LEHIGH VALLEY ENERGY PROFILE

Understanding Energy Sources + Consumption in the Region + the State

February 2014

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The following document was originally prepared for the Lehigh Valley Planning Commission's Environment Committee as an information packet. The purpose of the document was to inform members of the various energy sources, consumption of energy by sector and historical pricing. The information contained within would help shape goals, policies and strategies for the energy element of the Lehigh Valley Comprehensive Plan. The committee requested the release of the document to the public in an effort to provide a baseline for discussions on energy consumption and conservation and the impacts on the region. The document consists exclusively of data, and no analysis, policies or issues have been presented. The energy element will be released early this summer for discussion and comment.

CHAPTER 1

ENERGY SOURCES

ENERGY PROFILE

Gasoline[1] is a nonrenewable petroleum product used for fuel specifically made from crude oil.

Gasoline accounts for slightly more than 66% of all the energy used for transportation. Forty percent of crude oil used by U.S. refineries, 47% of all petroleum consumption and 18% of total U.S. energy is produced in the United States. Most gasoline is used in cars and light trucks. It also fuels boats, recreational vehicles, farm, construction and landscaping equipment. Nearly two-thirds of fuel used for transportation is in the form of gasoline.

There are about 254 million vehicles that use gasoline and they on average travel more than 11, 618 miles per year. There are about 162,000 fueling stations that provide convenient refueling for customers. Each gasoline station usually sells three grades of gasoline: regular, midgrade and premium. These grades have different "octane ratings" that reflect anti-knocking properties.

Unleaded gas was introduced in the 1970s when the health problems from lead became apparent. In the United States, leaded gasoline was completely phased out in the 1980s. Burning gasoline produces carbon dioxide.

Gasoline is a highly flammable and toxic liquid. The vapors given off when it evaporates and the substances produced when it is burned contributed to air pollution laws such as the Clean Air Act which was enacted to reduce environmental impacts. The Environmental Protection Agency put these laws into action by requiring the following: emissions control devices and cleaner burning engines, removal of leaded gasoline, reformulated gasoline, low sulfur gasoline and reduced risk of gasoline leaks.

[1]http://www.eia.gov/energyexplained/index.cfm?page=gasoline_home

ENERGY PROFILE

Natural gas[2], also known as utility gas, is mostly composed of methane, a gas (or compound). The formation of this energy source is similar to coal and petroleum. It is a nonrenewable energy source since it takes millions of years to be created, and the rate of depletion is faster than regeneration.

Natural gas is used to produce electricity, steel, paper, glass, brick and clothing. Natural gas is used to produce nearly 30% of U.S. electricity in 2012. It also serves as a necessary raw material for many products such as antifreeze, fertilizer, explosives and plastics. The major consumers of natural gas in 2012 were the electric power sector, industrial sector, residential sector and commercial sector. Natural gas is used as the main heating fuel in slightly over 50% of all homes in the United States. Natural gas is used to power home appliances such as stoves, clothes dryers, water heaters and other appliances.

In 2000, natural gas was used by 27% of occupied housing units in the Lehigh Valley as house heating fuel according to U.S. Census data. It was the third most used source of house heating fuel in the Lehigh Valley. In 2010, 31.1% of occupied housing units in the Lehigh Valley used natural gas for house heating fuel. It was the third most used source of house heating fuel in the Lehigh Valley.

A natural gas leak can cause an explosion. There are government regulations and industry standards for the transportation, distribution, storage and use of natural gas. Natural gas does not have an odor, color or taste; therefore, a chemical is added before distribution to alert of a leak. Mercaptan, an additive which smells like sulfur (rotten eggs), is used as a safety device to enable detection in cases where there is a leak.

[2]http://www.eia.gov/energyexplained/index.cfm?page=natural_gas_home

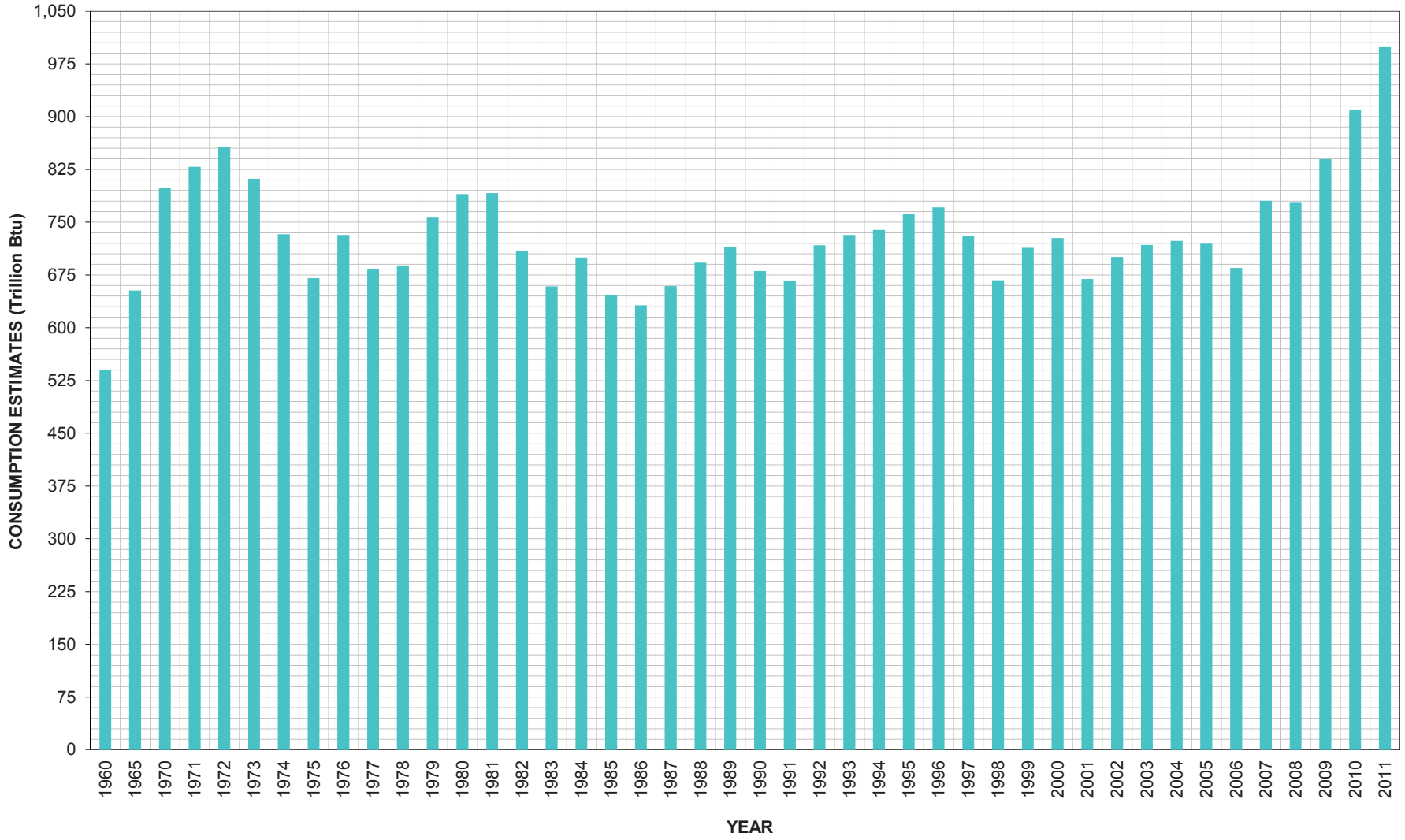
NATURAL GAS

ENERGY FACTS

- Between 2000 to 2011, the consumption of natural gas by the Electric Sector increased exponentially from 21.3 trillion BTU to 315 trillion BTU.
- Every year consecutively from 1999 to 2009, the Residential Sector was the largest consumer of natural gas.
- From 2006 to 2011, the Transportation Sector consumption of natural gas increased.
- Natural gas has increased in usage as a house heating fuel in the Lehigh Valley from 60,247 housing units in 2000 to 76,418 housing units in 2010.

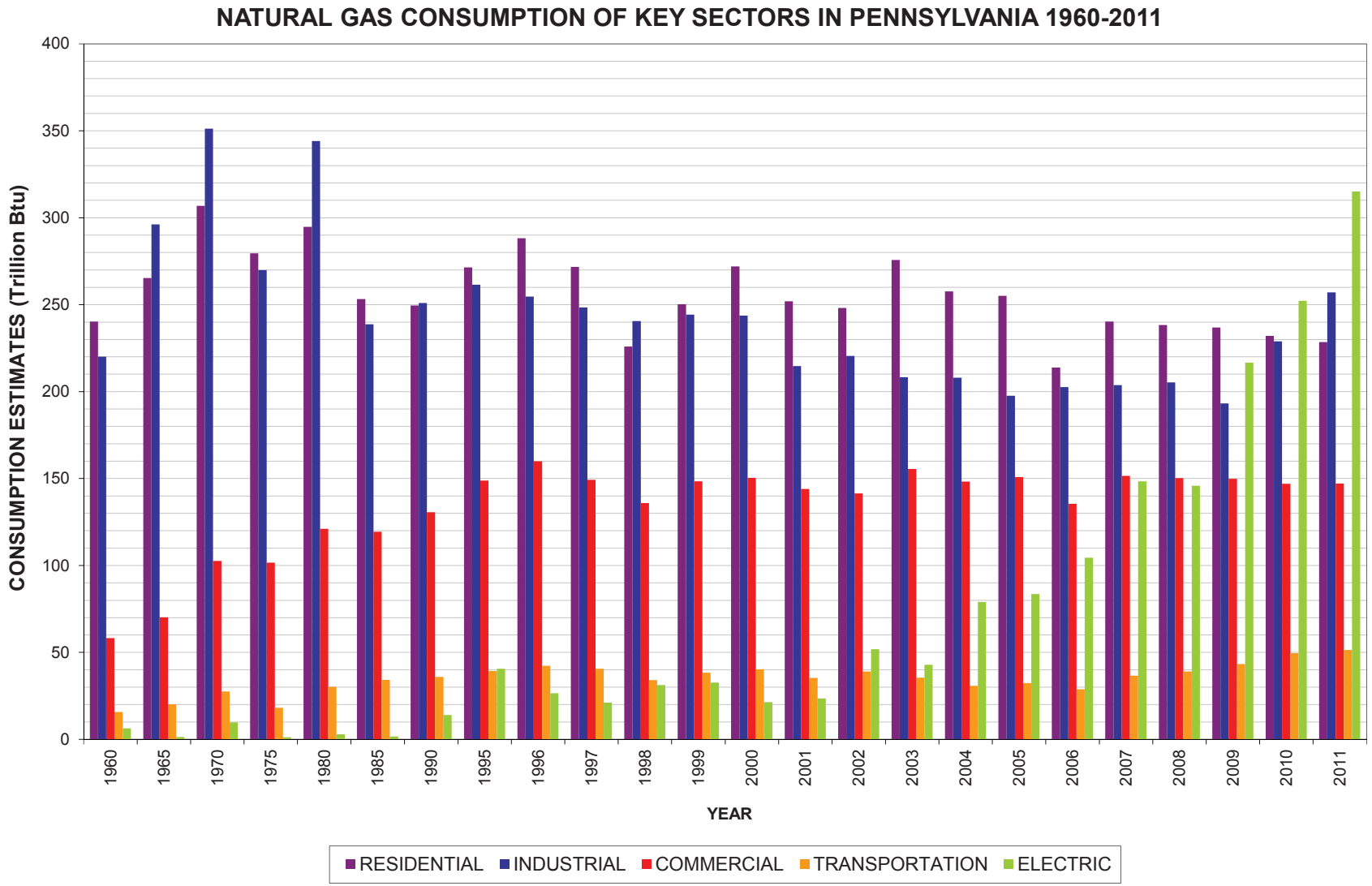
NATURAL GAS

PENNSYLVANIA NATURAL GAS CONSUMPTION 1960-2011



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION
STATE ENERGY DATA, 2011: CONSUMPTION TABLE CT2. PRIMARY ENERGY CONSUMPTION ESTIMATES, SELECTED YEARS, 1960-2011, PENNSYLVANIA

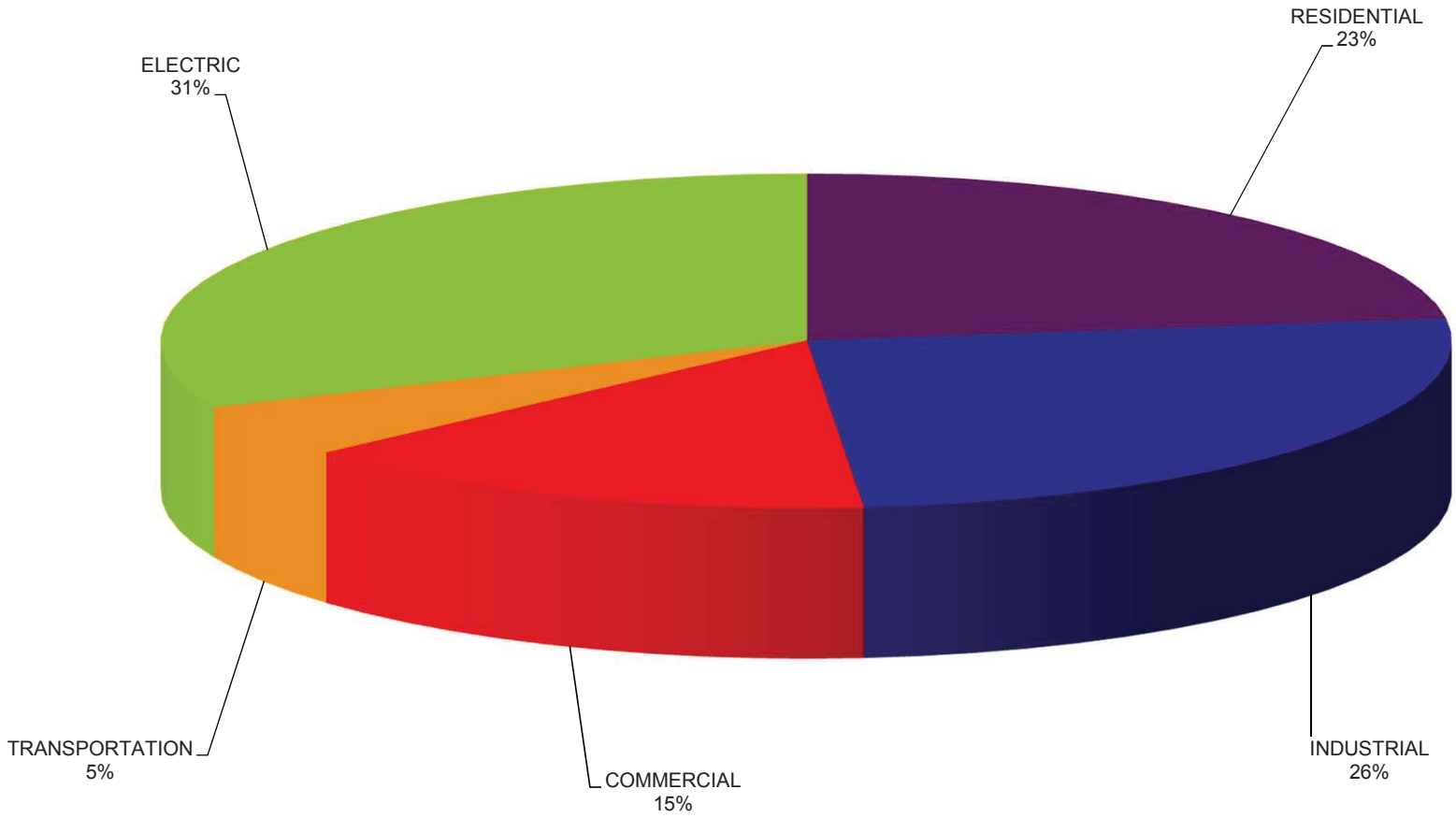
NATURAL GAS



SOURCE: U.S ENERGY INFORMATION ADMINISTRATION STATE ENERGY DATA, 2011: CONSUMPTION TABLES CT4, CT5, CT6, CT7 AND CT8

NATURAL GAS

PENNSYLVANIA NATURAL GAS CONSUMPTION 2011



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION, STATE ENERGY DATA, 2011

NATURAL GAS

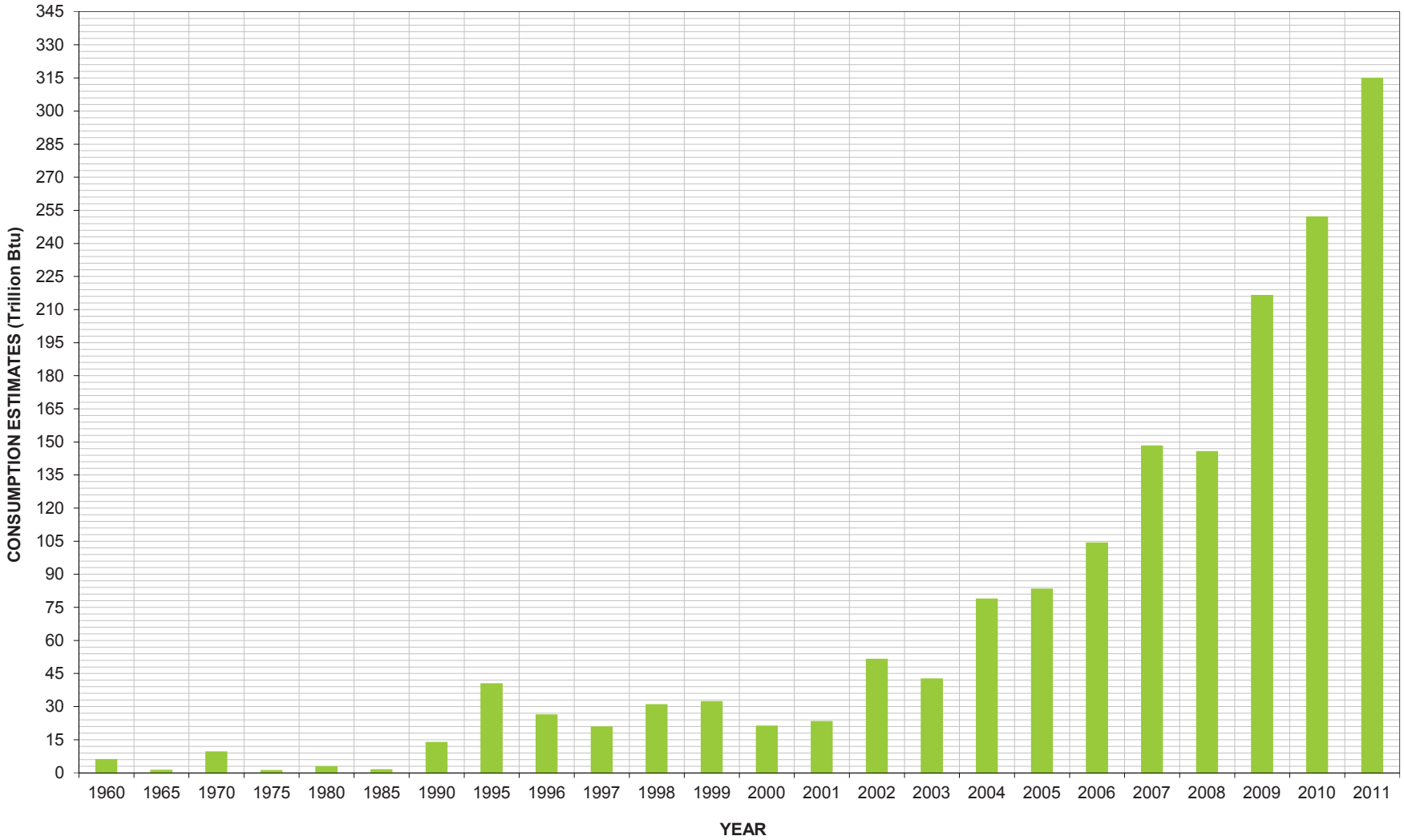
PENNSYLVANIA NATURAL GAS CONSUMPTION

Sector	Trillion Btu	Percentage
Total	998.7	100%
Electric	315.0	31%
Industrial	257.0	26%
Residential	228.4	23%
Commercial	147.0	15%
Transportation	51.3	5%

SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION, STATE ENERGY DATA, 2011

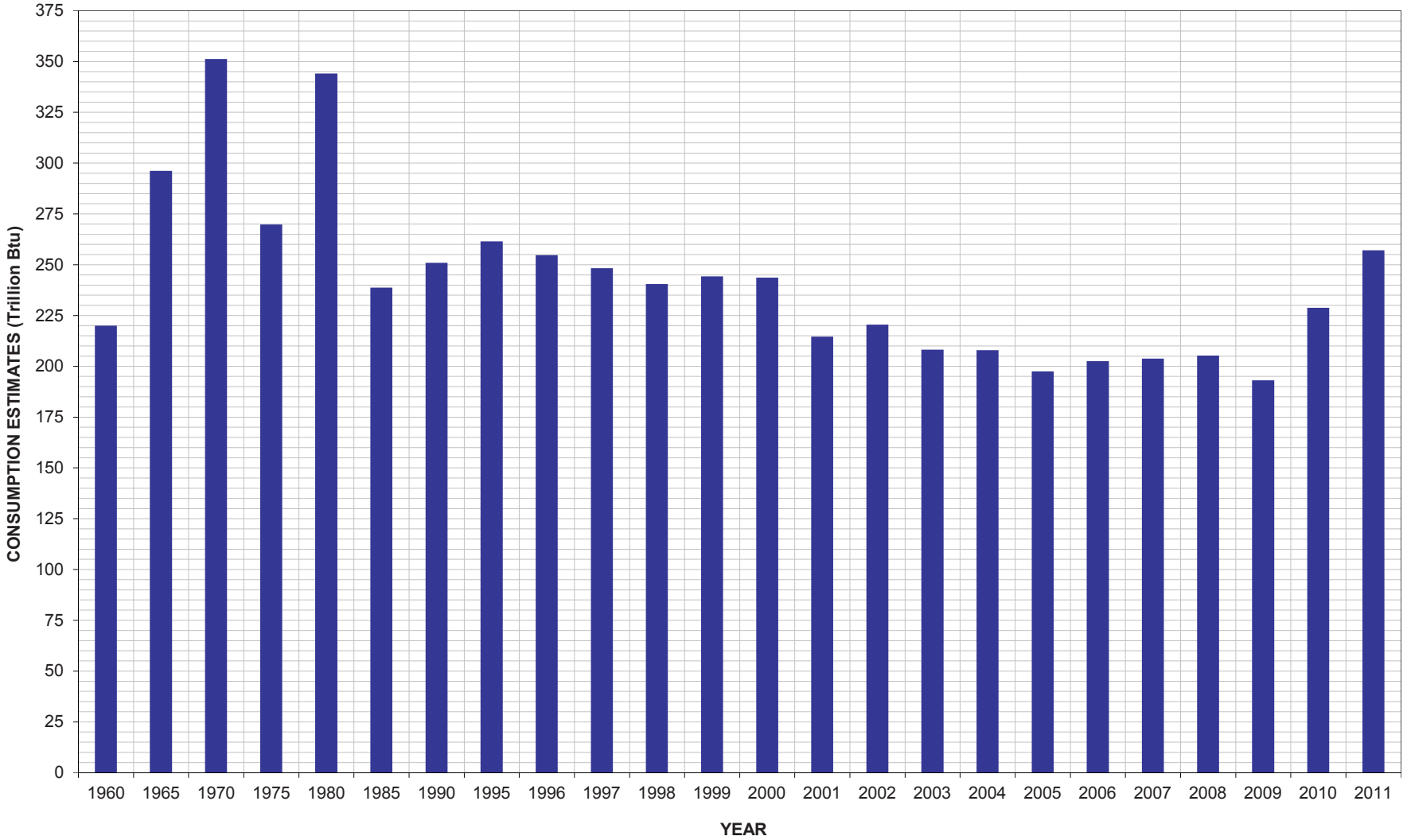
NATURAL GAS

ELECTRIC POWER SECTOR NATURAL GAS CONSUMPTION IN PENNSYLVANIA 1960-2011



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION
STATE ENERGY DATA, 2011: CONSUMPTION TABLE CT8. ELECTRIC POWER SECTOR CONSUMPTION ESTIMATES, SELECTED YEARS, 1960-2011, PENNSYLVANIA

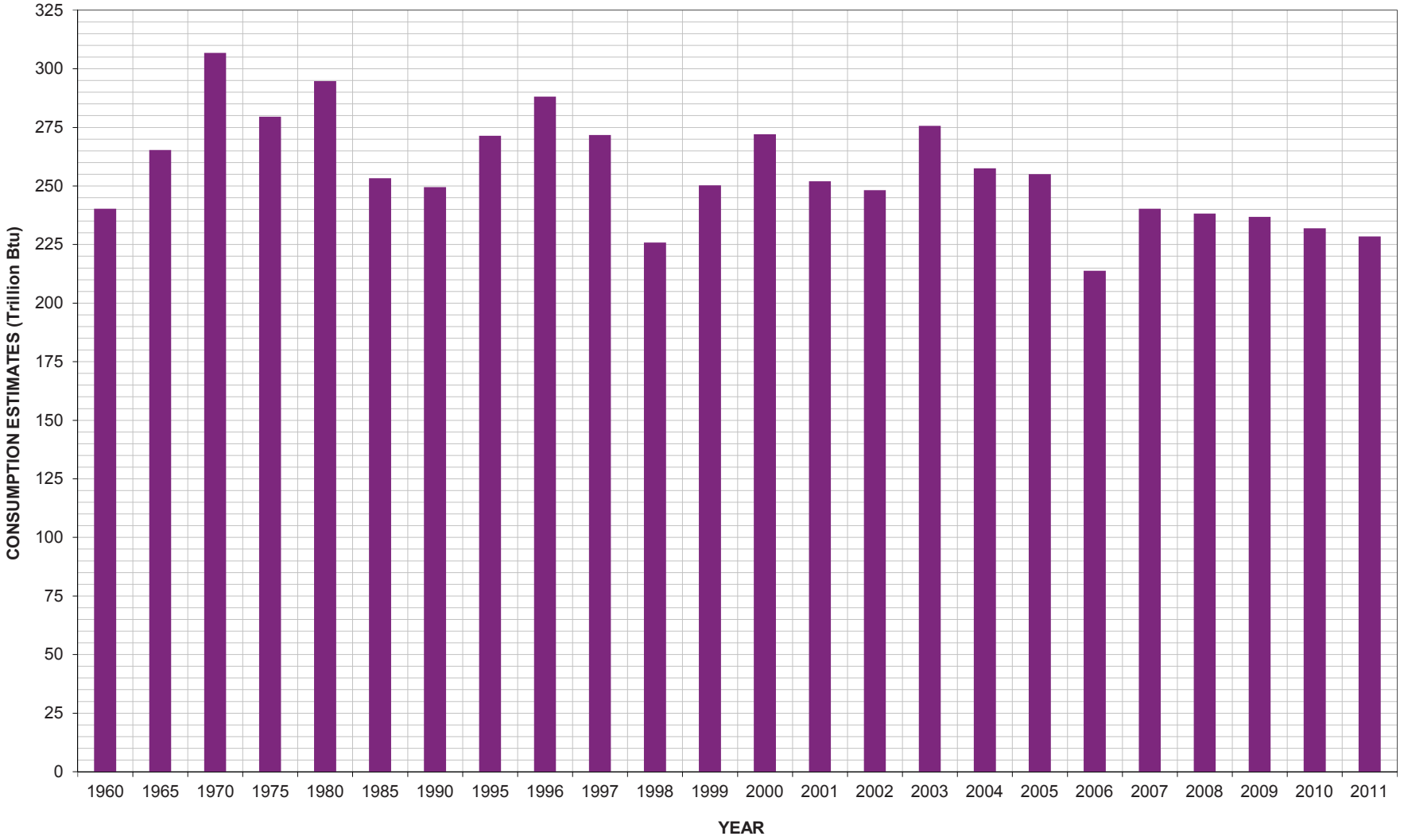
INDUSTRIAL SECTOR NATURAL GAS CONSUMPTION IN PENNSYLVANIA 1960-2011



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION
STATE ENERGY DATA, 2011: CONSUMPTION TABLE CT6. INDUSTRIAL SECTOR ENERGY CONSUMPTION ESTIMATES, SELECTED YEARS, 1960-2011, PENNSYLVANIA

