# Energy Trends Report

July 2007

State Utility Forecasting Group

Energy Center at
Discovery Park

Purdue University

## Introduction

This report illustrates a number of trends occurring in the energy industries, from both national and Indiana perspectives. The report is arranged into sections:

- Energy Consumption by Sector – Historical consumption for each of five different sectors: residential, commercial, industrial, electric power, and transportation.
- Energy Consumption by Fuel Type – Historical consumption for each of five different fuel sources: coal, natural gas, petroleum, electricity, and renewables.
- Energy Intensity – Historical energy use per unit of either gross domestic product or population and a 2003 comparison of Indiana to other states.
- Prices – Historical electricity prices for the residential, commercial, and industrial sectors and a 2006 comparison of Indiana to other states.
- End Use Saturation, Efficiency Standards, and Standby Power – Historical changes in the number of residential electricity end uses and their energy consumption, the impact of changing efficiency standards, and the rise in electricity use by standby power for various end uses.

While the State Utility Forecasting Group (SUFG) is grateful to the Indiana Utility Regulatory Commission for their support on this report, the SUFG is solely responsible for its content.

# Energy Consumption by Sector

This section is composed of a number of graphs of energy consumption spanning the 1960 to 2003 time period. The graphs were assembled using the Energy Information Agency (EIA), State Energy Consumption, and Price and Expenditure Estimates which may be obtained at <http://www.eia.doe.gov/emeu/states/_seds.html>.

The EIA consumption data covers five sectors: residential, commercial, industrial, electric power, and transportation. Fuels included are coal, natural gas, petroleum, nuclear, hydro, and renewables, as well as electricity. The consumption graphs included here are for Indiana and the United States, although the EIA database contains the same data for all fifty states and the District of Columbia. The last year for which these estimates are available is calendar year 2003.

The energy consumption graphs are of two types. In the first, consumption is plotted against time for several fuels. In these graphs energy is expressed in units of $10^{12}$ (or trillion) Btu, where Btu refers to the British thermal units and the choice of $10^{12}$ arises due to the desire to maintain readable graph scales across sectors and between Indiana and the United States. Energy content of all fuels is expressed in Btu in order to plot the consumption of different fuels on the same graph without the need for multiple axes. To put the unit of $10^{12}$ Btu in perspective, natural gas is often expressed in energy units of $10^{6}$ (or million) Btu. A million Btu is often shown as mmBtu or equivalently a decatherm and the term "quad" in reference to energy is a unit of a quadrillion ($10^{15}$) Btu.

In the second type of consumption graph, the vertical axis expresses the fraction of consumption attributable by fuel. In these graphs, energy use sums to 100 percent each year where the individual fuel shares are stacked horizontal over time. These graphs make it relatively easy to see how a particular fuel's share of the sector's total energy use change over time.

In the pages which follow the energy use graphs are arranged two per page with the energy level (Btu) graph at the top of the page and the energy share graph (Percent) at the bottom of the page. There are thus four graphs and two pages per sector; one page for Indiana and the second for the United States.

The most interesting observations regarding the residential sector are the rapid increases in energy use during the 1960s and the share of the various fuels. During the 1960s natural gas use rose rapidly, petroleum use was relatively constant, electricity use rose, but not as quickly as natural gas, and both coal and wood use declined. The net result is a rapid increase in residential energy use from roughly 230 trillion Btu in 1960 to about 320 trillion Btu in the early 1970s. After 1970 natural gas use is fairly constant, petroleum use drops by more than fifty percent from the mid-1970s to the mid-1980s (due to high prices during the energy crisis and the recession of the early 1980s), electricity use continued to grow, wood use increased, and coal use virtually disappeared. The result is that electricity use as a share of residential energy use grew from around ten percent in 1960 to over thirty percent in recent years, with electricity displacing coal, petroleum, and some wood as a space heating fuel, as well as increasing with increased saturation of electric using end use equipment such as televisions, VHS and DVD players, computers and so forth. These trends are observed for both Indiana and the nation.

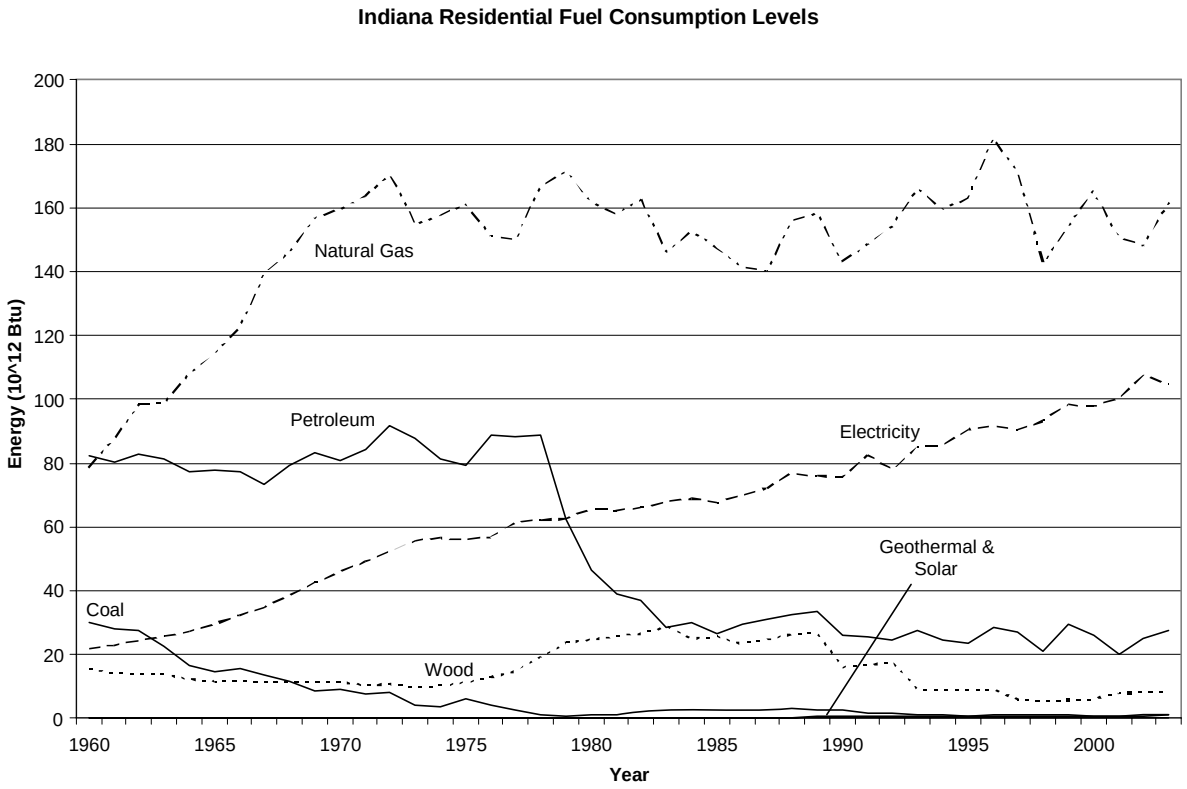
Similar trends are observed in the commercial sector and to a lesser degree in the industrial sector. In both the commercial and industrial sectors, coal is still used in significant quantities. In the commercial sector, coal is used for district heating and cooling, or combined heat and power applications at larger commercial institutions such as universities or municipalities. In the industrial sector, coal use involves steam production and process heat, in addition to its use in steel manufacturing as an input to the process. The marked increase in wood and waste use in the commercial sector in 1990 is due to EIA's expanded coverage of renewable energy sources, rather than to a sudden increase in wood and waste use. In both the commercial and industrial sectors electricity use as share of total energy use has increased with the increased share in the commercial sector following a very similar pattern of that seen in the residential sector. But, the change in industrial electricity use share is less than that observed in the other two sectors.

The fuel use trends in the electric industry are markedly different between Indiana and the U.S. as a whole. Almost all of the fuel used in Indiana to produce electricity is coal with coal maintaining a share of ninety-five percent or greater over the entire time period covered by the data. This dependence upon coal for electricity production is due to abundant, accessible, low cost supplies of coal in southwestern Indiana although large quantities of low sulfur coal are imported from the Colorado River Basin area to reduce sulfur dioxide emissions since Indiana coals tend to have higher sulfur content. Note that the EIA data is based on geographical boundaries rather than electric utility jurisdictional boundaries so some of the electricity produced with coal at plants geographically located in Indiana is not consumed in Indiana and conversely some electricity consumed in Indiana is produced outside Indiana using other fuels than coal (e.g., the AEP nuclear plant in southern Michigan which serves load in Indiana).

Fuel consumption in the transportation sector (beginning with Figure 17) is dominated as expected by petroleum products, with relatively small quantities of natural gas and ethanol supplementing petroleum. Ethanol use is expected to increase over time with the recent surge in ethanol production capacity and the development of an E85 delivery infrastructure.

Figure Page

**Figure 1**

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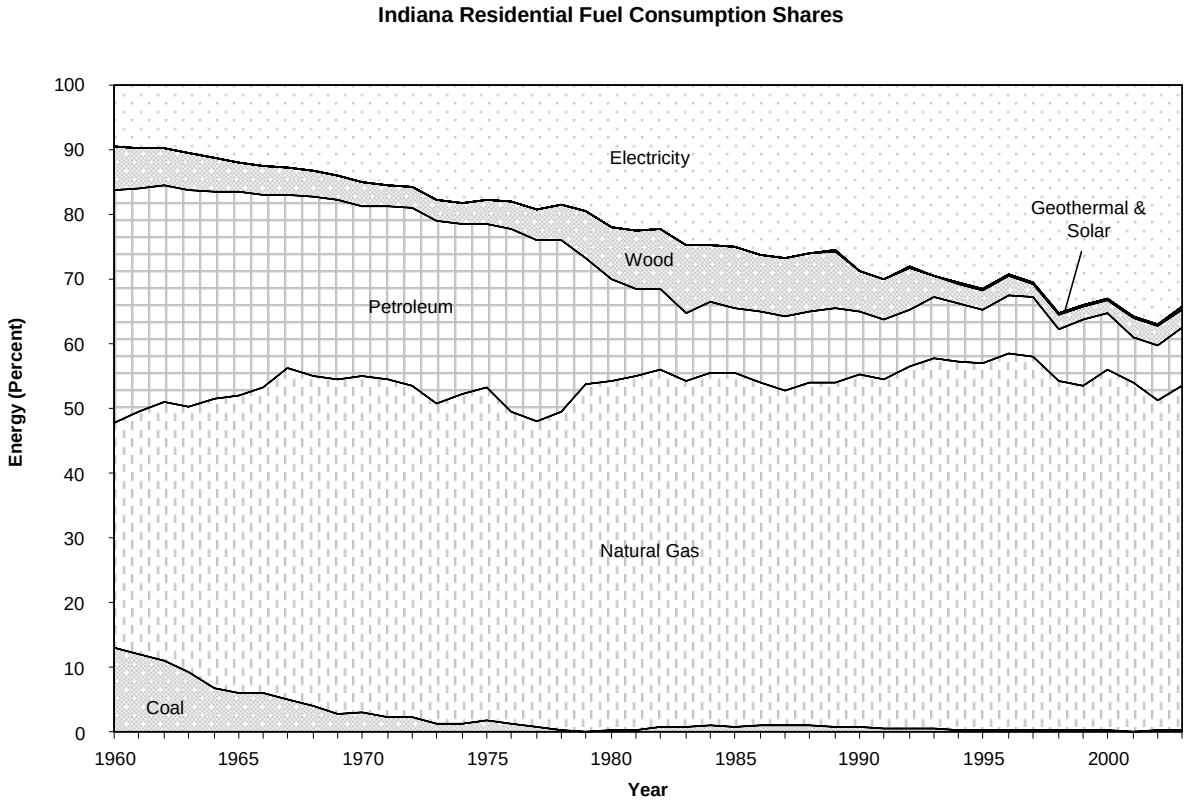

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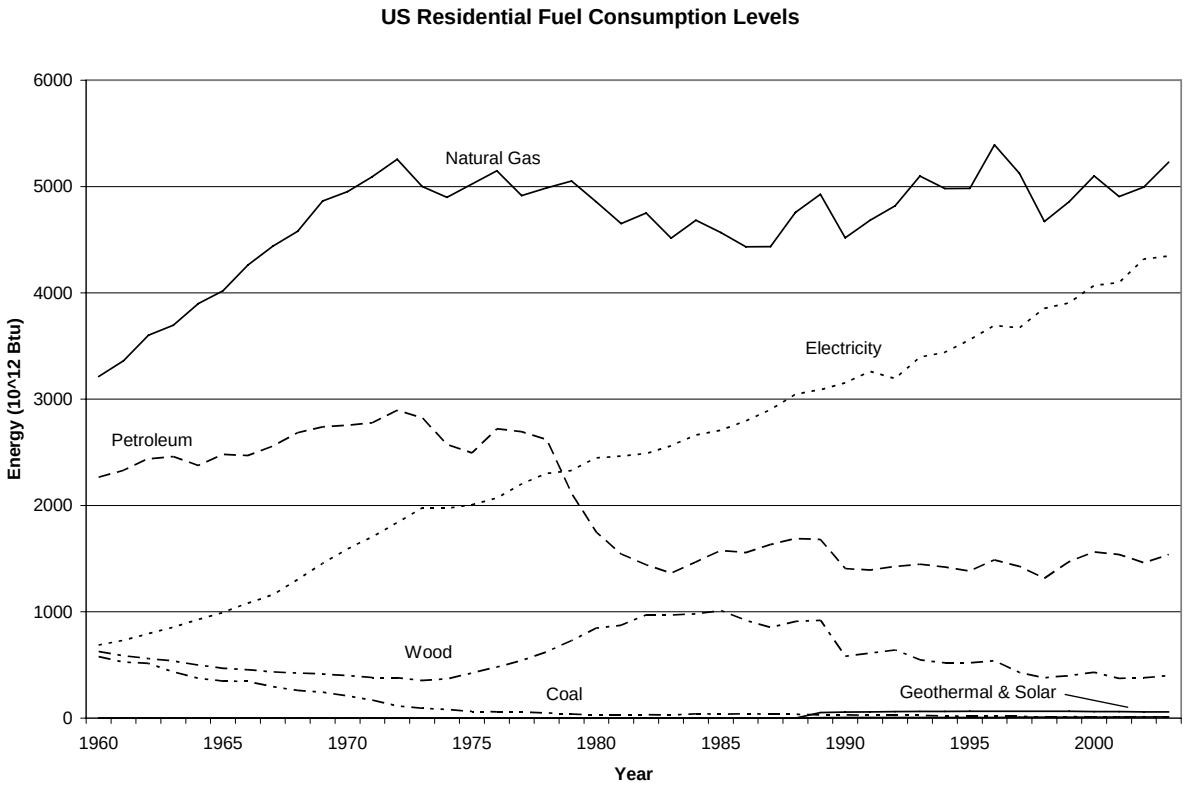


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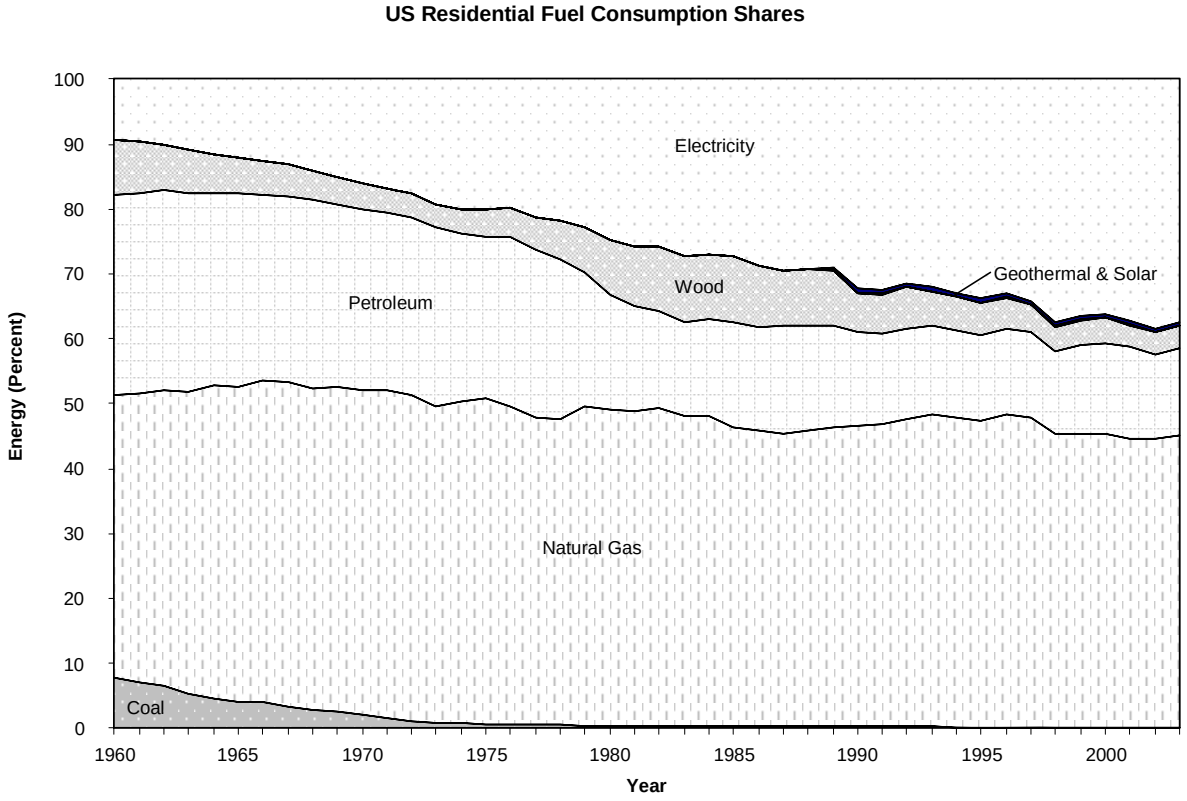

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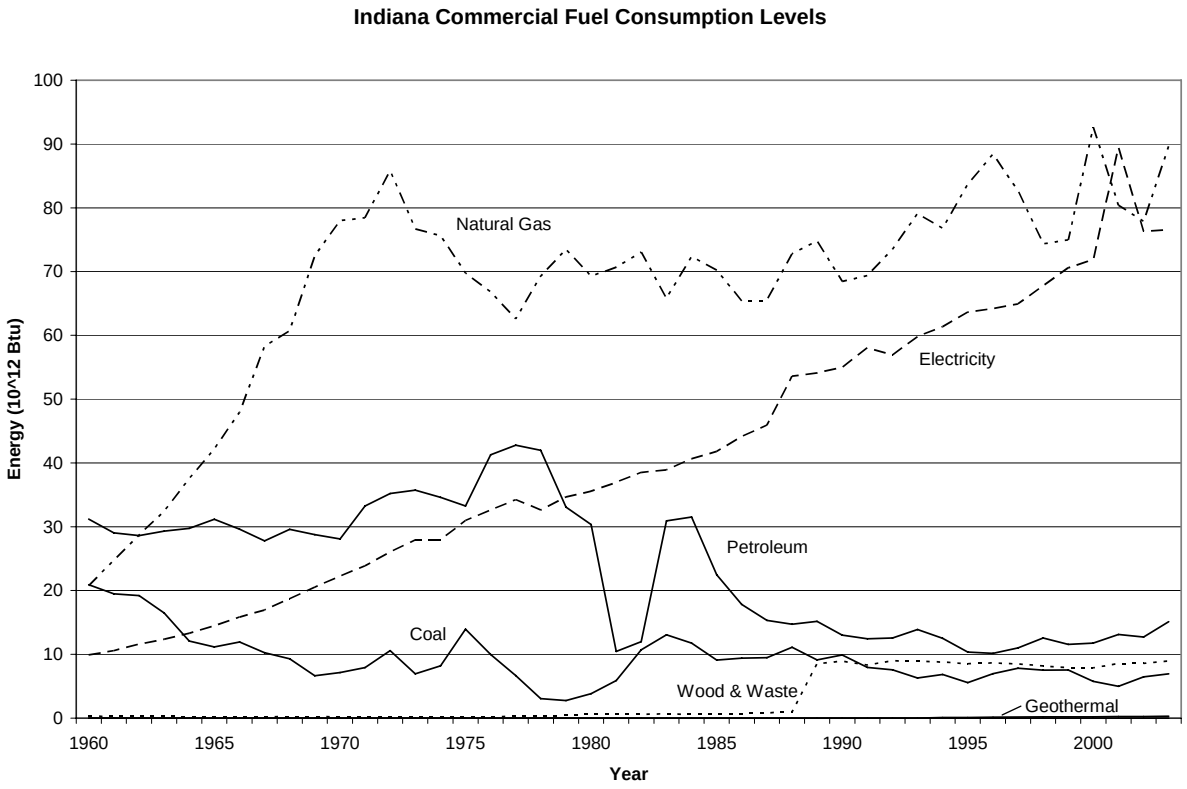


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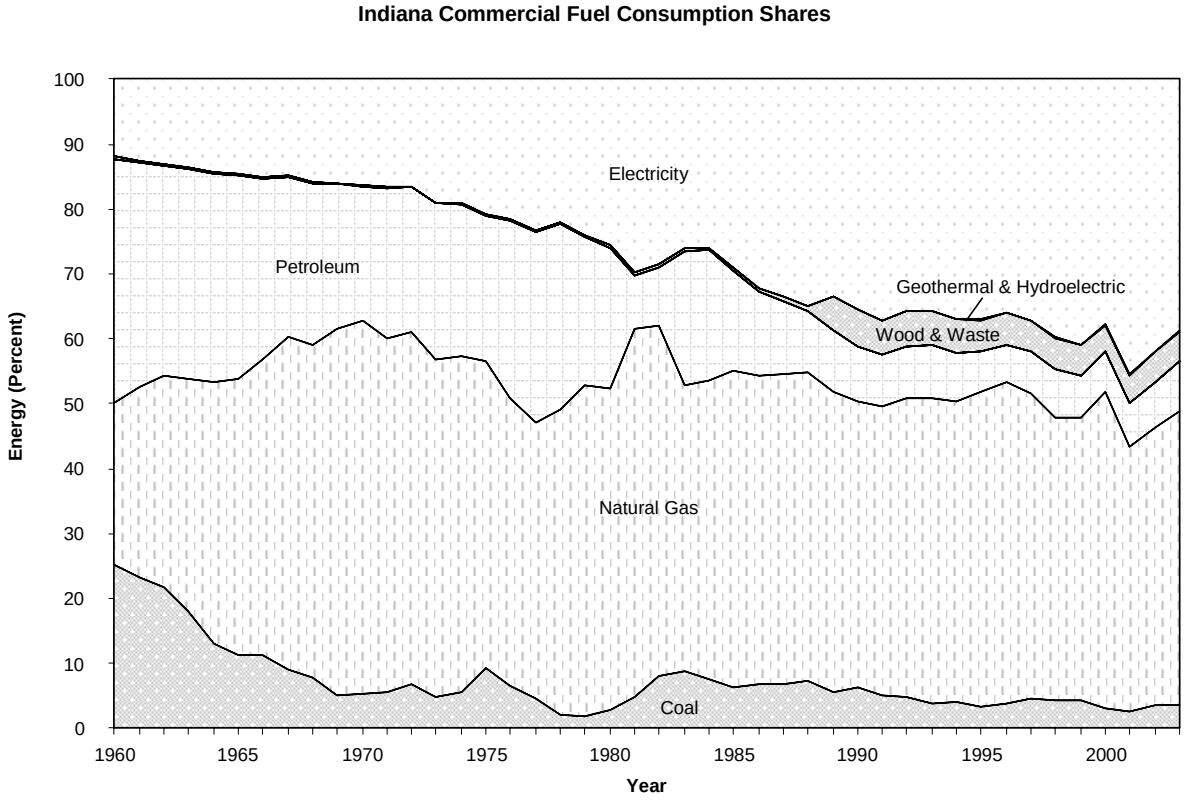

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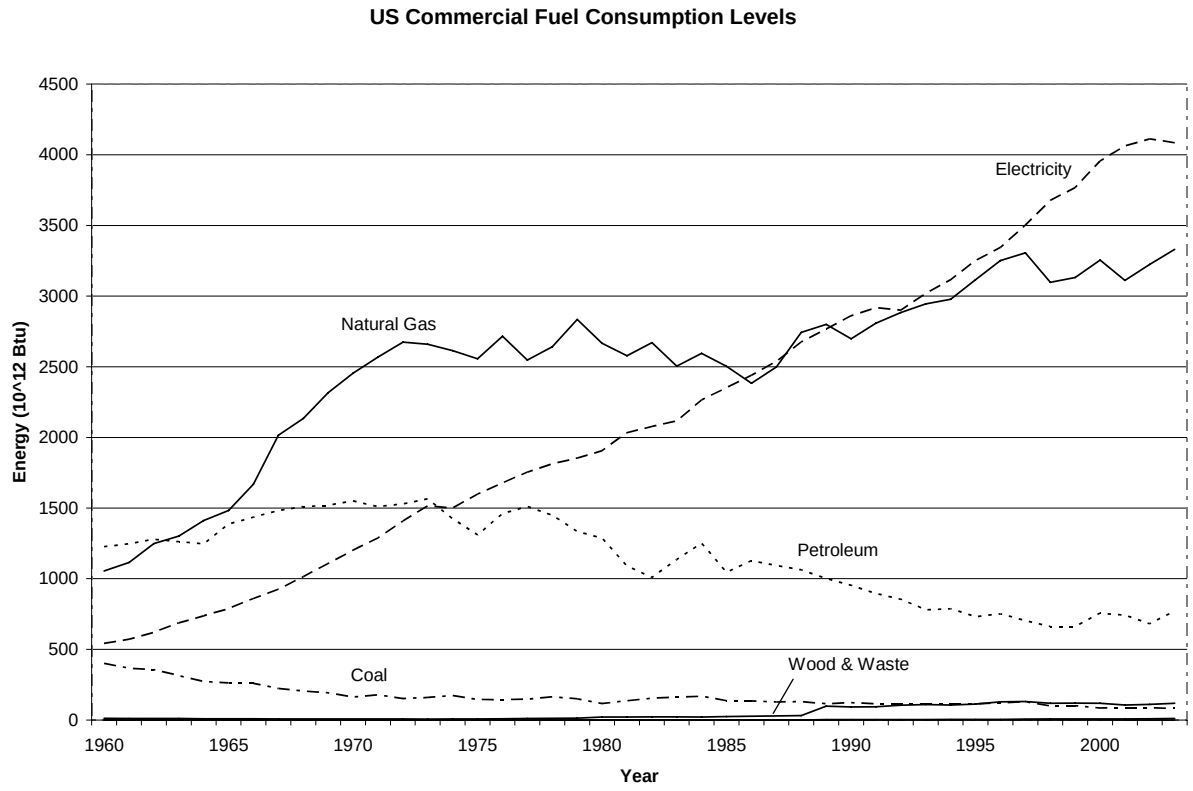


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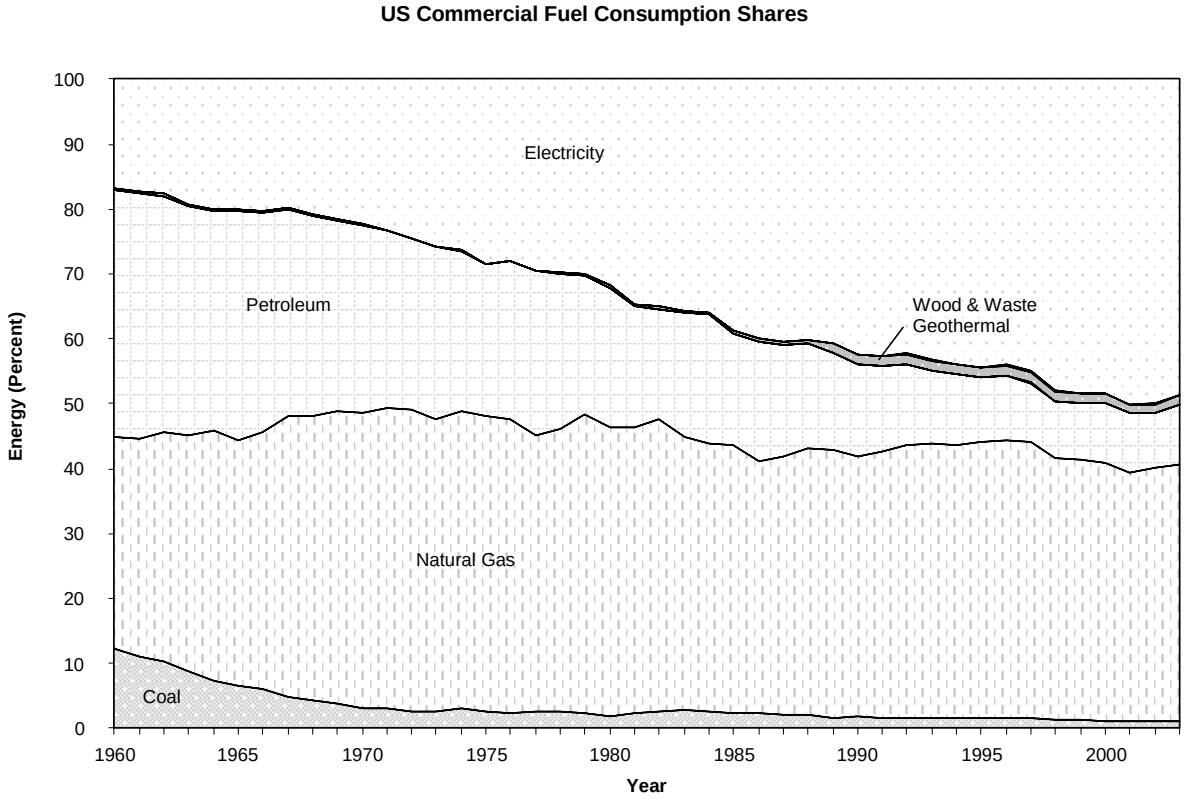

