing and employment that will ripple through the economy and multiply the value of the original expenditure.

TABLE E

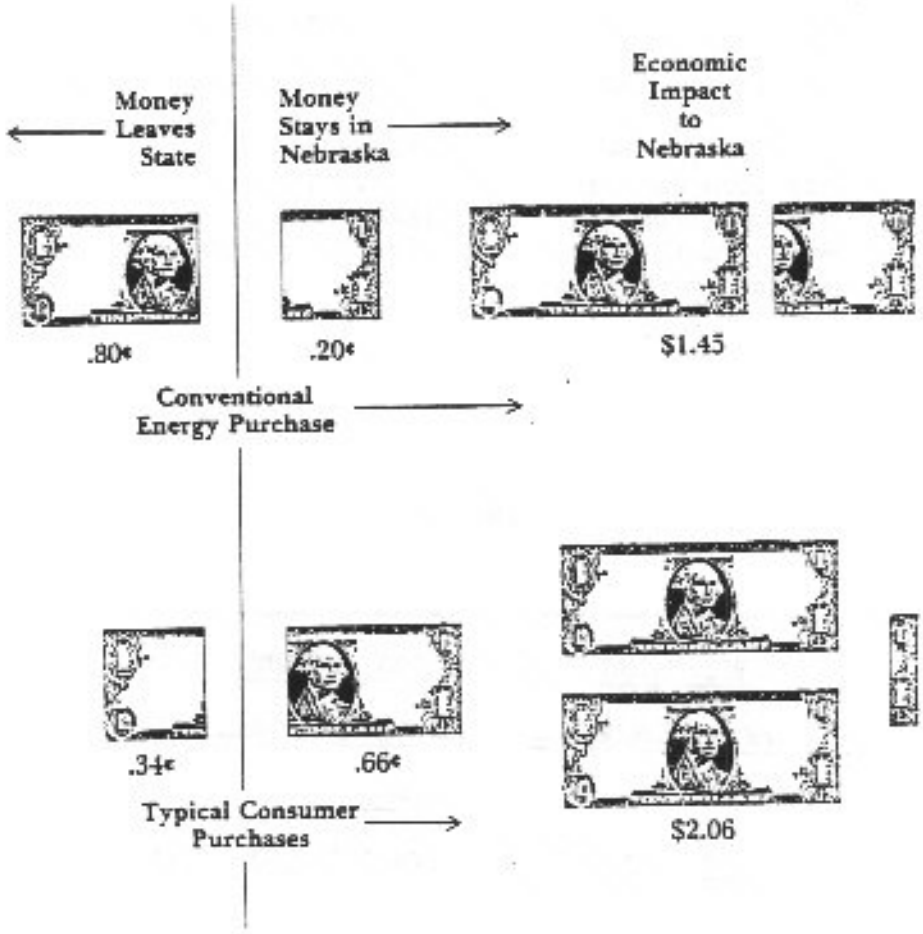
ESTIMATED LONG TERM NET ECONOMIC EFFECTS

OF A ONE DOLLAR PURCHASE OF CONVENTIONAL ENERGY SUPPLIES

VERSUS

CONSERVATION OR NORMAL CONSUMER PURCHASES

One Dollar Purchase	Money Exported From State	Amount Retained In Nebraska	Net Economic Nebraska Multiplier
Conventional Energy Supplies	.80	.20	1.45
Conservation or normal consumer expenditures	.34	.66	2.06



In the case of most conservation and normal consumer purchases, a one dollar expenditure under optimum conditions can yield $2.06 or more in net multiplied benefits to the state. Thus, for each dollar that can be diverted from conventional energy supplies in a cost-effective fashion, the local economy can gain as much as $.61, essentially the difference between a multiplier of $2.06 and a multiplier of $1.45 With this perspective in mind, then, we can consider the impact of future energy bills on the local economy by comparing a moderately aggressive conservation effort within the community to a "business-as-usual" approach to energy matters.

Under a business-as-usual scenario, total energy costs can be expected to increase almost 74 percent or more, through 2000, depending upon how strong the economic recovery proves to be.

If we anticipate the higher energy prices projected in Table C, the total energy bill for the Village of Allen can be expected to increase from $380,234 to $660,339 by the year 2,000. Because each dollar diverted from other sectors to pay for a higher energy bill "costs" the economy about $.61 in lowered productivity, $280,096 increase in the overall energy bill implies that Allen will experience as much as $171,000 less as part of its share of the Gross State Product than if the energy bill remained at the 1983 level. (See Table F, column 2).