NATURAL GAS

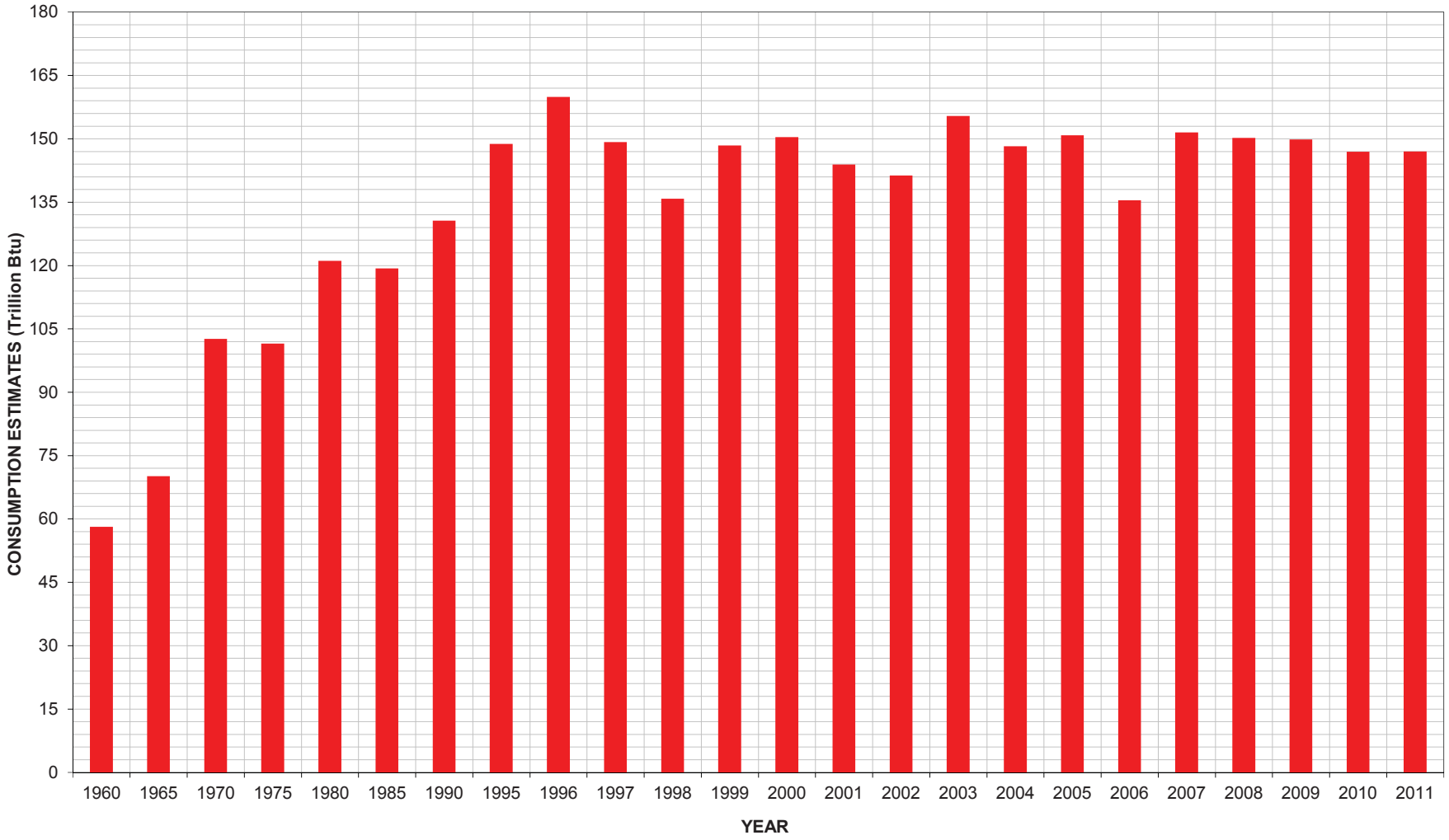
RESIDENTIAL NATURAL GAS CONSUMPTION IN PENNSYLVANIA 1960-2011



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION
STATE ENERGY DATA, 2011: CONSUMPTION TABLE CT4. RESIDENTIAL SECTOR ENERGY CONSUMPTION ESTIMATES, SELECTED YEARS, 1960-2011, PENNSYLVANIA

NATURAL GAS

COMMERCIAL SECTOR NATURAL GAS CONSUMPTION IN PENNSYLVANIA 1960-2011



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION
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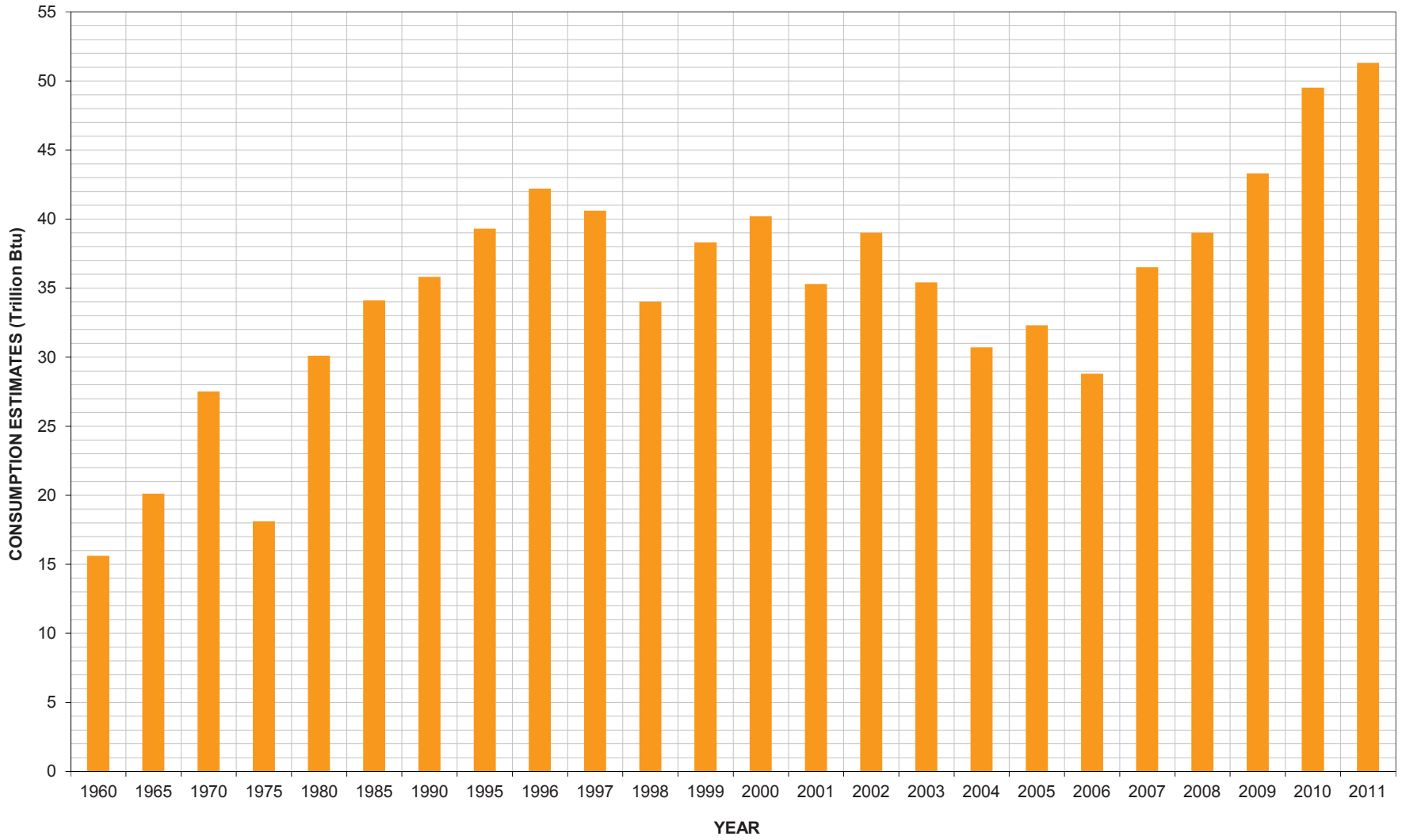
TRANSPORTATION SECTOR NATURAL GAS CONSUMPTION IN PENNSYLVANIA 1960-2011



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION
STATE ENERGY DATA, 2011: CONSUMPTION TABLE CT7. TRANSPORTATION SECTOR ENERGY CONSUMPTION ESTIMATES, SELECTED YEARS, 1960-2011, PENNSYLVANIA

ENERGY PROFILE

Heating oil[3] is a low viscosity, liquid petroleum product. It is used as a fuel for furnaces or boilers in buildings as well as an industrial fuel and for power generation. Heating homes is the primary use for heating oil making the demand highly seasonal. Most of the heating oil use occurs October through March. The area of the country most reliant on heating oil is the Northeast. Heating oil is a nonrenewable energy source and is a by-product of crude oil. Nearly 32% of occupied residential units in the Lehigh Valley use fuel oil/kerosene as a heating fuel according to the U.S. Census Bureau's 2010 American Community Survey.

The Internal Revenue Service requires heating oil and distillate fuel oils that are not for highway use to be marked with a red dye. The red color makes it clear that the product is tax exempt and cannot legally be used as highway diesel. Leaks from tanks and piping are an environmental concern. Various federal and state regulations are in place regarding the proper transportation, storage and burning of heating oil which is classified as hazardous material by federal regulators.

[3]http://www.eia.gov/energyexplained/index.cfm?page=heating_oil_home

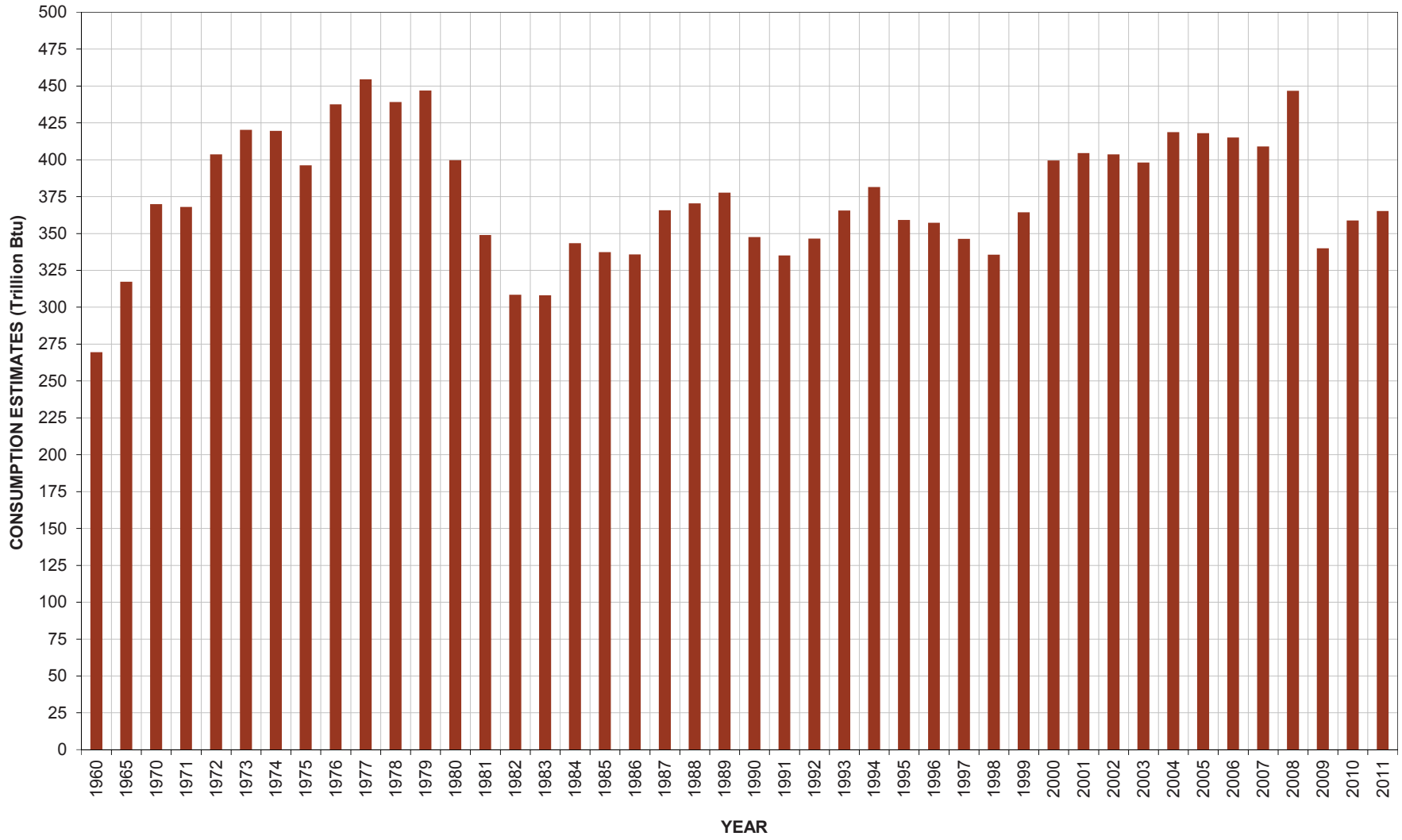
FUEL OIL / HEATING OIL

ENERGY FACTS

- The Transportation Sector is the largest consumer of distillate, surpassing the Residential Sector in consumption in 1990.
- The Electric Sector consumes around 1% of the distillate fuel oil; however, in 2000, this sector consumed more distillate fuel oil than 1999 and 2001 combined.
- Fuel oil, kerosene, etc. have decreased in usage as a house heating fuel in the Lehigh Valley from 84,351 housing units in 2000 to 78,273 housing units in 2010.

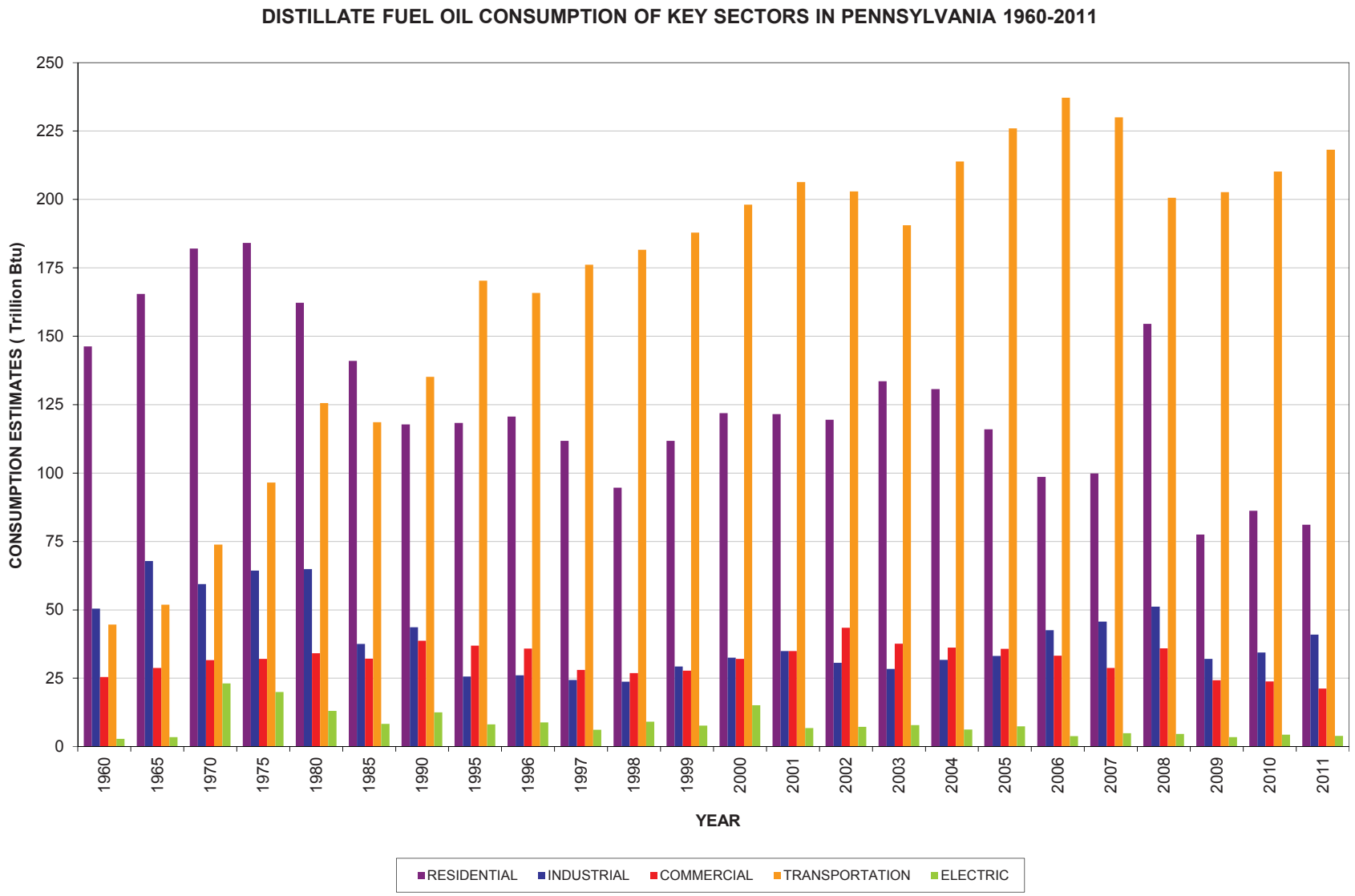
FUEL OIL / HEATING OIL

PENNSYLVANIA DISTILLATE FUEL OIL CONSUMPTION 1960-2011



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION
STATE ENERGY DATA, 2011: CONSUMPTION TABLE CT2. PRIMARY ENERGY CONSUMPTION ESTIMATES, SELECTED YEARS, 1960-2011, PENNSYLVANIA

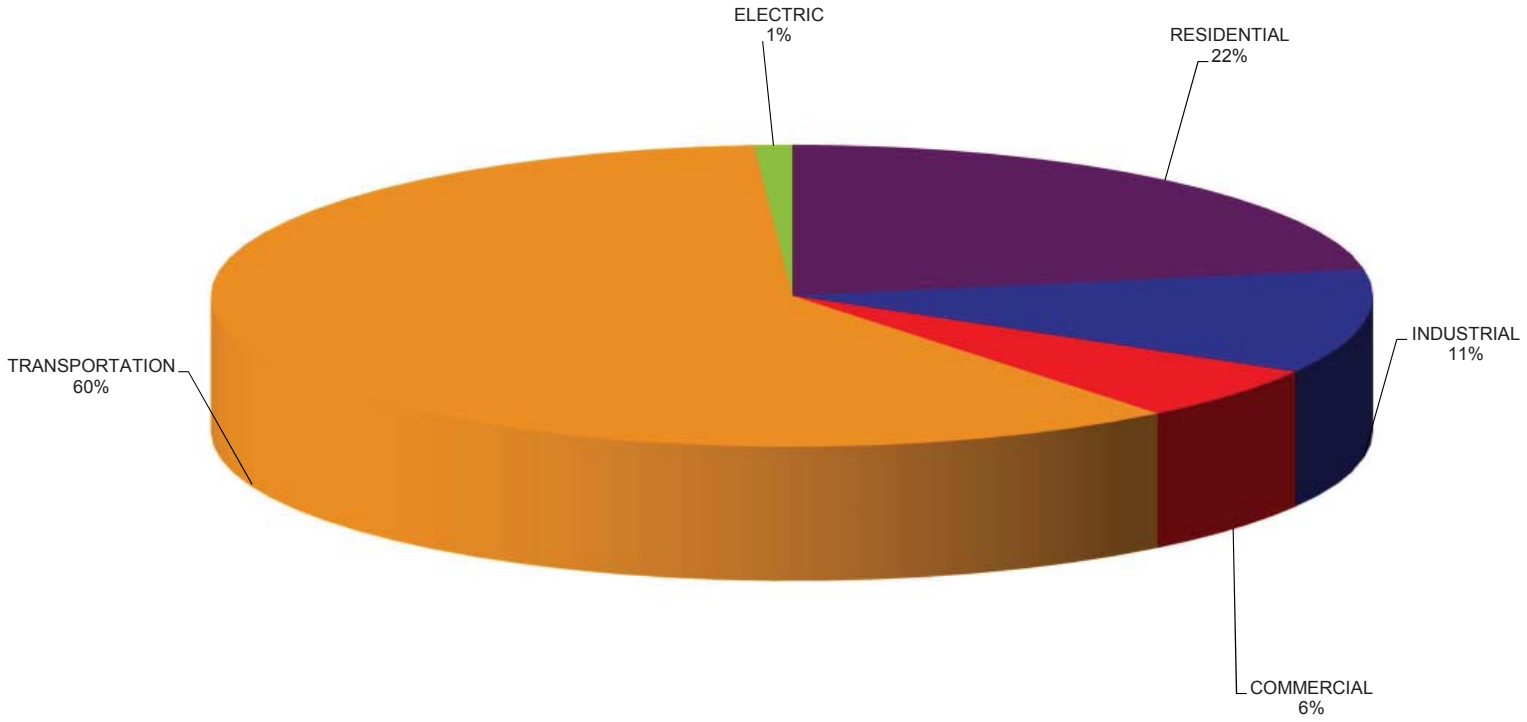
FUEL OIL / HEATING OIL



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION STATE ENERGY DATA, 2011: CONSUMPTION TABLES CT4, CT5, CT6, CT7 AND CT8

FUEL OIL / HEATING OIL

PENNSYLVANIA DISTILLATE FUEL OIL CONSUMPTION 2011



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION, STATE ENERGY DATA, 2011

FUEL OIL / HEATING OIL

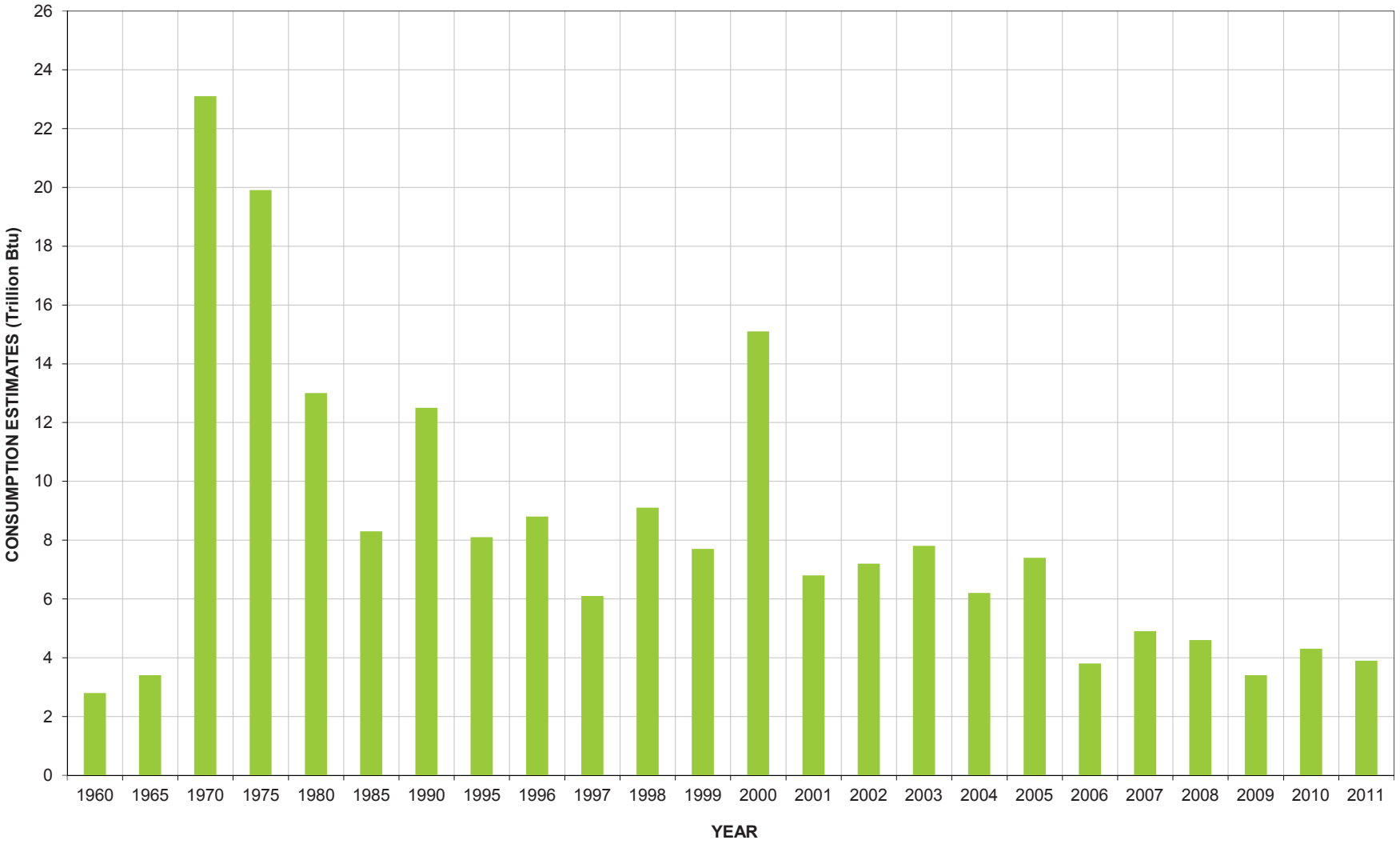
PENNSYLVANIA DISTILLATE FUEL OIL CONSUMPTION

Sector	Trillion Btu	Percentage
Total	365.2	100%
Electric	3.9	1%
Industrial	40.9	11%
Residential	81.1	22%
Commercial	21.2	6%
Transportation	218.1	60%

SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION, STATE ENERGY DATA, 2011

FUEL OIL / HEATING OIL

ELECTRIC POWER SECTOR DISTILLATE FUEL OIL CONSUMPTION IN PENNSYLVANIA 1960-2011



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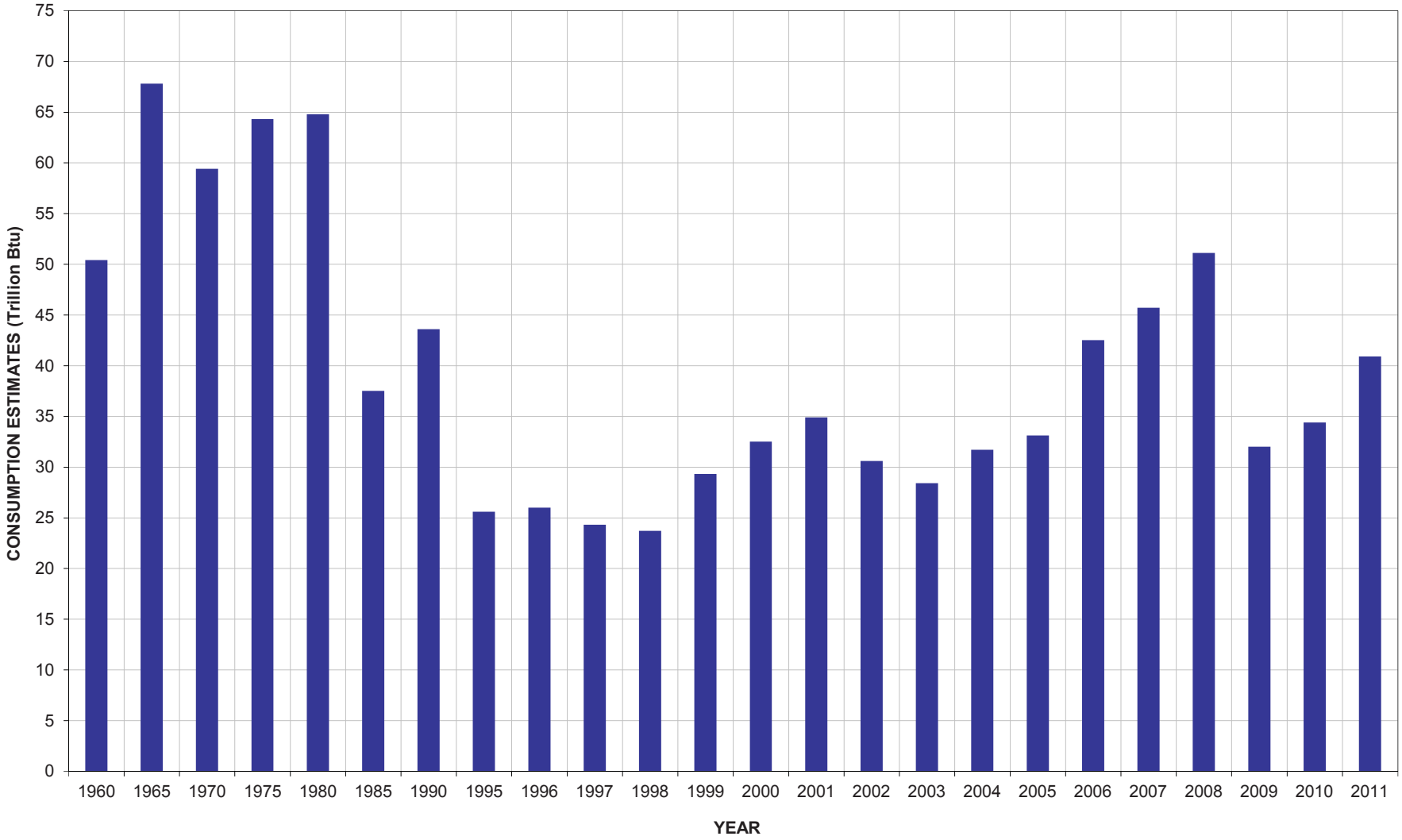
STATE ENERGY DATA, 2011: CONSUMPTION TABLE CT8. ELECTRIC POWER SECTOR CONSUMPTION ESTIMATES, SELECTED YEARS, 1960-2011, PENNSYLVANIA

FUEL OIL / HEATING OIL

INDUSTRIAL SECTOR DISTILLATE FUEL OIL CONSUMPTION IN PENNSYLVANIA 1960-2011



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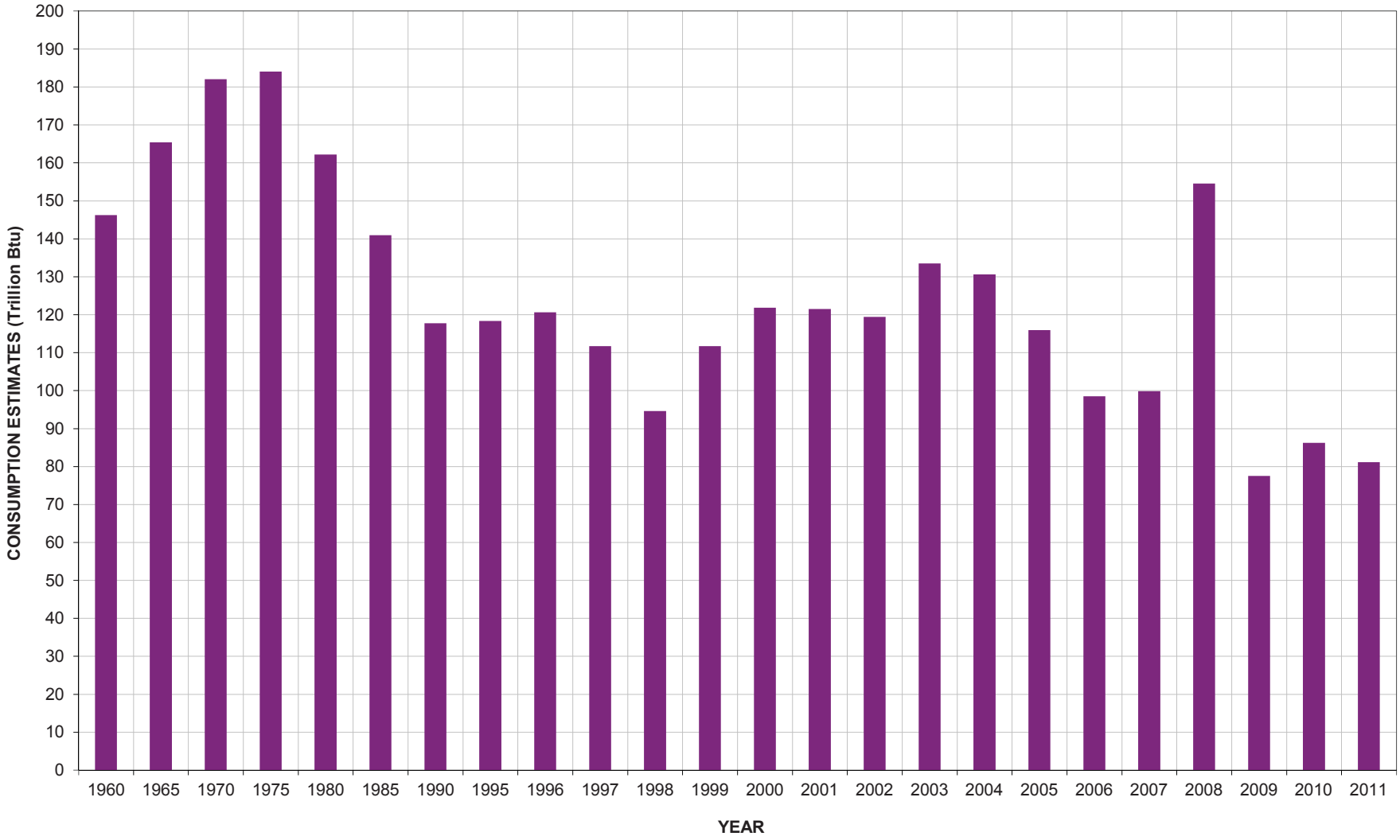
LVPC
Lehigh Valley Planning Commission

FUEL OIL / HEATING OIL

RESIDENTIAL DISTILLATE FUEL OIL CONSUMPTION IN PENNSYLVANIA 1960-2011



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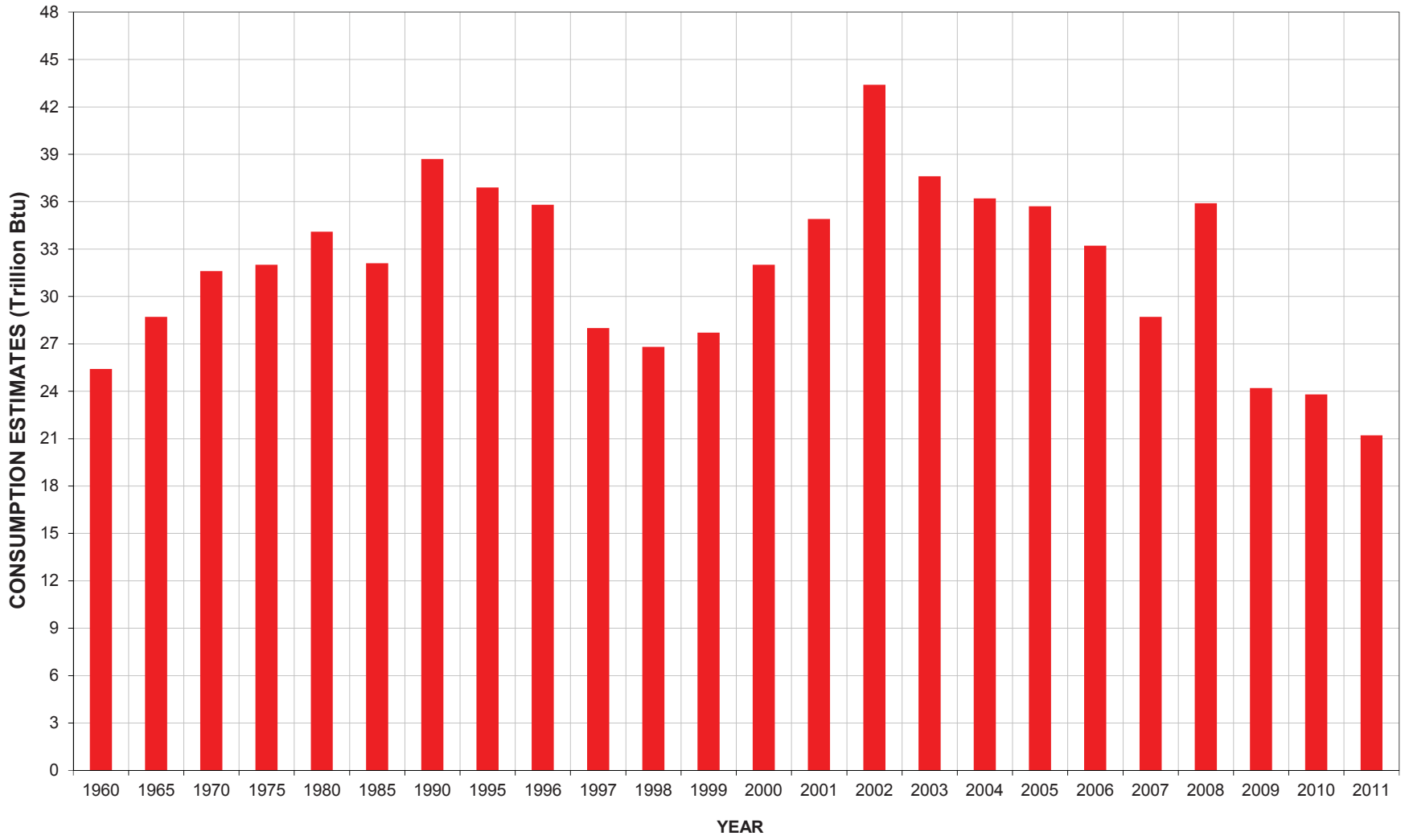
LVPC
Lehigh Valley Planning Commission

FUEL OIL / HEATING OIL

COMMERCIAL SECTOR DISTILLATE FUEL OIL CONSUMPTION IN PENNSYLVANIA 1960-2011



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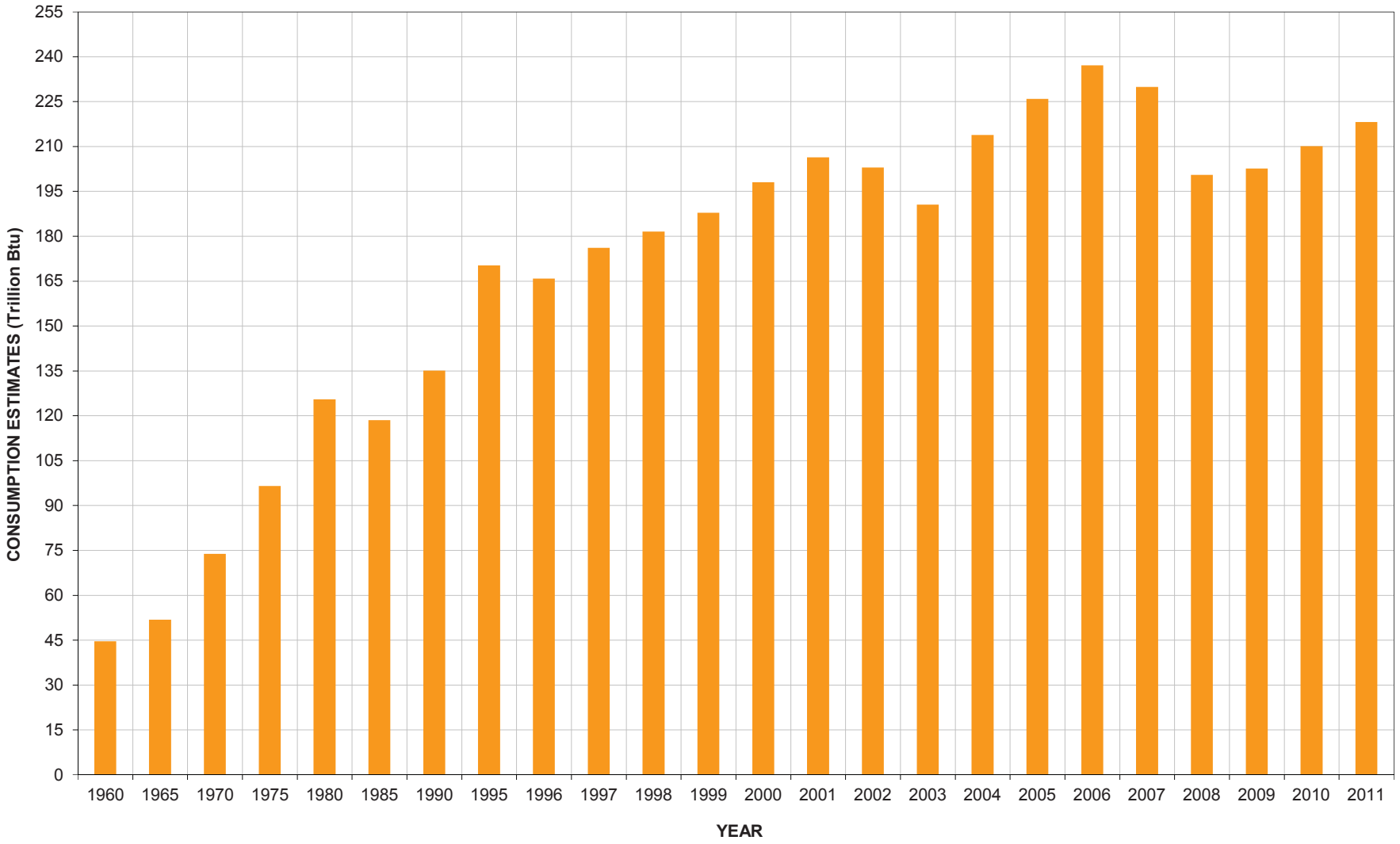
STATE ENERGY DATA, 2011: CONSUMPTION TABLE CT5. COMMERCIAL SECTOR ENERGY CONSUMPTION ESTIMATES, SELECTED YEARS, 1960-2011, PENNSYLVANIA

FUEL OIL / HEATING OIL

TRANSPORTATION SECTOR DISTILLATE FUEL OIL CONSUMPTION IN PENNSYLVANIA 1960-2011



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STATE ENERGY DATA, 2011: CONSUMPTION TABLE CT7. TRANSPORTATION SECTOR ENERGY CONSUMPTION ESTIMATES, SELECTED YEARS, 1960-2011, PENNSYLVANIA

ENERGY PROFILE

Coal[4], a fossil fuel, is a combustible sedimentary rock with a composition of carbon and hydrocarbons. It is a nonrenewable energy source since it takes millions of years to be created, and the rate of depletion is faster than regeneration. The main use of coal consumed in the United States is to generate electricity, accounting for over 90% of coal usage. The northeastern region of Pennsylvania supplies the majority of the nation's anthracite coal; however, the majority of the state's coal production is bituminous coal which is mined in the western part of the state. Several of the nation's largest underground coal mines are located in western Pennsylvania including Enlow Fork Mine, the largest underground coal mine in the U.S.

Pennsylvania is one of the top coal consuming states in the nation. Half of Pennsylvania's coal production is transported to other states in the midwest and along the east coast. The state's coal is used by its power generation market. The state's power generation market accounts for more than one-half of net electricity production. The net electricity generated from coal in 2012 based on preliminary data is 37% of the U.S. total. Based on cost per BTU (a unit of energy content), coal has been the least expensive fossil fuel used to generate energy since 1976. Coal is also used in the process for making steel. Coal used in the steel making process is nearly four times the cost of coal used to generate electricity with costs of $184.44 per ton and $46.29 per ton, respectively. In addition, the heat and by-products of coal are used by various industries for manufacturing products such as plastics, tar and synthetic fibers, to name a few.

In 2000, coal was used by 1.4% of occupied housing units in the Lehigh Valley as house heating fuel according to U.S. Census data. It was the fifth most used source of house heating fuel in the Lehigh Valley. In 2010, 0.8% of occupied housing units in the Lehigh Valley used coal for house heating fuel. It was the sixth most used source of house heating fuel in the Lehigh Valley.

Coal combustion produces emissions which contribute to smog, haze, acid rain, respiratory illness and lung disease. Due to the Clean Air Act and the Clean Water Act, industries are required to reduce the levels of pollutants released into the air and the water. Through technology, industries have found several ways to reduce the levels of impurities in coal such as sulfur, nitrogen oxides (NOx), and others. In addition, more effective ways of cleaning coal after it is mined have been found, and coal consumers have moved towards greater use of low sulfur coal. Energy plants utilize flue gas desulfurization equipment, also known as "scrubbers," to remove sulfur from the smoke before it leaves their smokestacks.

[4]http://www.eia.gov/energyexplained/index.cfm?page=coal_home#tab1

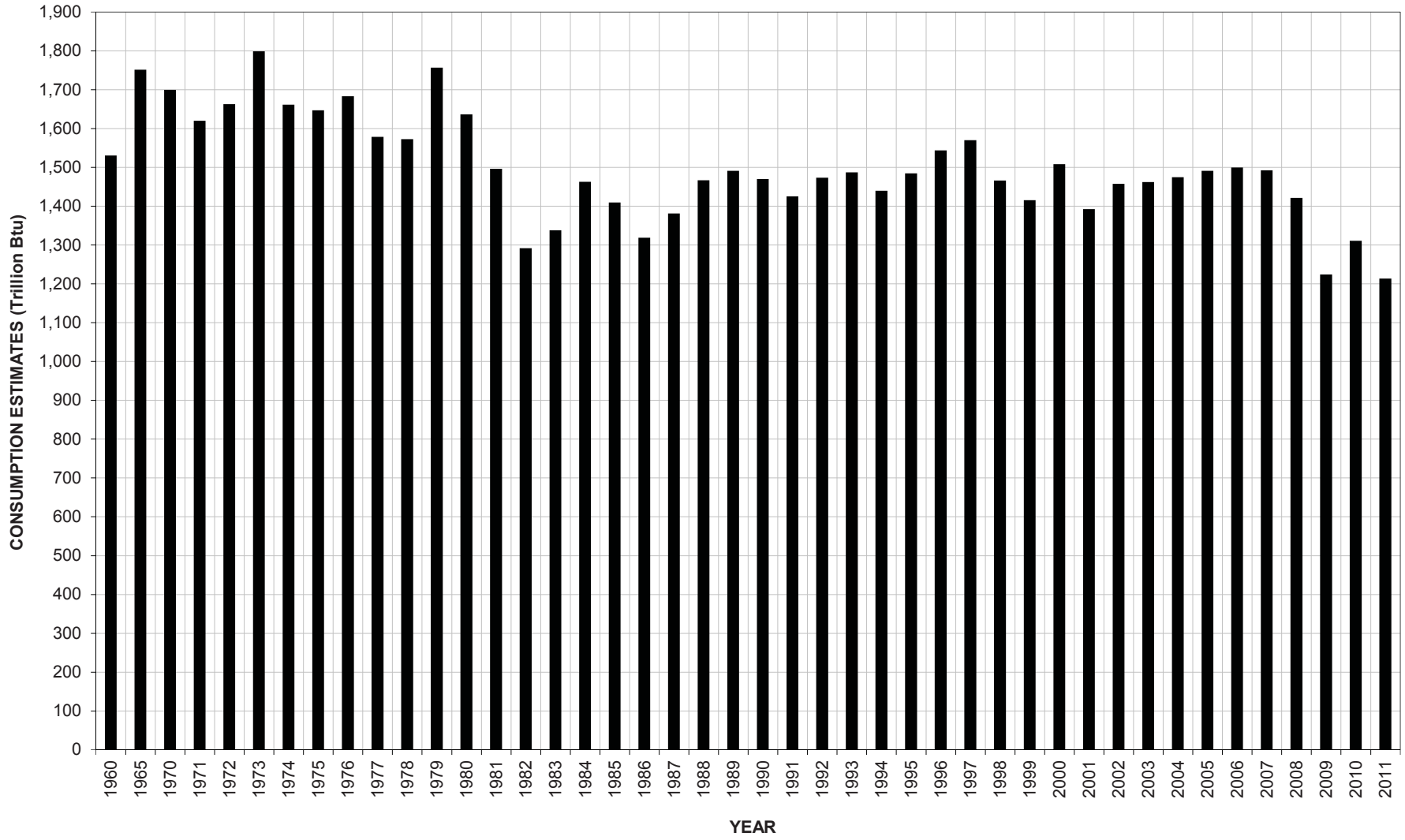
COAL

ENERGY FACTS

- The Electric and Industrial Sectors are the largest consumers of coal accounting for 85% and 15%, respectively, of Pennsylvania coal consumption in 2011.
- The Residential Sector has the lowest usage of coal with less than 1% of Pennsylvania's consumption.
- Coal has decreased in usage as a house heating fuel in the Lehigh Valley from 3,162 housing units in 2000 to 1,957 housing units in 2010.
- The Transportation Sector doesn't use coal.