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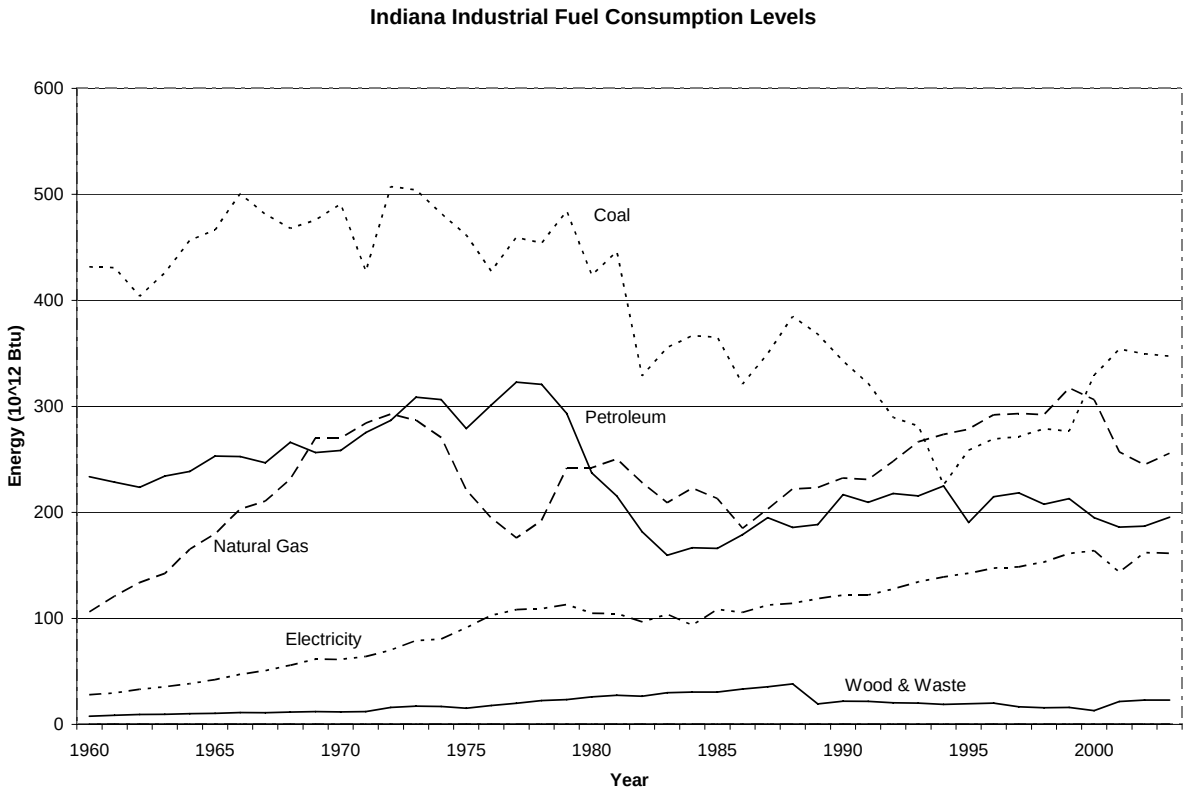


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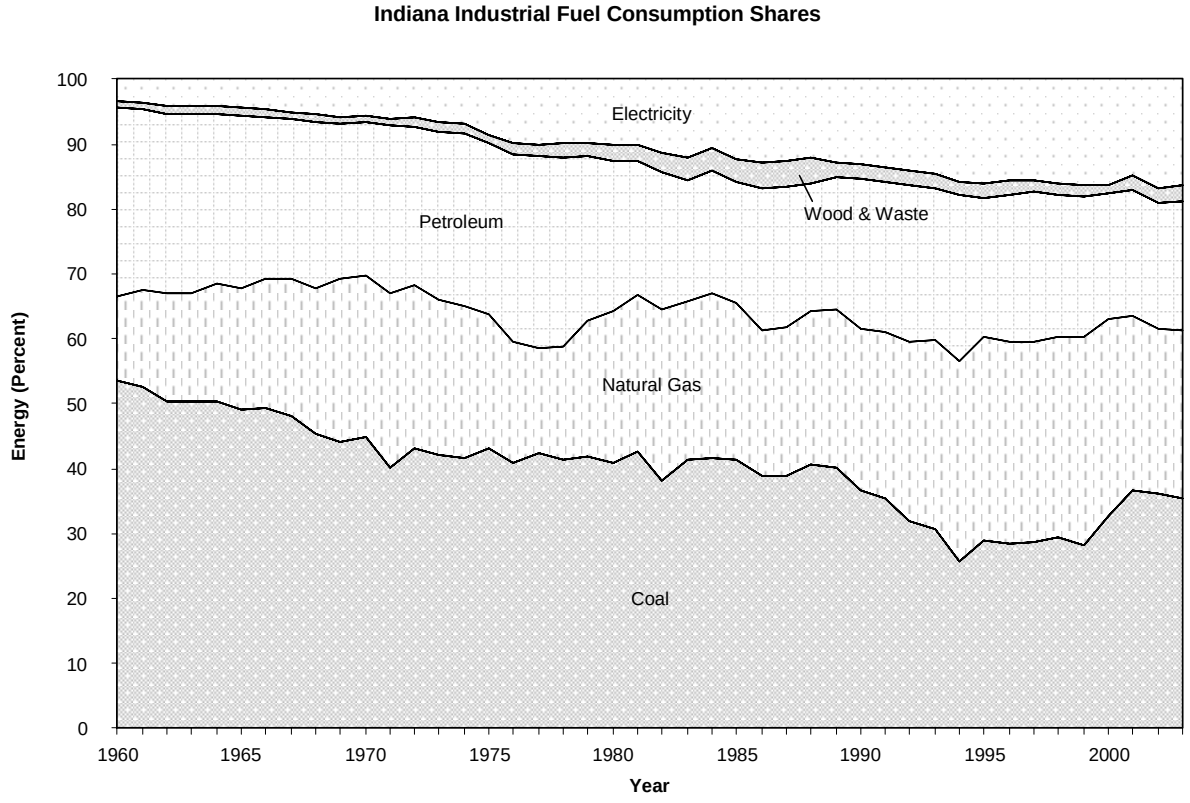

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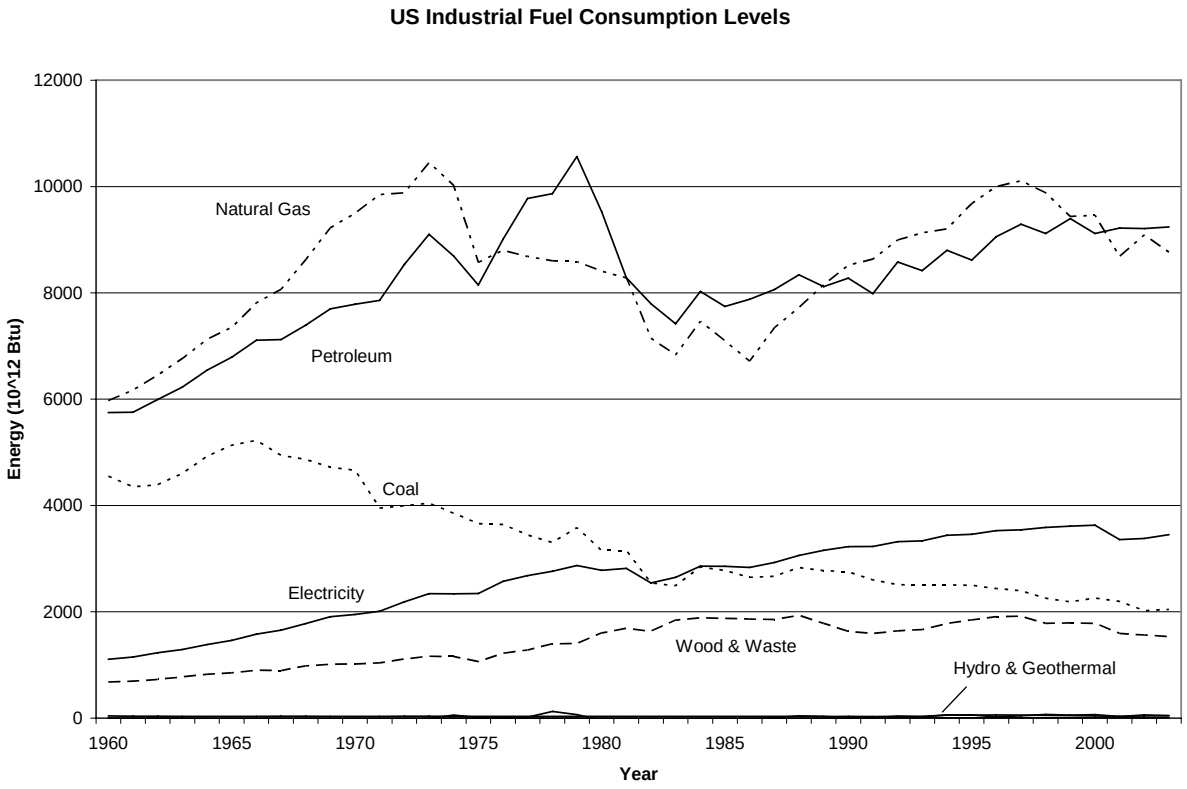


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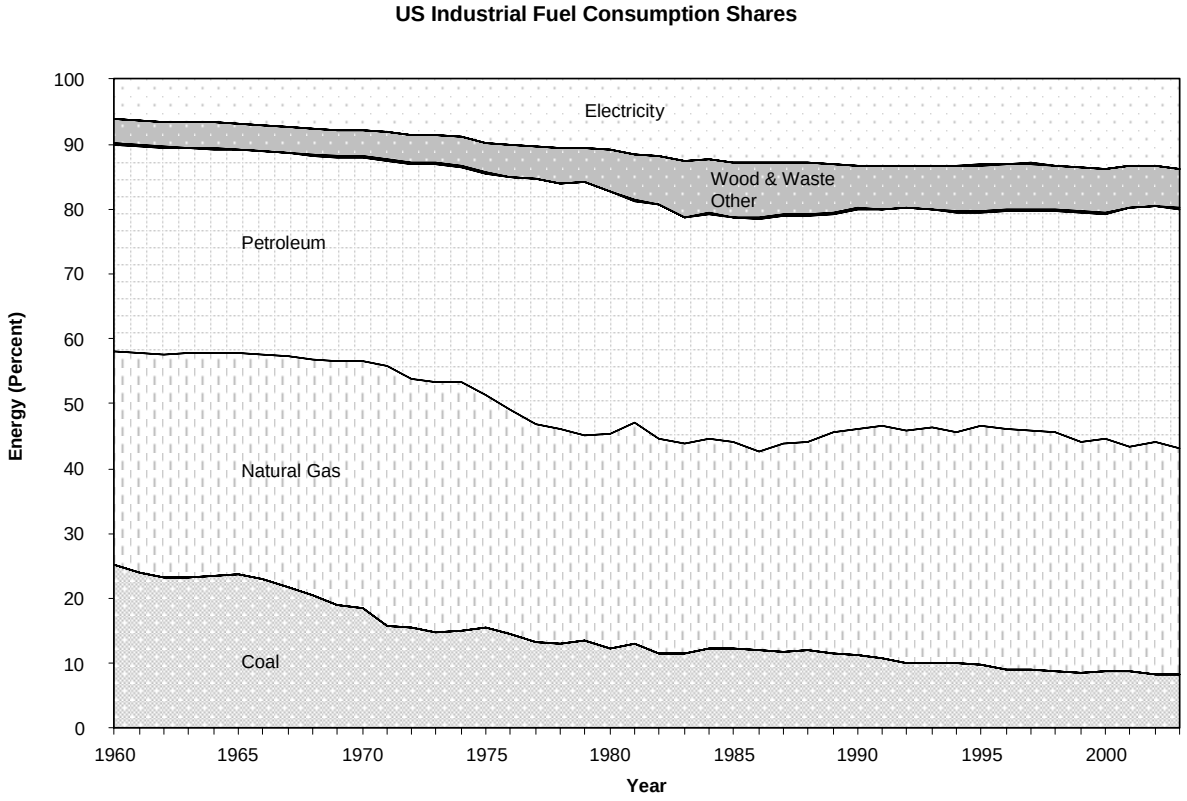

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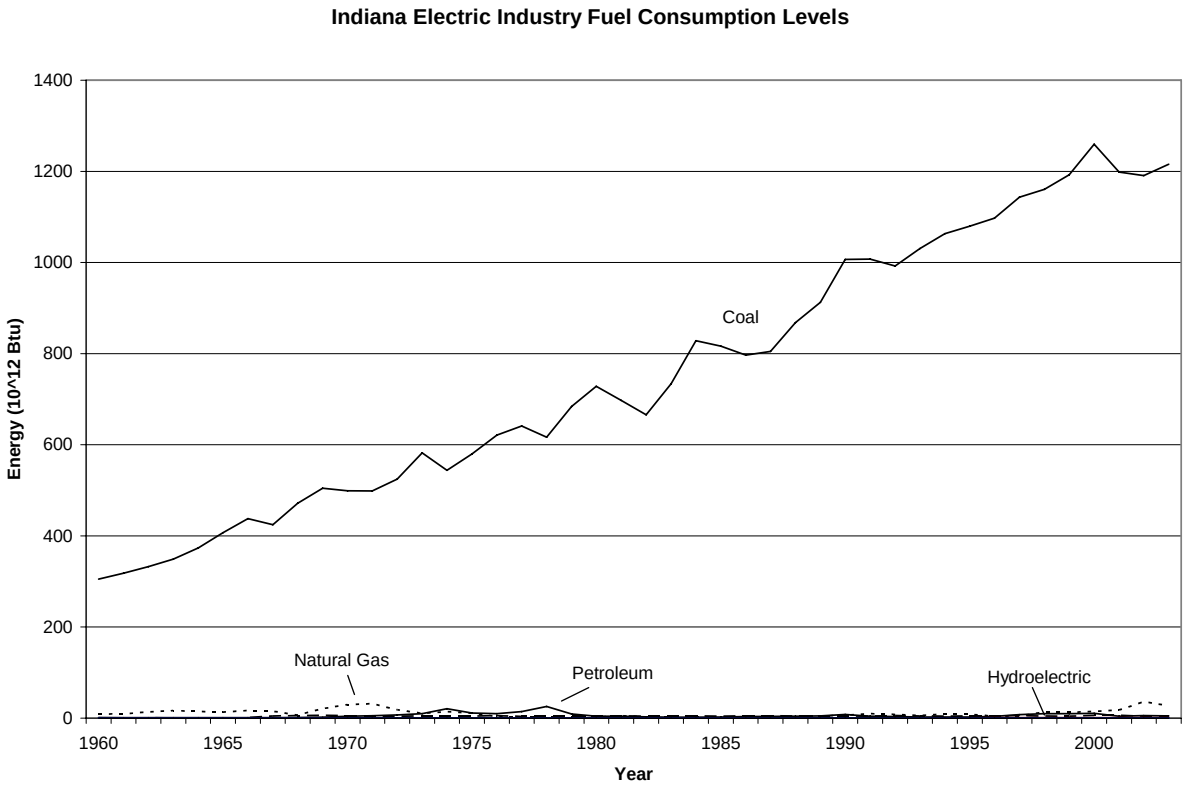


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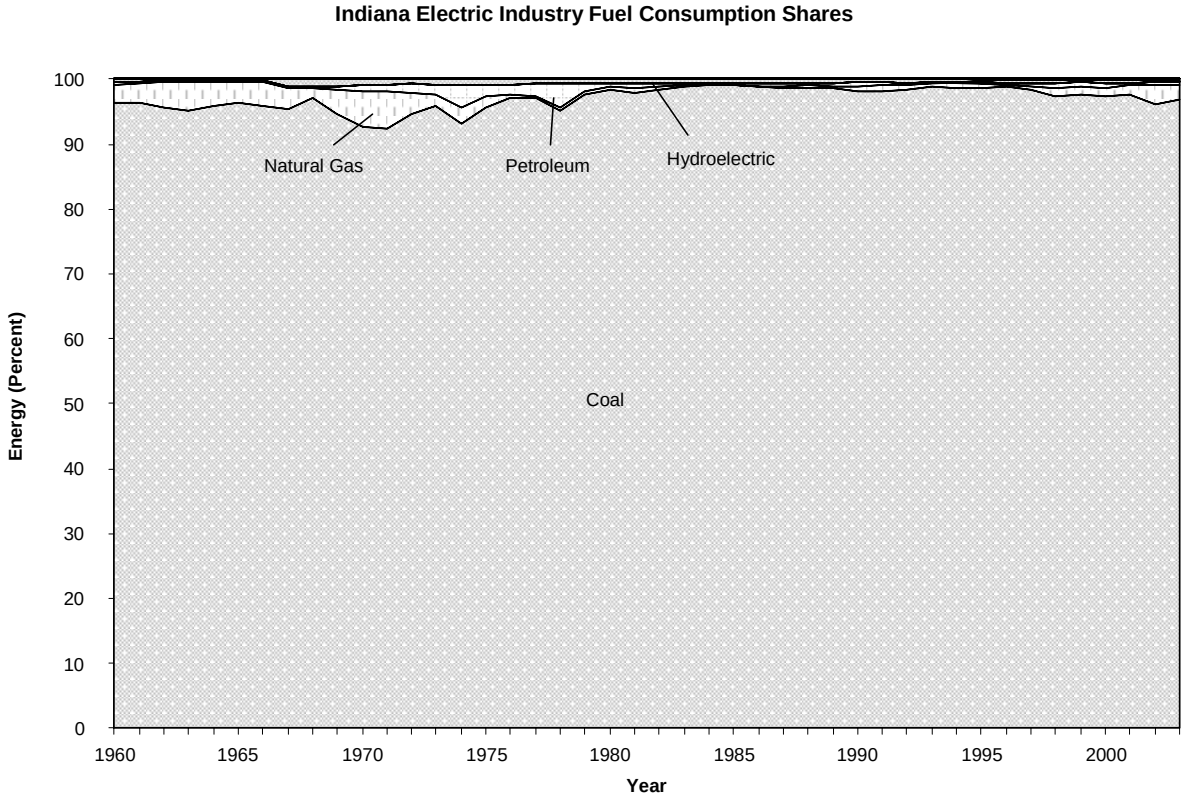

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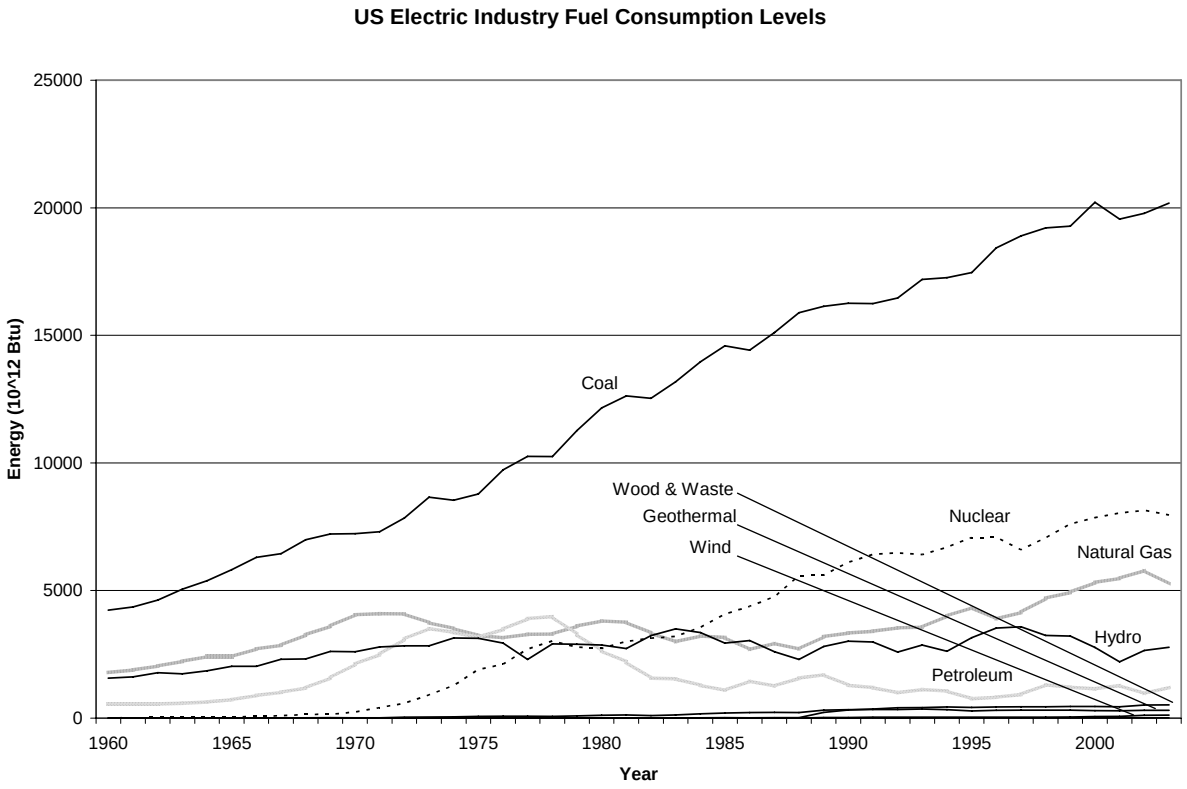


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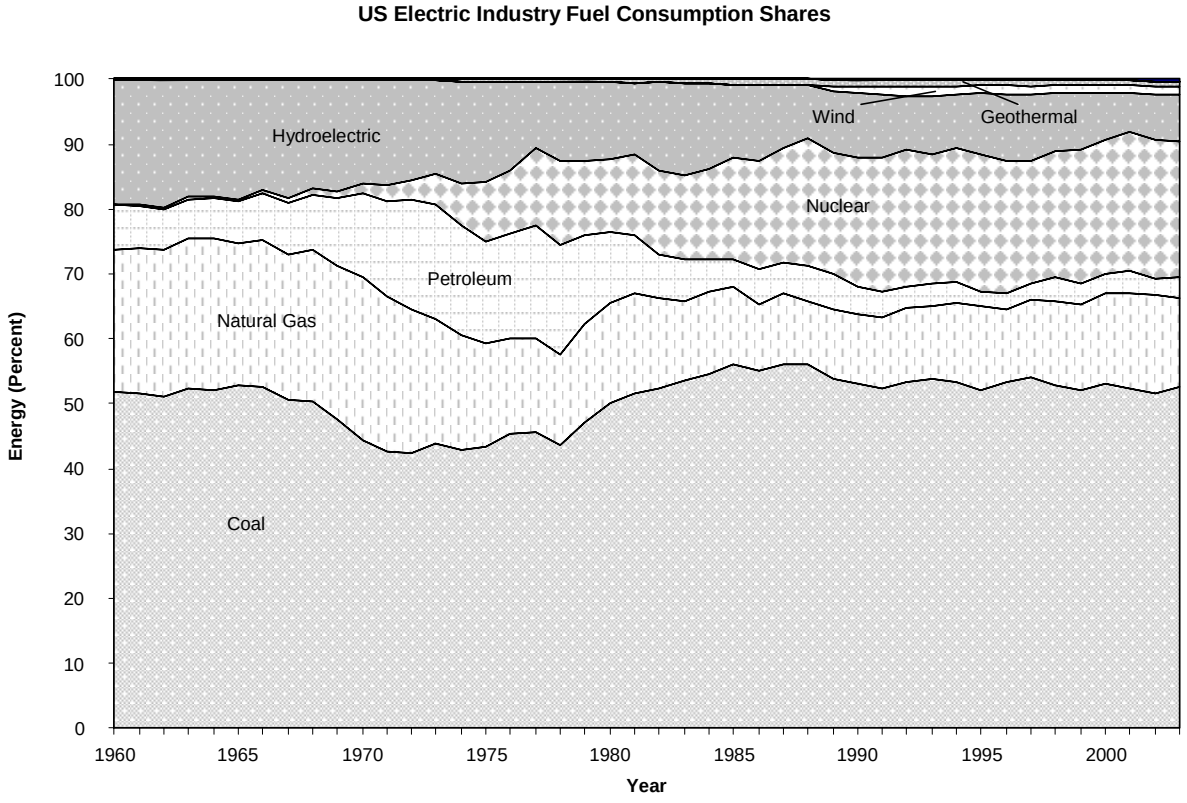

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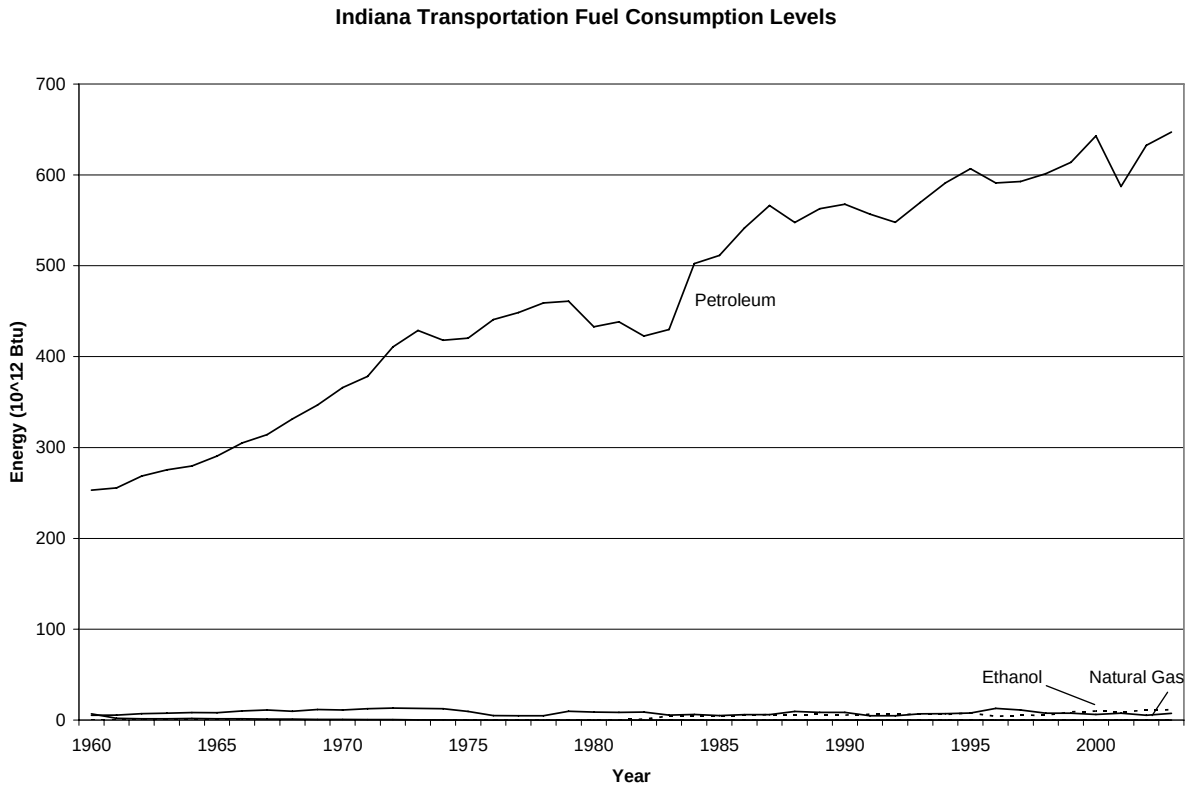


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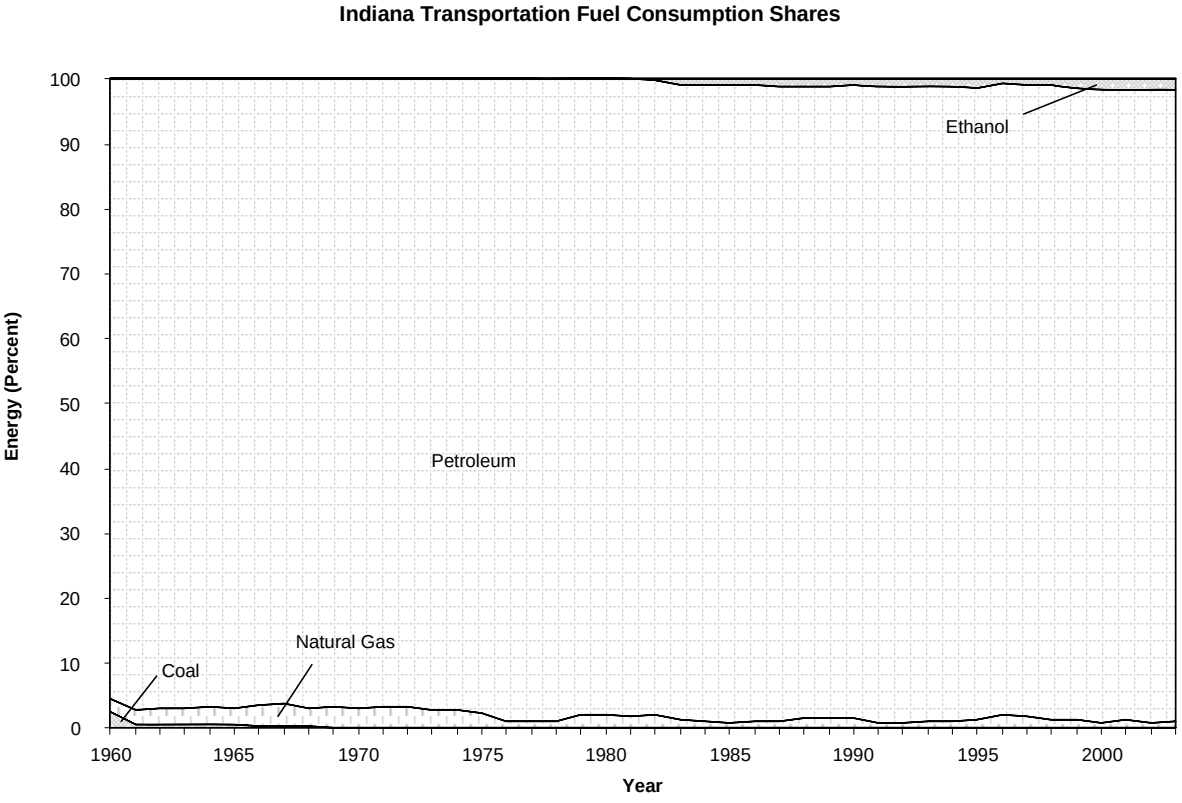