COAL

PENNSYLVANIA COAL CONSUMPTION 1960-2011



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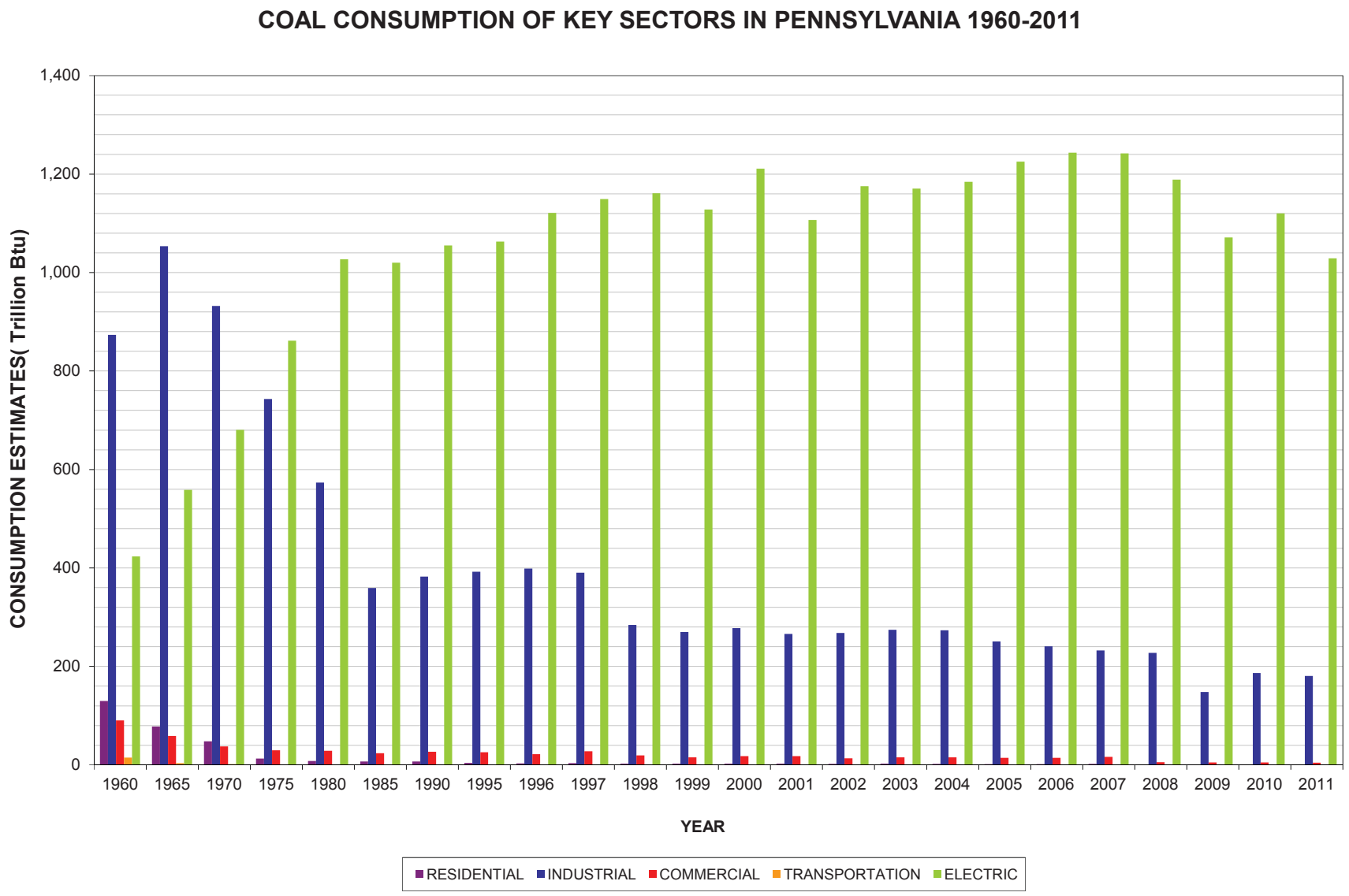
COAL



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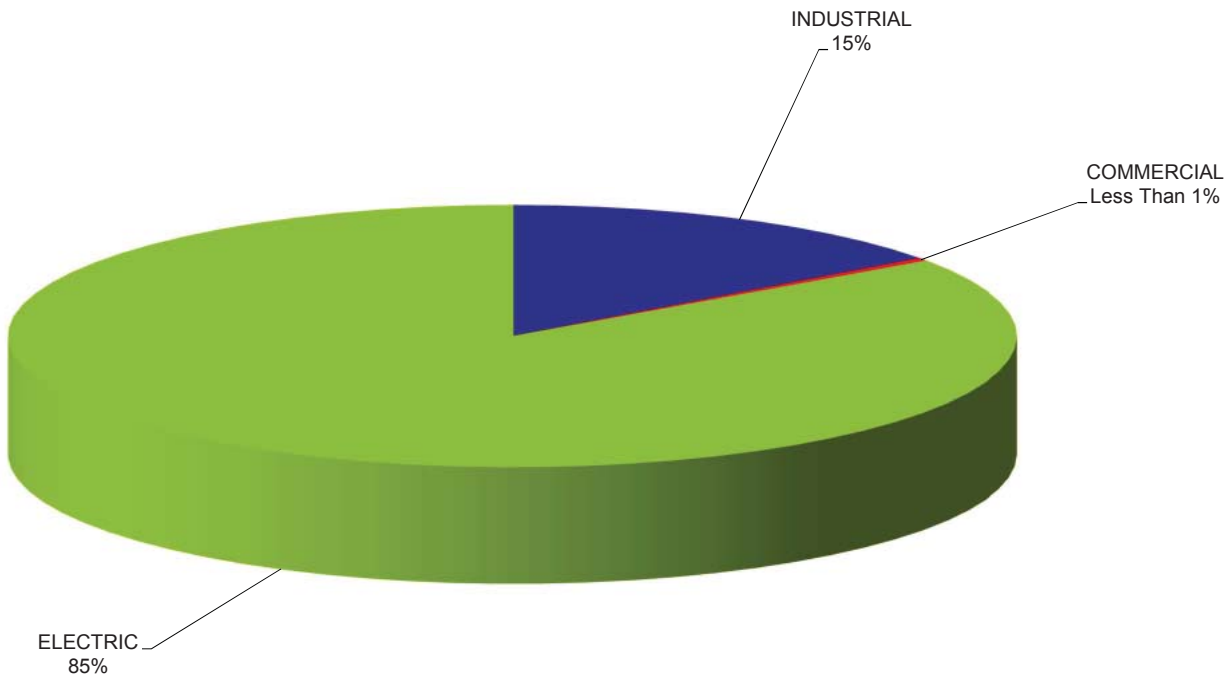
COAL

PENNSYLVANIA COAL CONSUMPTION 2011



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION, STATE ENERGY DATA, 2011

COAL

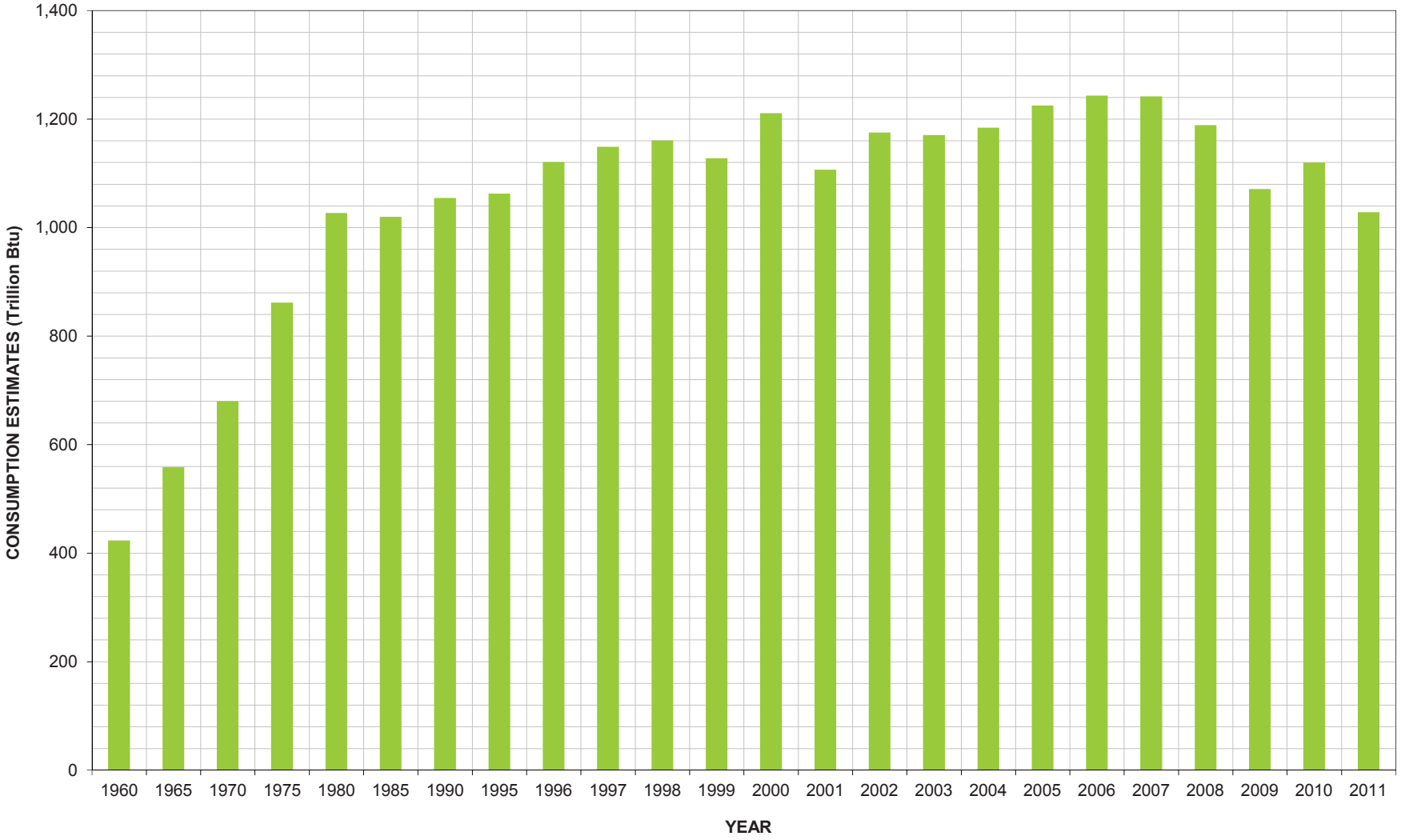
PENNSYLVANIA COAL CONSUMPTION

Sector	Trillion Btu	Percentage
Total	1,213.0	100%
Electric	1,028.4	85%
Industrial	180.3	15%
Residential	0.0	N/A
Commercial	4.3	Less Than 1%
Transportation	0.0	N/A

SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION, STATE ENERGY DATA, 2011

COAL

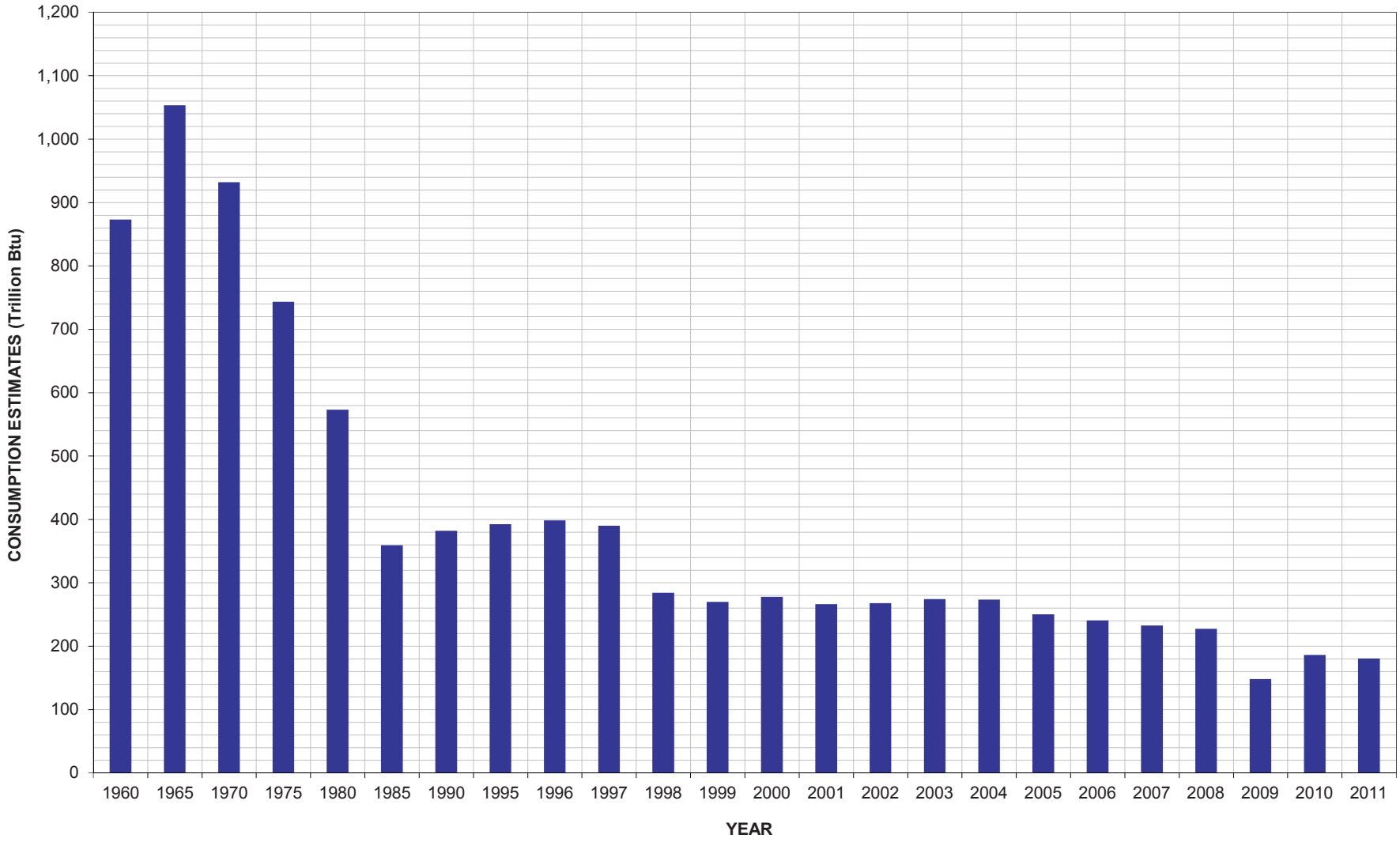
ELECTRIC POWER SECTOR COAL CONSUMPTION IN PENNSYLVANIA 1960-2011



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION
STATE ENERGY DATA, 2011: CONSUMPTION TABLE CT8. ELECTRIC POWER SECTOR CONSUMPTION ESTIMATES, SELECTED YEARS, 1960-2011, PENNSYLVANIA

COAL

INDUSTRIAL SECTOR COAL CONSUMPTION IN PENNSYLVANIA 1960-2011



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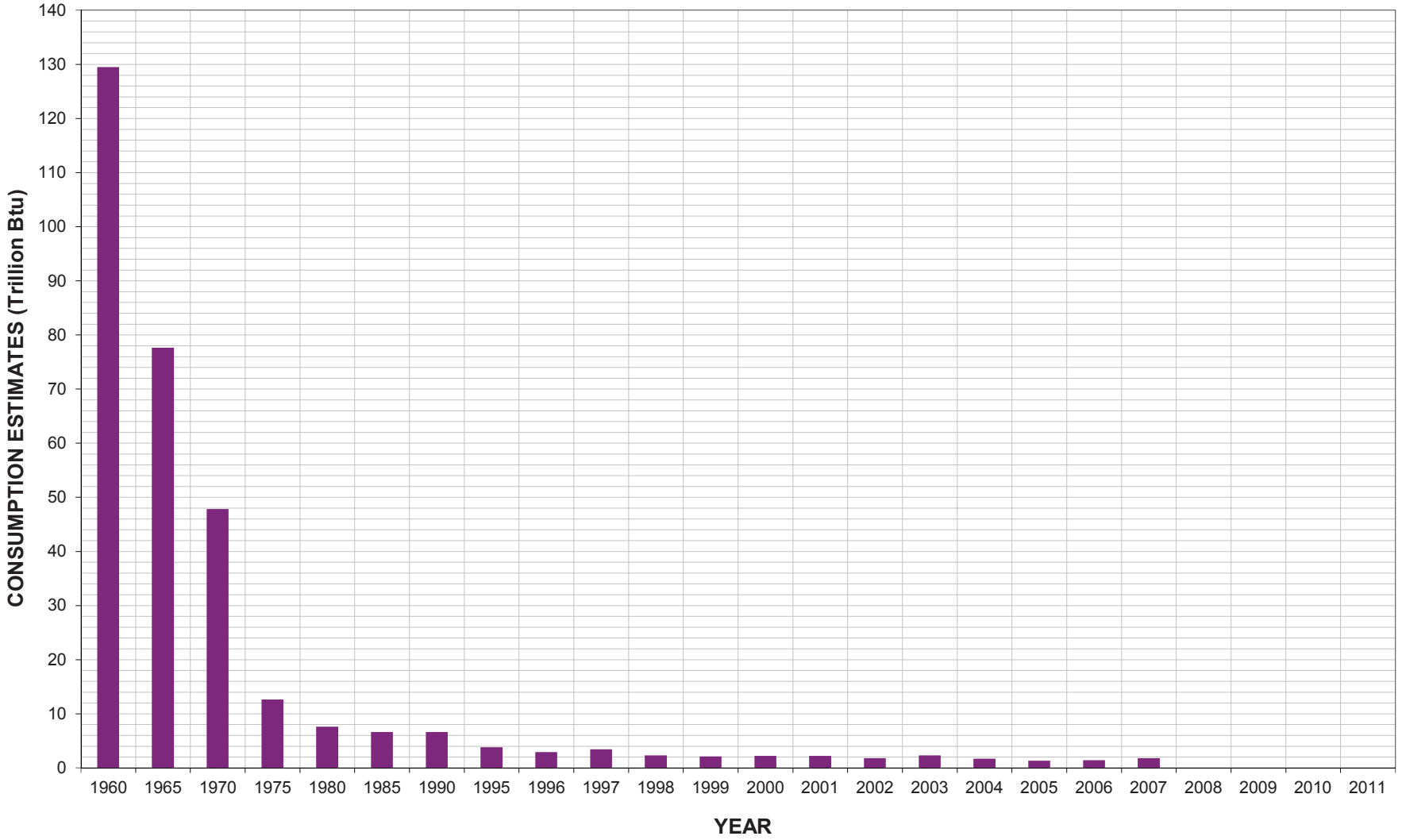
STATE ENERGY DATA, 2011: CONSUMPTION TABLE CT6. INDUSTRIAL SECTOR ENERGY CONSUMPTION ESTIMATES, SELECTED YEARS, 1960-2011, PENNSYLVANIA

COAL

RESIDENTIAL COAL CONSUMPTION IN PENNSYLVANIA 1960-2011



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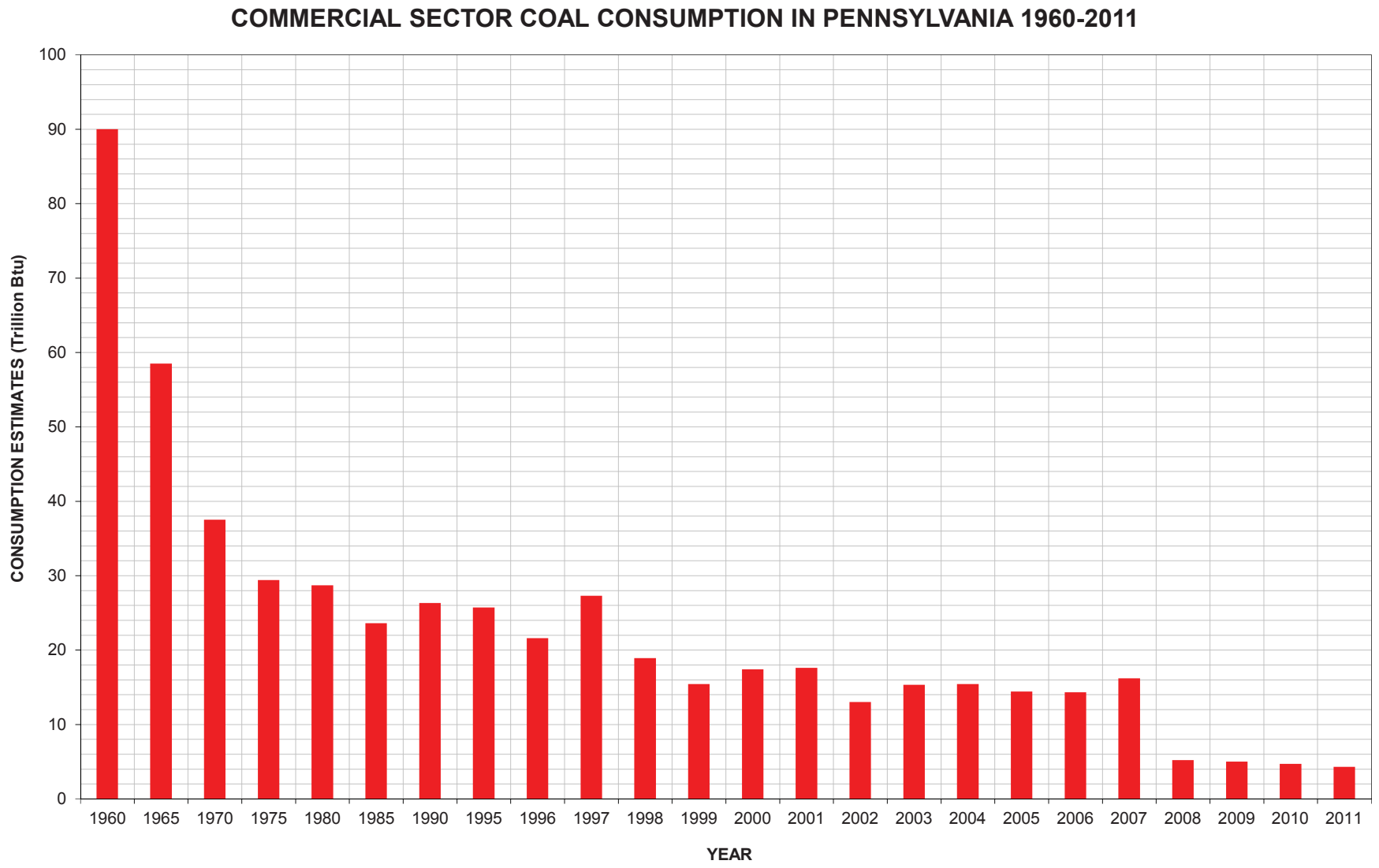

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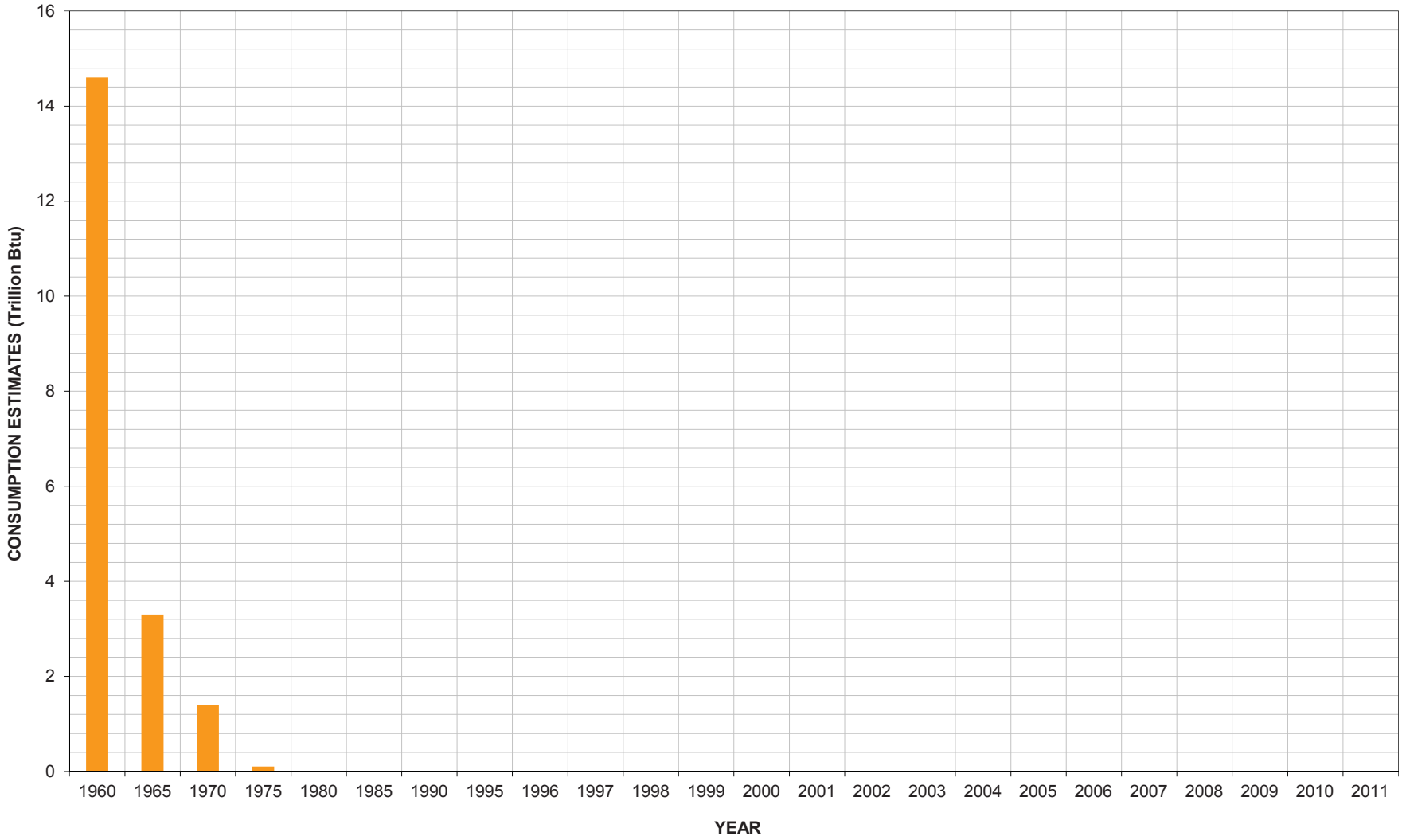
STATE ENERGY DATA, 2011: CONSUMPTION TABLE CT5. COMMERCIAL SECTOR ENERGY CONSUMPTION ESTIMATES, SELECTED YEARS, 1960-2011, PENNSYLVANIA

COAL

TRANSPORTATION SECTOR COAL CONSUMPTION IN PENNSYLVANIA 1960-2011



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ENERGY PROFILE

Electricity[5] is a secondary energy source. Electricity is an energy carrier since it is produced from the conversion of other energy sources such as coal, natural gas, and nuclear, among other sources. Electricity is neither renewable nor nonrenewable; however, the energy sources used to make electricity can be renewable or nonrenewable. Electricity is used by the commercial, industrial, transportation and residential sectors. Pennsylvania deregulated electricity in 1996. Consumers are allowed to price shop for the electricity generation portion of their energy cost. The transmission and delivery rates of electricity are regulated and do not change based on suppliers. The Lehigh Valley is served by PP&L and Met Ed Electric (GPU First Energy Corp) for electricity delivery.