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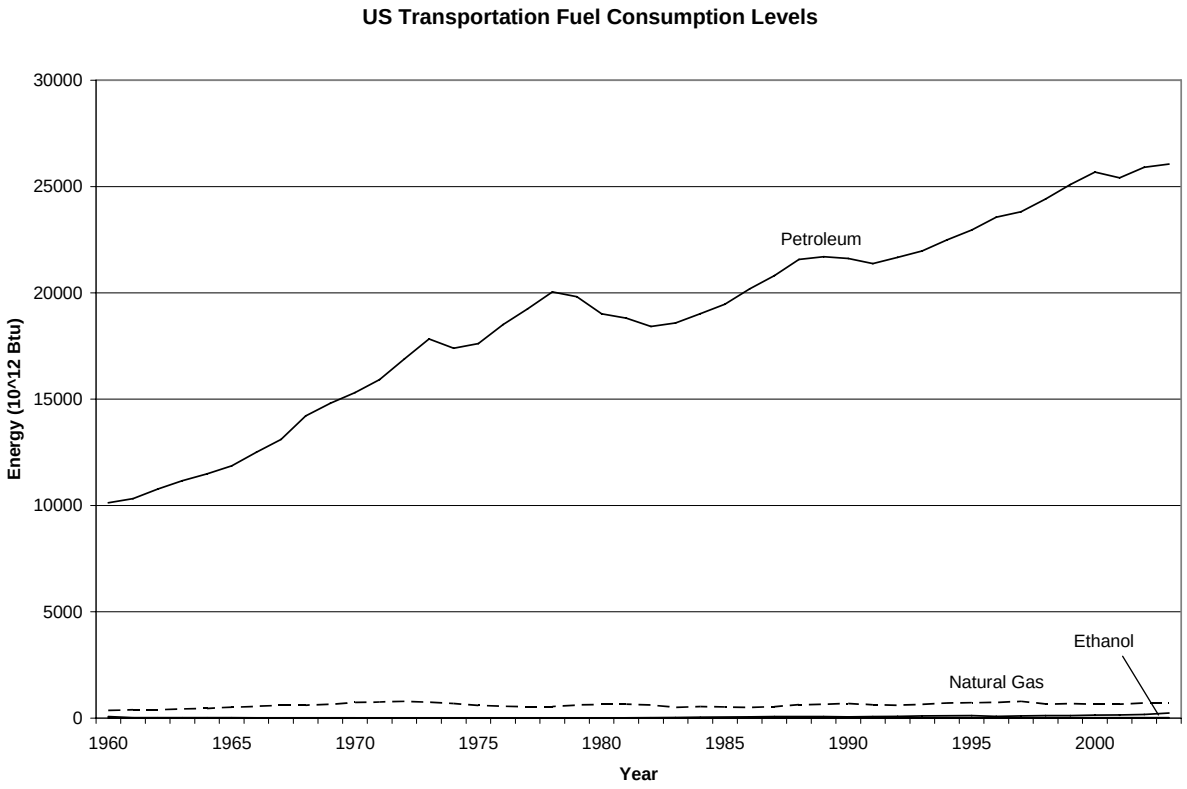


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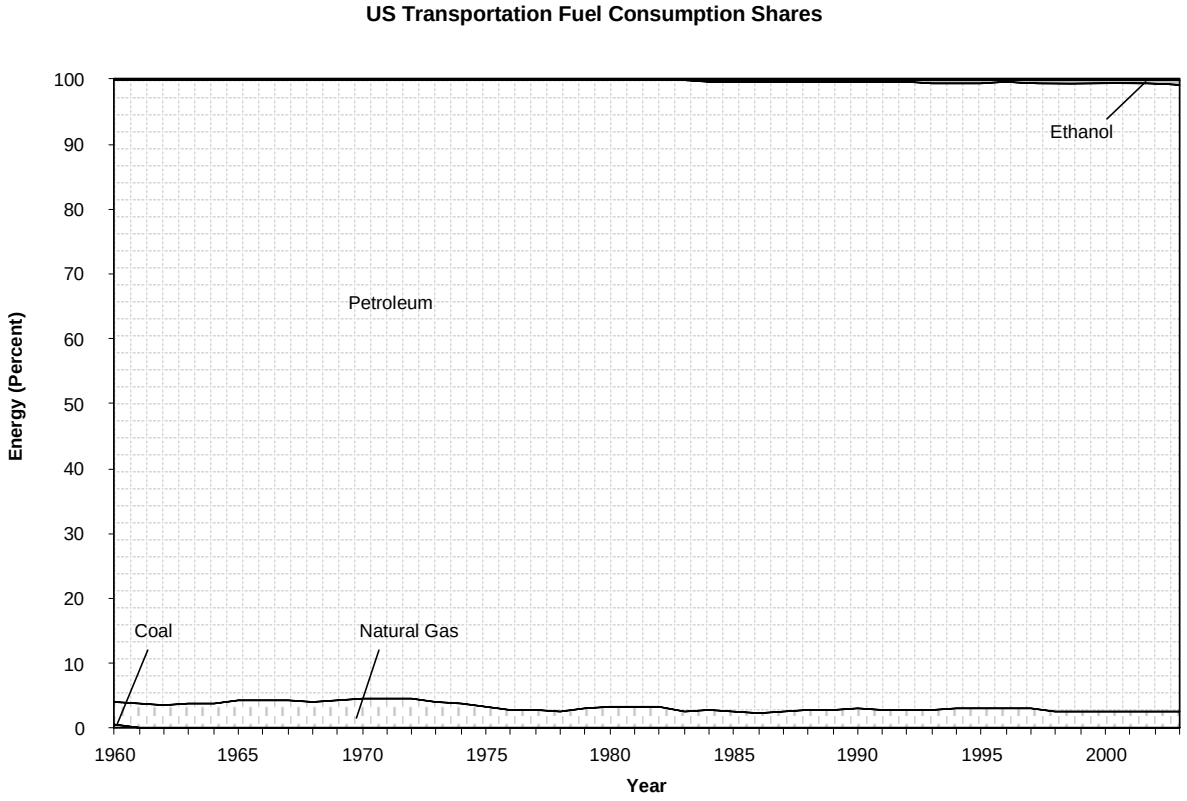


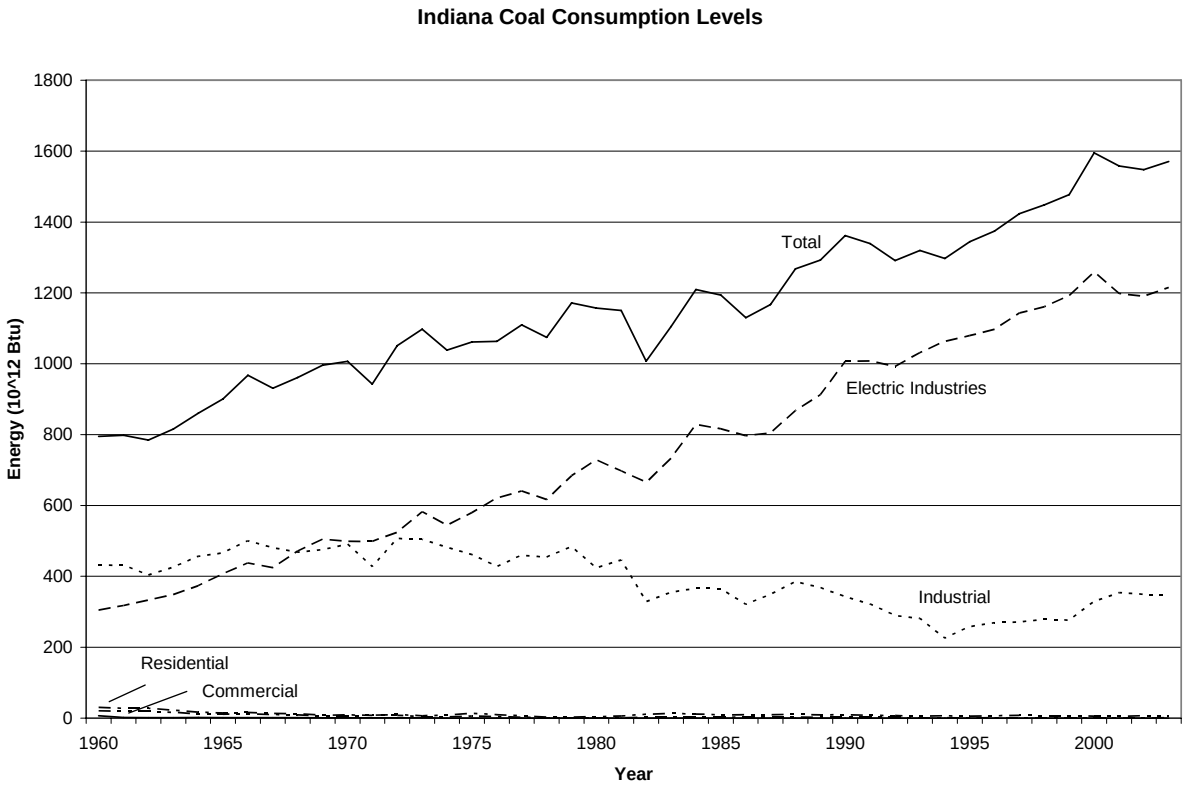
# Energy Consumption by Fuel Type

The graphs in this section show the same information as Figure 1 through Figure 20, but in this case energy use and shares are shown by individual fuel with use by sector for specific fuels. Presenting the data in this format makes it obvious that the dominant user of coal in Indiana is the electric industry (Figure 21 and Figure 22). In Figure 33 and Figure 34 the sudden upturn in commercial sector electricity consumption in 2001 and the corresponding downturn in industrial electricity consumption are most likely due to a data error, perhaps a data classification error, rather than being representative of actual electricity consumption.

Note that Figure 41 through Figure 44 contain some double counting in the calculation of the total energy consumption. This arises due to the thermal conversion efficiency of fossil fuel to electricity and electricity transmission and distribution losses. The energy content of the electricity delivered to the endusers facility may be only about one-third of the energy contained in the coal used to produce the electricity. In this case, the double counting contained in the total energy calculation would be one Btu for every three Btus of coal used in electricity production.

Figure Page

**Figure 21**

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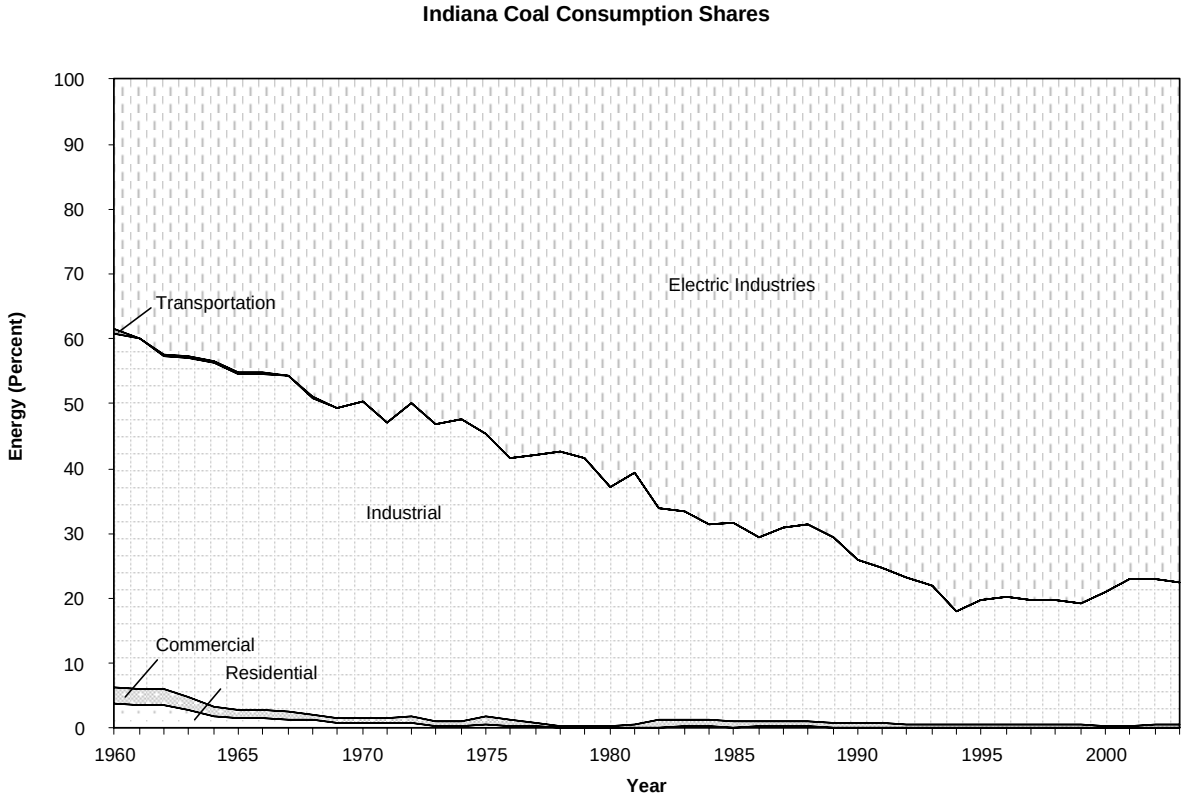

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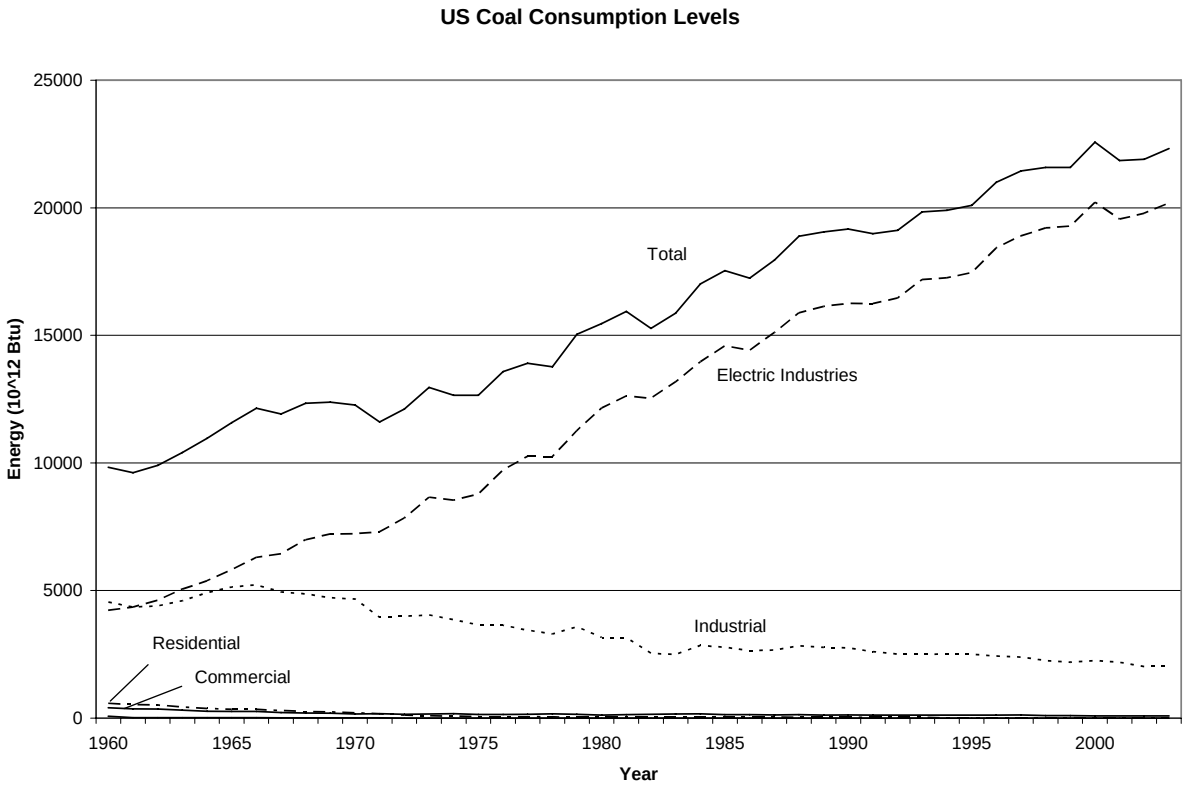


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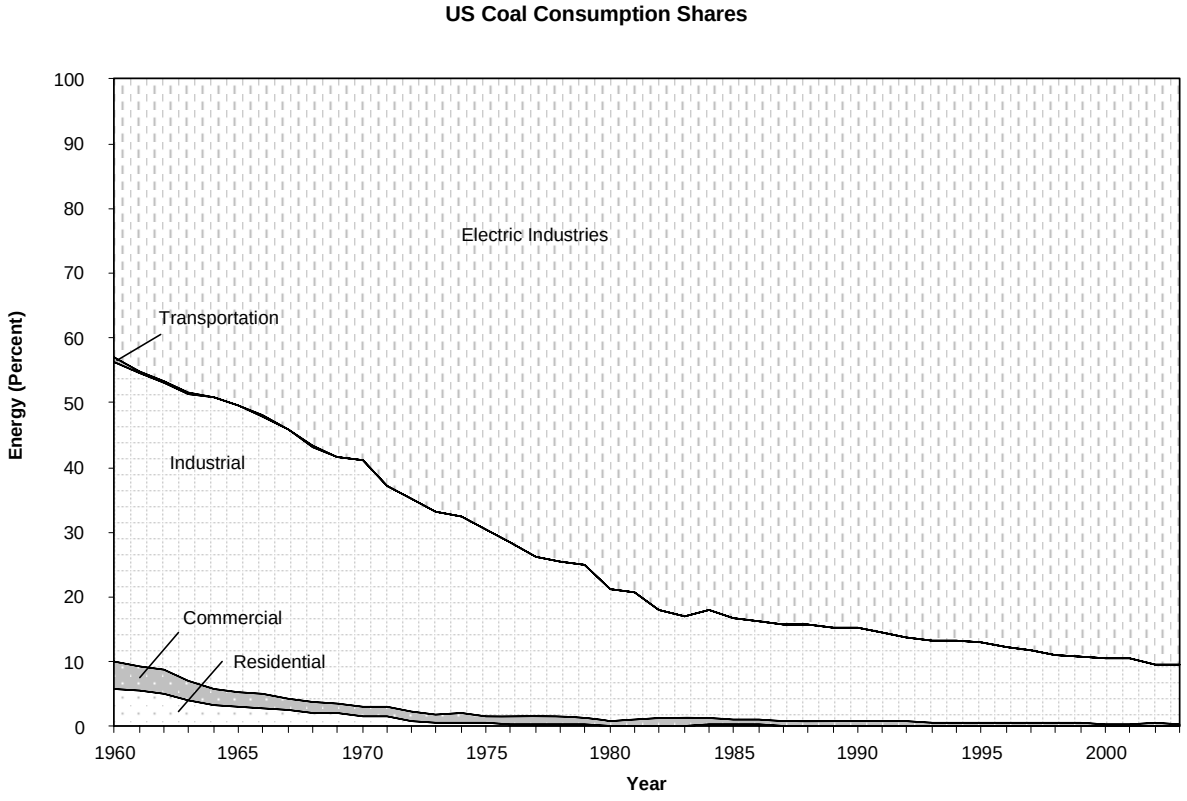

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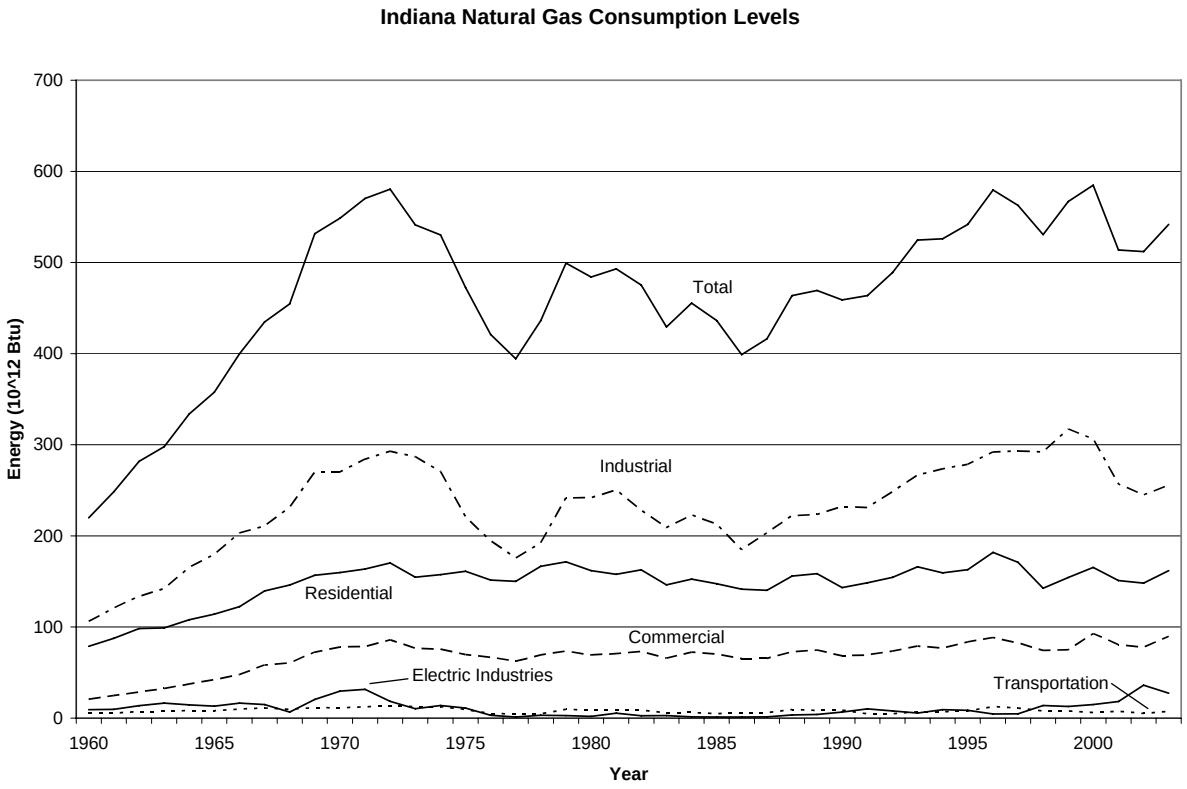


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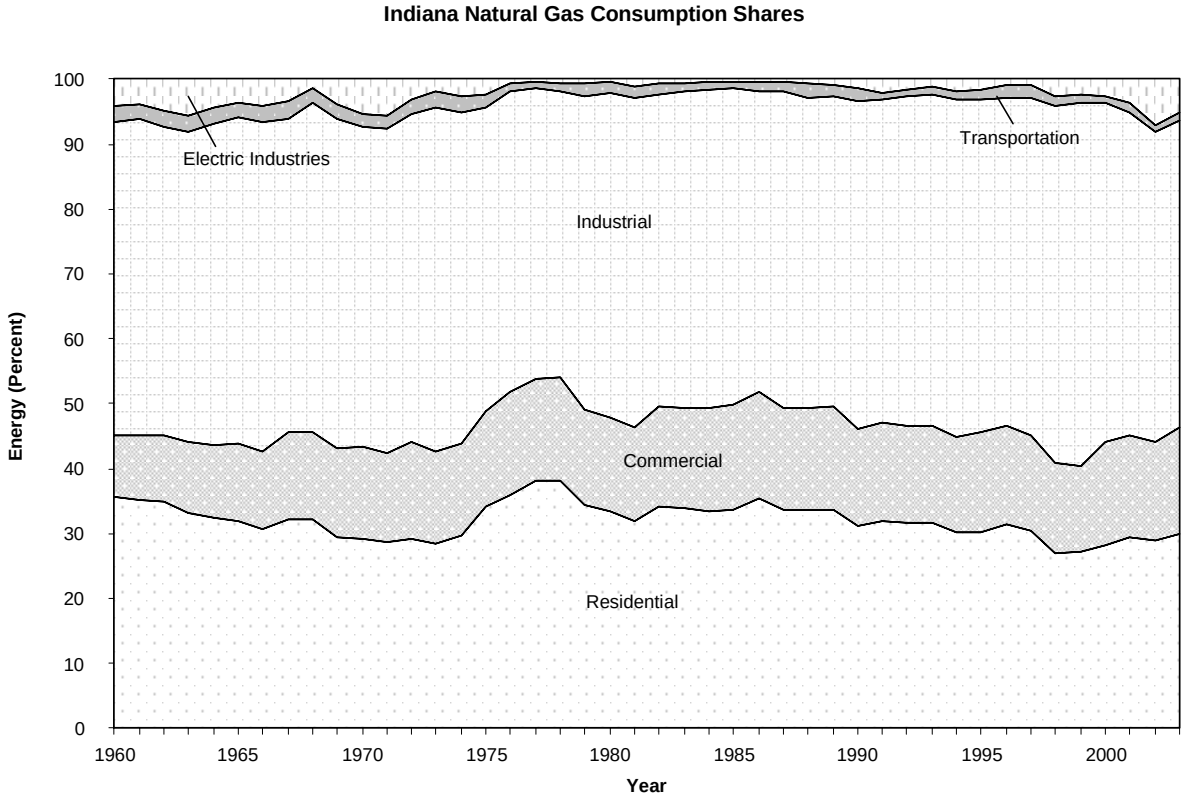

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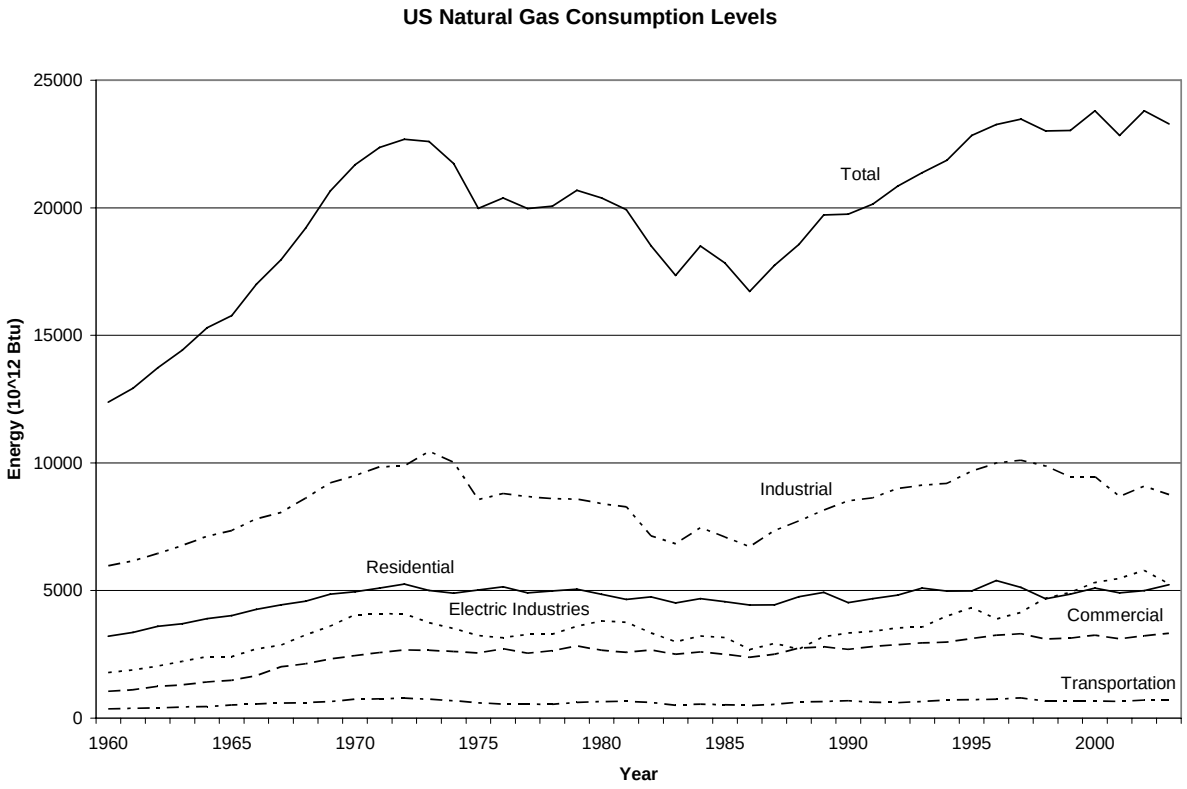


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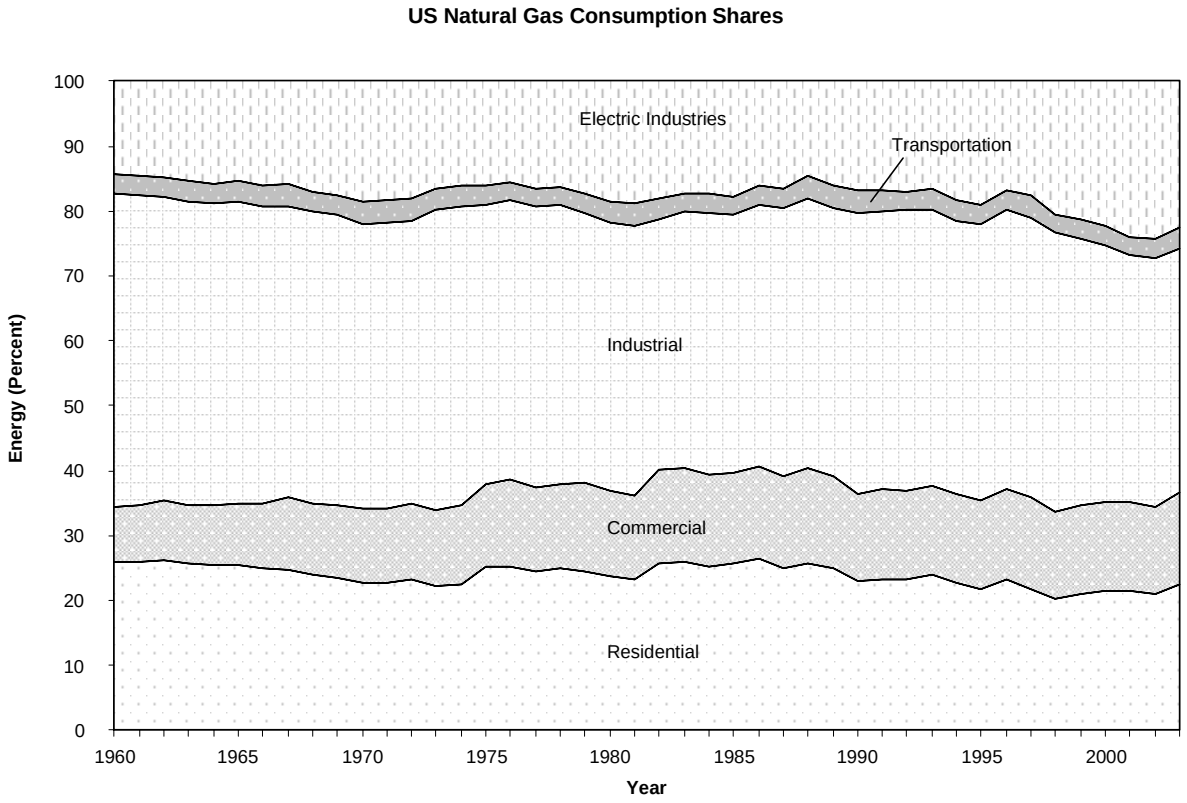

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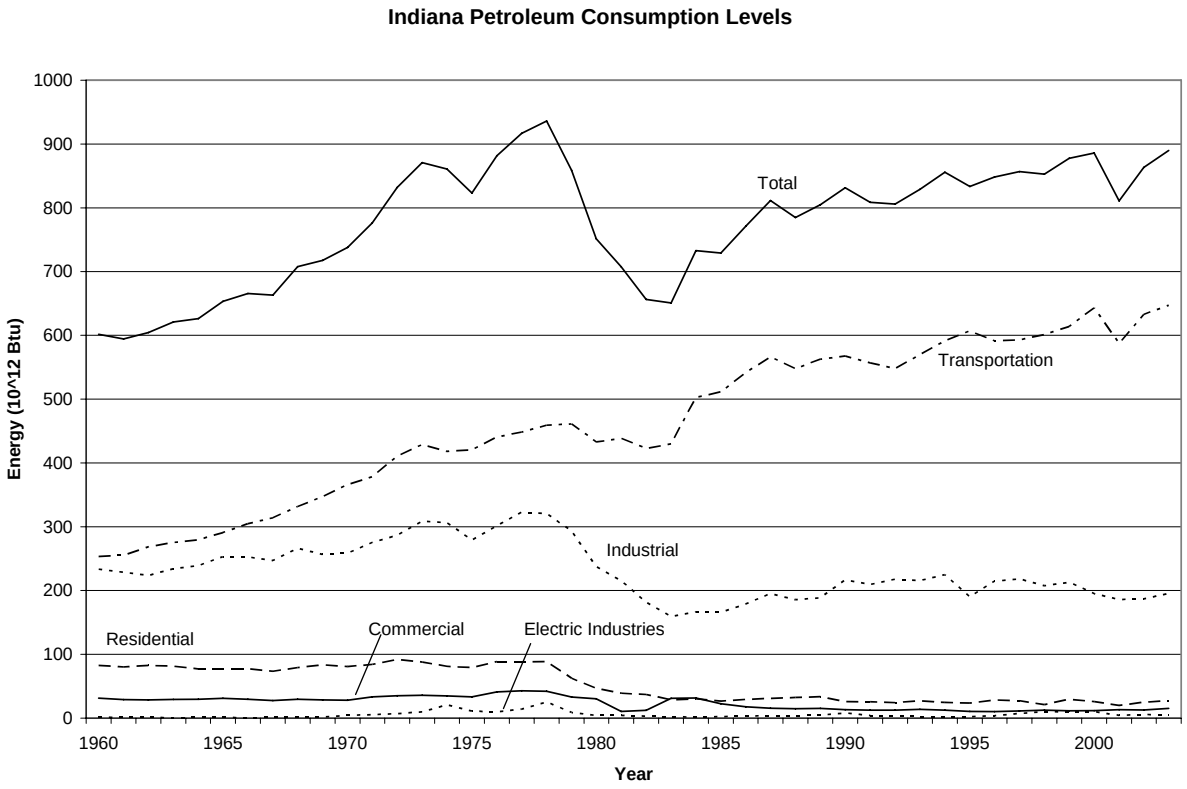


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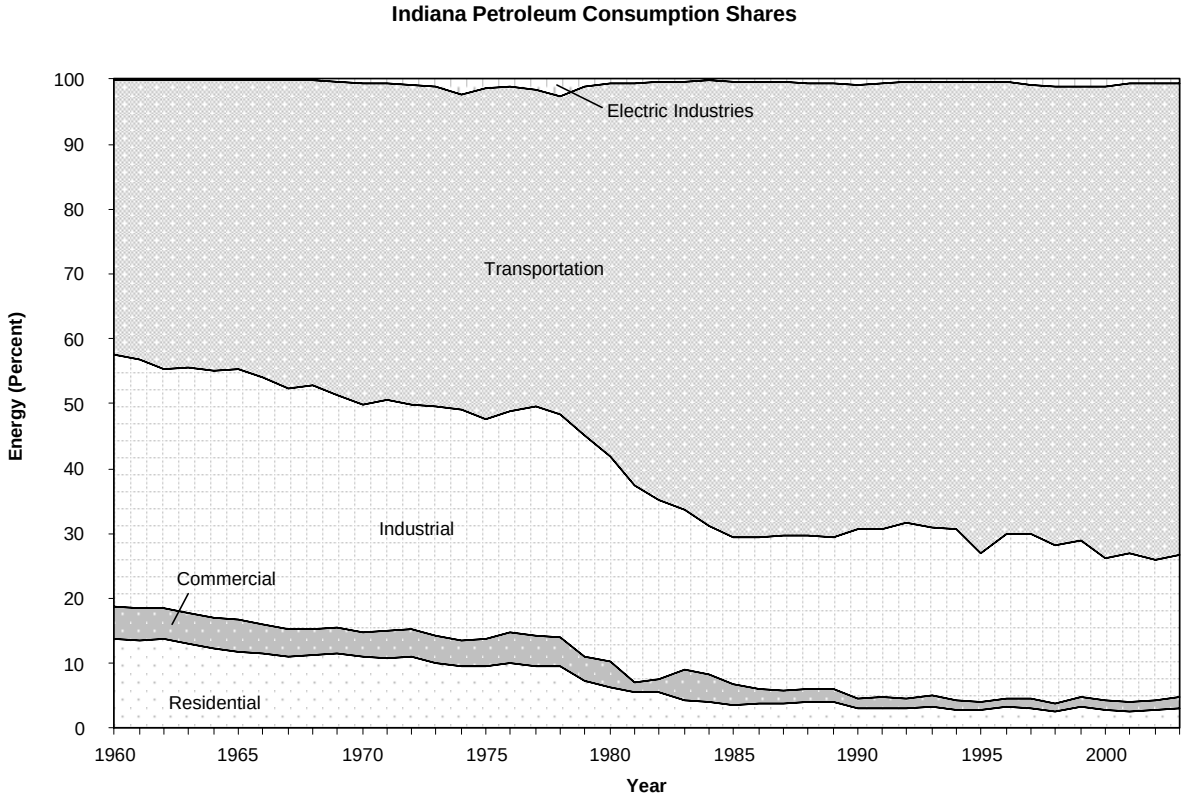

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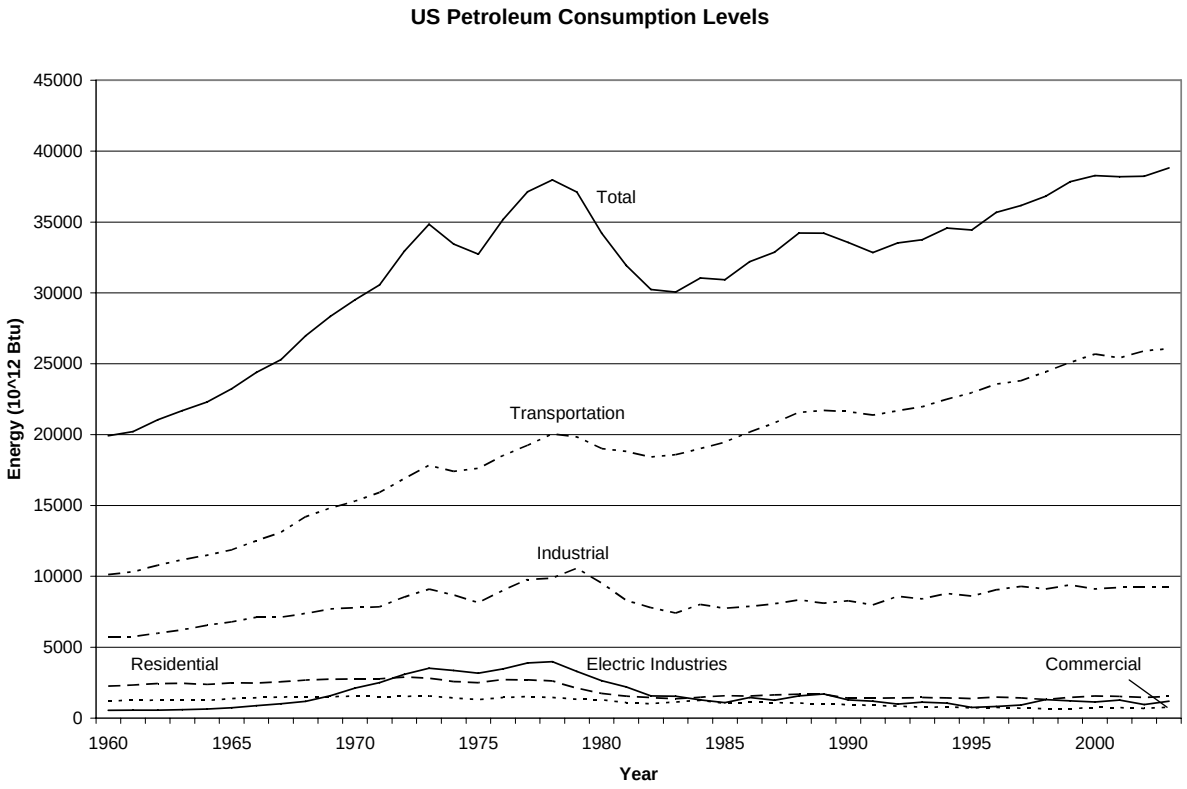


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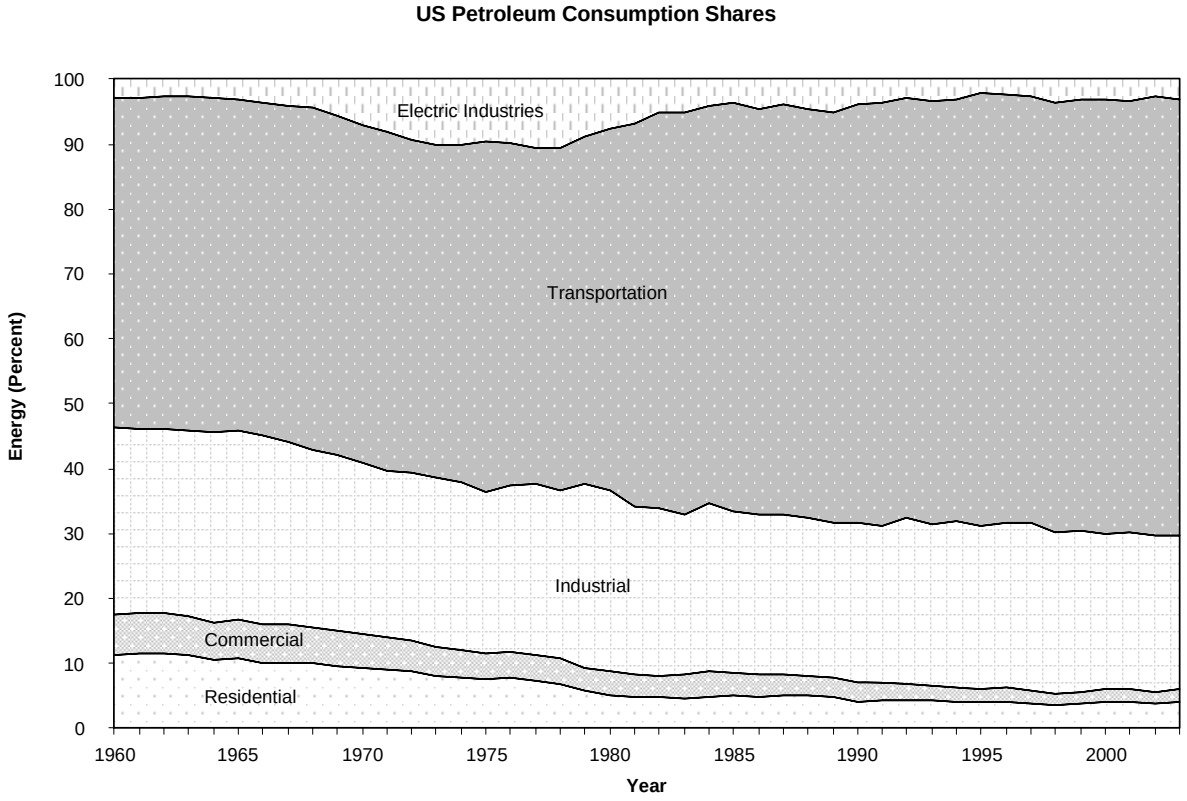

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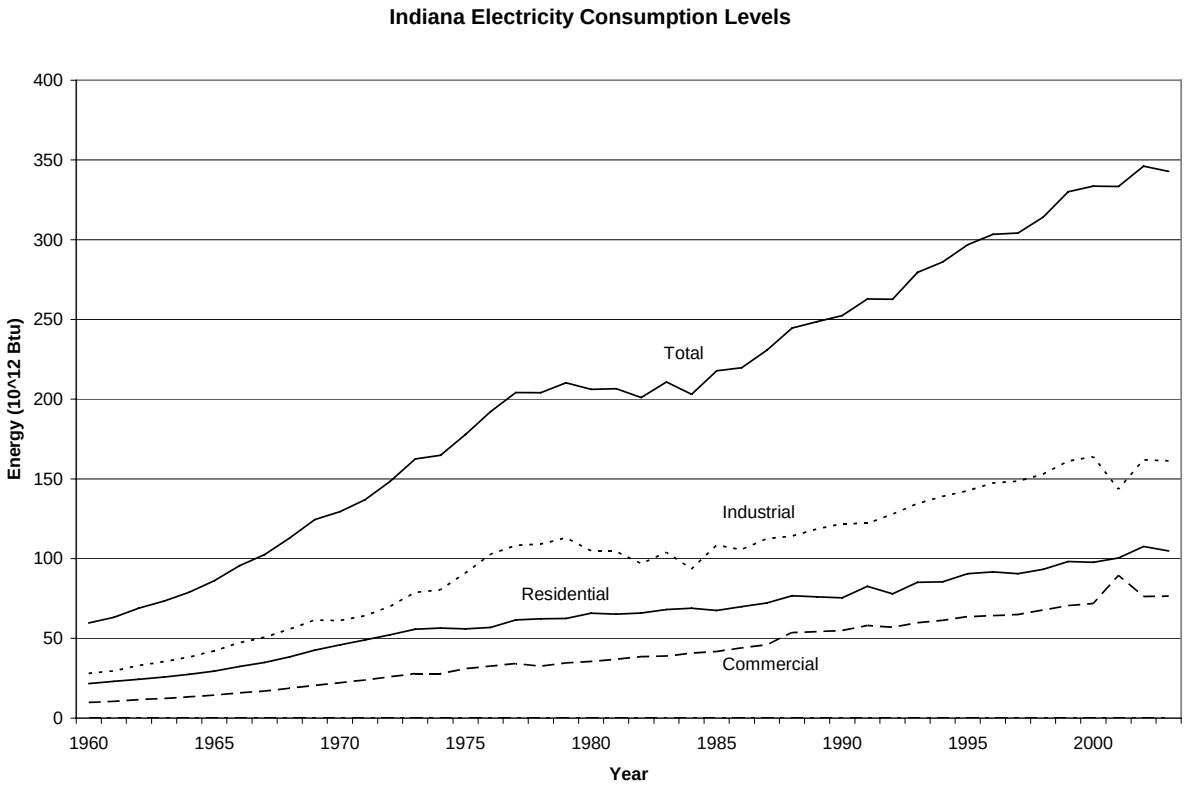


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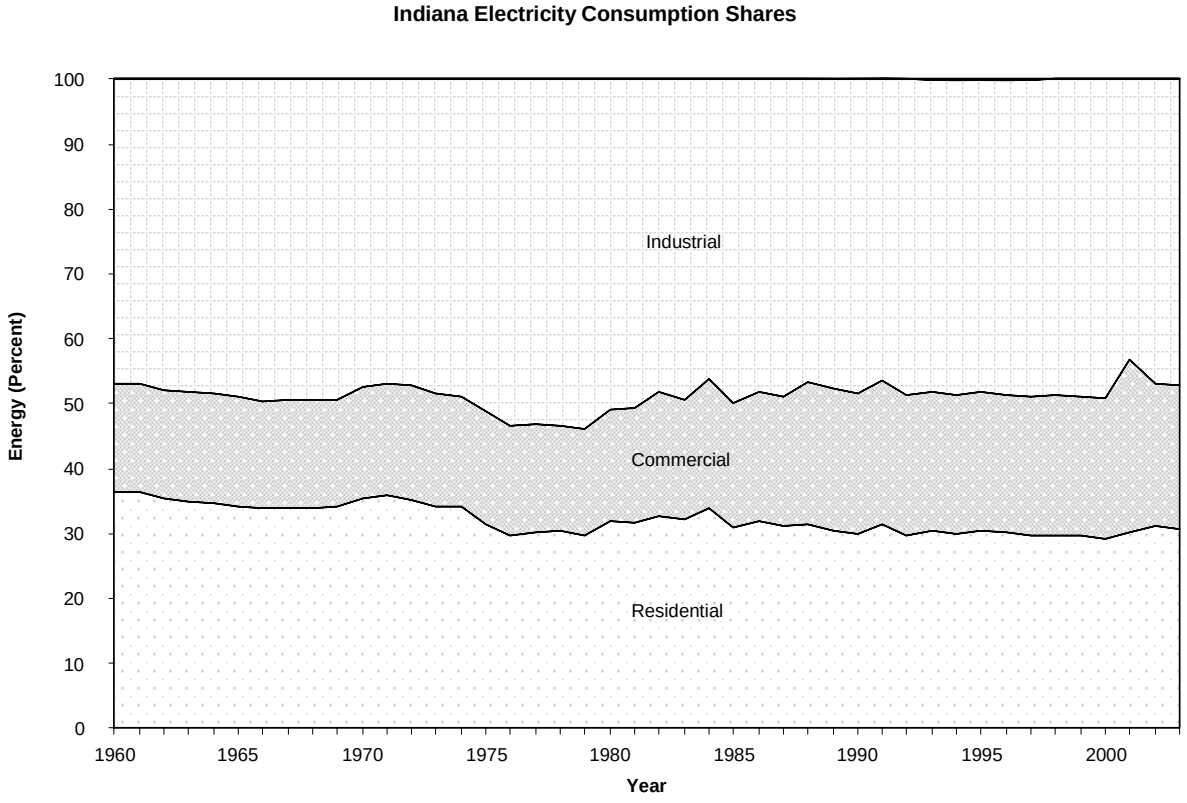

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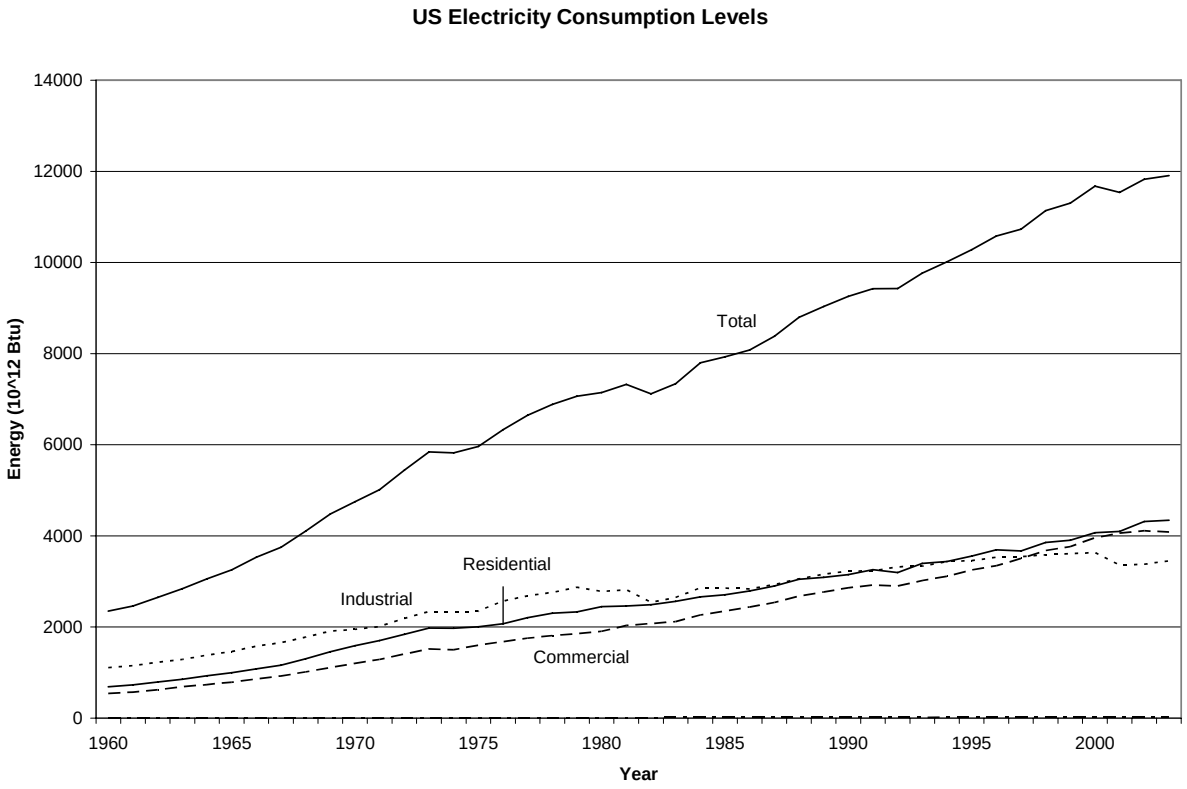


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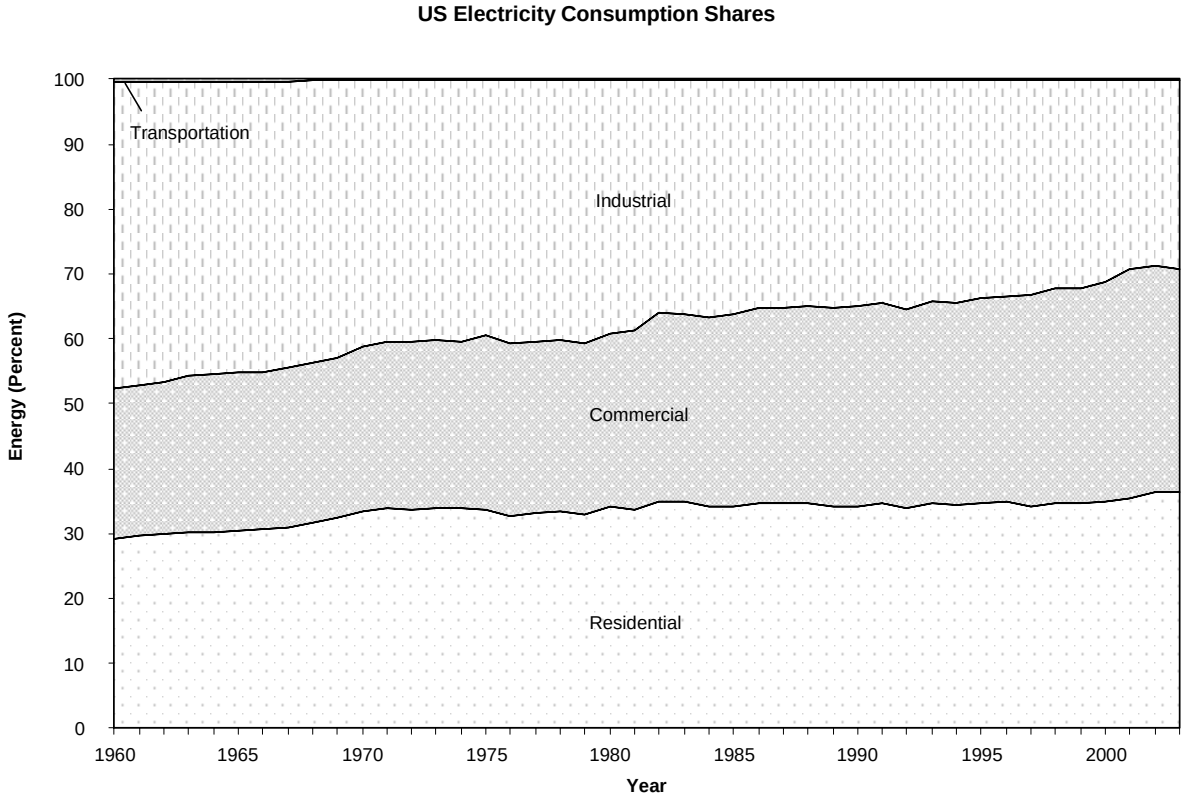

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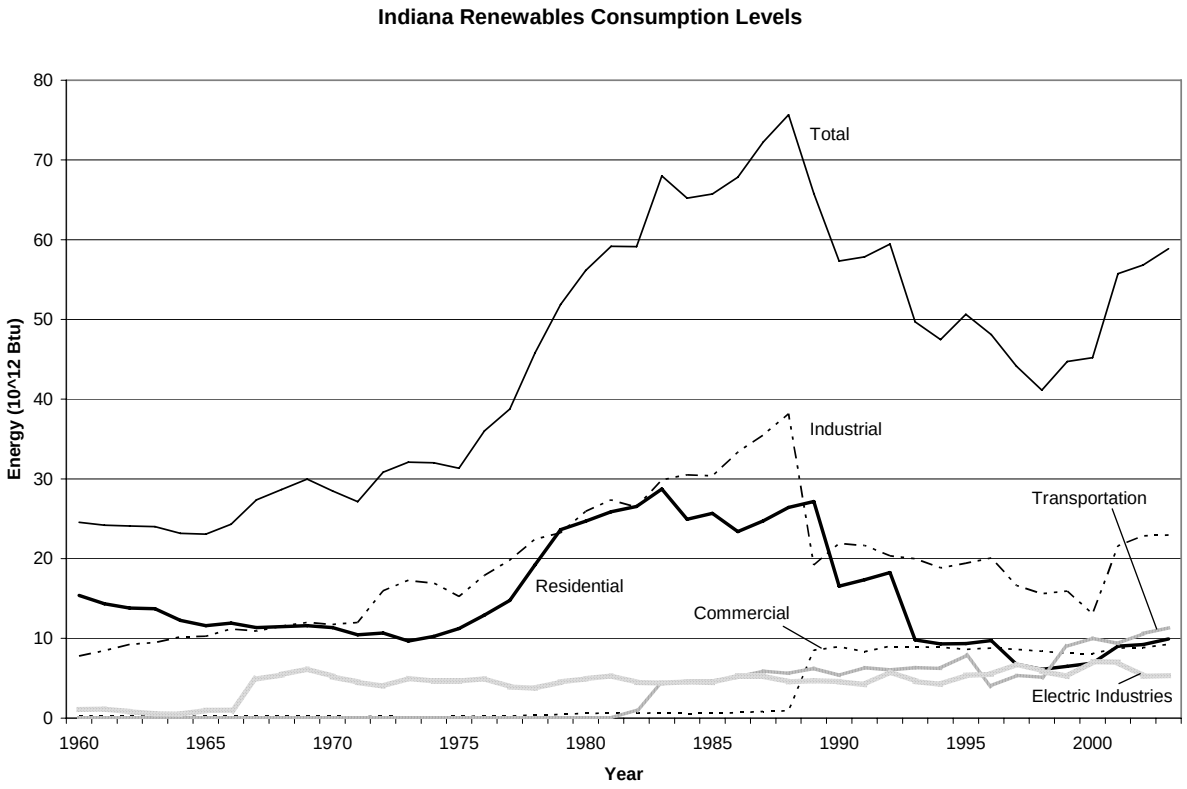