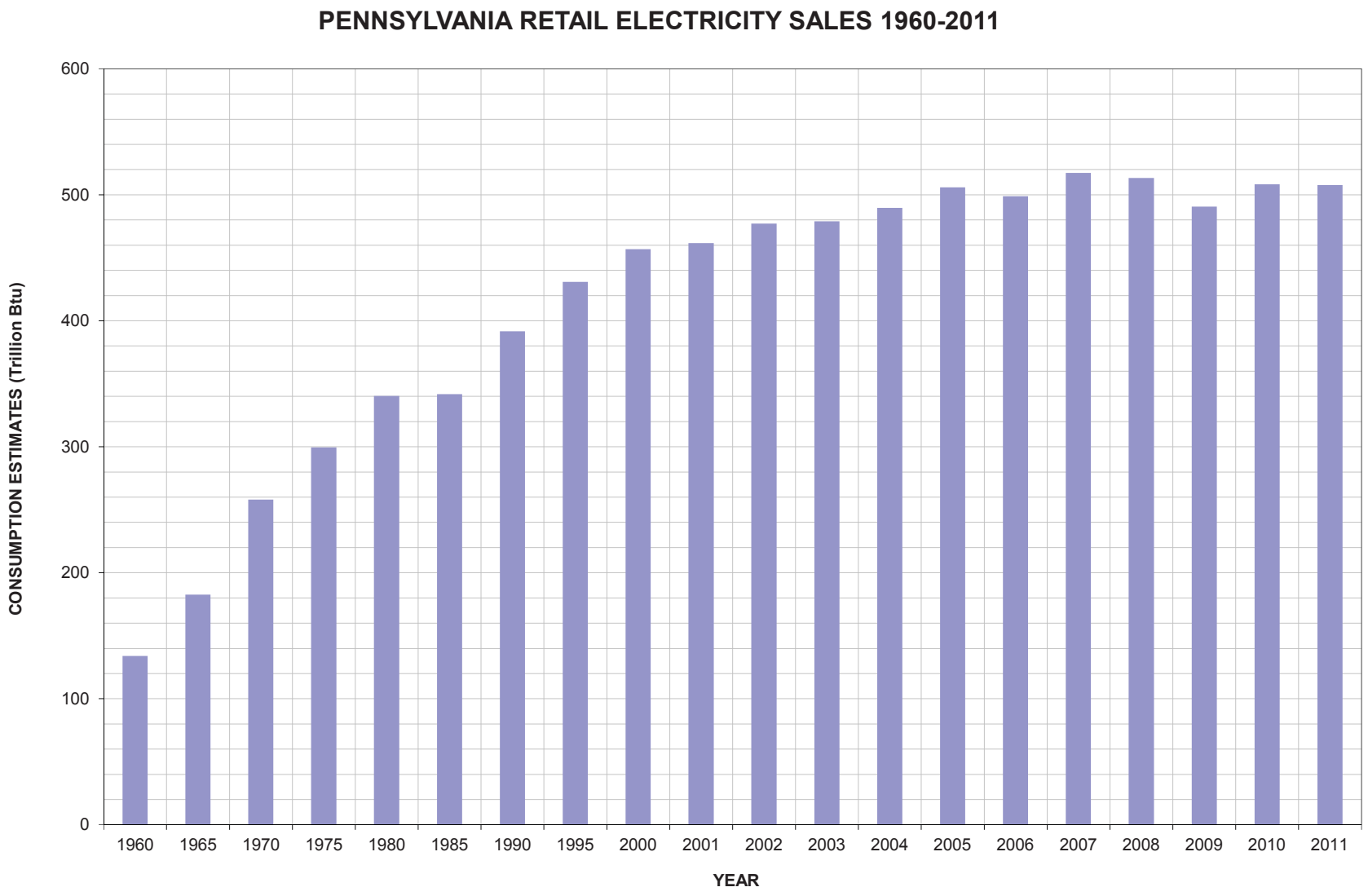
In 2000, electricity was used by 30.5% of occupied housing units in the Lehigh Valley as house heating fuel according to U.S. Census data. It was the second most used source of house heating fuel in the Lehigh Valley. In 2010, 31.8% of occupied housing units in the Lehigh Valley used electricity for house heating fuel. It was the second most used source of house heating fuel in the Lehigh Valley.

[5]http://www.eia.gov/energyexplained/index.cfm?page=electricity_home

ENERGY FACTS

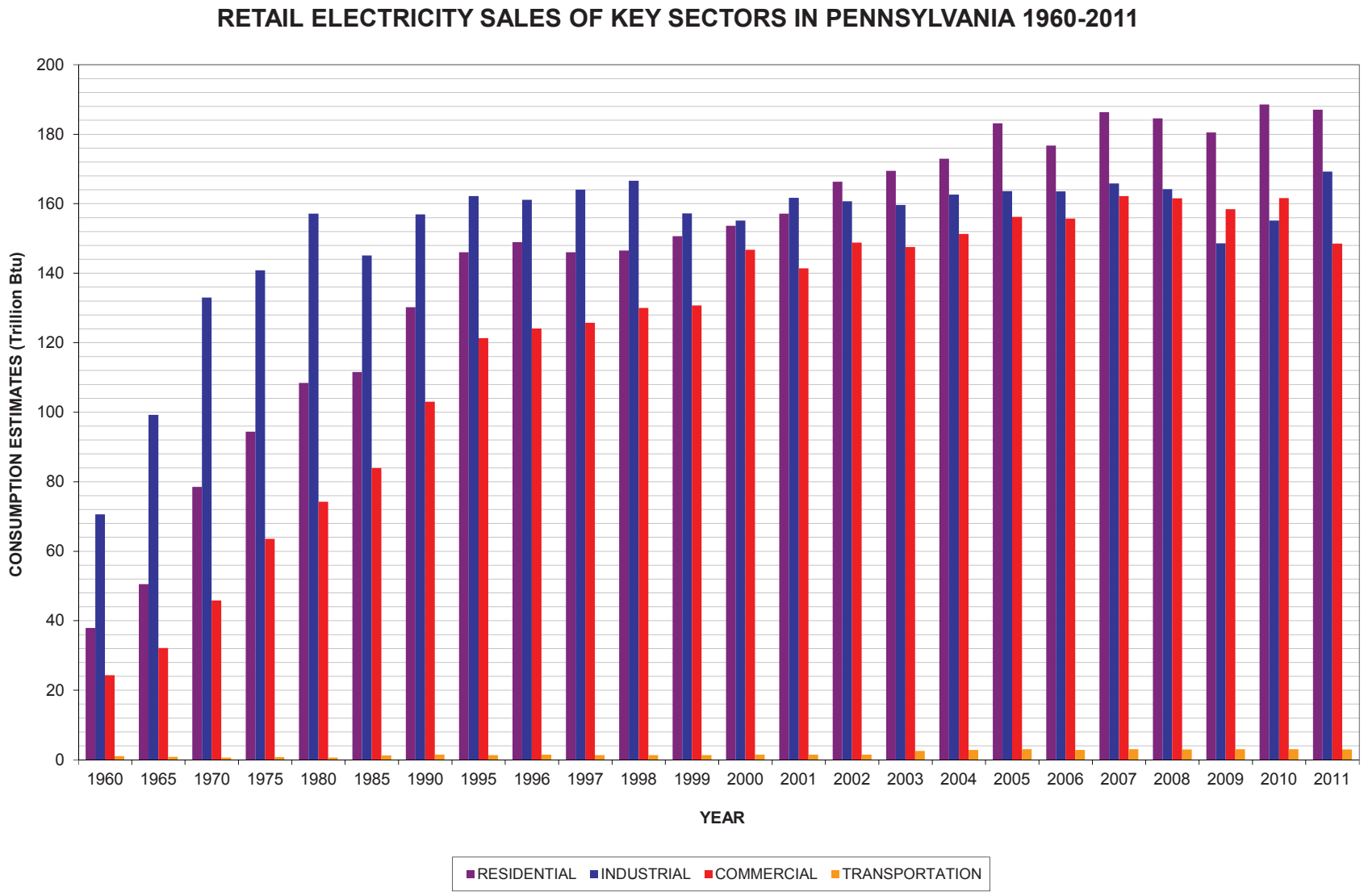
- The Residential Sector has the most retail electricity sales, followed by the Industrial and Commercial Sectors.
- After 2002, the Transportation Sector retail sales nearly doubled and thereafter, leveled off with minimal fluctuations at 2.9 trillion BTU in 2011.
- Electricity has increased in usage as a house heating fuel in the Lehigh Valley from 68,163 housing units in 2000 to 78,237 housing units in 2010.

ELECTRICITY



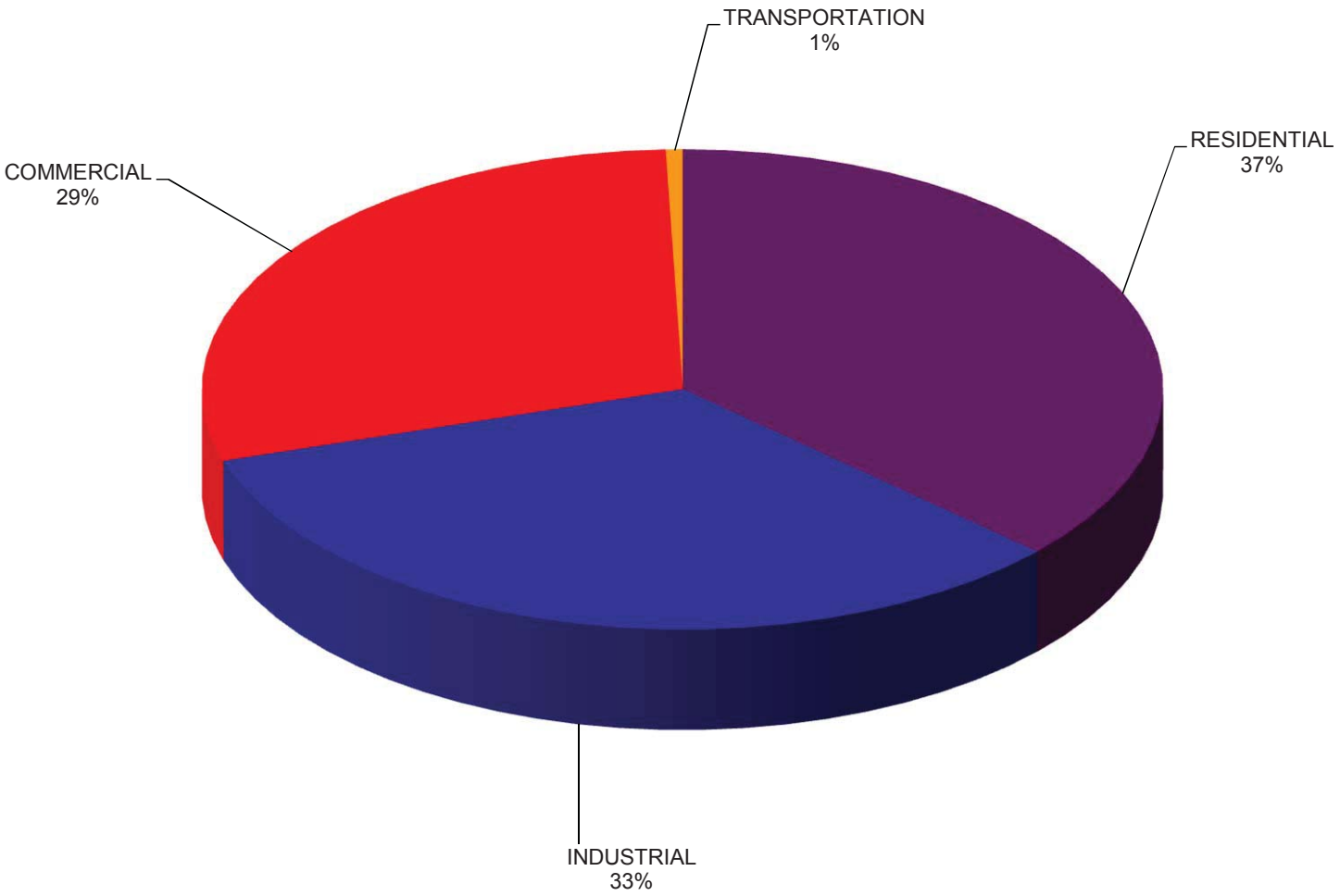
SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION
STATE ENERGY DATA, 2011: CONSUMPTION TABLE CT2. PRIMARY ENERGY CONSUMPTION ESTIMATES, SELECTED YEARS, 1960-2011, PENNSYLVANIA

ELECTRICITY



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION STATE ENERGY DATA, 2011: CONSUMPTION TABLES CT4, CT5, CT6, CT7 AND CT8

PENNSYLVANIA RETAIL ELECTRICITY SALES 2011



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION, STATE ENERGY DATA, 2011

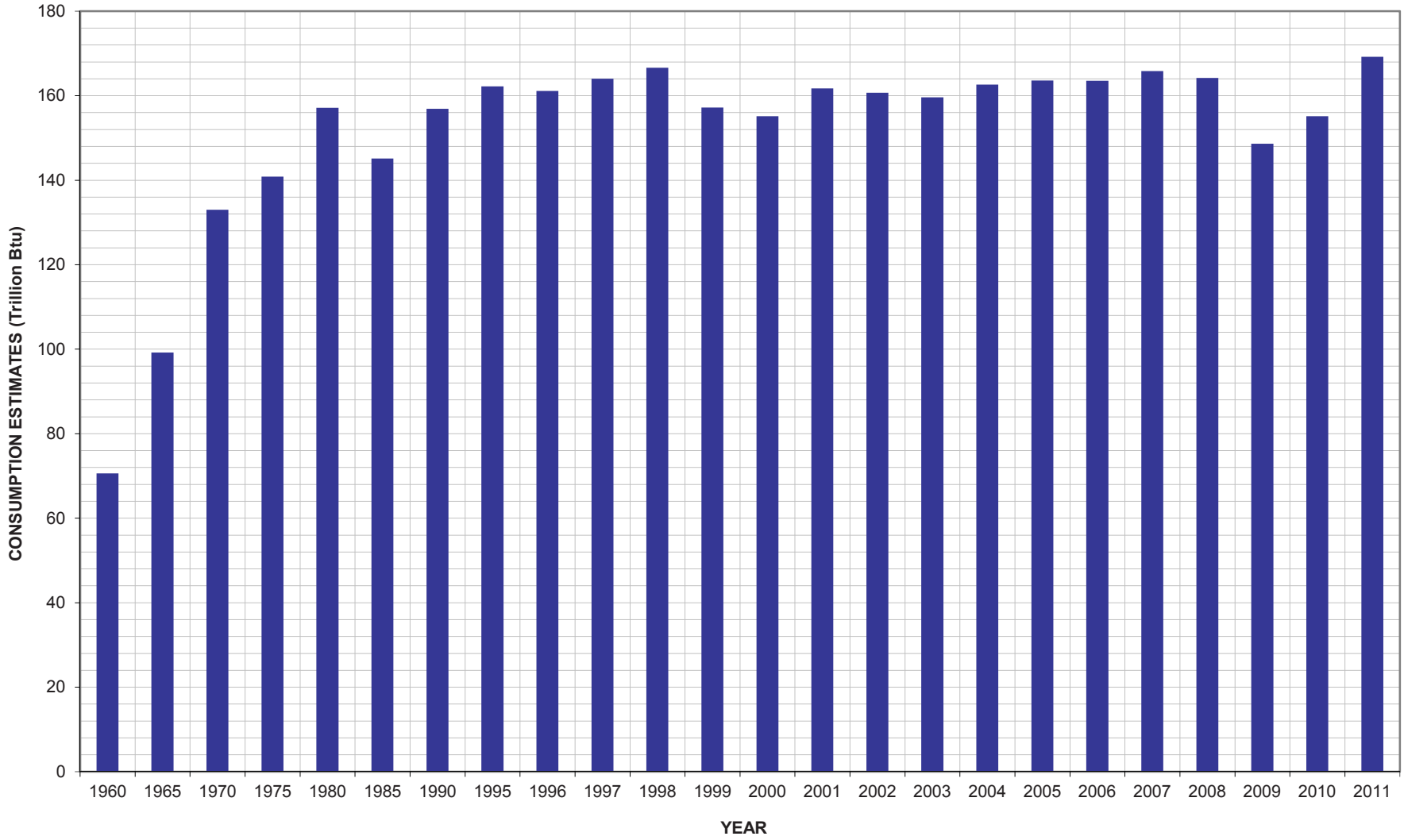
ELECTRICITY

PENNSYLVANIA RETAIL ELECTRICITY SALES

Sector	Trillion Btu	Percentage
Total	507.6	100%
Electric	N/A	N/A
Industrial	169.2	33%
Residential	187.0	37%
Commercial	148.5	29%
Transportation	2.9	1%

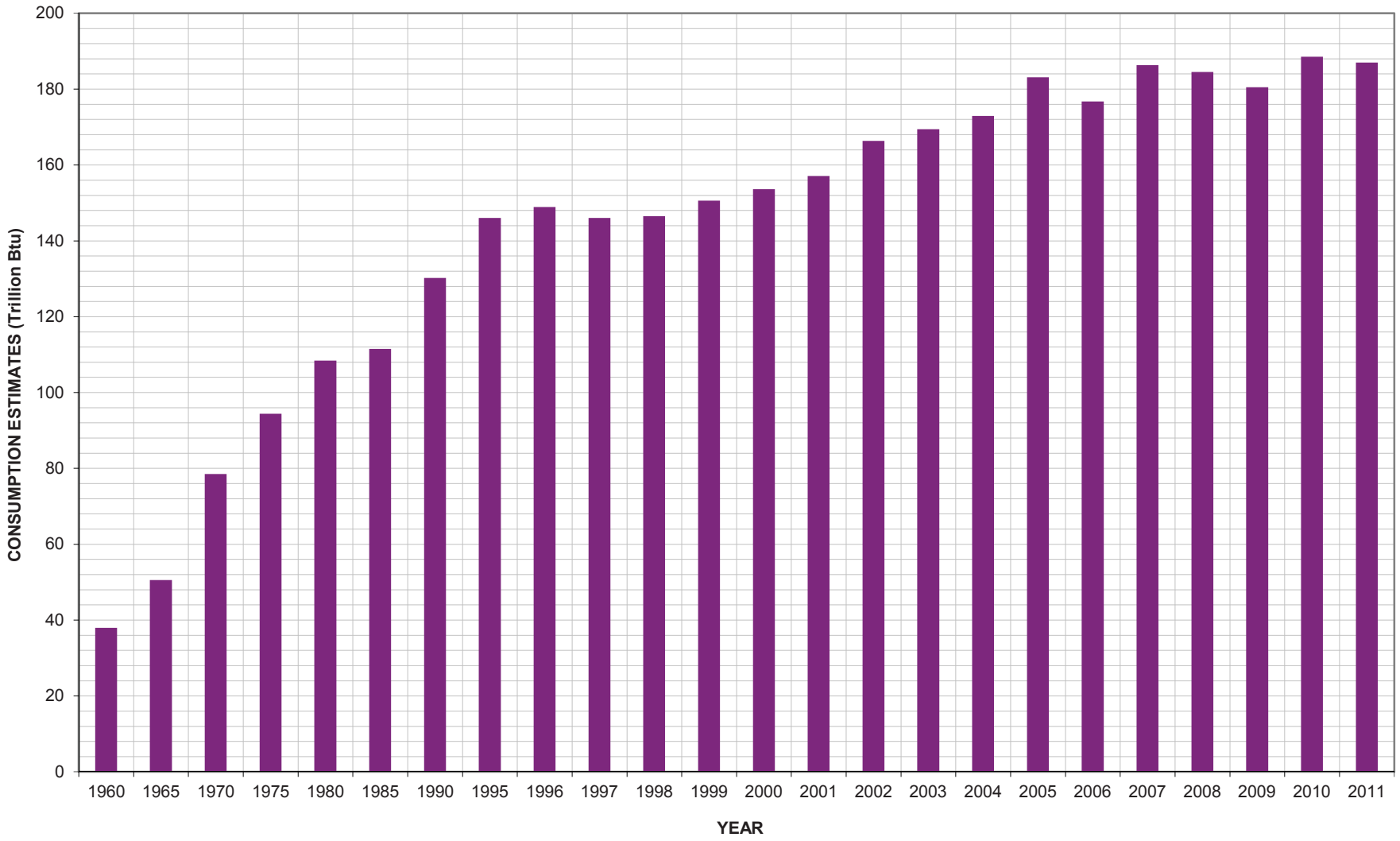
SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION, STATE ENERGY DATA, 2011

INDUSTRIAL SECTOR RETAIL ELECTRICITY SALES IN PENNSYLVANIA 1960-2011



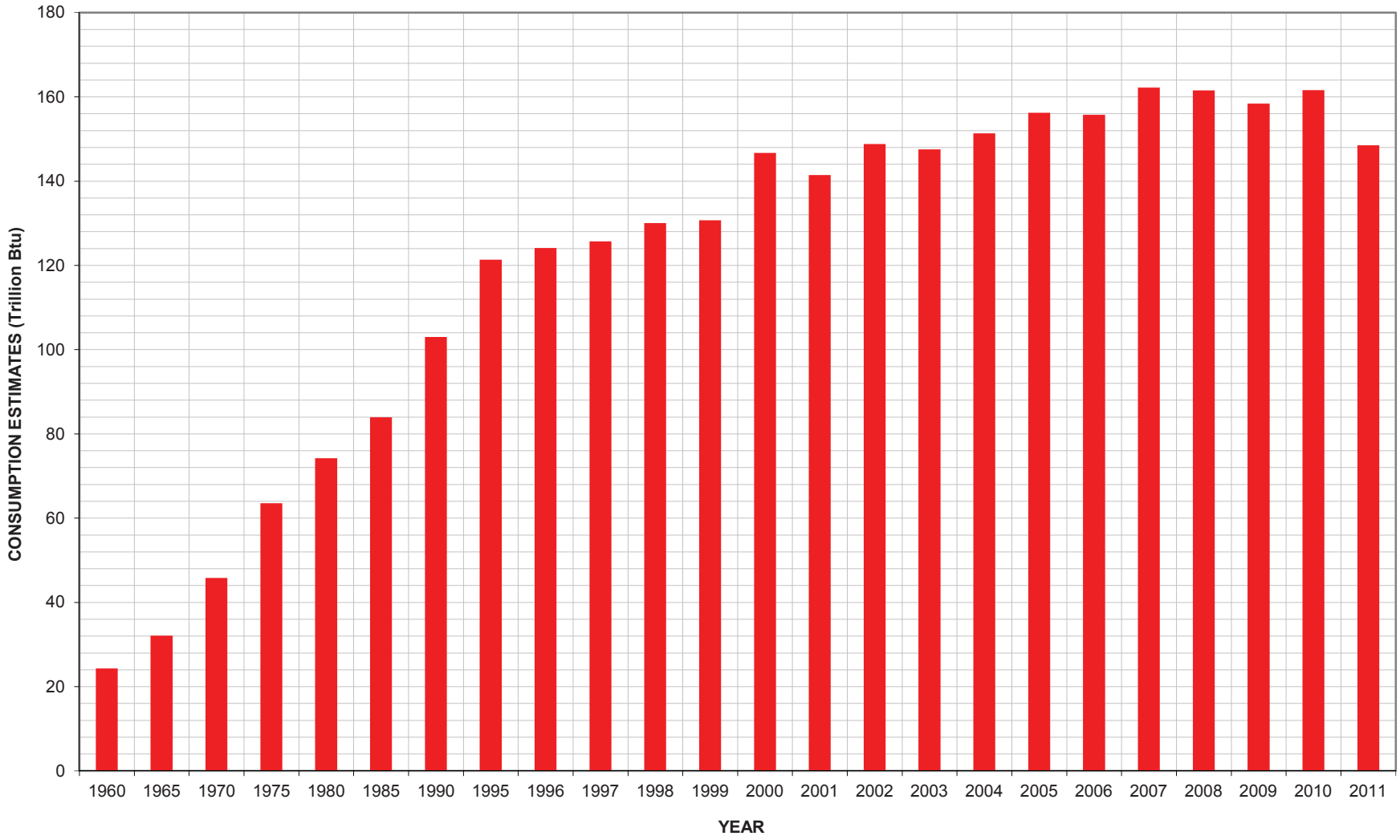
SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION
STATE ENERGY DATA, 2011: CONSUMPTION TABLE CT6. INDUSTRIAL SECTOR ENERGY CONSUMPTION ESTIMATES, SELECTED YEARS, 1960-2011, PENNSYLVANIA

RESIDENTIAL RETAIL ELECTRICITY SALES IN PENNSYLVANIA 1960-2011



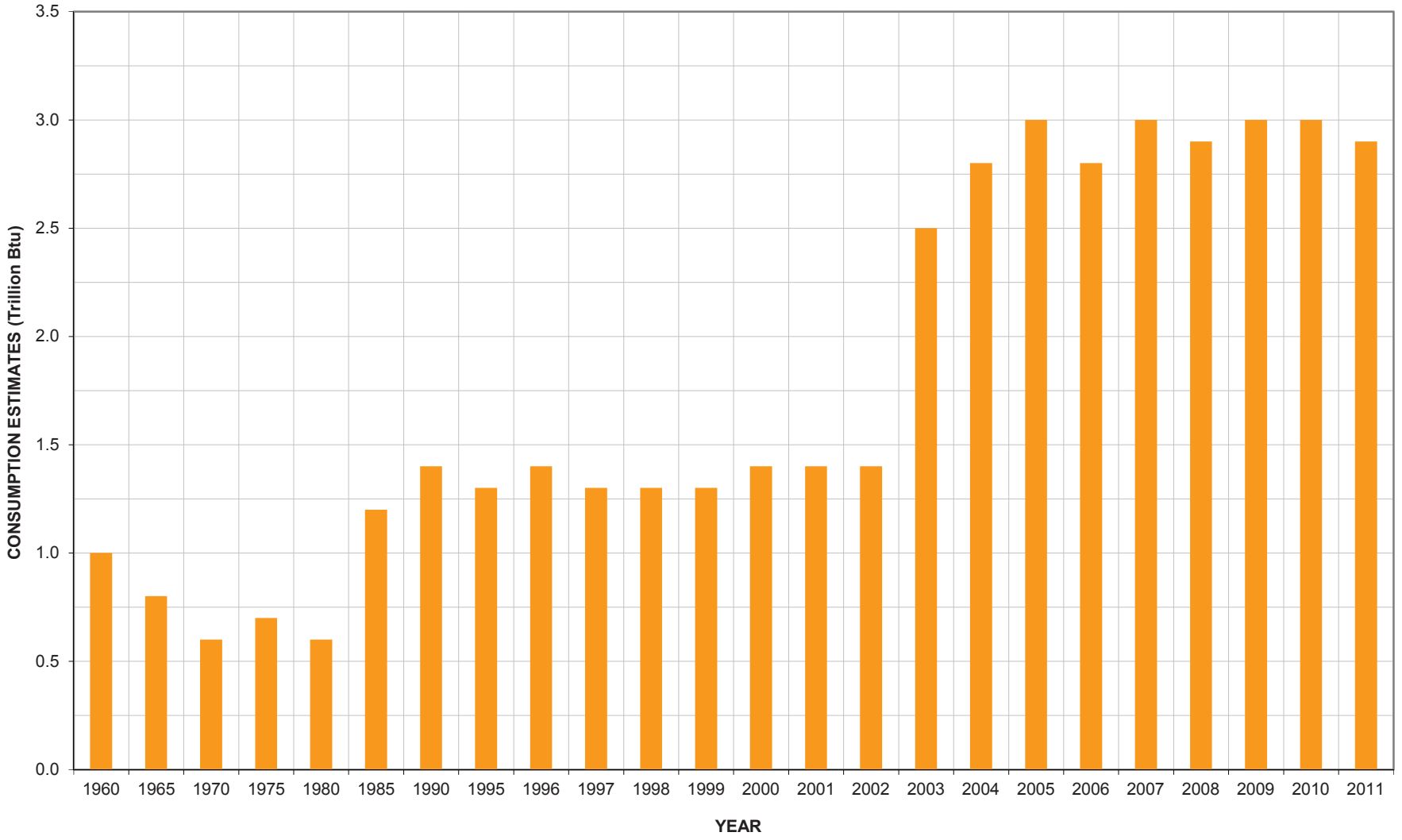
SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION
STATE ENERGY DATA, 2011: CONSUMPTION TABLE CT4. RESIDENTIAL SECTOR ENERGY CONSUMPTION ESTIMATES, SELECTED YEARS, 1960-2011, PENNSYLVANIA

COMMERCIAL SECTOR RETAIL ELECTRICITY SALES IN PENNSYLVANIA 1960-2011



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION
STATE ENERGY DATA, 2011: CONSUMPTION TABLE CT5. COMMERCIAL SECTOR ENERGY CONSUMPTION ESTIMATES, SELECTED YEARS, 1960-2011, PENNSYLVANIA

TRANSPORTATION SECTOR RETAIL ELECTRICITY SALES IN PENNSYLVANIA 1960-2011



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION
STATE ENERGY DATA, 2011: CONSUMPTION TABLE CT7. TRANSPORTATION SECTOR ENERGY CONSUMPTION ESTIMATES, SELECTED YEARS, 1960-2011, PENNSYLVANIA

ENERGY PROFILE

Propane[6] is an energy rich gas (C_3H_8) also known as bottled gas. It is one of the liquefied petroleum gases (LP gases or LPGs) that is found mixed with natural gas and oil. Propane is a nonrenewable fossil fuel, like the natural gas and oil it is produced from. Like natural gas (methane), propane is colorless and odorless, and foul smelling Mercaptan is added to it to make gas leaks easy to detect. Propane naturally occurs as a gas. However, at higher pressure or lower temperatures it becomes a liquid. Because propane is 270 times more compact as a liquid than as a gas, it is transported and stored as a liquid. Propane becomes a gas again when a valve is opened to release it from its pressurized container.

In homes, propane is used for heating homes and water, cooking, refrigerating food, drying clothes and fueling gas fireplaces and barbecue grills. The average residential tank holds between 500 and 1,000 gallons of liquid fuel and is refilled several times a year. On farms, propane is used to dry corn and power farm equipment and irrigation pumps. Businesses and industry use propane to run their fork lifts and other equipment. While only a small fraction of propane is used for transportation, it is the second largest alternate transportation fuel in use today. Propane often fuels fleets of vehicles used by school districts, government agencies and taxicab companies. Propane accounts for less than 2% of all energy used in the United States. It is the most common source of energy in rural areas that do not have natural gas service. Approximately 2.5% of occupied residential units in the Lehigh Valley use bottled, tank or LP gas as a heating fuel according to the U.S. Census Bureau's 2010 American Community Survey.

[6]http://www.eia.gov/energyexplained/index.cfm?page=propane_home

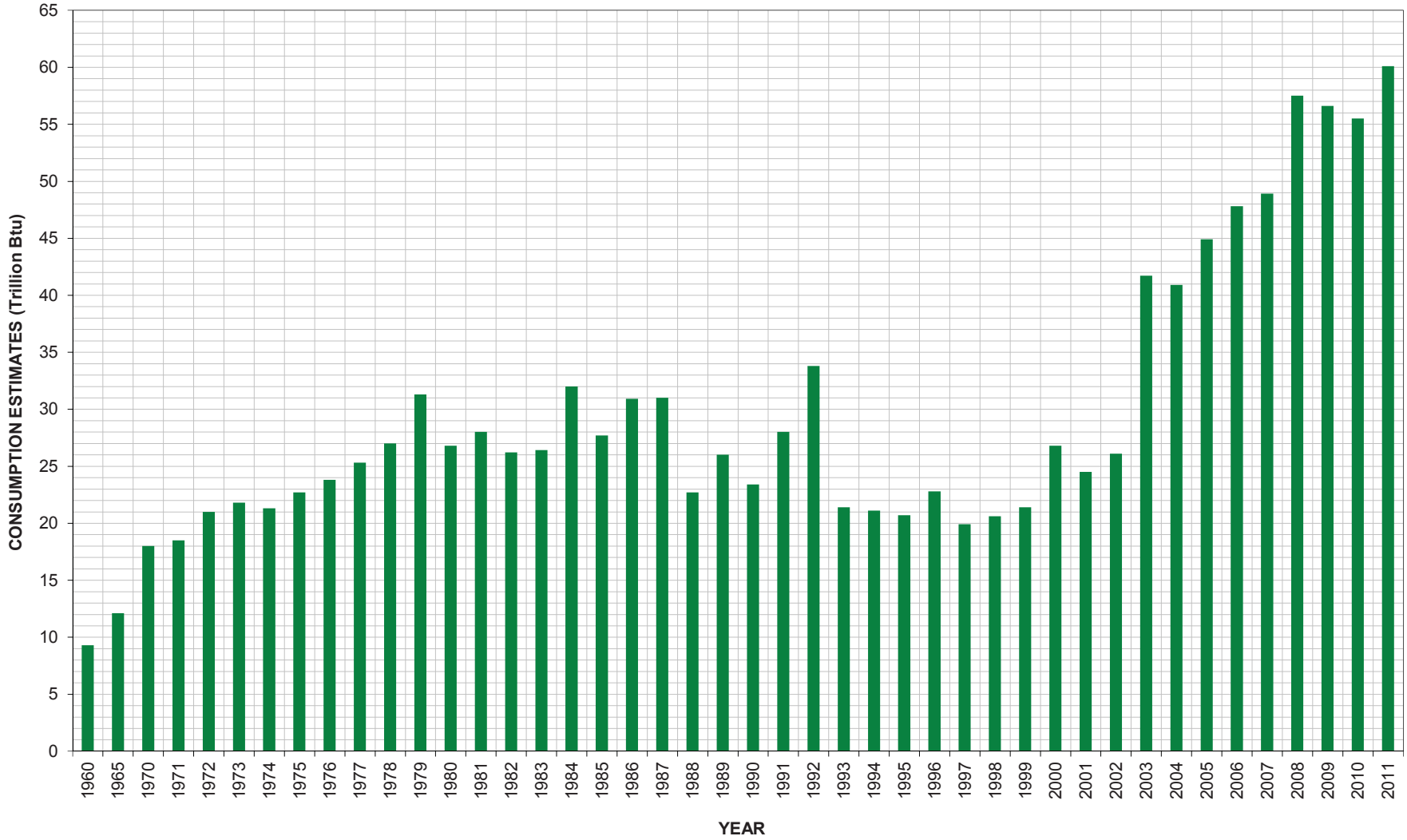
PROPANE

ENERGY FACTS

- From 1995 to 2002 the Residential Sector was the largest consumer of LP gas.
- From 2003 to 2011 the Industrial Sector was the largest consumer of LP gas.
- Between 2002 to 2011, the consumption of LP gas by the Industrial Sector increased significantly from 7.6 trillion BTU to 30.8 trillion BTU.
- LP gas has increased in usage as a house heating fuel in the Lehigh Valley from 4,360 housing units in 2000 to 6,165 housing units in 2010.

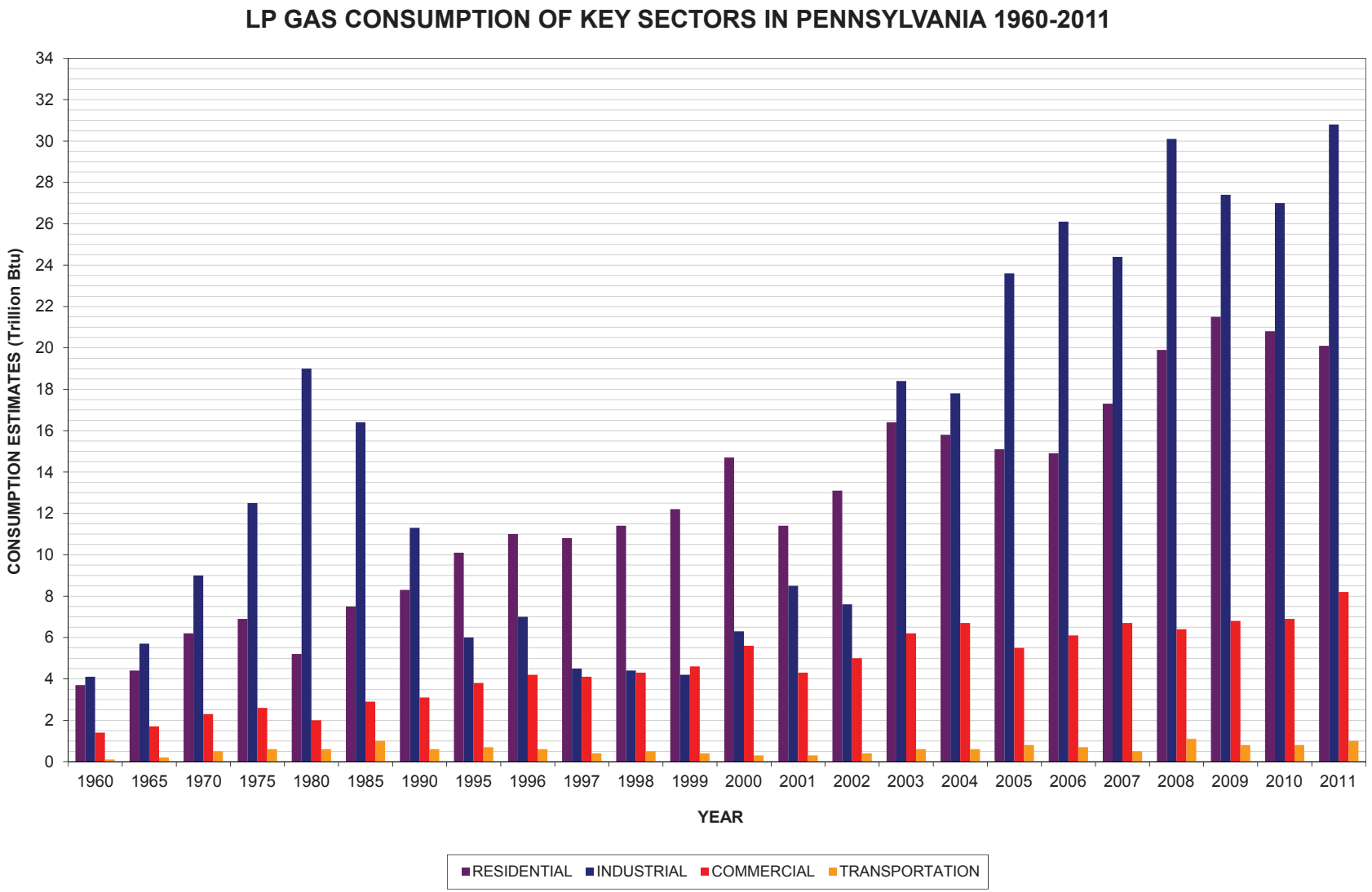
PROPANE

PENNSYLVANIA LP GAS CONSUMPTION 1960-2011



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION
STATE ENERGY DATA, 2011: CONSUMPTION TABLE CT2. PRIMARY ENERGY CONSUMPTION ESTIMATES, SELECTED YEARS, 1960-2011, PENNSYLVANIA

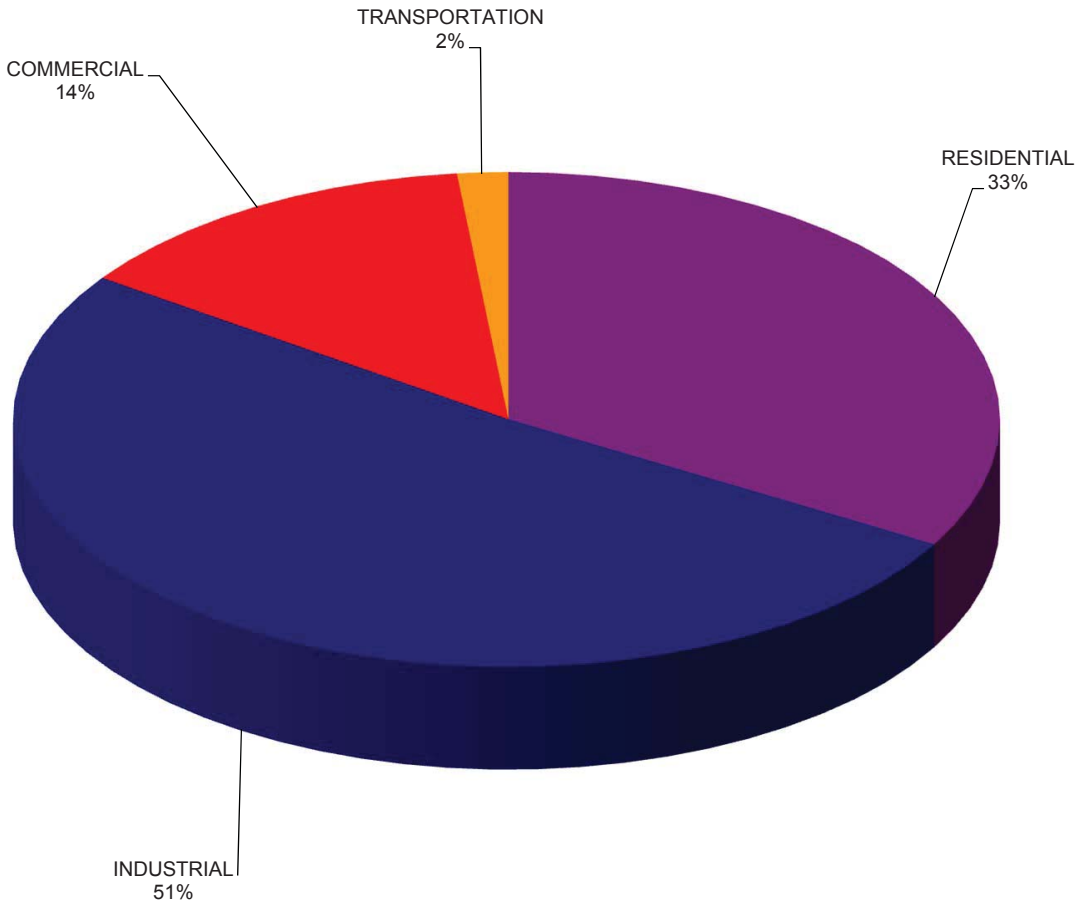
PROPANE



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION STATE ENERGY DATA, 2011: CONSUMPTION TABLES CT4, CT5, CT6, CT7 AND CT8

PROPANE

PENNSYLVANIA LP GAS CONSUMPTION 2011



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION, STATE ENERGY DATA, 2011

PROPANE

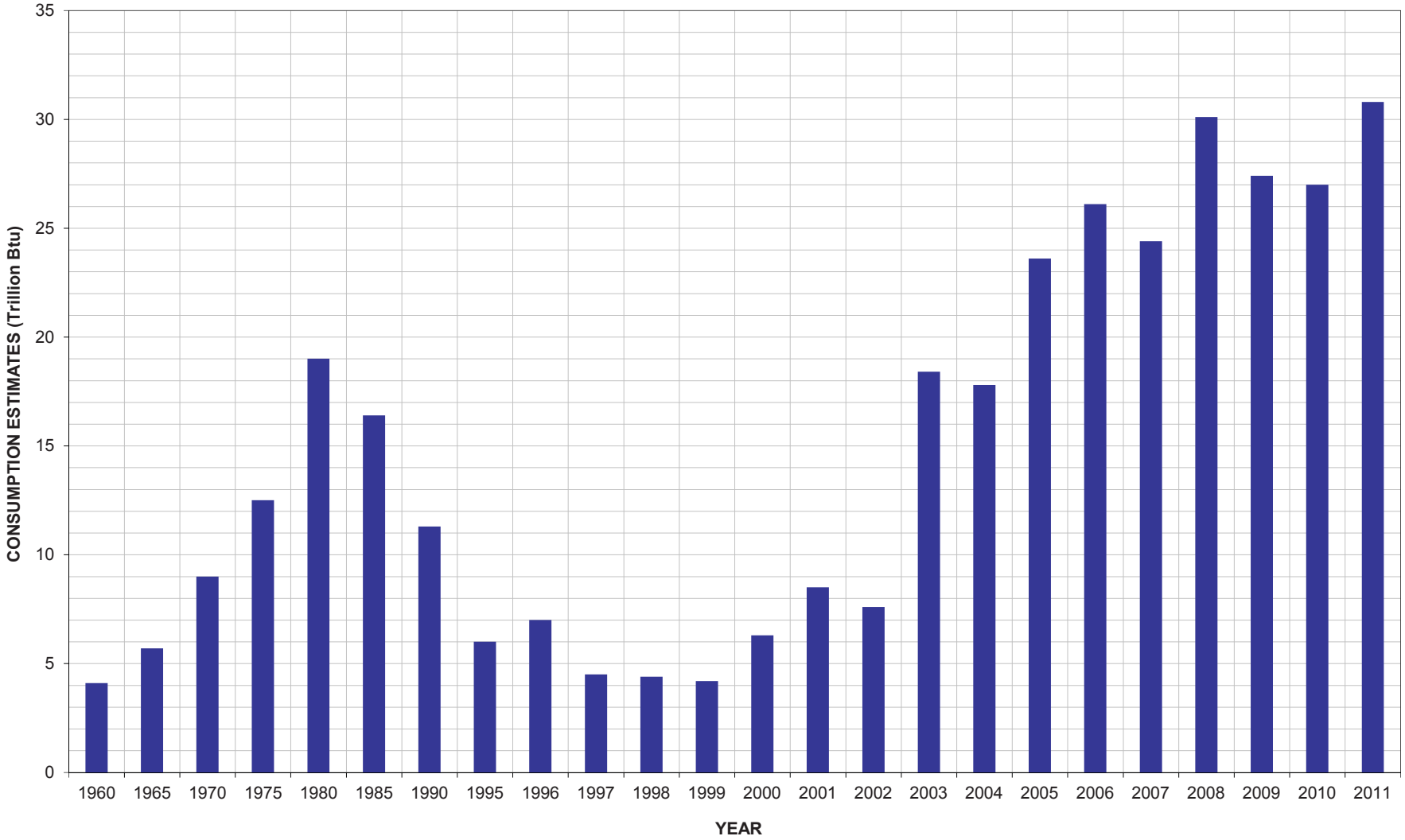
PENNSYLVANIA LP GAS CONSUMPTION

Sector	Trillion Btu	Percentage
Total	60.1	0%
Electric	0.0	0%
Industrial	30.8	51%
Residential	20.1	33%
Commercial	8.2	14%
Transportation	1.0	2%

SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION, STATE ENERGY DATA, 2011

PROPANE

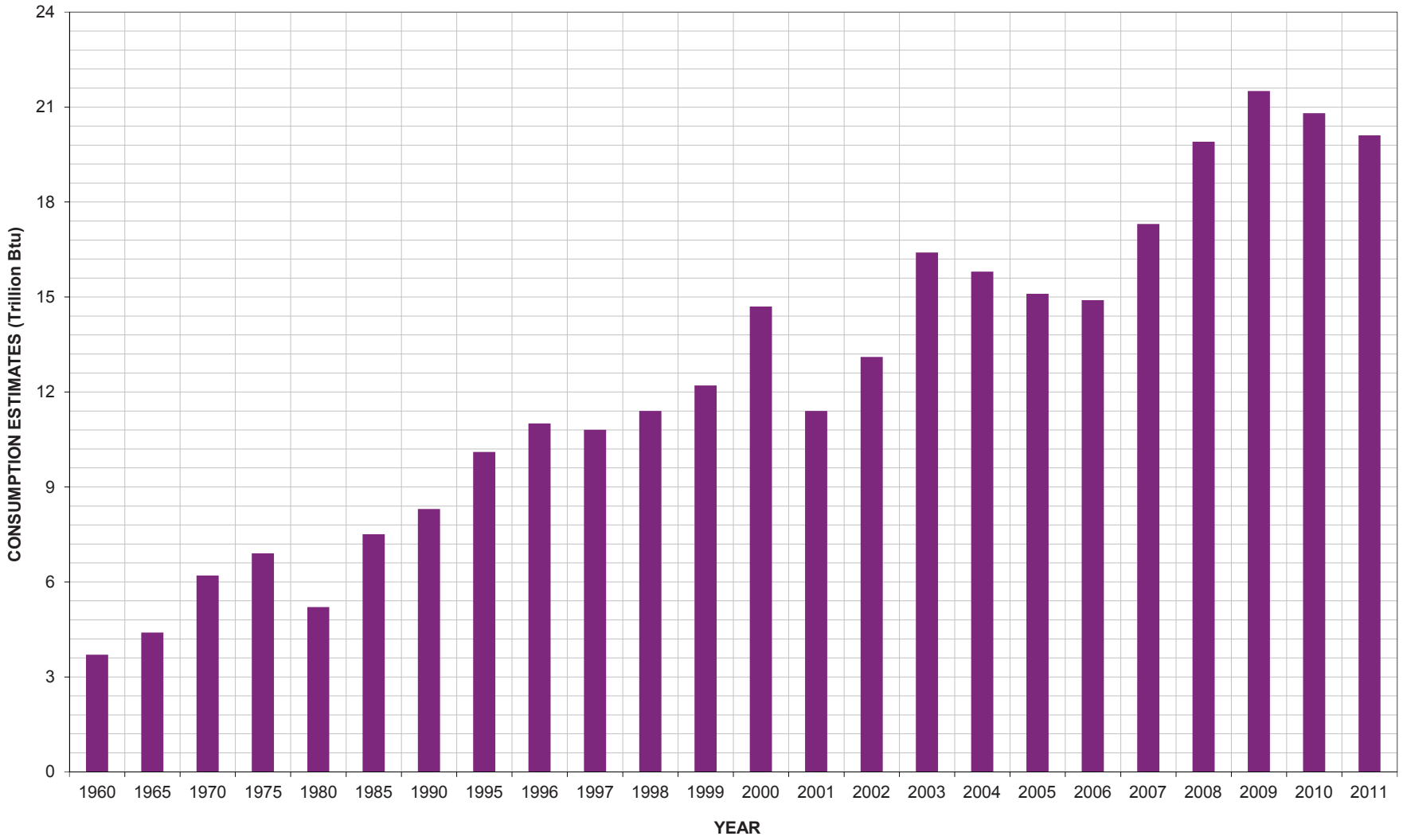
INDUSTRIAL SECTOR LP GAS CONSUMPTION IN PENNSYLVANIA 1960-2011



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION
STATE ENERGY DATA, 2011: CONSUMPTION TABLE CT6. INDUSTRIAL SECTOR ENERGY CONSUMPTION ESTIMATES, SELECTED YEARS, 1960-2011, PENNSYLVANIA