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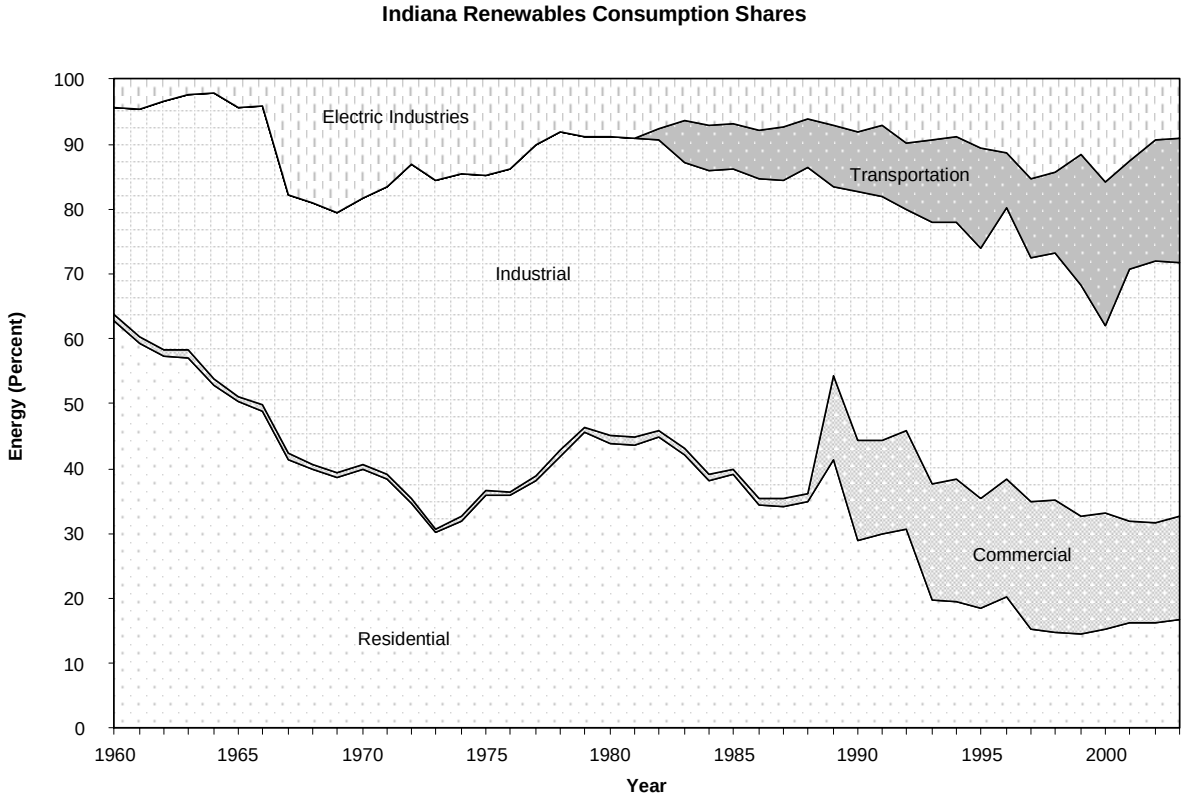

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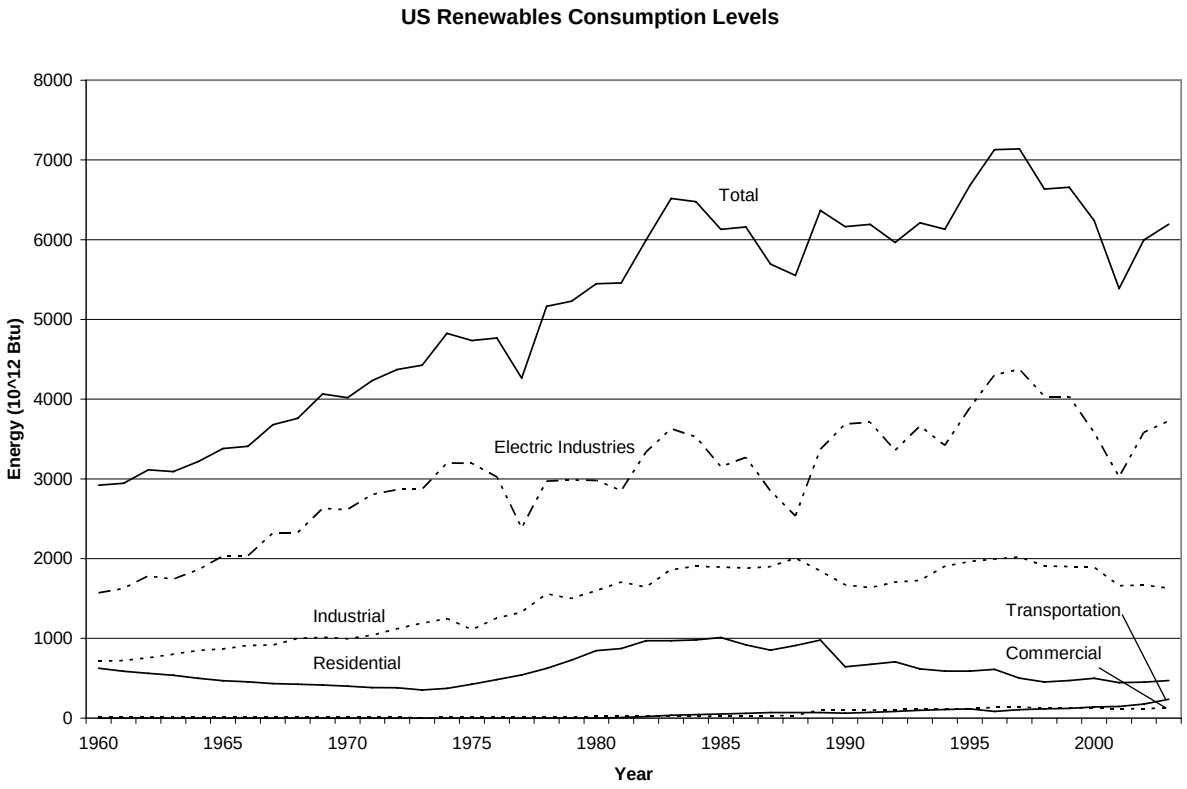


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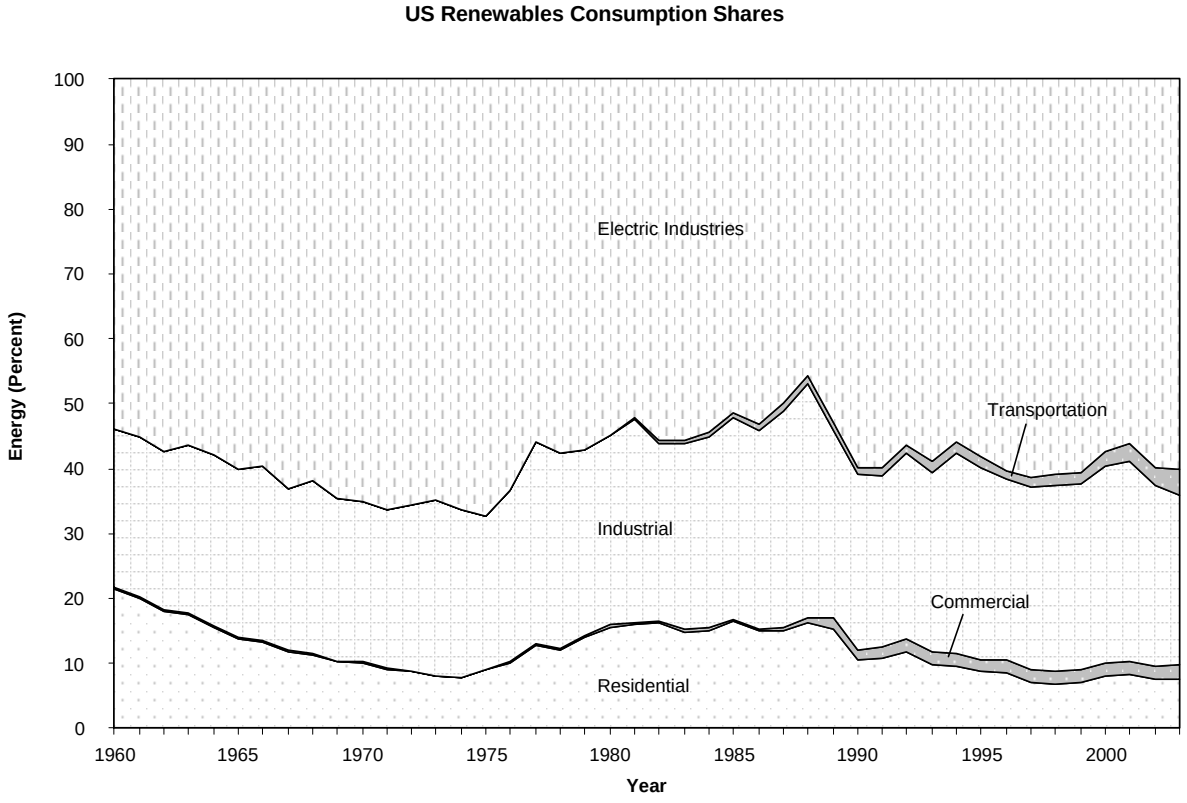

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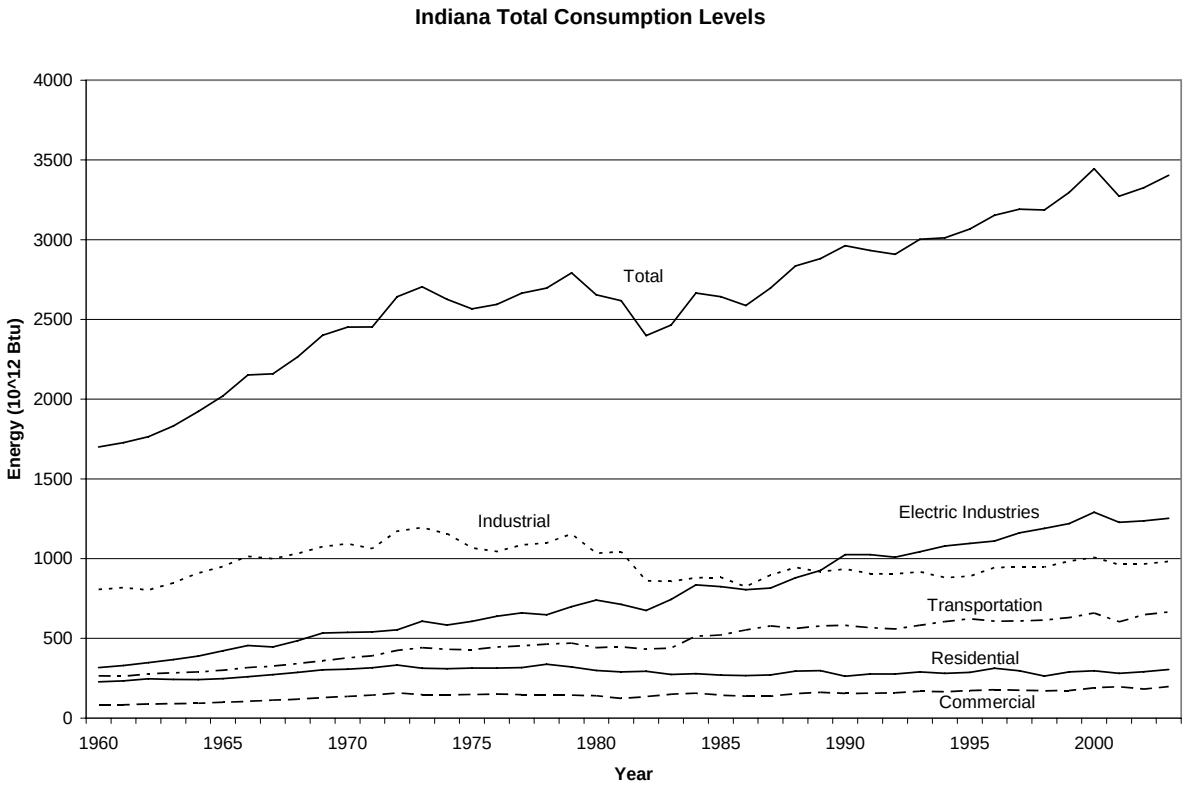


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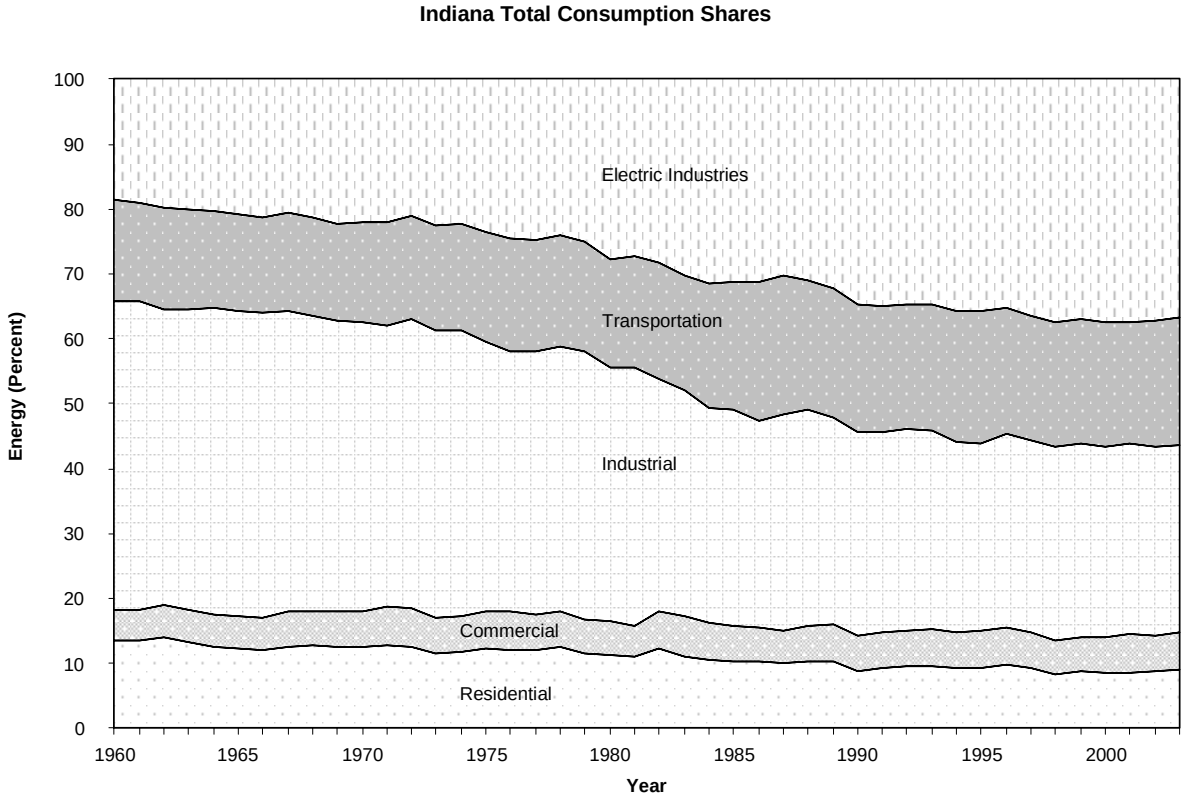

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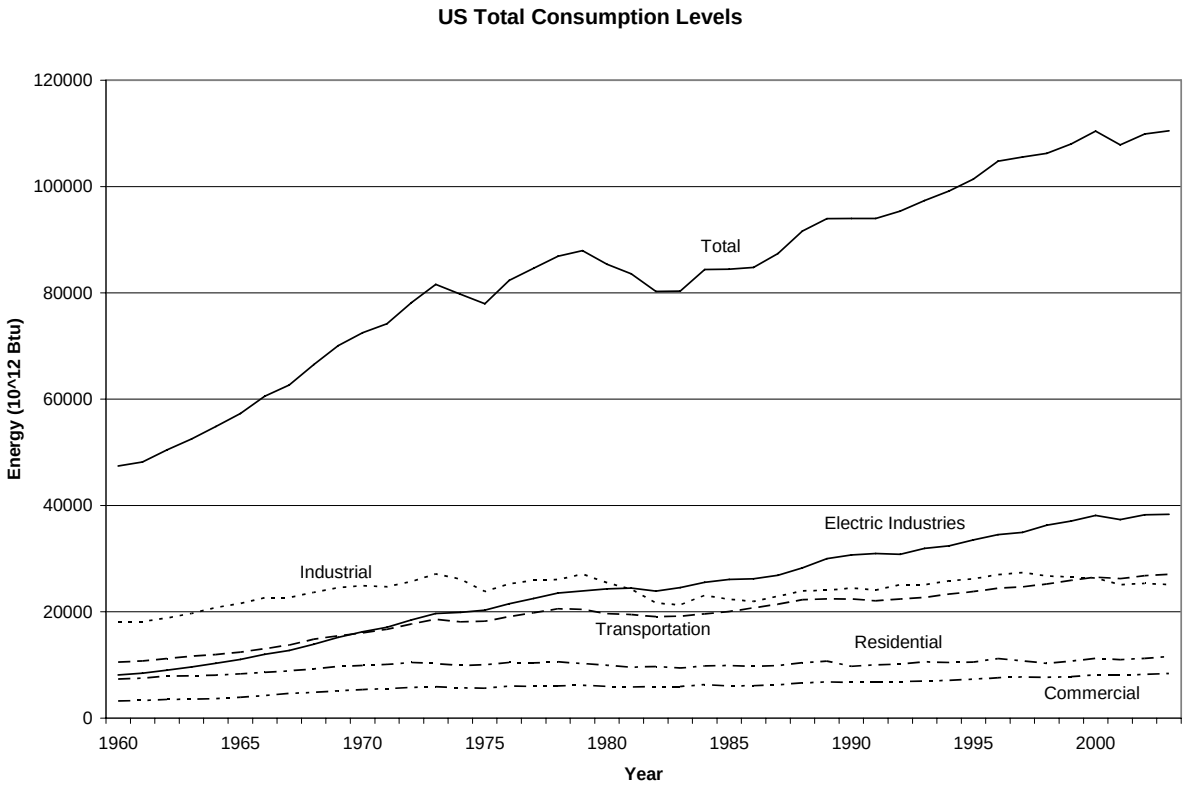


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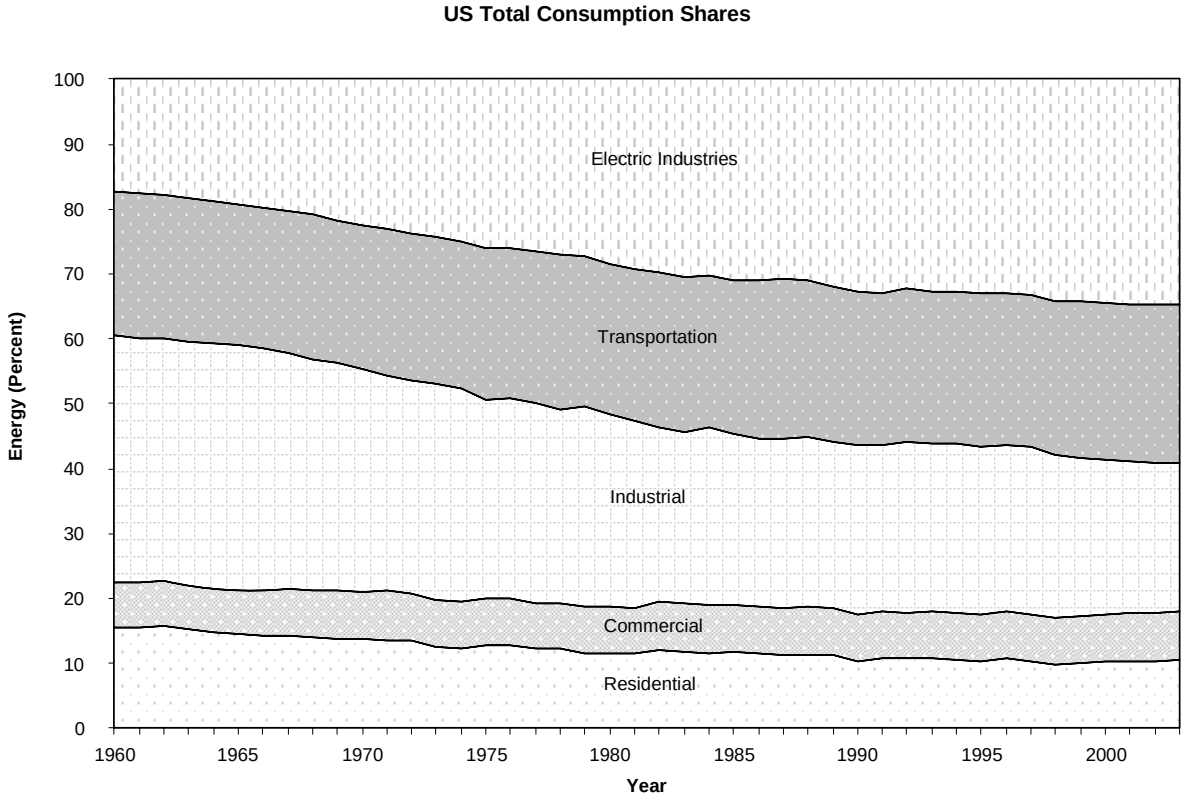


# Energy Intensity

The figures in this section pertain to energy use intensity. Two measures of intensity are considered: energy use per capita and energy use per dollar of economic activity. These intensity measures were constructed by dividing energy use by fuel type by either population or gross domestic product (GDP).

The population estimates were obtained from the U.S. Census Bureau <http://www.census.gov/popest/states> and the GDP values were obtained from the Bureau of Economic Analysis (BEA) <http://www.bea.gov/regional/gsp>. GDP is measured in chained weighted 2000 dollars thus is adjusted for inflation. Also note that BEA has renamed gross state product (GSP), the traditional measure of state economic activity, state GDP, thus the use of the term GDP when referring to economic activity in these Figures.

Energy use intensity in Indiana follows the same general pattern as that of the United States with per capita use increasing over time and per dollar GDP decreasing over time. However the intensity of use is higher in Indiana than the nation as a whole due to the state's relatively large manufacturing sector (with large, energy-intensive industries) and a climate that requires significant resources for winter heating and summer cooling. The fuel mixes are different due to Indiana's high reliance upon coal as a source of electricity.

Figures 45 through 48 contain some double counting in the calculations of the intensity measures for total energy as described in the previous section. The remaining figures in this section are based on EIA data that include an adjustment to remove double counting in total energy use.

Figures 49 and 50 are simple scatter plots of state total energy use versus population and GDP for calendar year 2003. In general, Indiana is similar to most other states but is somewhat more energy intensive. Figures 51 and 52 show this more clearly by ranking 2003 energy intensity by state.

Figure Page

**Figure 45**

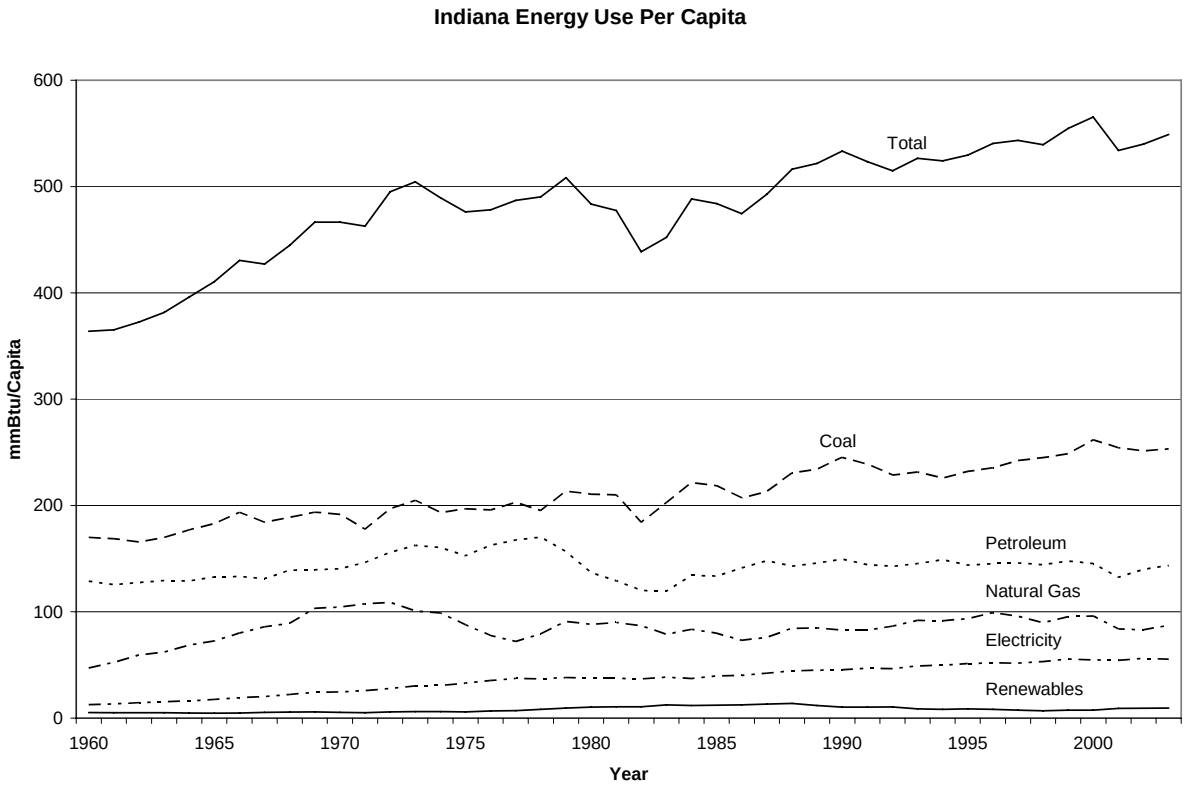



**Figure 46**

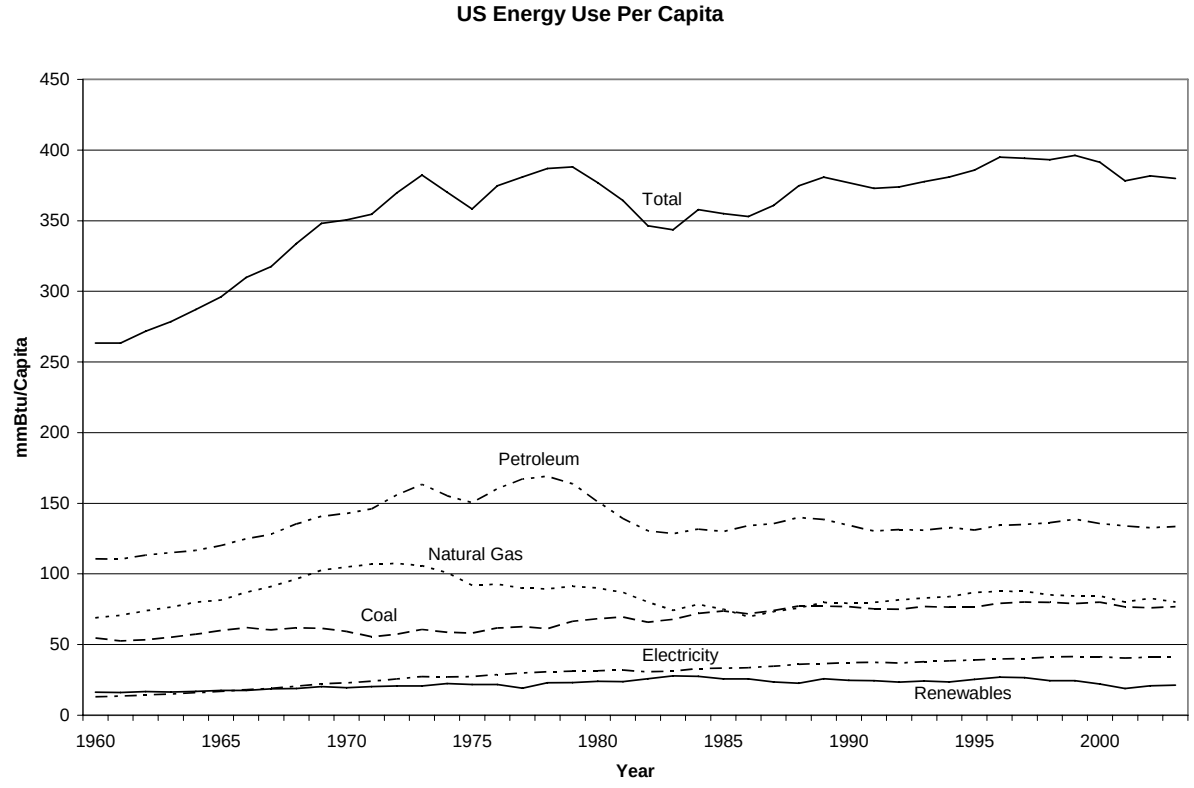


**Figure 47**

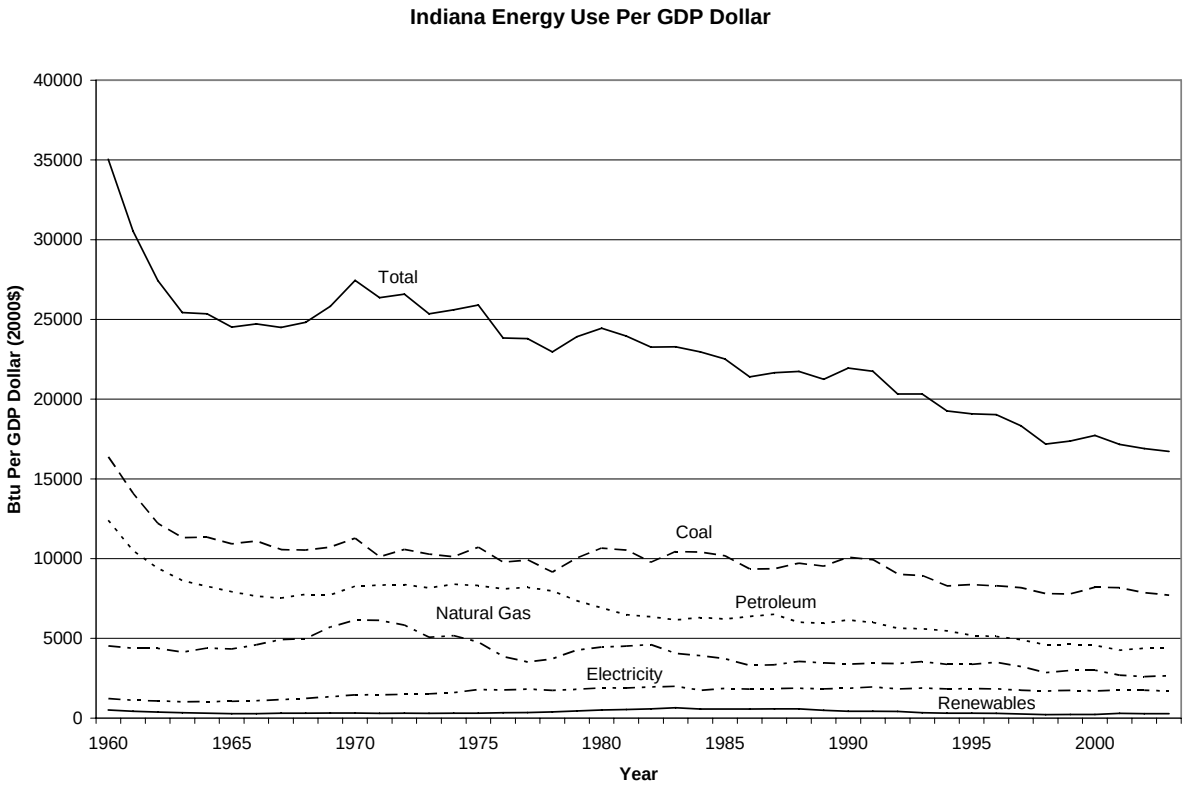



**Figure 48**

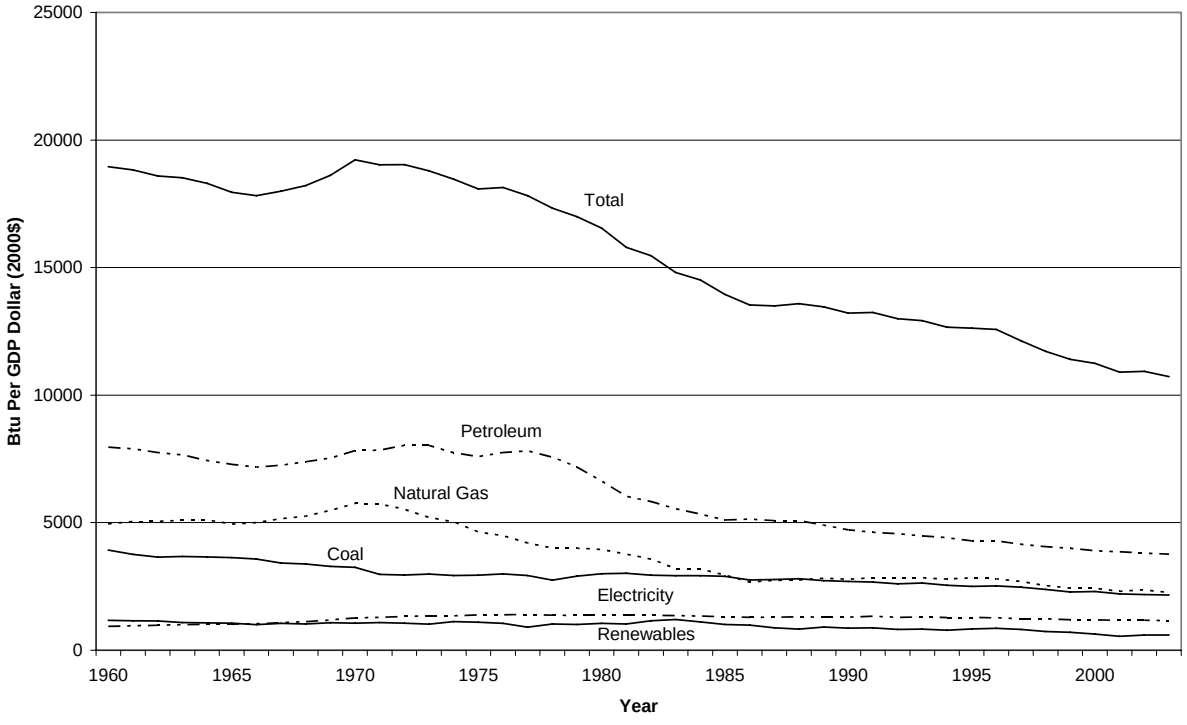


**Figure 49**

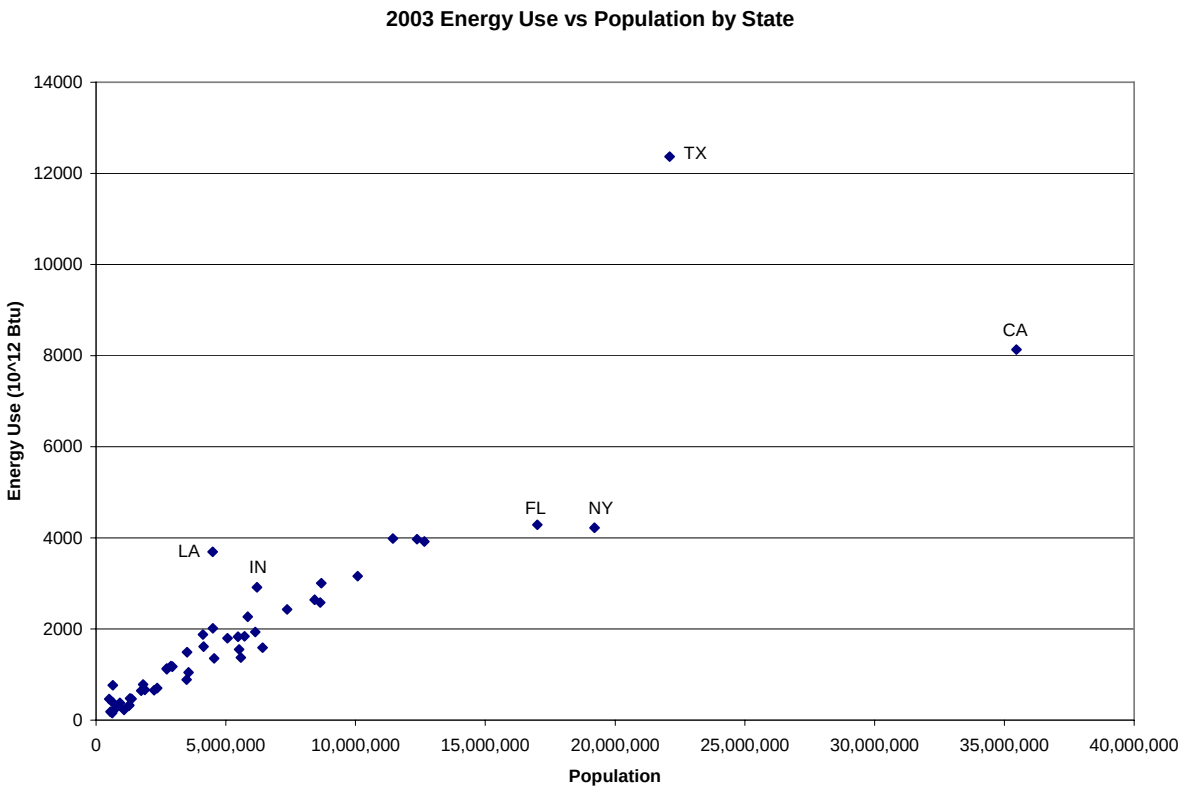



**Figure 50**

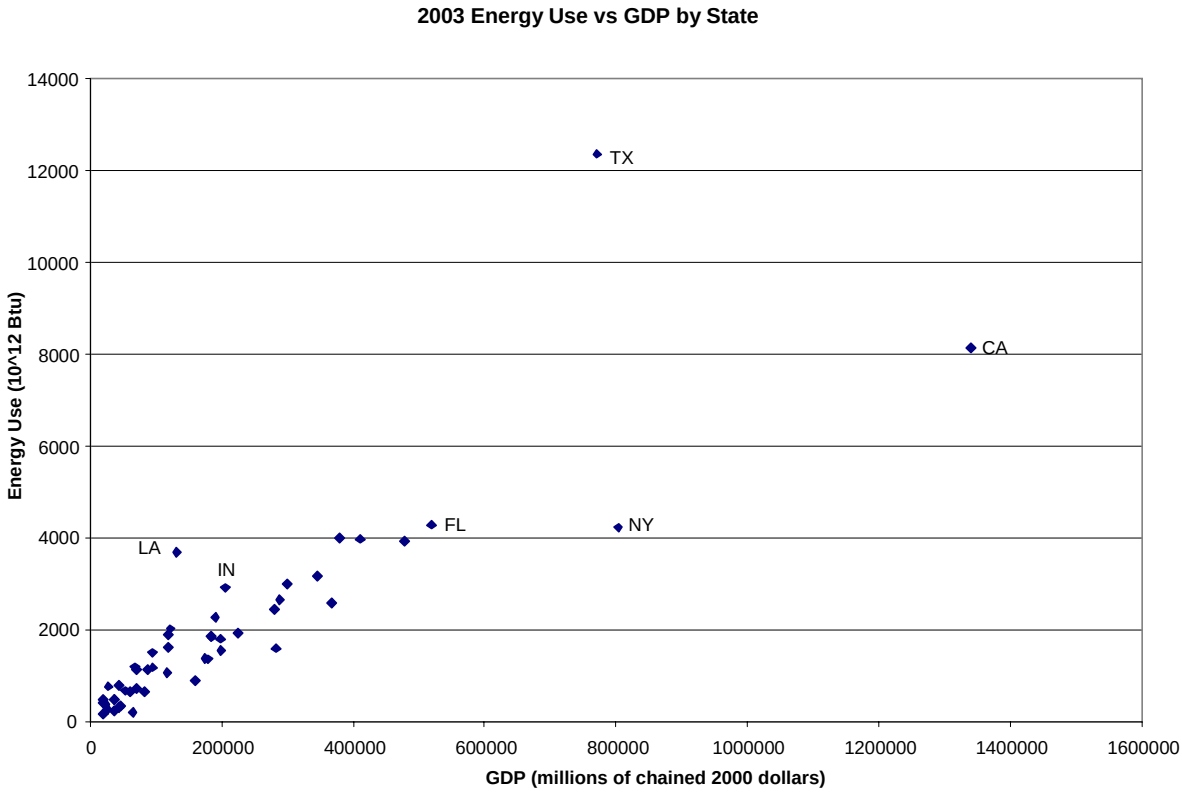


**Figure 51**

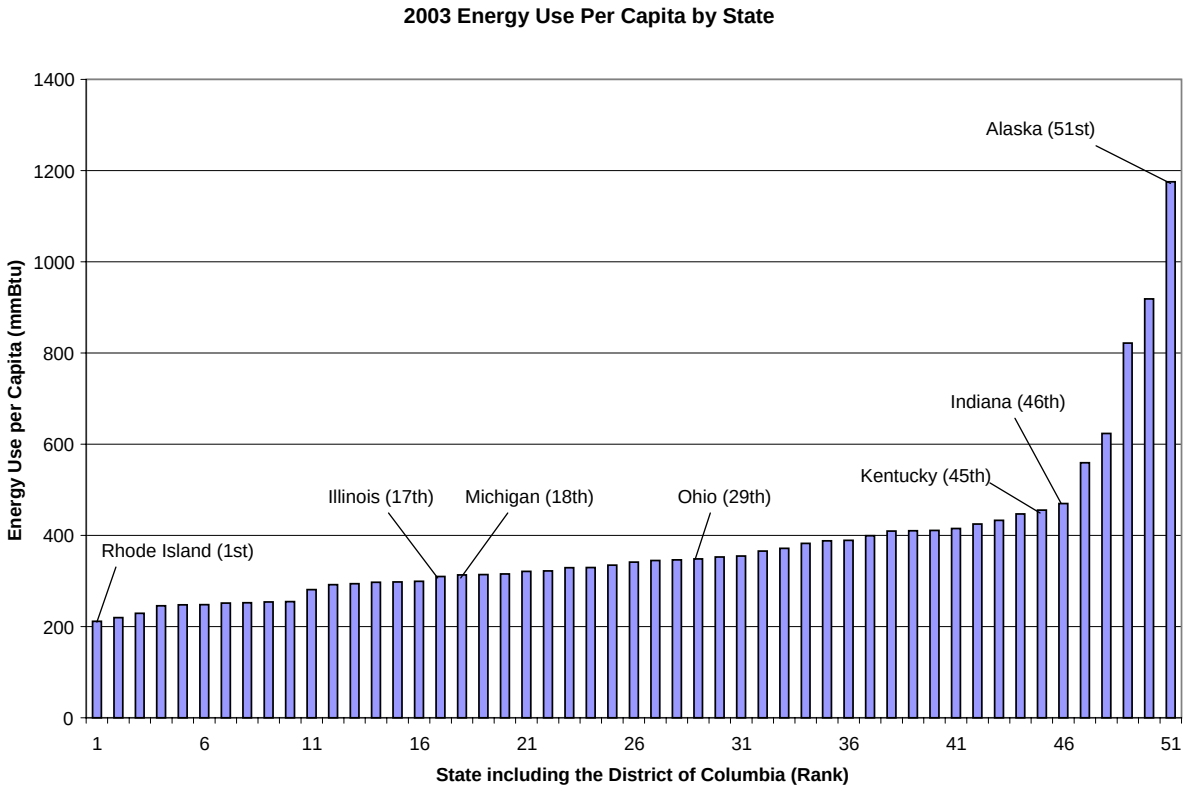
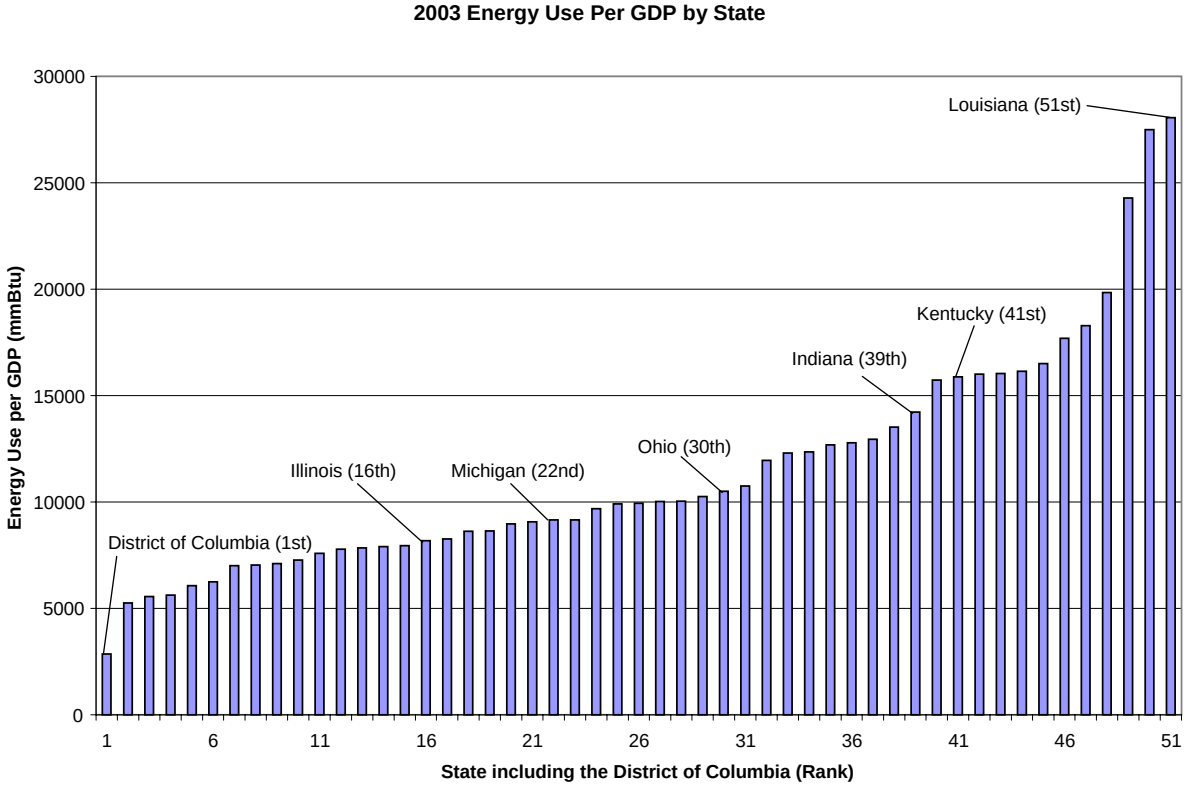



**Figure 52**



# Prices

The first set of figures in this section, Figures 53 through 60, is a series of graphs of energy prices over time for Indiana and the United States. These figures were assembled using the same set of Energy Information Agency data files as the energy use figures in the previous sections.

The prices of all energy sources shown are expressed in nominal dollars per million British thermal units ($/mmBtu). Thus, the prices of various fuels are readily plotted using a common axis. The prices are average annual retail prices to end users, thus intrayear variations are masked as is any short term volatility in the underlying wholesale markets. This price data is currently unavailable for recent years, thus the last year included in the figures is calendar year 2003.

In general, Indiana nominal electricity prices have been remarkably stable since the mid 1980s (real, or inflation adjusted electricity prices have fallen). The aberration in 2001 for the Indiana commercial sector (Figure 55) and industrial sector (Figure 57) electricity prices is most likely due to a data error as noted in a previous section. In contrast, United States electricity prices have drifted upward over the same time period.

Coal prices have been stable for both Indiana and the nation since the late 1970s. In contrast, petroleum and natural gas prices tended to increase periodically with short periods of stability.

The last four figures in this section show the state by state ranking of calendar year 2006 electricity prices ($/kwh) for the residential, commercial, and industrial sectors and for their aggregate. It is interesting that Indiana ranks 13$^{th}$, 15$^{th}$, and 14$^{th}$ respectively for the individual sectors but ranks 9$^{th}$ in aggregate. This result is caused by a combination of two factors; first Indiana industrial sector electricity use exceeds that of both the commercial and residential sectors, and second industrial sector prices are the lowest of the three sectors.

The data source for Figures 61 through 64 is the EIA. State prices of other fuels are also available. <http://tonto.eia.doe.gov/state/SEP_MorePrices.cfm>.