PROPANE

RESIDENTIAL LP GAS CONSUMPTION IN PENNSYLVANIA 1960-2011



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION
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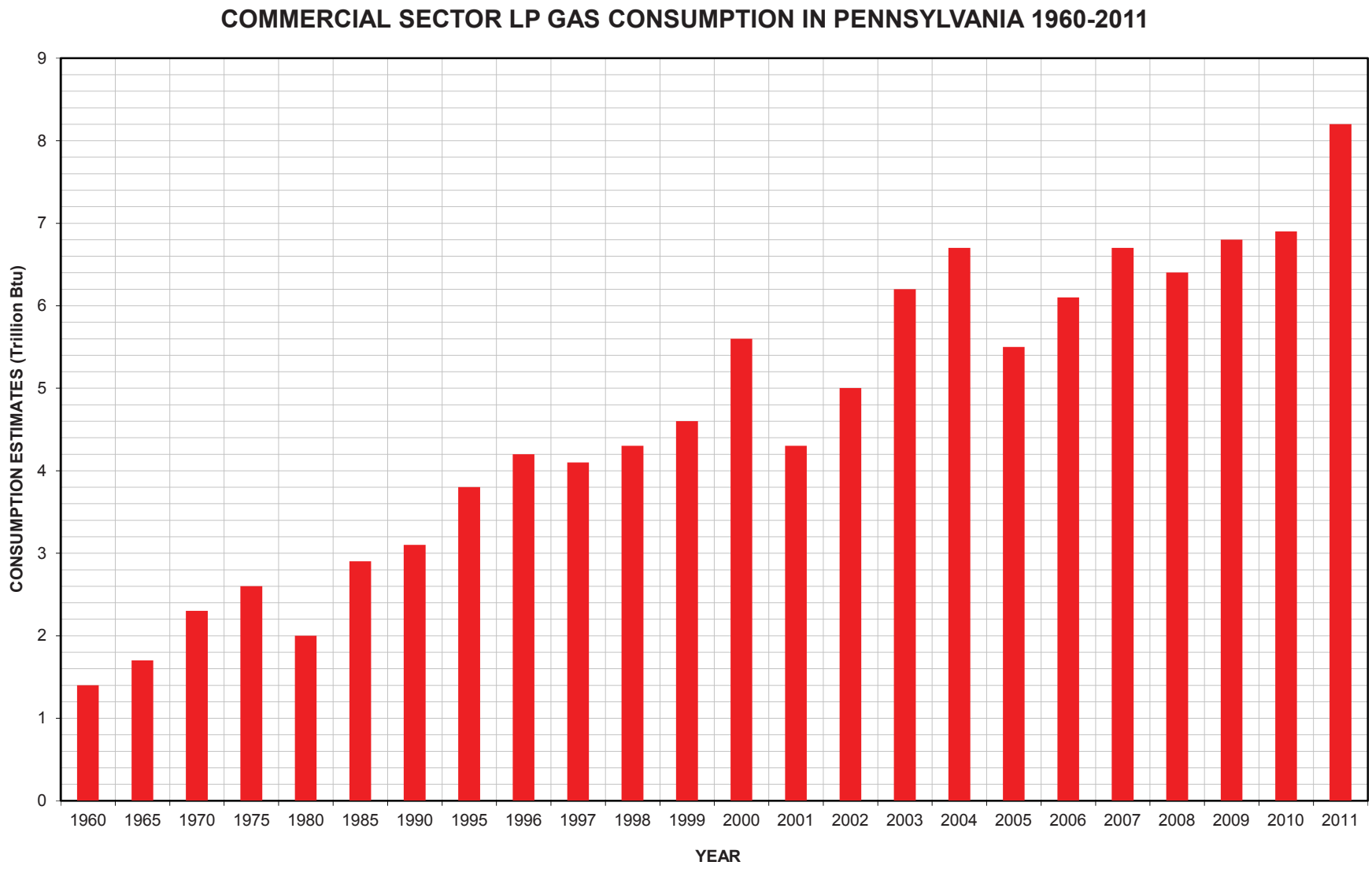
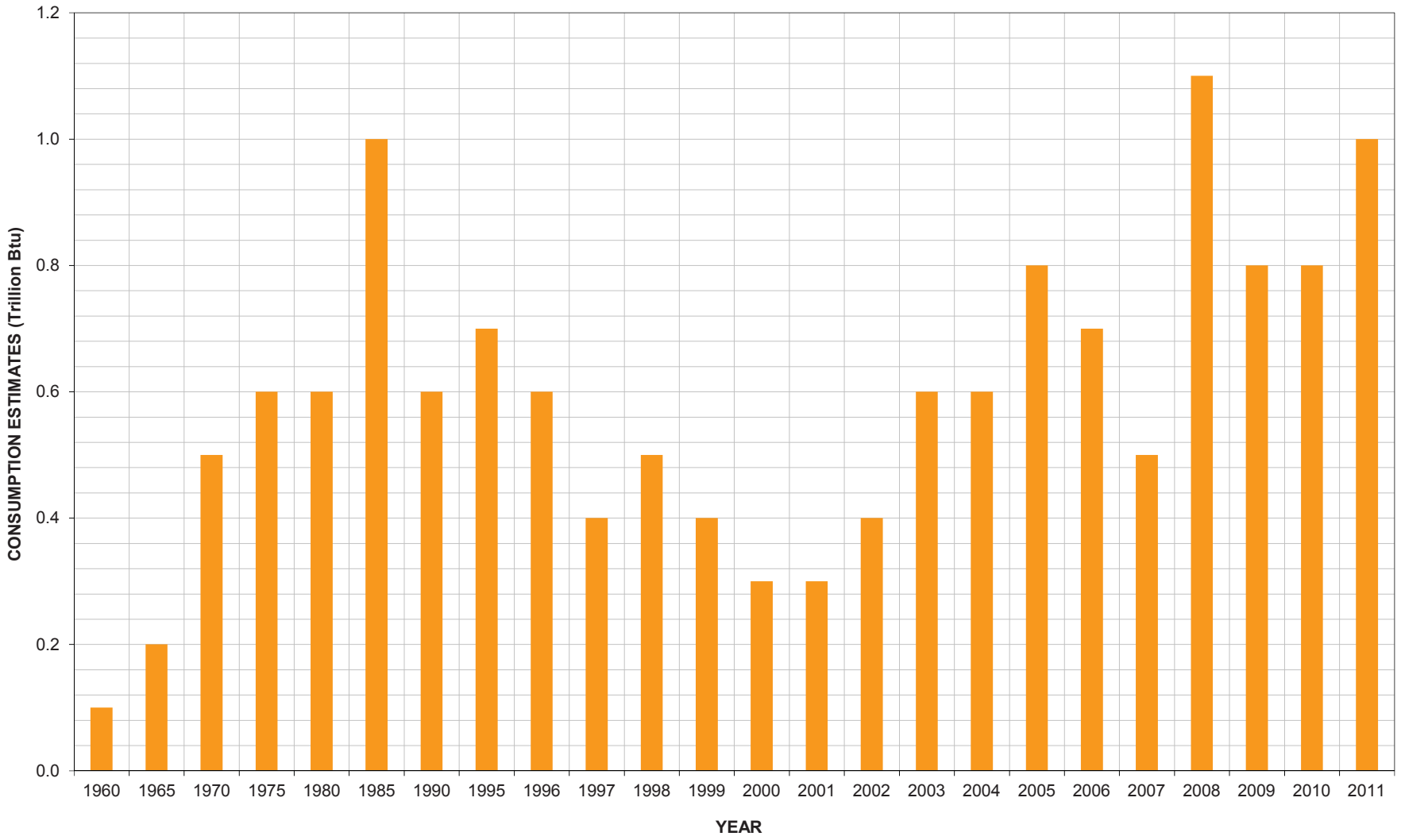
PROPANE



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION
STATE ENERGY DATA, 2011: CONSUMPTION TABLE CT5. COMMERCIAL SECTOR ENERGY CONSUMPTION ESTIMATES, SELECTED YEARS, 1960-2011, PENNSYLVANIA

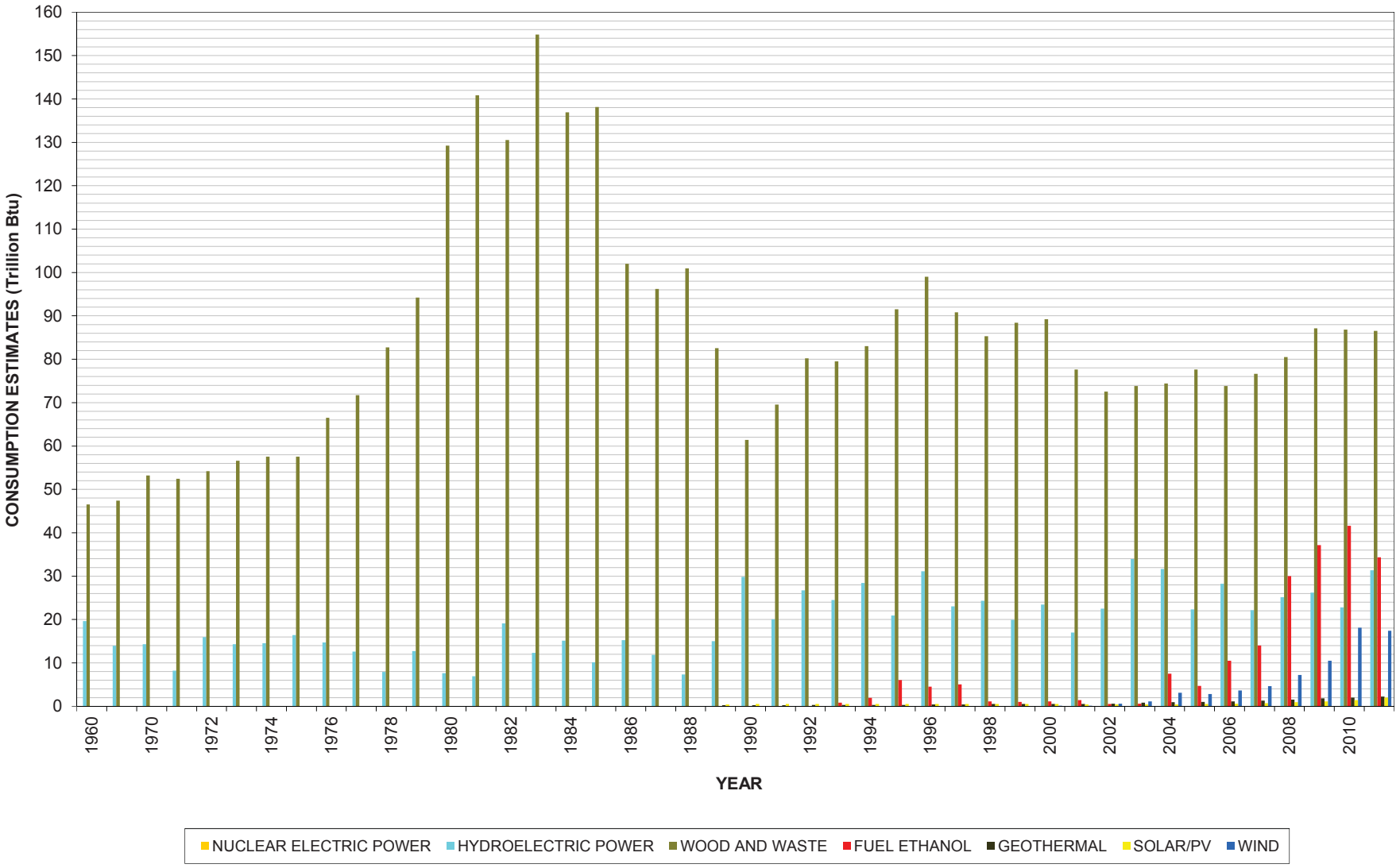
PROPANE

TRANSPORTATION SECTOR LP GAS CONSUMPTION IN PENNSYLVANIA 1960-2011



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION
STATE ENERGY DATA, 2011: CONSUMPTION TABLE CT7. TRANSPORTATION SECTOR ENERGY CONSUMPTION ESTIMATES, SELECTED YEARS, 1960-2011, PENNSYLVANIA

PENNSYLVANIA NUCLEAR AND RENEWABLE ENERGY CONSUMPTION 1960-2011



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION
STATE ENERGY DATA, 2011: CONSUMPTION TABLE CT2. PRIMARY ENERGY CONSUMPTION ESTIMATES, SELECTED YEARS, 1960-2011, PENNSYLVANIA

ENERGY PROFILE

Nuclear[7] energy is energy in the core of the atom. There is enormous energy in the bonds that hold the nucleus together. Breaking those bonds releases that energy. In nuclear fission, atoms are split apart to form smaller atoms, releasing energy in the process.

Nuclear power plants use this energy to produce electricity. Uranium (U-235) is widely used by nuclear plants for nuclear fission. U-235 is widely used as a fuel because its atoms are easily split apart. U-235 is relatively rare. U-235 must be extracted and processed before it can be used as fuel. During nuclear fission, a small particle called a neutron hits the uranium atom and splits it, releasing a great amount of energy as heat and radiation. Nuclear power plants use heat from nuclear fission to produce electricity.

Nuclear power provided slightly more than 19% of electricity and about 8% of all energy consumed in the U.S. as of 2011. Pennsylvania was one of the top 5 states for nuclear generation of electricity in 2011. The first large scale U.S. commercial nuclear power plant opened at Shippingport, PA in 1957. The state has five operating nuclear plants which supplied slightly more than one third of the state's electricity generation in the last few years. Nuclear power as a percentage of the total U.S. electricity generation increased quickly from nearly 5% in 1973 to 9% in 1975 and then to the current level (2011) of about 20% by 1988. In 2010, Pennsylvania ranked second in net generation. Unlike fossil fuel fired power plants, nuclear reactors do not produce air pollution or carbon dioxide while operating. The main environmental concern for nuclear power use is radioactive wastes such as uranium mill tailing, spent(used) reactor fuel and other radioactive waste.

[7]http://www.eia.gov/energyexplained/index.cfm?page=nuclear_home

ENERGY PROFILE

Hydropower[8] relies on the water cycle. Solar energy heats water on the Earth's surface, causing it to evaporate. The water vapor condenses into clouds and falls back onto the surface as precipitation (rain, snow, etc.). The water flows through rivers back into the oceans where it can evaporate and begin the cycle over again. Mechanical energy is harnessed from moving water. The amount of available energy in moving water is determined by its flow or fall. The water flows through a pipe or penstock then pushes against and turns the blades in a turbine to spin a generator to produce electricity. The force of the current applies the needed pressure in a run of the river system. Water is accumulated in reservoirs created by dams then released as needed to generate electricity in a storage system.

Over half of U.S. hydroelectric capacity for electricity generation is concentrated in three states: Washington, Oregon and California. Approximately 29% of the total U.S. hydropower was generated in Washington in 2011, the location of the nation's largest hydroelectric facility – the Grand Coulee Dam. Most hydropower is produced at large facilities built by the federal government. Only a small percentage of all dams in the United States produce electricity. Most dams were constructed solely to provide irrigation and flood control.

Hydro turbines kill and injure some of the fish that pass through the turbine. Different approaches to fixing this problem have been used, including the construction of "fish ladders" that help the salmon "step up" and around the dam to the spawning grounds upstream. Also, creating a reservoir (or diverting water to a run of river hydropower plant) may obstruct migration of fish to their upstream spawning areas. The use of a reservoir and operation of a dam can also change the natural water temperatures, chemistry, flow characteristics and silt loads, all of which can lead to significant changes in the ecology (living organisms and their environment) and physical characteristics (rocks and land forms) of the river upstream and downstream.

[8]http://www.eia.gov/energyexplained/index.cfm?page=hydropower_home

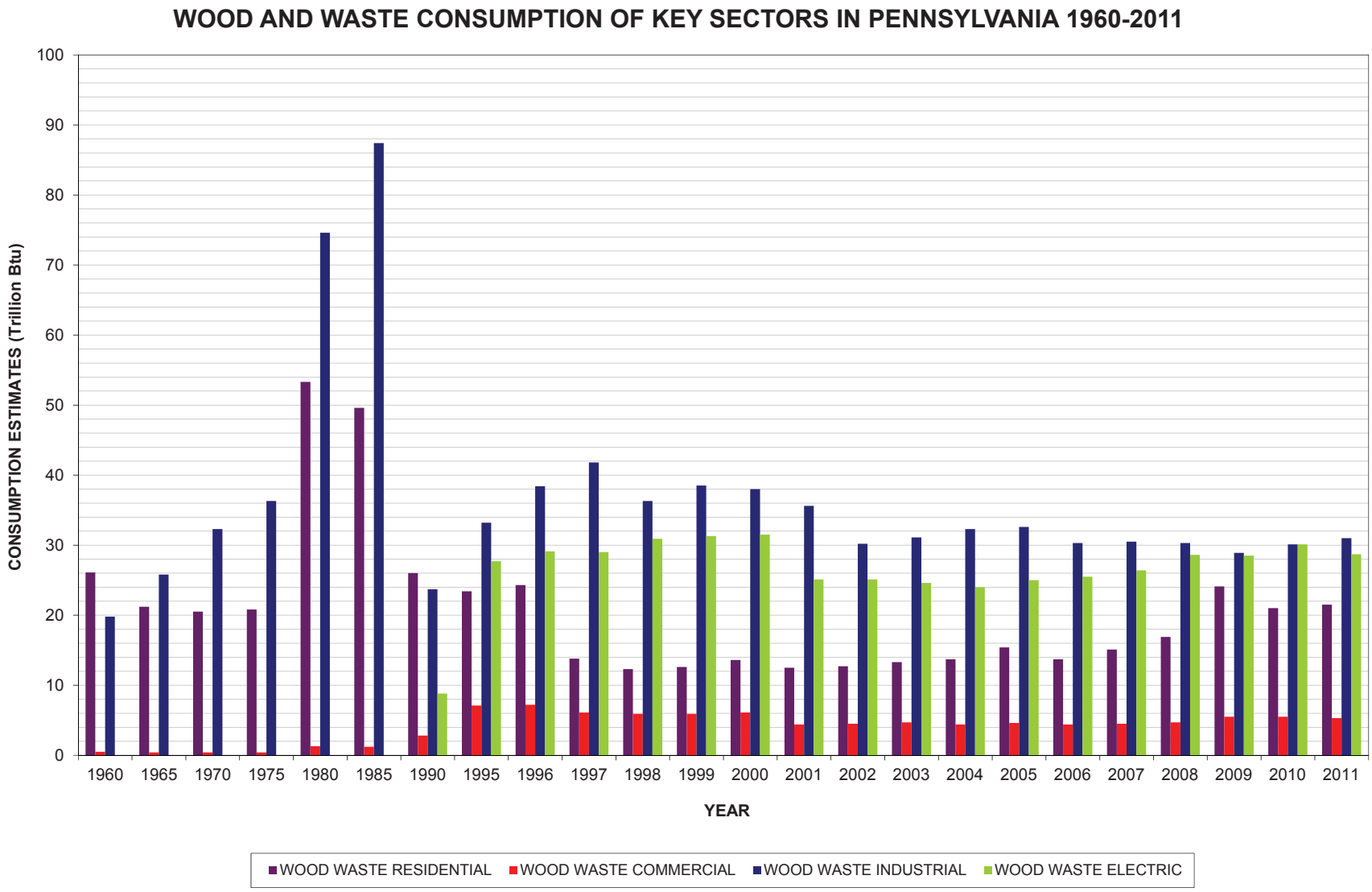
ENERGY PROFILE

Wood[9] is used as fuel and consists of firewood, charcoal, chips, sheets, pellets, bark, sawdust, wood scrap, and paper mill residues. Eighty percent of the wood and wood waste fuel used in the United States is consumed by industry, electric power producers and commercial business. The rest, mainly wood, is used in homes for heating and cooking. Many manufacturing plants in the wood and paper products industry use wood waste to produce their own steam and electricity, providing an energy savings to companies due to the use of wood waste products for energy generation.

Wood may be harvested from forest or wood lots that have to be thinned or come from urban trees that fall down or have to be cut down anyway. Approximately 1.2% of occupied residential units in the Lehigh Valley use wood as a heating fuel according to the U.S. Census Bureau's 2010 American Community Survey. Wood contains some harmful pollutants like carbon monoxide and particulate matter.

[9]http://www.eia.gov/energyexplained/index.cfm?page=biomass_wood

WOOD



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION
STATE ENERGY DATA, 2011: CONSUMPTION TABLES CT4,CT5,CT6 AND CT8

ENERGY PROFILE

Biomass[10] is organic material made from plants and animals. It contains stored energy from the sun. Biomass releases chemical energy as heat when burned and can also be converted to other types of energy as heat when burned. Biomass can be converted to other useable forms of energy including methane gas or transportation fuels such as ethanol and biodiesel. Methane gas is the main ingredient in natural gas. Rotting garbage, agricultural and human waste release methane gas. Crops like corn and sugar cane can be fermented to produce ethanol. Biodiesel, a transportation fuel, can be produced from leftover food products like vegetable oils and animal fats.

Some farmers produce biogas in large tanks called "digesters" where they put manure and bedding material from their barns. Some cover their manure ponds (also called lagoons) to capture biogas. The biogas can be used to generate electricity or heat for use on the farm or to sell electricity to electric utility companies. Incinerators and waste to energy power plants must use technology to prevent harmful gases and particulates from coming out of their smoke stacks.

Garbage, or municipal solid waste (MSW), is the source of about 6% of the total biomass energy consumed in the United States. MSW contains biomass (or biogenic) materials like paper, cardboard, food scraps, grass clippings, leaves, wood and leather products and other non-biomass combustible materials, mainly plastics and other synthetic materials made from petroleum. MSW is burned in special waste to energy plants that use its heat energy to make steam to heat buildings or to generate electricity. In 2011, these plants generated 14 million kilowatt hours of electricity, about the same amount used by 1.3 million U.S. households. Many large landfills also generate electricity with the methane gas that is produced as biomass decomposes in the landfills. As of June 2012, there were 594 operating landfill gas energy products in the United States, 40 of which are in Pennsylvania, and three of those are in the Lehigh Valley. Chrin Brothers Sanitary Landfill in Northampton County produces 3.2 megawatts (MW) of electricity for an industrial park. Grand Central Sanitary Landfill in Northampton County produces 10MW of electricity used by a local utility company. IESI Bethlehem Landfill of Northampton County produces 5.1 MW of electricity that is sold to a power company.

[10]http://www.eia.gov/energyexplained/index.cfm?page=biomass_home

ENERGY PROFILE

Biofuels[11] are transportation fuels like ethanol and biodiesel that are made from biomass materials. These fuels are usually blended with the petroleum fuels – gasoline and diesel fuel – but they can also be used on their own. Ethanol and biodiesel are usually more expensive than the fossil fuels that they replace, but they are also cleaner burning fuels, producing fewer air pollutants. Ethanol is an alcohol fuel made from sugars found in grains such as corn, sorghum and barley. Other sources of sugars to produce ethanol include potato skin, rice, sugar cane, sugar beets, yard clippings, bark and switch grass. Biodiesel is a fuel made from vegetable oils, fats or greases – such as recycled restaurant grease.

About 99% of the fuel ethanol consumed in the U.S. is added to gasoline in mixtures of up to 10% ethanol (E10) and 90% gasoline. Any gasoline powered engine in the U.S. can use E10 but only specific types of vehicles can use higher amounts. Biodiesel fuels can be used in regular diesel vehicles without making any changes to the engine. Ethanol is a renewable fuel because it is made from plants.

Ethanol and ethanol-gasoline mixtures burn cleaner and have higher octane rates than pure gasoline, but have higher "evaporative emissions" from fuel tanks that can be used instead of diesel fuel, which is made from petroleum. Biodiesel is often blended with petroleum diesels in rations of 2% (B2), 5% (B5) or 20% (B20). It can also be used as pure biodiesel (B100).

Due to environmental benefits, ease of use, and available subsidies, biodiesel use in the U.S. grew from about 10 million gallons in 2001 to 358 million gallons in 2007. Consumption dropped to around 320 million gallons in 2008 and in 2009. Biodiesel is nontoxic and biodegradable.

[11]http://www.eia.gov/energyexplained/index.cfm?page=biofuel_home

ENERGY PROFILE

Geothermal[12] energy is heat from within the Earth. We can recover this heat as steam or hot water and use it to heat buildings or generate electricity. Geothermal energy is a renewable energy source because the heat is continuously produced inside the earth. Shallow well heat pumps are the most common form of geothermal energy in Pennsylvania. The heat pumps utilize the constant temperature within the earth's upper crust.[13] People around the world use geothermal energy to heat their homes and to produce electricity by digging deep wells and pumping the heated underground water or steam to the surface. We can also make use of the stable temperatures near the surface of the Earth to heat and cool buildings. Most geothermal reservoirs are deep underground with no visible clues showing above ground. However, geothermal energy sometimes finds its way to the surface in the form of volcanoes and fumaroles (steam vents), hot springs and geysers. The most active geothermal resources are usually found along major plate boundaries where earthquakes and volcanoes are concentrated. Most of the geothermal power plants in the United States are located in the western states and Hawaii, where geothermal energy resources are close to the surface. California generates the most electricity from geothermal energy. Three main uses of geothermal energy are direct use and direct heating systems, electricity generation power plants and geothermal heat pumps. After bathing, the most common direct use of geothermal energy is for heating buildings through direct heating systems. Industrial applications of geothermal energy include food dehydration, gold mining and milk pasteurizing. Dehydration or the drying of vegetable and fruit products is the most common industrial use of geothermal energy.

[12]http://www.eia.gov/energyexplained/index.cfm?page=geothermal_home

[13]http://www.gggc.state.pa.us/portal/server.pt/community/green_energy/13833/geothermal/588171

ENERGY PROFILE

Solar[14] energy is the sun's rays (solar radiation) that reach the Earth. This energy can be converted into other forms of energy, such as heat and electricity. Solar energy can be converted to thermal (or heat) energy to heat water, heat spaces and heat fluids. Solar energy can be converted to electricity via photovoltaic (PV devices) or solar cells and solar thermal/electric power plants.

Less than 1% of occupied residential units in the Lehigh Valley use solar energy as a heating fuel according to the U.S. Census Bureau's 2010 American Community Survey.

There are some toxic materials and chemicals that are used in the manufacturing of PV cells, which convert sunlight into electricity. Some solar thermal systems use potentially hazardous fluids to transfer heat. Clearing land for construction of the power plant may have long term impacts on plant and animal life. They may require water for cleaning solar collectors or concentrators and for cooling turbine generators. Using groundwater from wells may affect the ecosystem in some arid locations. Birds and insects can be killed if they fly by a solar power tower.

[14]http://www.eia.gov/energyexplained/index.cfm?page=solar_home

SOLAR — MORAVIAN ACADEMY

SOLAR — MORAVIAN ACADEMY

The photovoltaic solar array project at Moravian Academy was a collaborative effort that was 2½ years in the making. In April of 2010, Moravian Academy teamed with 4 other independent schools in the Philadelphia area through the independent school consortium PAISBOA (Philadelphia Area Independent School Business Officer Association) and The Stone House Group, an energy and environmental consulting firm in Bethlehem working with PAISBOA. Together, we coordinated our efforts and secured state grants that made solar arrays at the five schools a financial possibility. Moravian Academy was awarded a $1.4MM grant for our particular solar project. The team found Hudson Energy Solar, a subsidiary of Just Energy, to be the partner that would own and maintain the solar array and RGS (Real Goods Solar) to design and construct the array.

In 2007, Moravian Academy engaged in a master plan of its 121 acre Merle-Smith Campus located in Bethlehem Township. When the prospect of a solar array installation came to light, the Academy had already designated space on the campus for planned and future development and had approximately 10 to 15 acres that were not planned for building, site or athletic field development. With the planned construction of a 40,000 square foot Athletic & Wellness Center in the works, and the prospect of transitioning the fifth through eighth grade Middle School from downtown Bethlehem to the Merle-Smith Campus, it made sense to design a solar that would meet the electricity consumption needs of the developing Merle-Smith Campus. With Hudson Energy providing the financing, ownership and maintenance of the solar array and RGS designing and installing the array, Moravian Academy only needed to provide the land for the next 20 years. In turn, the Academy receives environmentally clean, renewable and inexpensive electricity. All in all a very sensible use of Moravian Academy resources that fixes our electrical costs at a very favorable rate and enhances our commitment to environmental sustainability.

The 1.29 megawatt photovoltaic solar array is a ground mounted system consisting of 4,532 solar panels rated at 285 watts each. The panels cover nearly 7 acres and are estimated to produce 1,657,377 kilowatts during the first year electrical production. The array was activated on November 20, 2012 and will produce electrical energy for at least the next 20 to 25 years. The estimated environmental impact over 25 years is approximately equivalent to:

- Reducing CO2 emissions by 61,798,888 lbs, or
- Planting 718,757 trees, or
- Taking 227.5 passenger vehicles off the road each year, or
- Reducing consumption of 133,858 gallons of gasoline each year

While the students, faculty, families and Board of Trustees of Moravian Academy are very proud of the successful implementation of the solar array, there are a number of other environmentally sustainable initiatives that the Academy has put into action. These include:

- Repurposing of the old maintenance building into a physics lab and two environmental sustainability research units that will enhance the education and awareness of environmental science. This project was partially funded through a grant from the Edward E Ford Foundation.
- Composting biodegradable dining facilities waste through the Rodale Institute in Kutztown.
- Striving for Leadership in Energy and Environmental Design (LEED) certification of the 40,000 square foot Athletic & Wellness Center which is currently under construction and estimated to open in the fall of 2013.