Figure Page

**Figure 53**

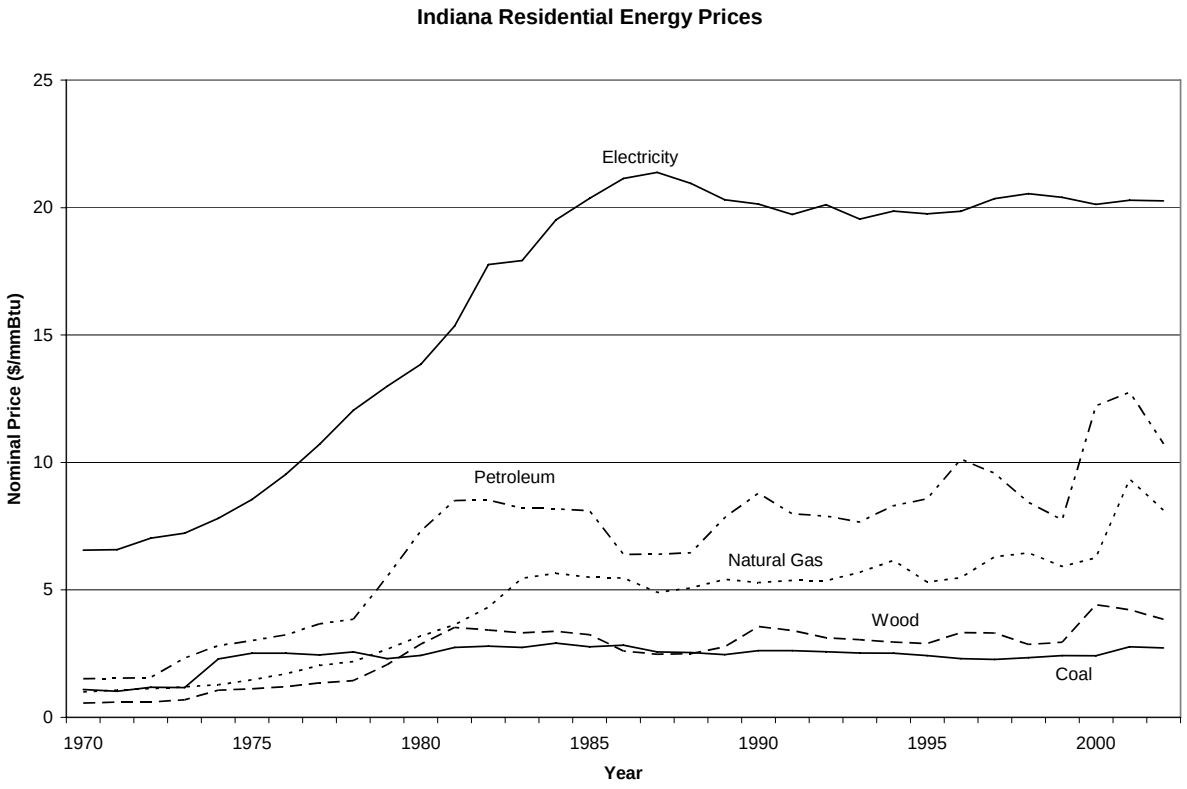



**Figure 54**

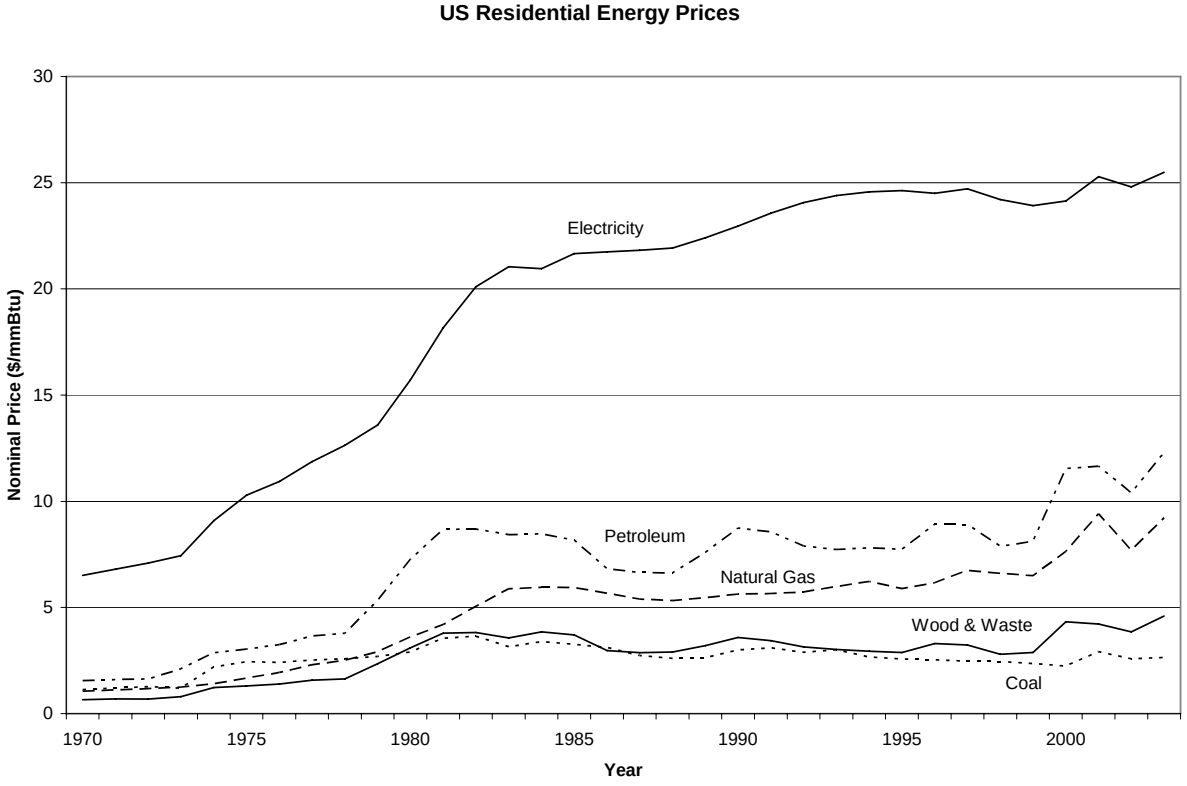


**Figure 55**

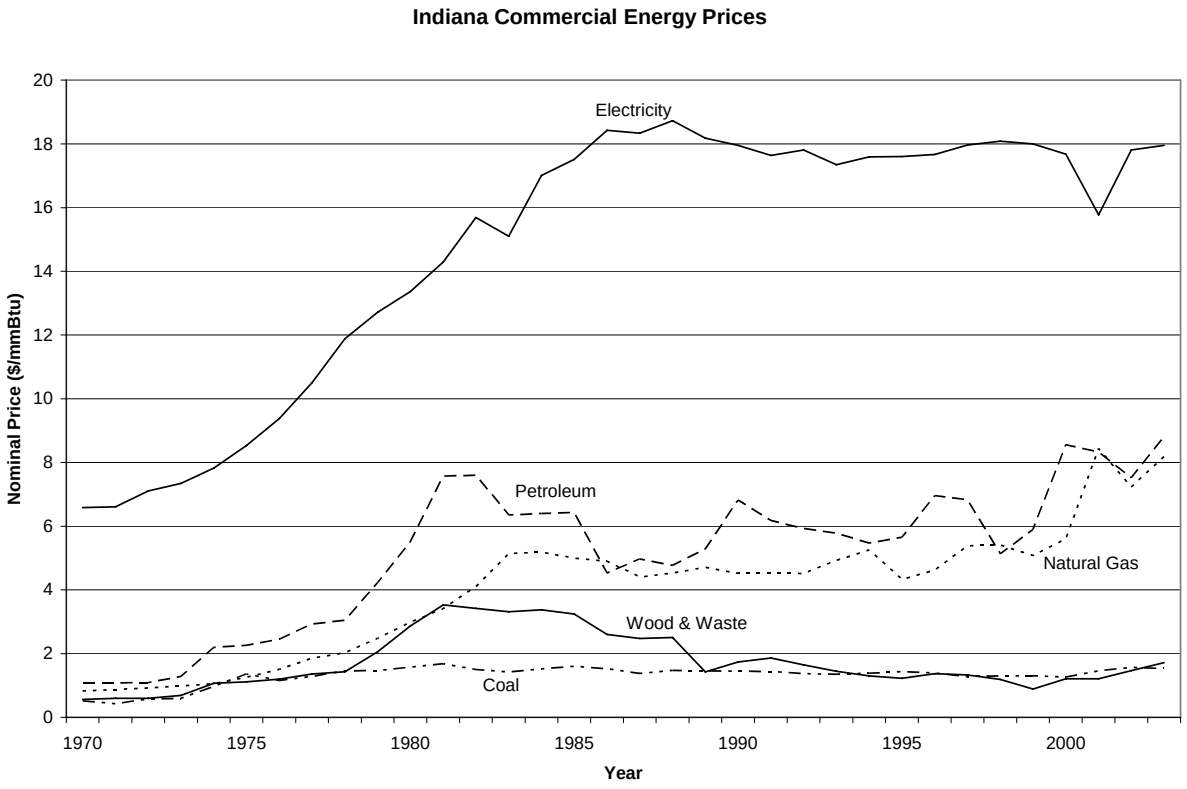



**Figure 56**

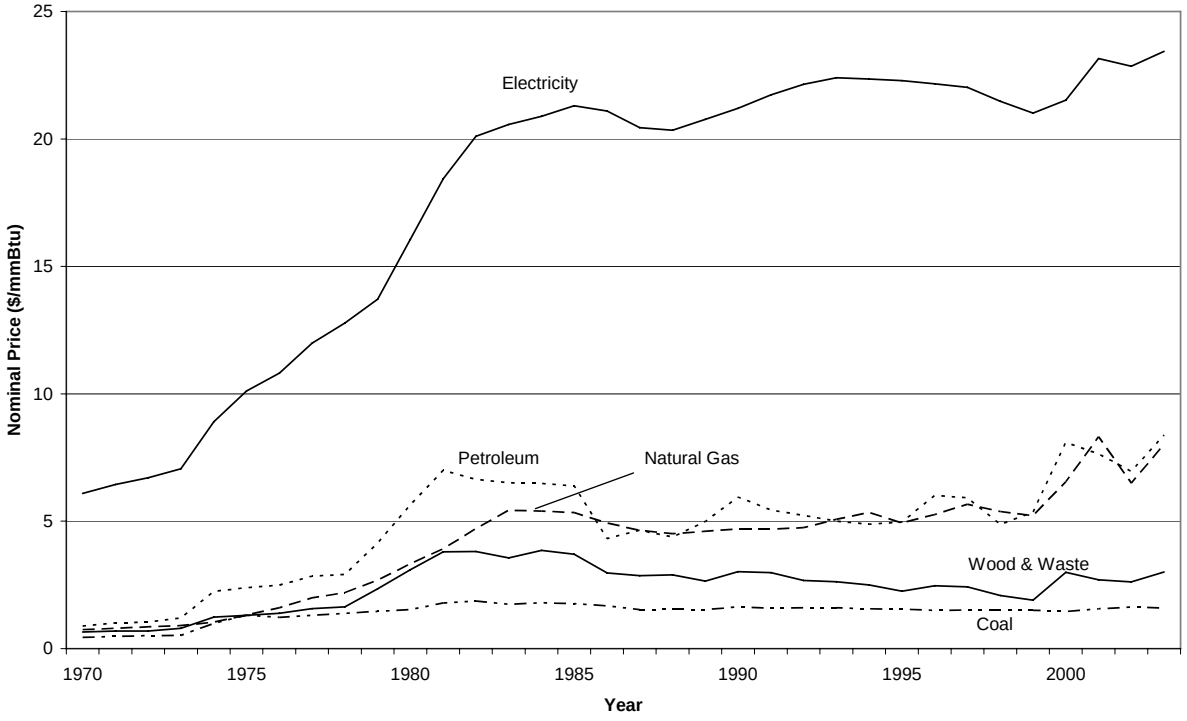


**Figure 57**

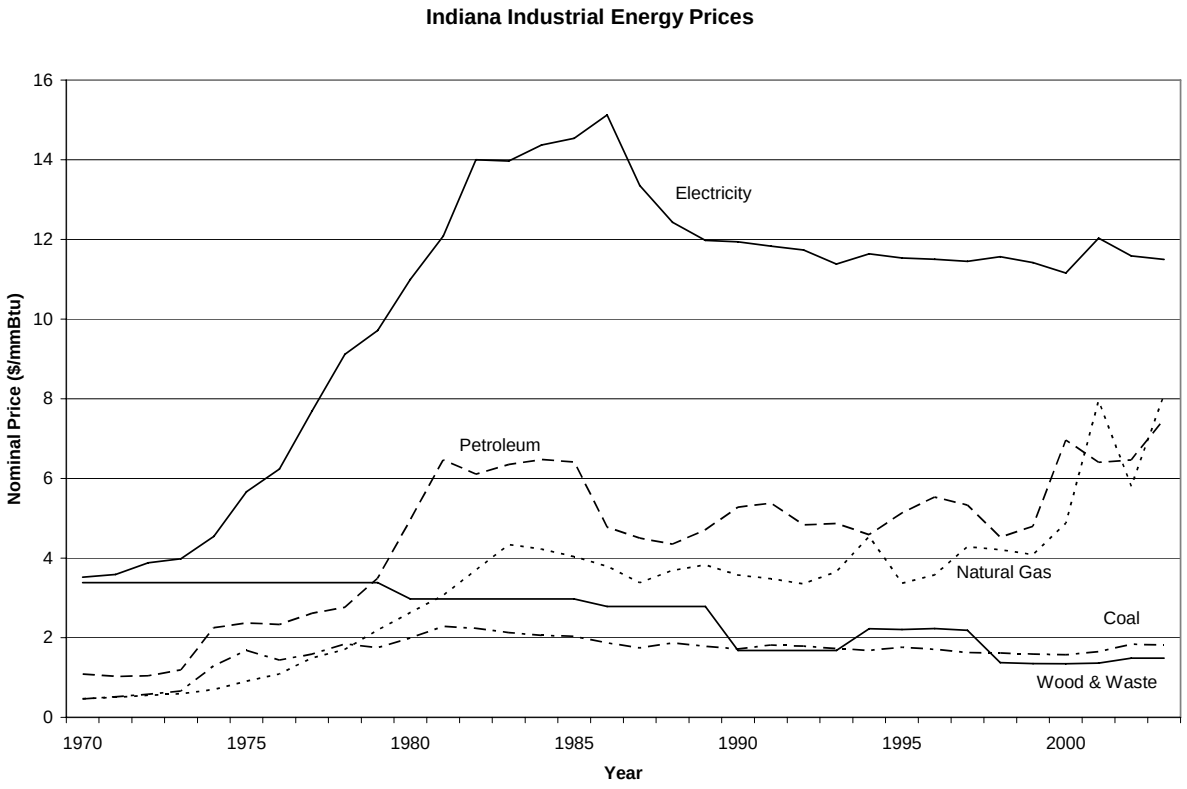



**Figure 58**

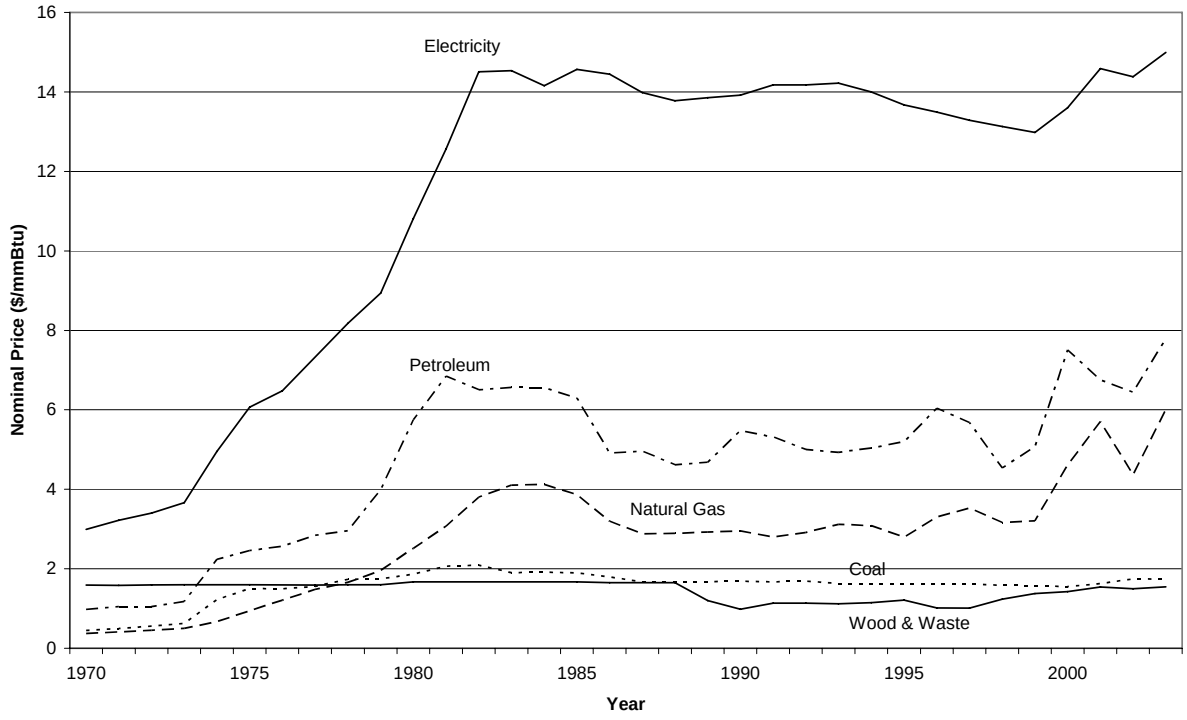


**Figure 59**

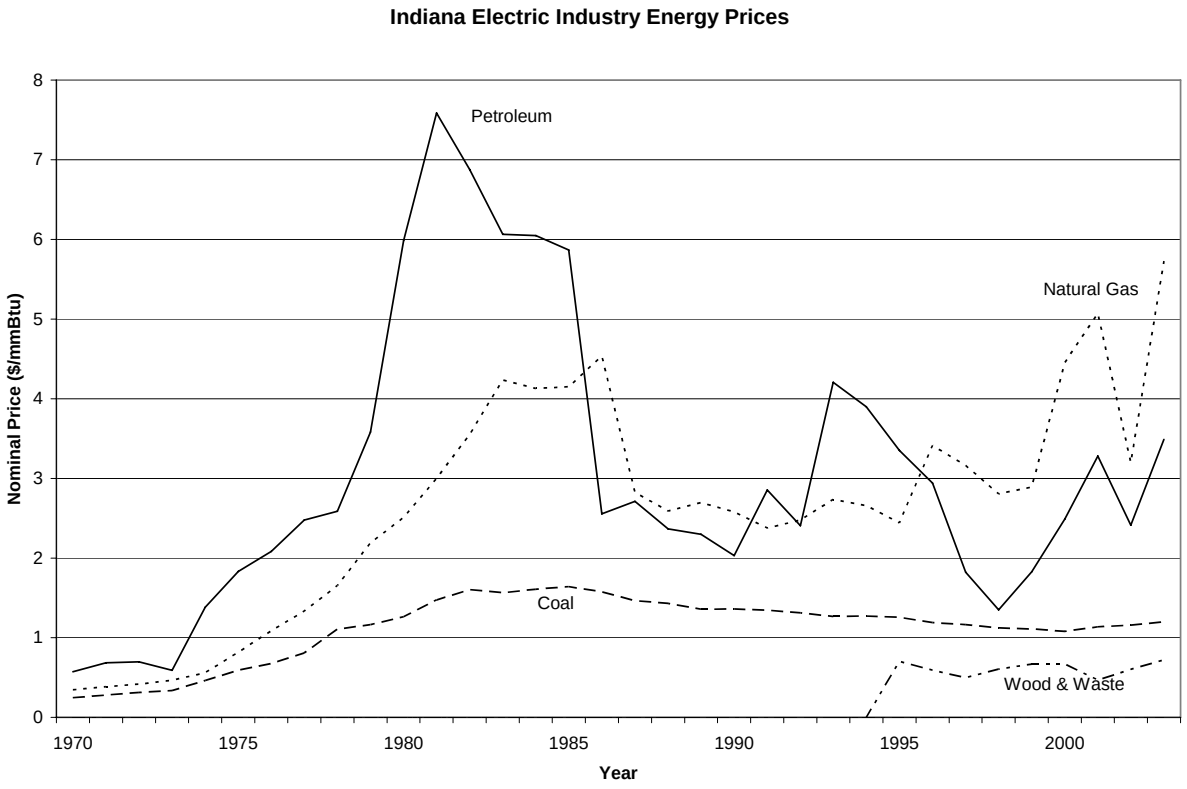



**Figure 60**

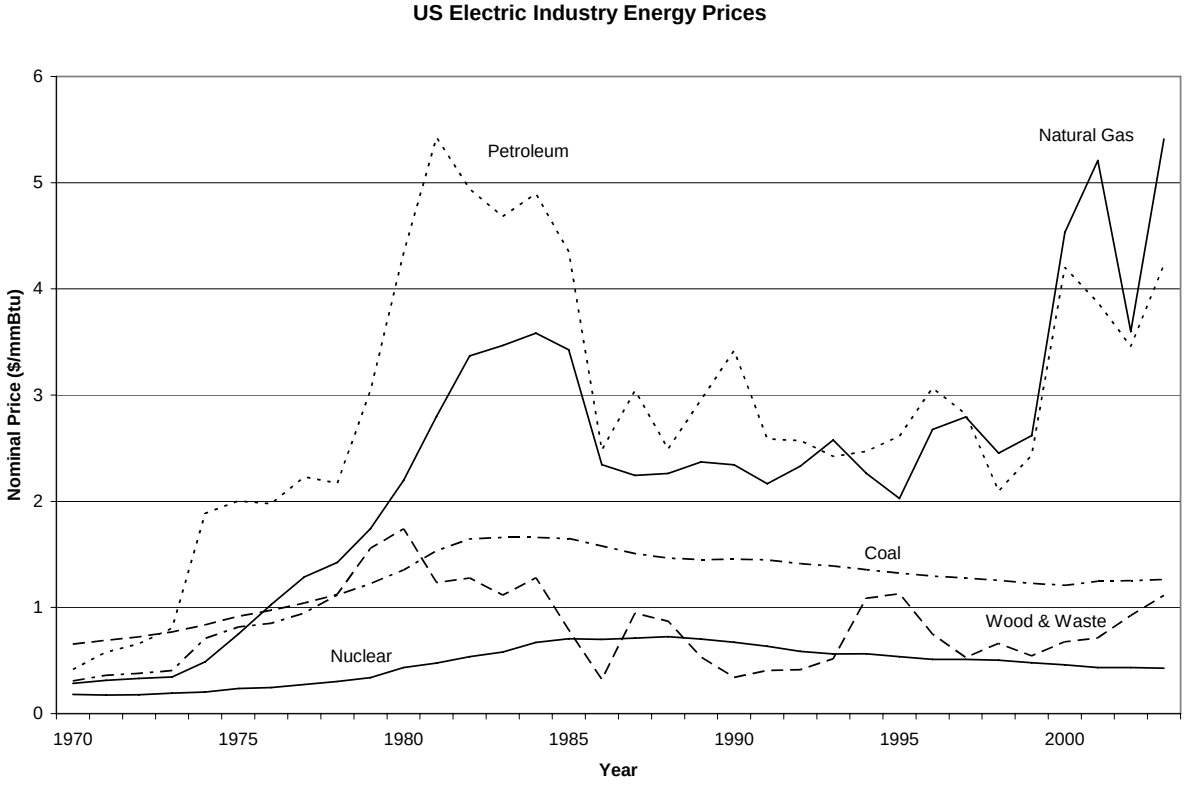


**Figure 61**

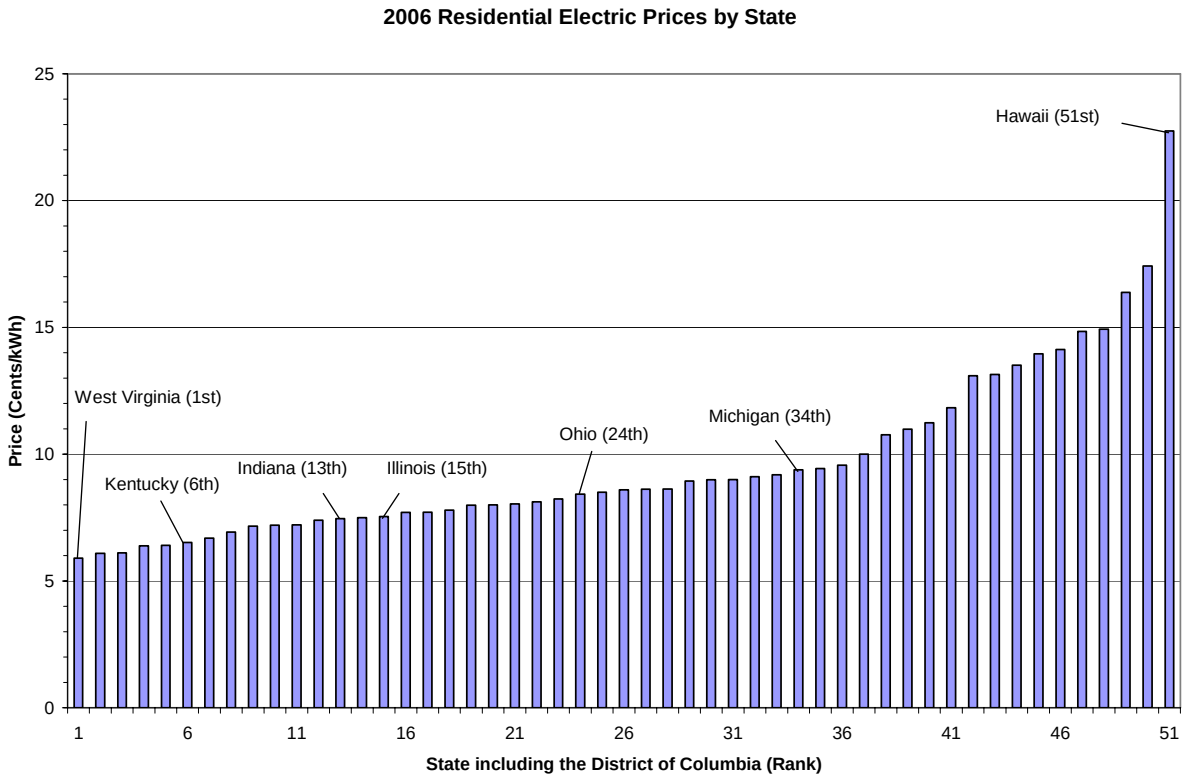



**Figure 62**

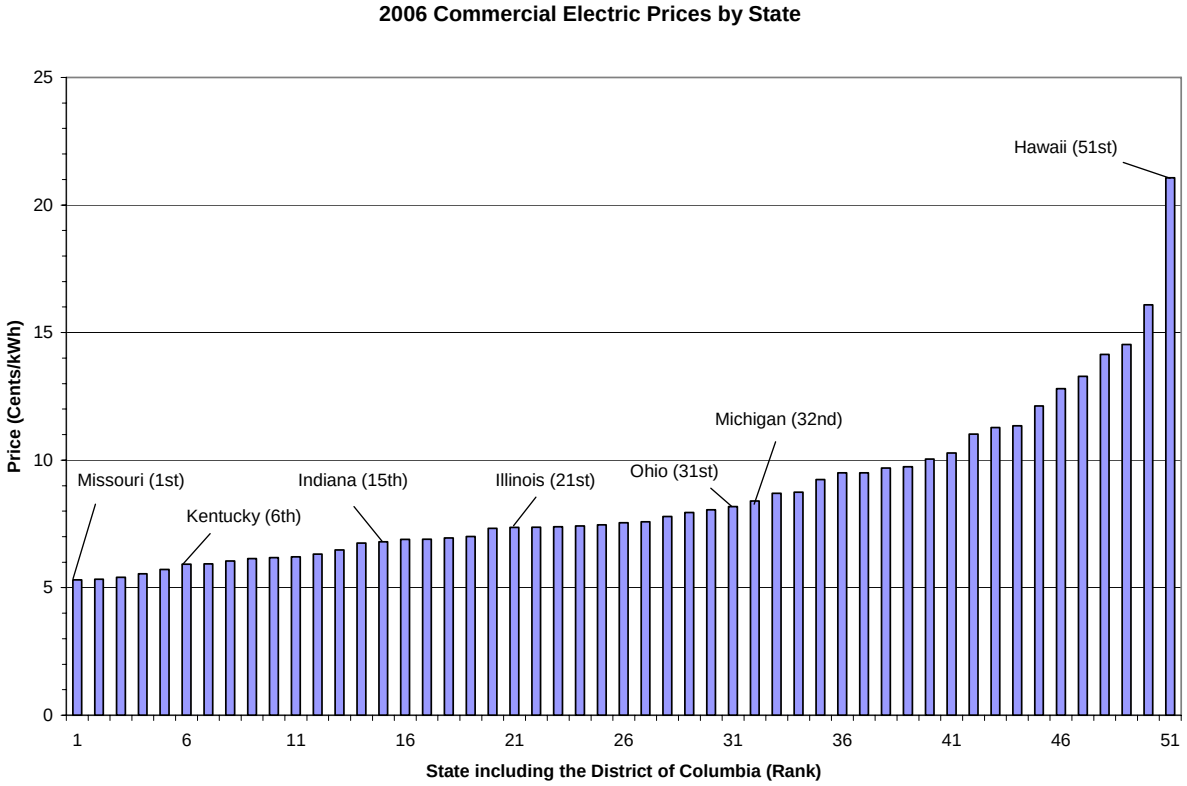


**Figure 63**

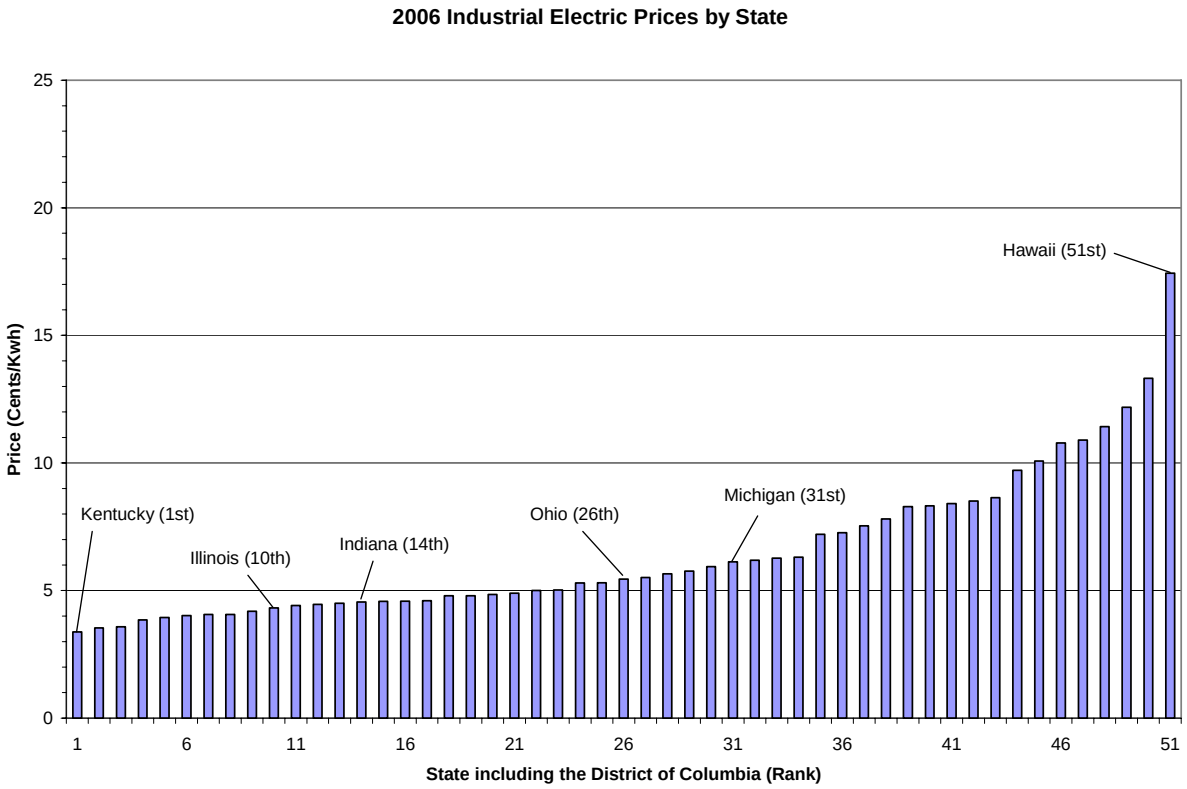
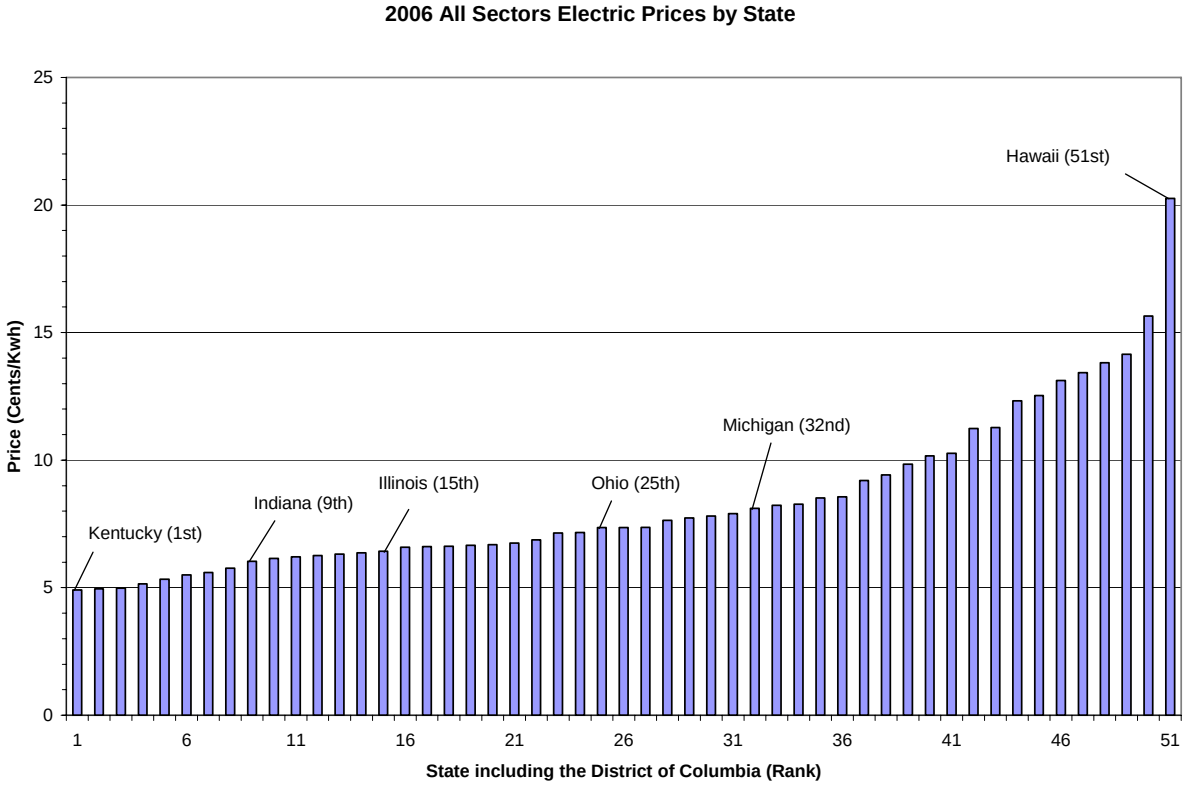



**Figure 64**



# End Use Saturation, Standby Power, and Efficiency Standards

The focus of this section is end-use equipment energy use, saturations, and efficiency, as well as equipment and building standards. The examples used and data presented are for the residential sector, primarily due to more complete and readily available data and information as compared to the commercial and industrial sectors. The trends in the commercial sector are similar to those in the residential sector although the end-use energy mix is much more diverse across commercial building types (for example, large lighting loads in office and retail establishments, large cooling and refrigeration loads in grocery stores, and less intense energy use in warehouse and storage facilities). The industrial sector energy use is even more diverse due to energy use being driven by the manufacturing processes employed to produce various commodities, components, and finished goods.

EIA estimates of residential electric energy use by end-use equipment type for the United States are shown in Table 1. The various end uses are presented generally in order of energy use with space heating and cooling accounting for the highest share followed by kitchen appliances, water heating, home electronics, and laundry appliances. SUFG estimates that the average Indiana residential household uses about 11,500 kWh per year, slightly above EIA's national estimate of 10,656 kWh per year.

Appliance saturation estimates over time are shown in Table 2. This EIA table contains estimates for both electric and natural gas fueled residential end-use equipment for the East North Central census region. In addition to Indiana, this census region includes Illinois, Michigan, Ohio, and Wisconsin. Therefore, the table may underestimate Indiana air-conditioning saturation due to climate differences within the region.

Note that the saturation of air conditioning, a large electric load, has roughly doubled over the 1980 to 2001 period. Also note the substantial increase in dishwasher saturations as well as that of personal computers and microwave ovens.

Refrigerators, another substantial component of electricity use, have a saturation of over 100 percent, which means that on average households have more than one refrigerator even if the majority of households have only one (82 percent in 2001). Although not shown in the EIA table, the saturation of television sets is also over 100 percent.

Recently, the issue of standby power electricity use has drawn attention from some conservation advocates, efficiency experts, and policy makers. Many consumer appliances such as televisions, DVD and VCR players, and others which contain clocks, timers, or stored information are consuming electricity continuously to maintain these items even when the appliance is turned off. Table 3 and Figure 65 from Lawrence Berkeley National Laboratory give estimates of the standby power use for several common appliances and electronic devices. The data in Table 3 is for a single computer belonging to a Lawrence Berkeley staff member and therefore may not be representative of an average computer. What is most interesting about Table 3 is that this computer when on but not being used consumes about ten times as much electricity as when it is turned off, and many computers are routinely left turned on when not in use. This style of operation is common with networked computers to permit centralized software upgrades and similar routine maintenance as well as to make the computational capacity of these machines available to all network users. Home computers are also left on continuously to facilitate unattended automatic software updates and similar tasks as well as for the

convenience of instantly being on or ready to use. While there has been some discussion of placing limits on standby power use, no action has been taken. Manufacturers argue that consumers value the convenience provided by clocks, timers, memories, instant-on capabilities and so forth and that standby power consumption should be factored into the existing appliance efficiency standards.

In the early 1970s California adopted minimum efficiency standards on several residential appliances. Other states soon followed California's lead and by the early 1980s several states had adopted efficiency standards. At the federal level the Energy Policy and Conservation Act (EPCA) of 1975 established voluntary appliance labeling and efficiency targets, but did not include mandatory efficiency standards. Faced with the possibility of a patchwork of state mandatory standards, appliance manufacturers supported a national standard which prevented states from establishing state specific standards. In 1987 the National Appliance Energy Conservation Act (NAECA) was enacted directing the U.S. Department of Energy to establish minimum standards for several appliances and to periodically review the standards. Over the years the NAECA has been supplemented with additional legislation and the Department of Energy has revised the standards (see Figures 66 and 67).

An example of the effect of energy standards and changing standards over time is shown for refrigerators in Figures 68 through 71. Figure 68 is an estimate of the average annual energy consumption (kWh) of new refrigerators over time. Figures 69 through 71 show the average estimated energy consumption for one type of refrigerator available in the market place before and after standards became effective in 1990, and when the standards were revised in 1993 and 2001. The upward sloping solid lines in these figures represent the minimum efficiency standard for Top-Mounted Auto-Defrost refrigerators with increasing refrigerator volumes, points above the solid line are estimates of energy consumption prior to the efficiency standards, and points below the solid line are energy consumption estimates after the standard becomes effective. Note that the standard varies with the size of the refrigerator and other types of refrigerators have different standards which also vary with size. The efficiency standard adjustment for size and/or type of appliance is applied to other appliances such as air-conditioners and arises due to technical constraints.

While building codes also have a substantial impact on energy efficiency, they are established in a manner that is quite different from appliance efficiency standards. The U.S. Department of Energy is given a role in residential and commercial new building codes through the EPCA (1975) and the Energy Policy Act of 1992. Beginning in 1977 DOE began working with the states to implement the Model Energy Code (MEC) developed by the Council of America Building Officials (CABO) and the related ASHRAE/IES standard developed by the American Society of Heating, Refrigeration and Air-Conditioning Engineers, Inc. The MEC was updated approximately every three years through 1998 when it was replaced by the International Energy Conservation Code (IECC) when CABO passed the responsibilities for MEC to the International Code Council. Since 1998 the IECC has been updated almost every year. DOE reviews the IECC and when it determines that the changes would result in improving residential and/or commercial building energy efficiency, develops building standards which individual states are encouraged to adopt in whole or in part, although the states are not mandated to do so. Thus while not mandated by law, the DOE building codes are often

adopted by states in whole or in part. The most recent DOE model codes were developed in 2001 and 2004.

Enforcement of code standards is a state matter that is normally enforced by county or municipal building inspectors. Also, states and local governments are permitted to develop their own standards. Thus building standards and their enforcement vary by state, county, and local area. The current Indiana Energy Conservation Code is based upon the 1992 MEC as amended by Indiana in 2001.

Table Page



Figure Page

**Table 1**. Electricity Consumption by End Use in U.S. Households, 2001

| End-Use Category and End Use | Households (millions) | Units [a] (millions) | Annual Electricity Consumption | | | |
|---|---|---|---|---|---|---|
| | | | Per Unit [b] (kWh) | Per HH (kWh) | Total (billion kWh) | Share of Total (percent) |
| **Heating, Ventilation, and Cooling** | | | | | **355.7** | **31.2** |
| **Air-Conditioning [c]** | **80.8** | - | - | - | **182.8** | **16.0** |
| Central | 57.5 | - | - | 2,796 | 160.6 | 14.1 |
| Individual Room Units | 23.3 | 38.2 | 580 | 950 | 22.2 | 1.9 |
| **Space Heating [d]** | **43.9** | - | - | - | **115.5** | **10.1** |
| Main System | 30.9 | - | - | 3,524 | 109.0 | 9.6 |
| Secondary Equipment | 12.9 | - | - | 503 | 6.5 | 0.6 |
| **Related Appliances** | | | | | **57.4** | **5.0** |
| Furnace Fan | 76.3 | - | 500 | - | 38.2 | 3.3 |
| Ceiling Fan | 69.6 | 192.8 | 50 | 138 | 9.6 | 0.8 |
| Dehumidifier | 12.1 | - | 400 | - | 4.8 | 0.4 |
| Humidifier | 15.6 | - | 100 | - | 1.6 | 0.1 |
| Evaporator Cooler | 2.7 | - | 1,183 | - | 3.2 | 0.3 |
| **Kitchen Appliances** | | | | | **304.5** | **26.7** |
| Refrigerator | 106.8 | 126.0 | 1,239 | 1,462 | 156.1 | 13.7 |
| Freezer | 34.2 | 37.9 | 1,039 | 1,149 | 39.3 | 3.5 |
| Dishwasher [e] | 56.7 | - | - | 512 | 29.0 | 2.5 |
| Range Top [f] | 59.7 | - | 536 | - | 32.0 | 2.8 |
| Oven [g] | 47.8 | - | 440 | - | 21.0 | 1.8 |
| Microwave Oven | 92.1 | - | 209 | - | 19.3 | 1.7 |
| Coffee Maker [h] | 51.3 | - | 116 | - | 6.0 | 0.5 |
| Toaster Oven | 36.1 | - | 50 | - | 1.8 | 0.2 |
| **Water Heating** | **40.8** | - | - | **2,552** | **104.1** | **9.1** |
| **Lighting [i]** | **107.0** | - | - | **940** | **100.5** | **8.8** |
| **Home Electronics** | | | | | **82.3** | **7.2** |
| Color TV | 105.8 | 242.6 | 137 | 313 | 33.1 | 2.9 |
| PC and Printer [j] | 60.0 | - | - | 384 | 23.1 | 2.0 |
| VCR/DVD | 96.1 | 161.9 | 70 | 118 | 11.3 | 1.0 |
| Stereo [k] | 80.3 | - | - | 70 | 5.6 | 0.5 |
| Cable Box | 24.4 | - | 120 | - | 2.9 | 0.3 |
| Satellite Dish | 13.9 | - | 130 | - | 1.8 | 0.2 |
| Cordless Phone | 81.5 | - | 26 | - | 2.1 | 0.2 |
| Answering Machine | 65.7 | - | 35 | - | 2.3 | 0.2 |
| **Laundry Appliances** | | | | | **76.0** | **6.7** |
| Clothes Dryer | 61.1 | - | - | 1,079 | 65.9 | 5.8 |
| Clothes Washer [e] | 84.1 | - | 120 | - | 10.1 | 0.9 |
| **Other Equipment** | | | | | **28.7** | **2.5** |
| Pool Filter/Pump | 6.5 | - | 1,500 | - | 9.8 | 0.9 |
| Hot Tub/Spa/Pool Heater | 3.3 | - | 2,300 | - | 7.6 | 0.7 |
| Waterbed Heater | 5.5 | 6.4 | 900 | 1,035 | 5.7 | 0.5 |
| Well Water Pump | 13.8 | - | 400 | - | 5.5 | 0.5 |
| **Other End Uses [l]** | | | | | **88.0** | **7.7** |
| **U.S. Total** | **107.0** | - | - | **10,656** | **1,139.9** | **100.0** |

[a] One unit is one system, appliance, or piece of equipment. The number of units is assumed to equal the number of households, except where shown.</< font>

[b] Consumption per unit is assumed to equal consumption per household, except where shown.

[c] Households with both central air-conditioning and individual room units are counted only under "Central."

[d] Households with both main space-heating systems and secondary equipment are counted only under "Main System."

[e] Energy used to heat water coming into the washer is excluded.

[f] Only those households where the most-used range top is electric and where more than one meal per week is cooked are counted.

[g] Only those households where the most-used oven is electric and the oven is used more than once per week are counted.

[h] Only those households where the coffee maker is used more than once per week are counted.

[i] "Lighting" includes indoor and outdoor uses. Halogen torchiere lamps are not included.

[j] "PC" includes desktop and laptop personal computers. "Printer" includes printers with and without fax/copiers.

[k] "Stereo" includes component and compact stereo systems and portable stereos ("boom boxes").

[l] "Other End Uses" includes many end uses, such as the operation of irons, hair dryers, electric blankets, power tools, and air cleaners, not specifically listed, as well as errors that may be present in estimates of annual consumption.

- = Not applicable.

<http://eia.doe.gov/emeu/reps/enduse/er01_us_tab1.html>

**Table 2**. Appliances in East North Central Households, Selected Years, 1980-2001

| | Survey Year | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Survey Category** | **1980** | **1981** | **1982** | **1984** | **1987** | **1990** | **1993** | **1997** | **2001** |
| Number of Households (millions) | 15 | 15 | 15 | 15 | 16 | 17 | 16 | 17 | 17 |
| **Air-Conditioners** [1, 2] | (percent of households) | | | | | | | | |
| Central | 20 | 22 | 20 | 21 | 27 | 35 | 42 | 48 | 56 |
| Individual Room Units | 32 | 32 | 30 | 32 | 36 | 34 | 27 | 26 | 24 |
| None | 48 | 45 | 50 | 47 | 37 | 31 | 31 | 26 | 20 |
| **Electric Appliances** | | | | | | | | | |
| Clothes Dryer | 45 | 44 | 42 | 40 | 49 | 48 | 54 | 45 | 49 |
| Clothes Washer | 77 | 75 | 69 | 71 | 75 | 75 | 78 | 76 | 78 |
| Computer, Personal | NA | NA | NA | NA | NA | 15 | 22 | 38 | 58 |
| Dehumidifier | 18 | 18 | 17 | 16 | 21 | 23 | 22 | NA | 24 |
| Dishwasher | 29 | 29 | 28 | 27 | 30 | 38 | 38 | 45 | 47 |
| Evaporative Cooler | (s) | (s) | (s) | (s) | 1 | (s) | (s) | NA | (s) |
| Fan, Ceiling | NA | NA | NA | NA | NA | NA | 56 | 61 | 72 |
| Fan, Whole House | NA | NA | 6 | 6 | 10 | 8 | 4 | NA | NA |
| Fan, Window or Ceiling | NA | NA | 34 | 38 | 46 | 51 | 64 | NA | NA |
| Freezer, Separate | 42 | 45 | 41 | 40 | 40 | 37 | 41 | 37 | 35 |
| Oven, Microwave | 15 | 19 | 21 | 36 | 65 | 83 | 89 | 85 | 90 |
| Pump for Swimming Pool [3] | 2 | 2 | 2 | NA | NA | 5 | 2 | 3 | 6 |
| Pump for Well Water | NA | NA | NA | NA | NA | 23 | 19 | 20 | 19 |
| Range (stove-top burner) | 49 | 49 | 54 | 48 | 50 | 52 | 56 | 52 | 54 |
| Refrigerator (one) [4] | 80 | 84 | 83 | 85 | 81 | 79 | 81 | 83 | 82 |
| Refrigerator (two or more) | 20 | 15 | 17 | 15 | 18 | 21 | 19 | 17 | 18 |
| Television Set (any type) | 99 | 99 | 99 | 99 | 99 | 100 | 98 | NA | NA |
| Television Set (b/w) | 55 | 51 | 49 | 42 | 38 | 38 | 23 | NA | NA |
| Television Set (color) | 84 | 85 | 86 | 88 | 93 | 96 | 98 | 99 | 100 |
| Waterbed Heaters | NA | NA | NA | 12 | 15 | 17 | 18 | 12 | 8 |
| **Gas** [5] **Appliances** | | | | | | | | | |
| Clothes Dryer | 26 | 25 | 21 | 23 | 22 | 24 | 22 | 28 | 27 |
| Heater for Swimming Pool [6] | (s) | (s) | (s) | (s) | (s) | 1 | (s) | 1 | 1 |
| Outdoor Gas Grill | 9 | 10 | 8 | 10 | 23 | 31 | 32 | NA | NA |
| Outdoor Gas Light | 4 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 |
| Range (stove-top burner) | 51 | 52 | 47 | 50 | 51 | 48 | 44 | 47 | 44 |
| **Kerosene Appliance** | | | | | | | | | |
| Portable Heater | (s) | 1 | 2 | 6 | 7 | 6 | 5 | 2 | 2 |

[1] Air-conditioning units may be powered by electricity or natural gas.

[2] Households with both central air-conditioning and individual room units are counted only under "Central."

[3] In all survey years except 1993, all reported swimming pools were assumed to have electric pumps for filtering and circulating water. In 1993, the survey explicitly asked about filtering systems.

[4] Less than 0.5 percent of households lacked a refrigerator.

[5] "Gas" means natural gas or liquefied petroleum gases.

[6] For the years 1984 and 1987, the heater-for-swimming-pool category includes heaters for Jacuzzis and hot tubs.

NA = Not Available.

(s) = Less than 0.5 percent of households.

Note: Data are available only for the 9 years shown above (years for which surveys were conducted).

Sources: Energy Information Administration, Form EIA-457, "Residential Energy Consumption Survey" for each year shown.

<http://eia.doe.gov/emeu/reps/appli/e_n_c_table.html>

**Table 3**. Energy Use of Personal Computer in Standby Mode (watts)

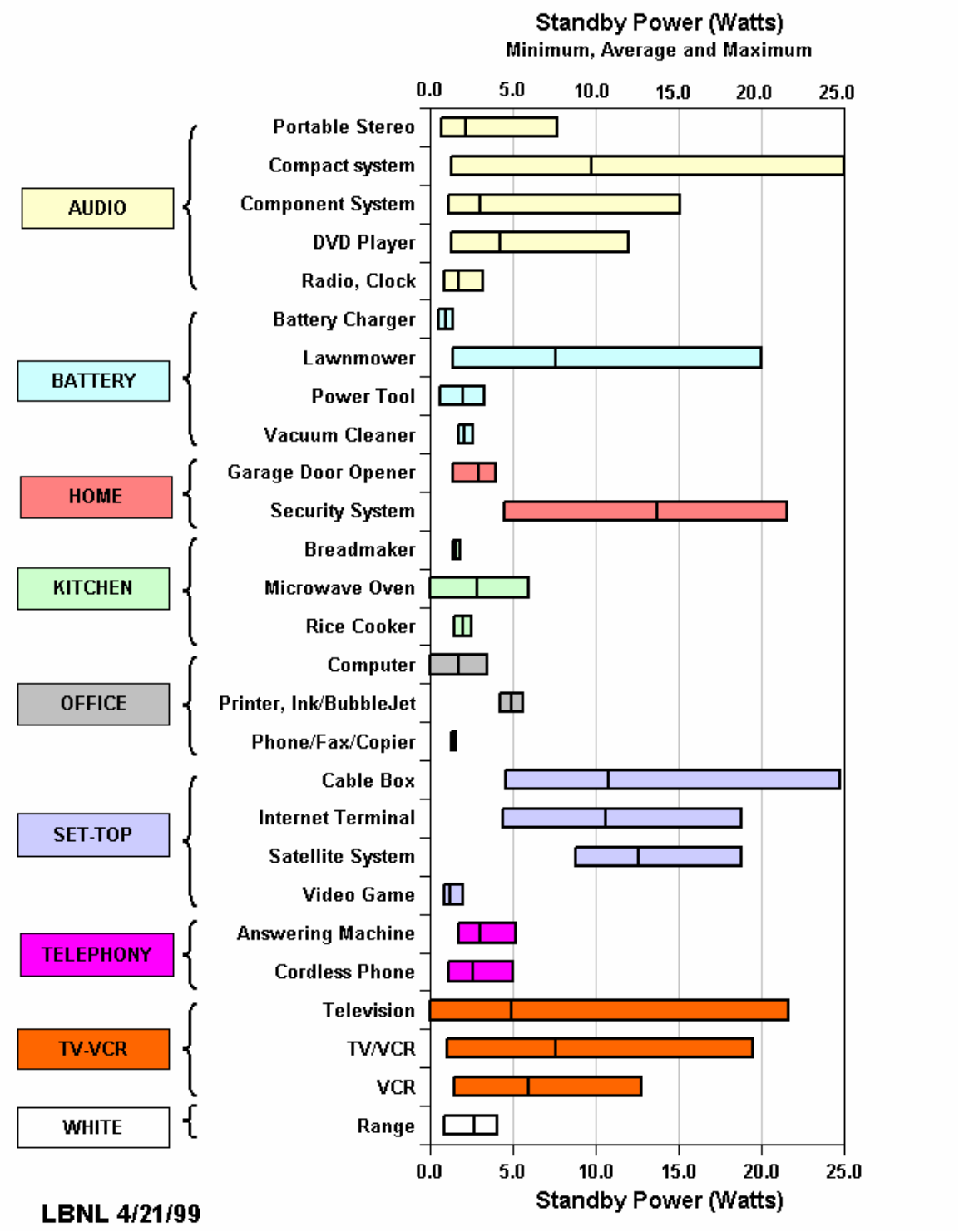
| | **Power supply only [1]** | **Plugged in but "off"** | **Turned on but not being used** |
|---|---|---|---|
| **Westell WireSpeed DSL modem as supplied by Pacific Bell** | 1.4 | 1.4 | 7.4 |
| **Linksys DSL router with firewall** | 2.7 | NA (no switch) | 6.5 |
| **Hewlett Packard Desk Jet (ink jet) printer** | 2.4 | 2.4 | 7.7 |
| **Micron 17" monitor** | NA | .7 | 2 (+/- 1) [2] |
| **Generic Pentium PC** | NA | 0 | 43 (+/- 3) |
| | | | |
| **Total standby energy** | | | 67 |

[1] Equipment unplugged from power supply

[2] Computer off or in Energy Star™ "sleep" mode

<http://ateam.lbl.gov/news/dsl.html>

**Figure 65**

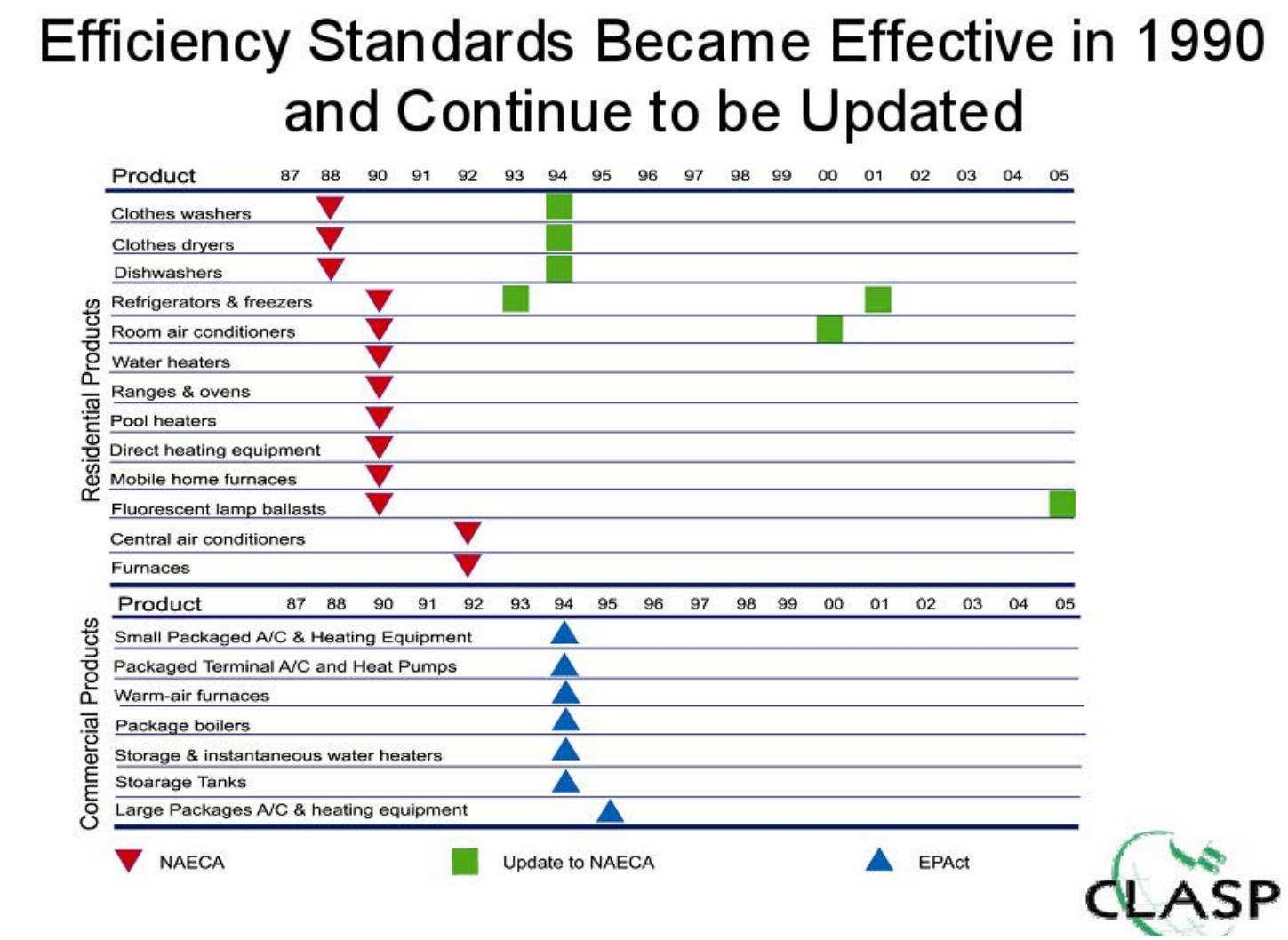



<http://standby.lbl.gov/Data/SummaryChart.html>

**Figure 66**

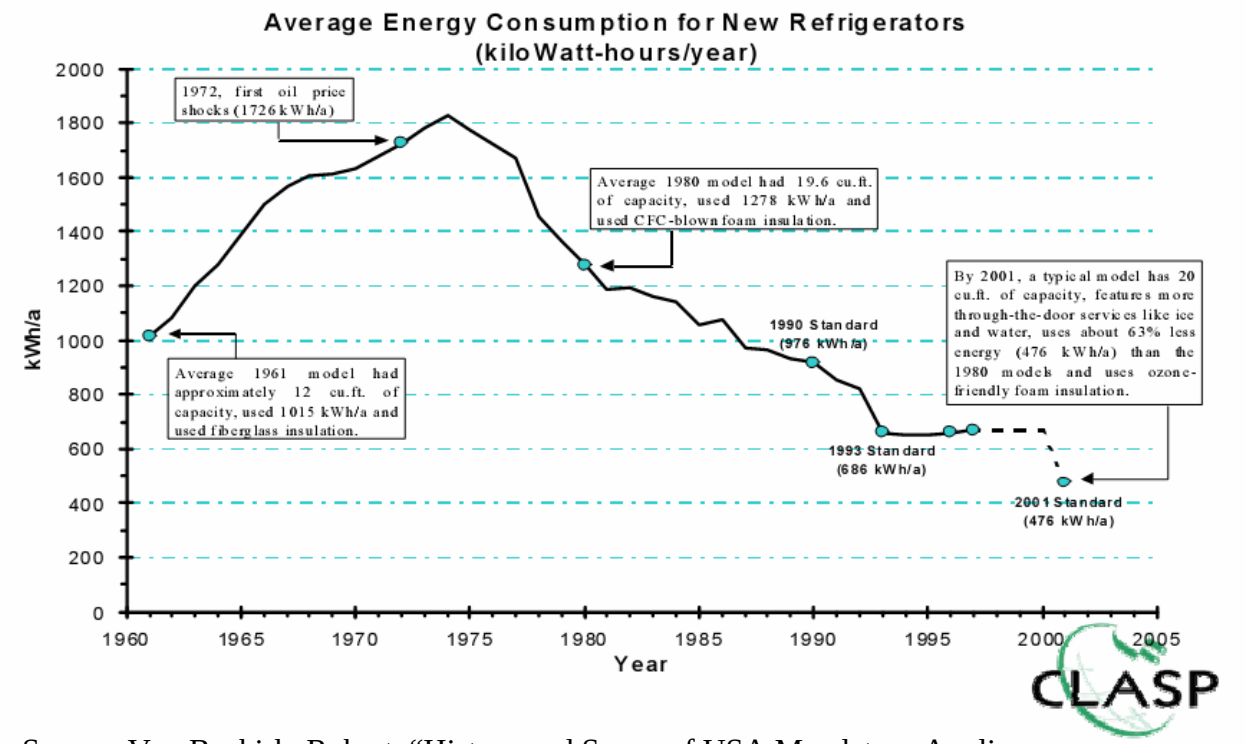

Source: Van Buskirk, Robert. "History and Scope of USA Mandatory Appliance Efficiency Standards." (CLASP).

**Figure 67**



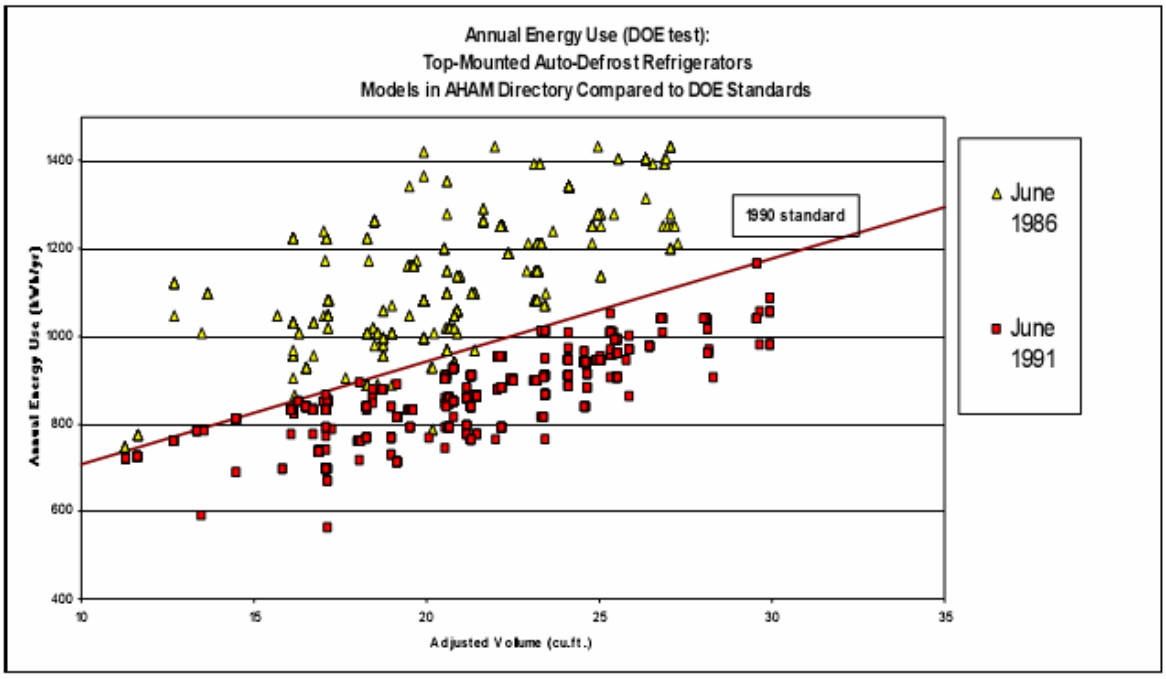

Source: Van Buskirk, Robert. “History and Scope of USA Mandatory Appliance Efficiency Standards.” (CLASP).

**Figure 68**



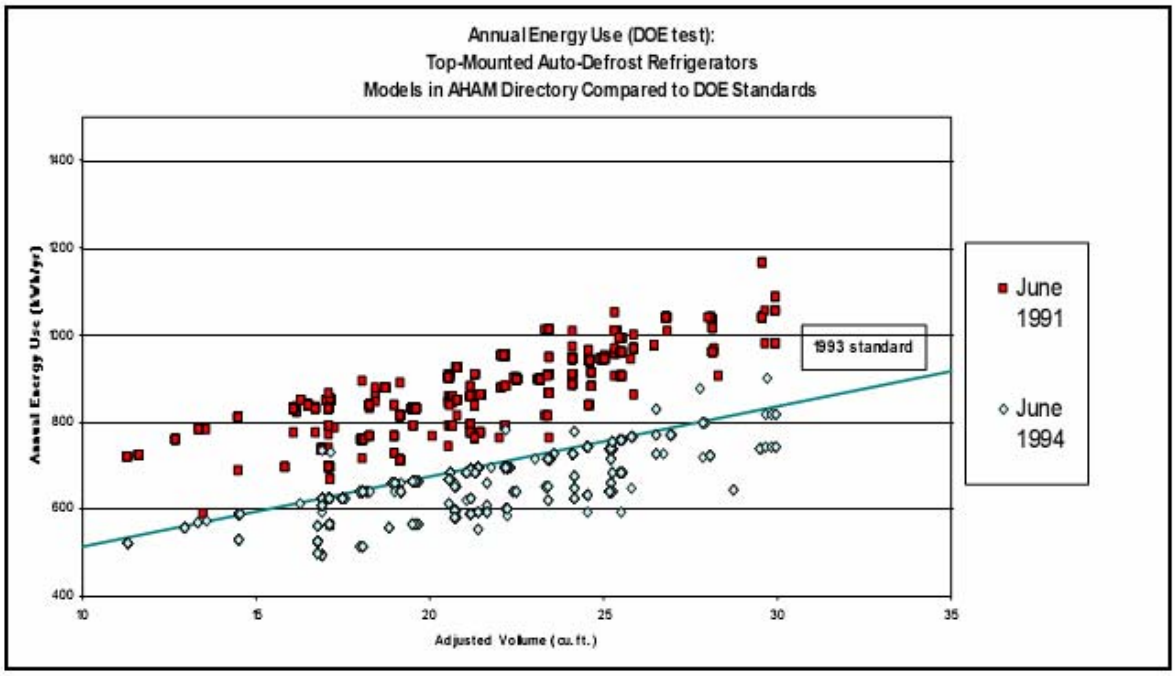

Source: Van Buskirk, Robert. "History and Scope of USA Mandatory Appliance Efficiency Standards." (CLASP).

**Figure 69** Refrigerator Efficiency Before and After 1990 Standard



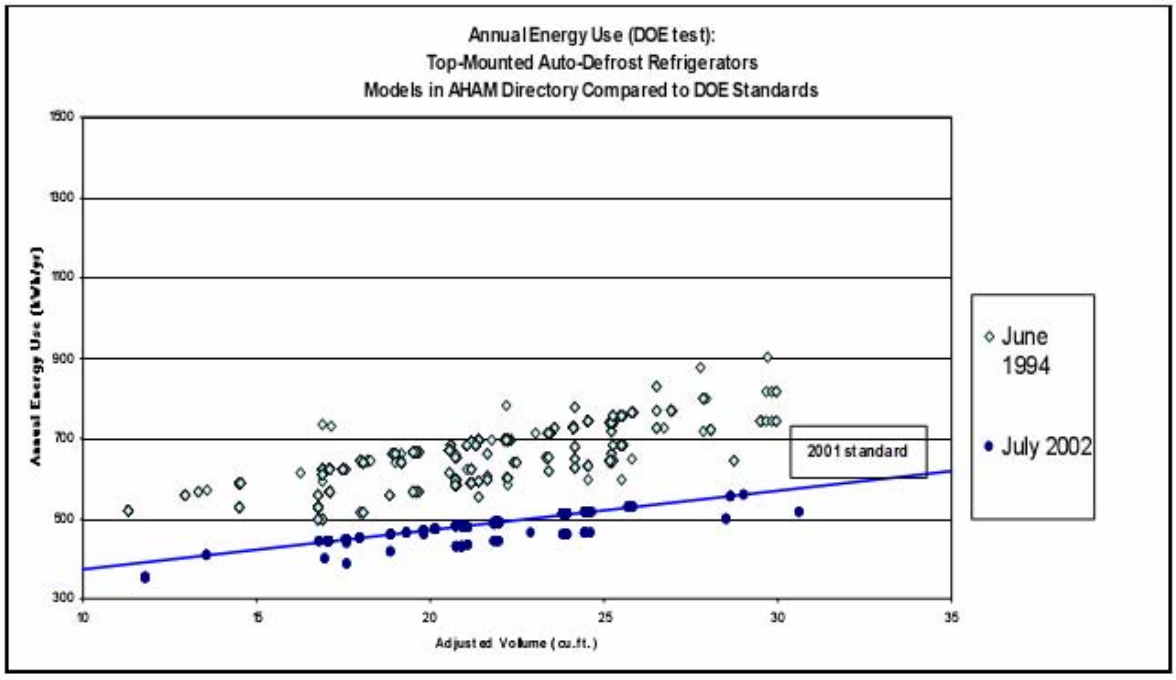

Source: Meyers, Stephen. "Efficiency of Appliance Models on the Market Before and After DOE Standards." (CLASP).

**Figure 70** Refrigerator Efficiency Before and After 1993 Standard




Source: Meyers, Stephen. "Efficiency of Appliance Models on the Market Before and After DOE Standards." (CLASP).

**Figure 71** Refrigerator Efficiency Before and After 2001 Standard




Source: Meyers, Stephen. "Efficiency of Appliance Models on the Market Before and After DOE Standards." (CLASP).