Source: *Moravian Academy*

ENERGY PROFILE

Hydrogen[15] is found only in compound form with other elements on Earth. It has the highest energy content of any common fuel by weight but the lowest energy content by volume. Hydrogen is an energy carrier like electricity; it must be produced from another substance. Hydrogen is not widely used currently but has the potential as an energy carrier in the future. It can be produced from a variety of resources (water, fossil fuels or biomass) and is a by-product of other chemical processes. The two most common methods for producing hydrogen are steam reforming and electrolysis (water splitting).

Hydrogen fuel cells make electricity and are used to power electric cars, remote areas with no power lines, and as a source of emergency power for hospitals and wilderness locations. Portable fuel cells provide power for laptop computers, cell phones and military applications. The high cost to build fuel cells is prohibitive compared to building large hydrogen power plants. There are over 300 hydrogen fueled vehicles in the U.S. Most of these vehicles are powered by electric motors. These vehicles are in use by a few state agencies and a few private entities. They store hydrogen gas or liquid on board and convert the hydrogen into electricity for the motor using a fuel cell. Only a few of these vehicles burn the hydrogen directly. Nine million metric tons of hydrogen are produced annually in the United States, enough to power 20-30 million cars or 5-8 million homes. California, Louisiana and Texas produce the most hydrogen. The steam reforming process results in greenhouse gas emissions linked with global warming, and electrolysis creates no emission but is a costlier method.

[15]http://www.eia.gov/energyexplained/index.cfm?page=hydrogen_home

ENERGY PROFILE

Wind[16] is the circulation/movement of air. Wind farms are forest, grazing and farmland that contain wind turbines. They are owned and operated by business and independent power producers who sell the electricity produced to electric utilities. Wind turbines are large and have a visual impact on the landscape. They are machines with blades to collect the kinetic energy from the wind. The blades turn when the wind flows over them creating lift. The turbines blades are connected to a drive shaft that turns an electric generator to produce electricity. There are two types of wind turbines based on the direction of the rotating shaft: horizontal axis and vertical axis. The horizontal axis is the most commonly used and is 20 stories high with 3 blades 200 feet across.

In 2012, 3% of total U.S. electricity generation was produced by wind turbines. This is equal to the annual electricity of about 12 million households.

Wind is a nonhazardous source of energy in that wind turbines (often called windmills) do not release emissions which pollute water or air, and they do no not require water for cooling.

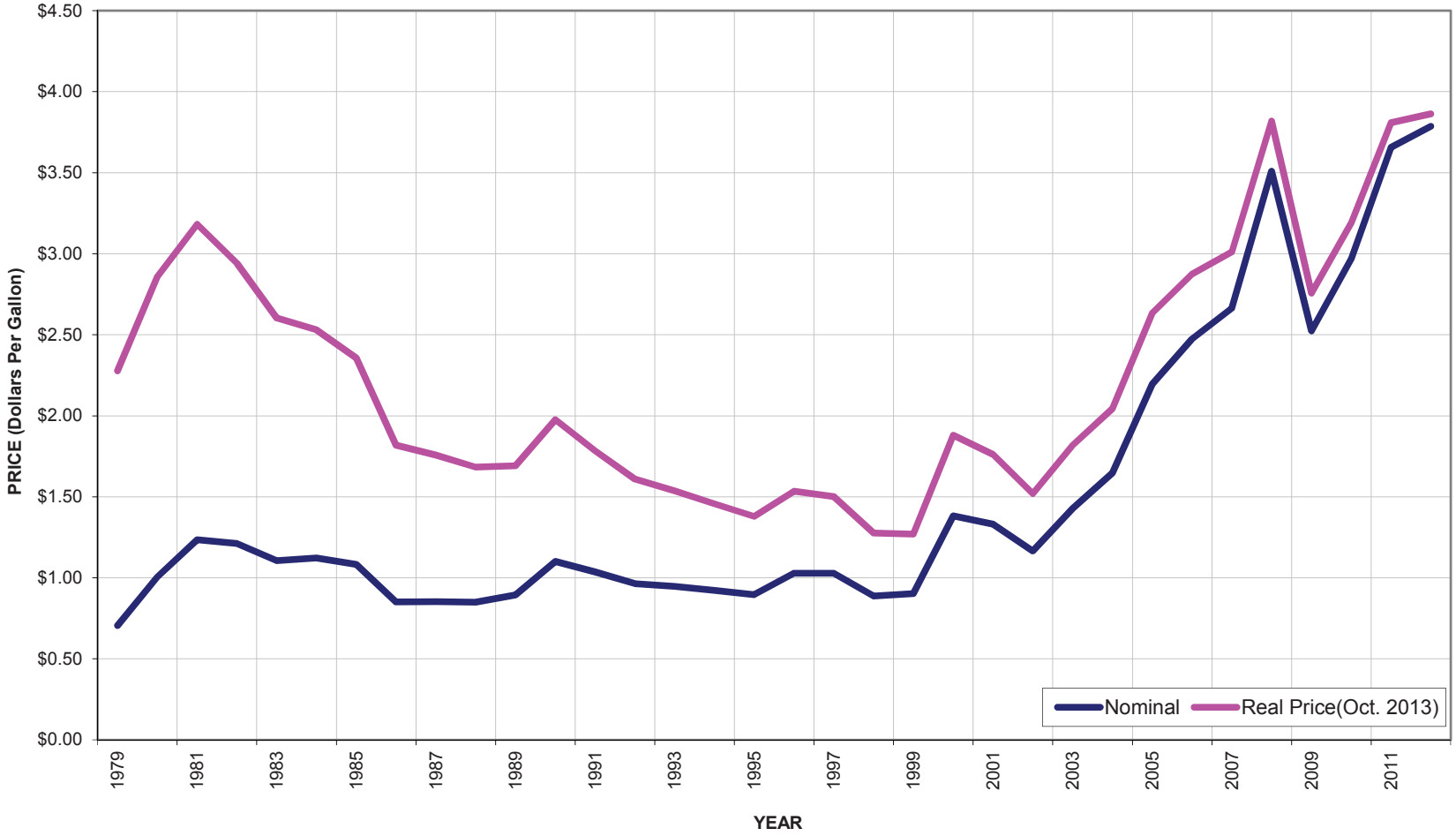
[16]http://www.eia.gov/energyexplained/index.cfm?page=wind_home

CHAPTER 2

ENERGY PRICING

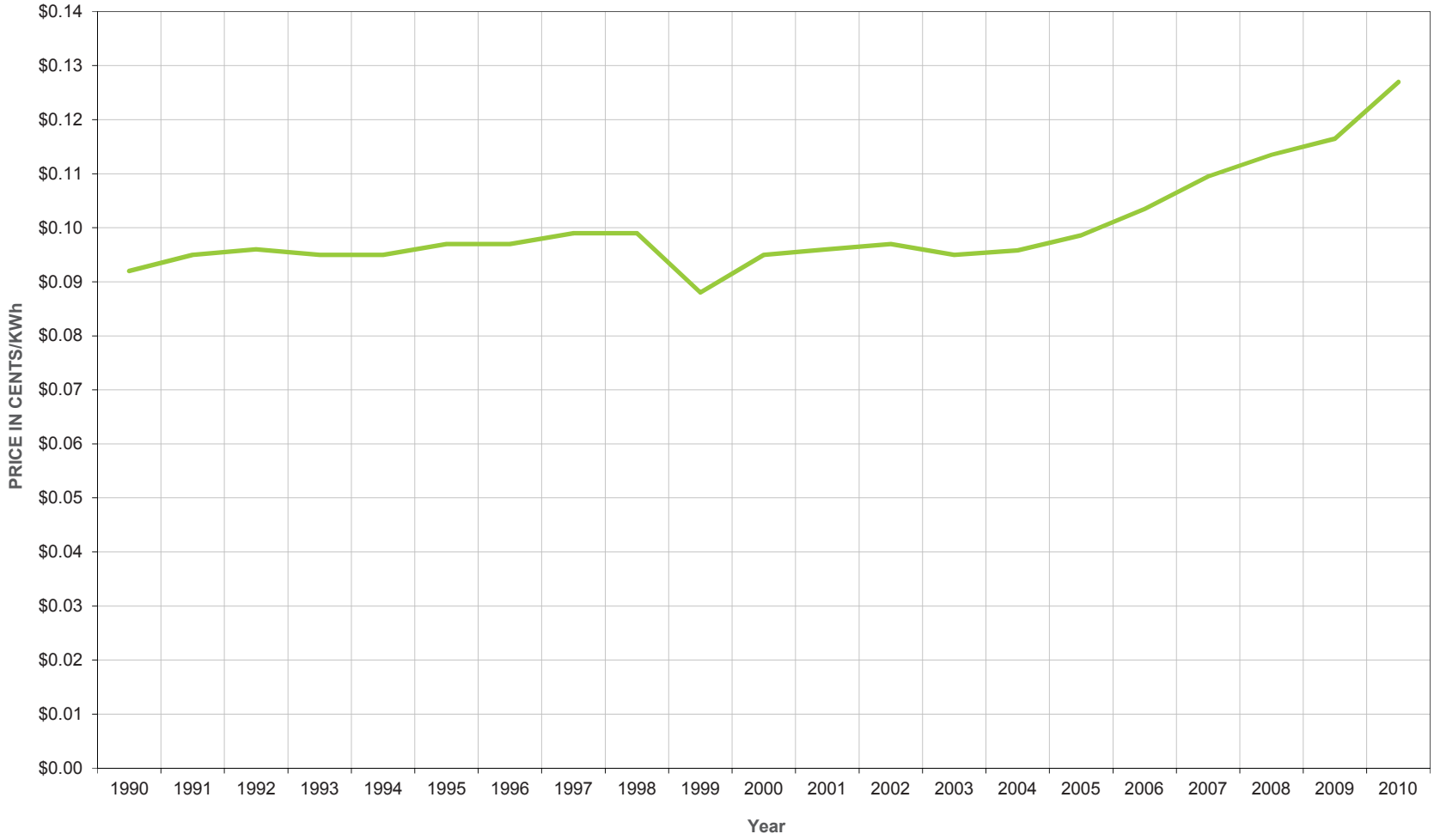
HEATING OIL

NATIONAL ANNUAL AVERAGE HEATING OIL PRICE 1979-2012



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION SHORT TERM ENERGY OUTLOOK, OCTOBER 2013, ANNUAL AVERAGE HEATING OIL PRICE

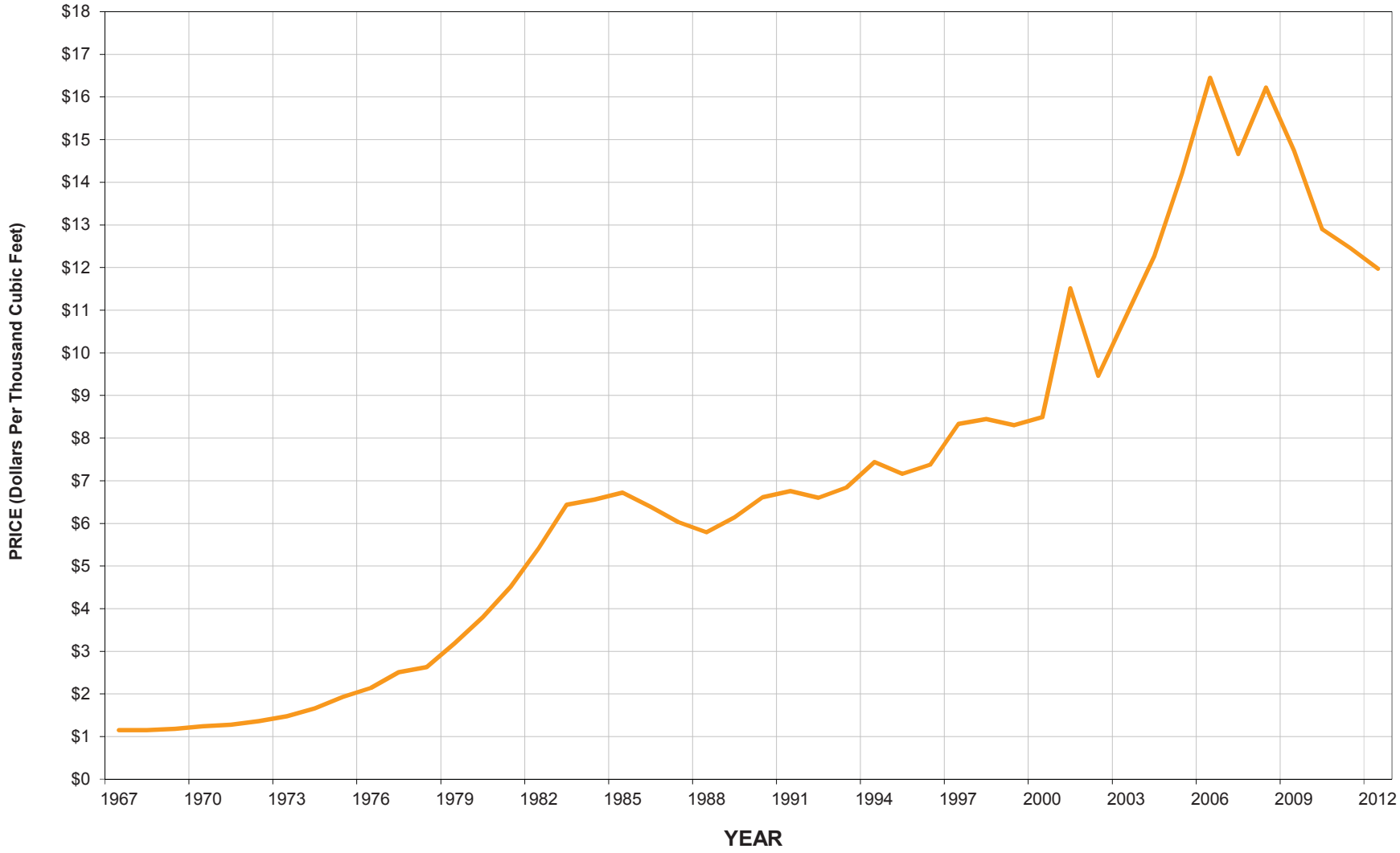
PENNSYLVANIA AVERAGE RETAIL PRICE OF ELECTRICITY - RESIDENTIAL 1990-2010



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION, TABLE 8. RETAIL SALES, REVENUE, AND AVERAGE RETAIL PRICE BY SECTOR, 1990-2010

NATURAL GAS

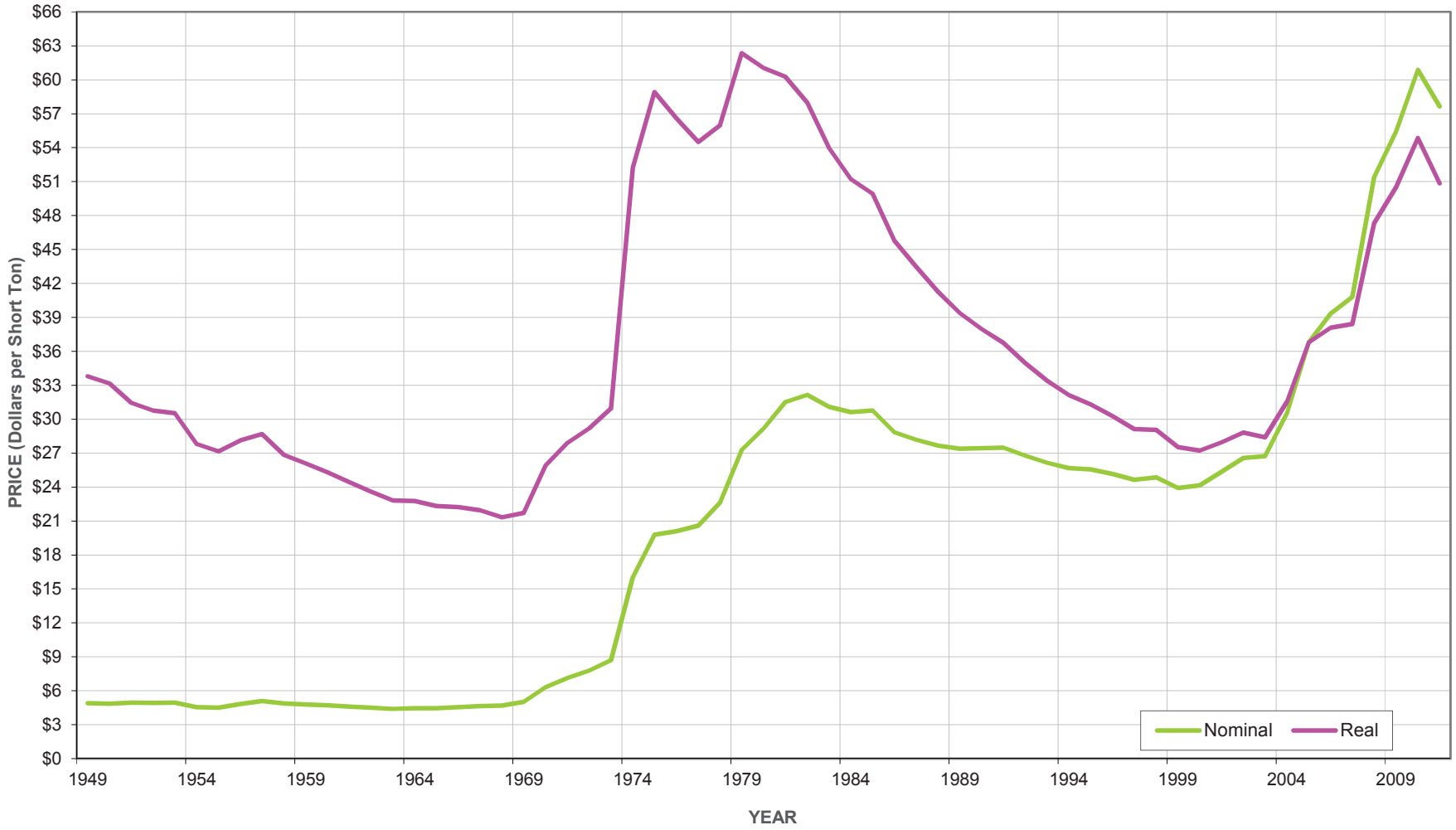
PENNSYLVANIA PRICE OF NATURAL GAS - RESIDENTIAL 1967-2012



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION, PENNSYLVANIA PRICE OF NATURAL GAS DELIVERED TO RESIDENTIAL CONSUMERS (DOLLARS PER THOUSAND CUBIC FEET)

COAL

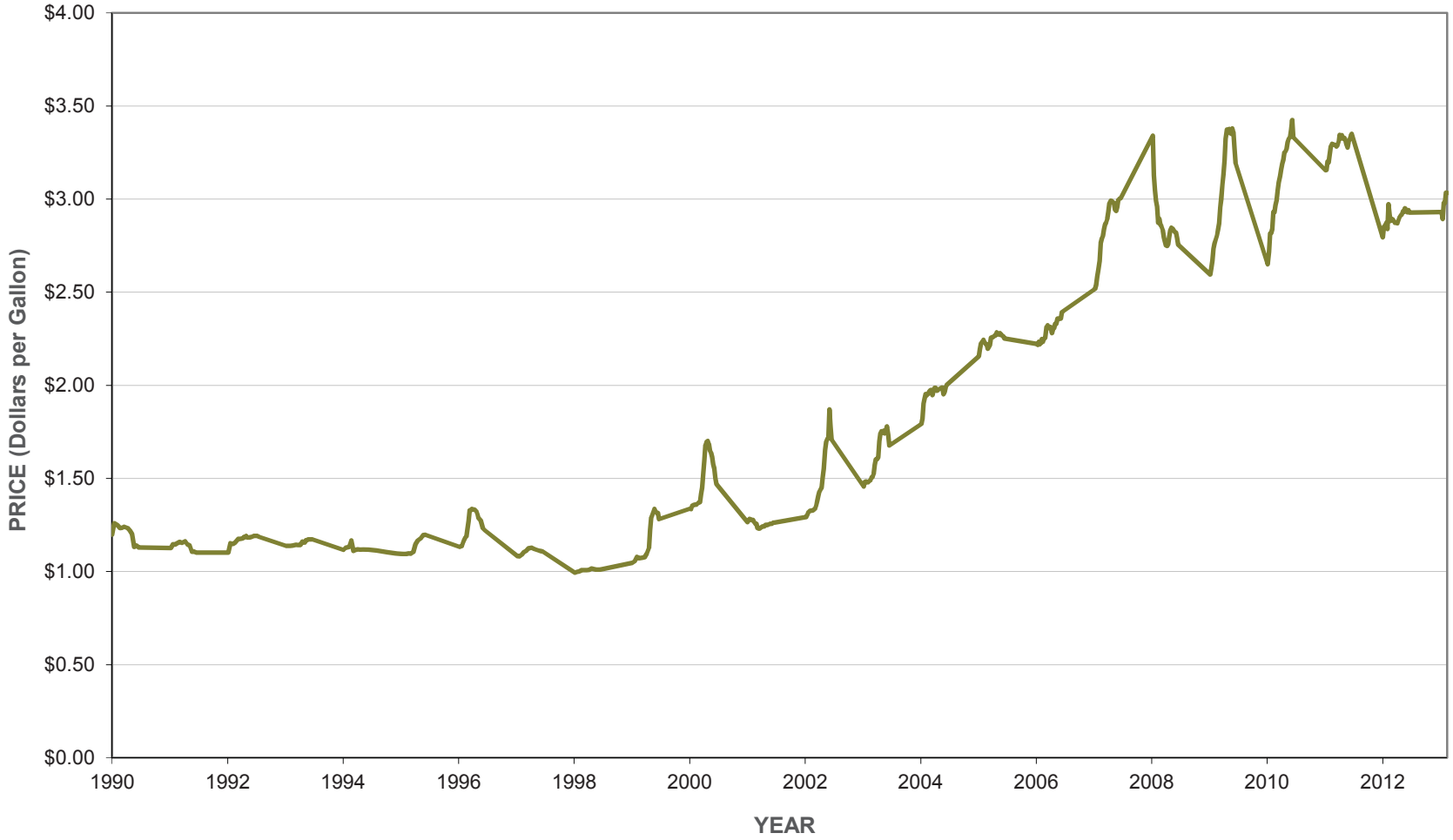
NATIONAL BITUMINOUS COAL PRICES 1949-2011



SOURCE: U.S ENERGY INFORMATION ADMINISTRATION / ANNUAL ENERGY REVIEW 2011 TABLE 7.9 COAL PRICES, SELECTED YEARS, 1949-2011

PROPANE

WEEKLY PENNSYLVANIA PROPANE RESIDENTIAL PRICE 1990-2013

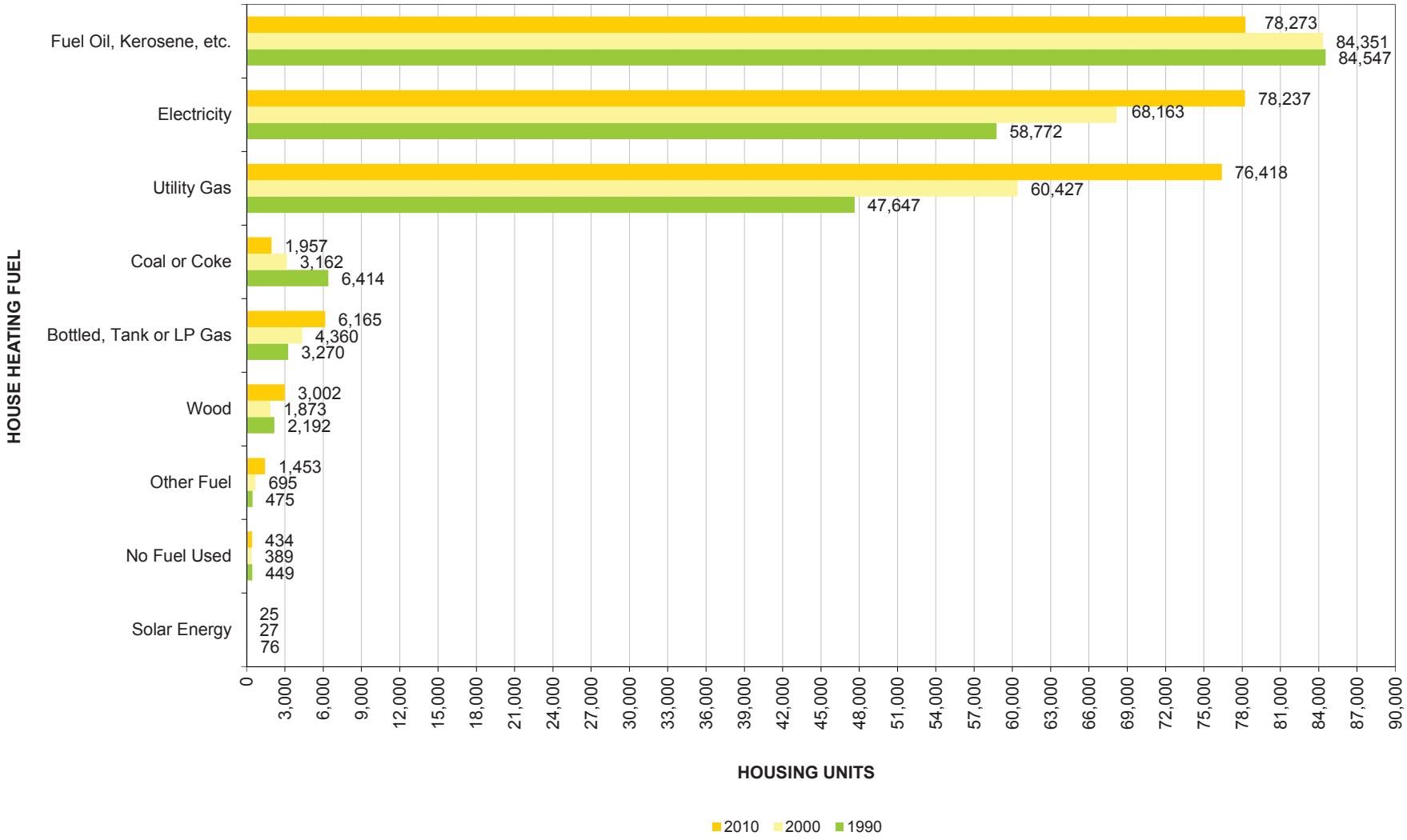


SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION, DATA 1: WEEKLY PENNSYLVANIA PROPANE RESIDENTIAL PRICE (DOLLARS PER GALLON)

CHAPTER 3

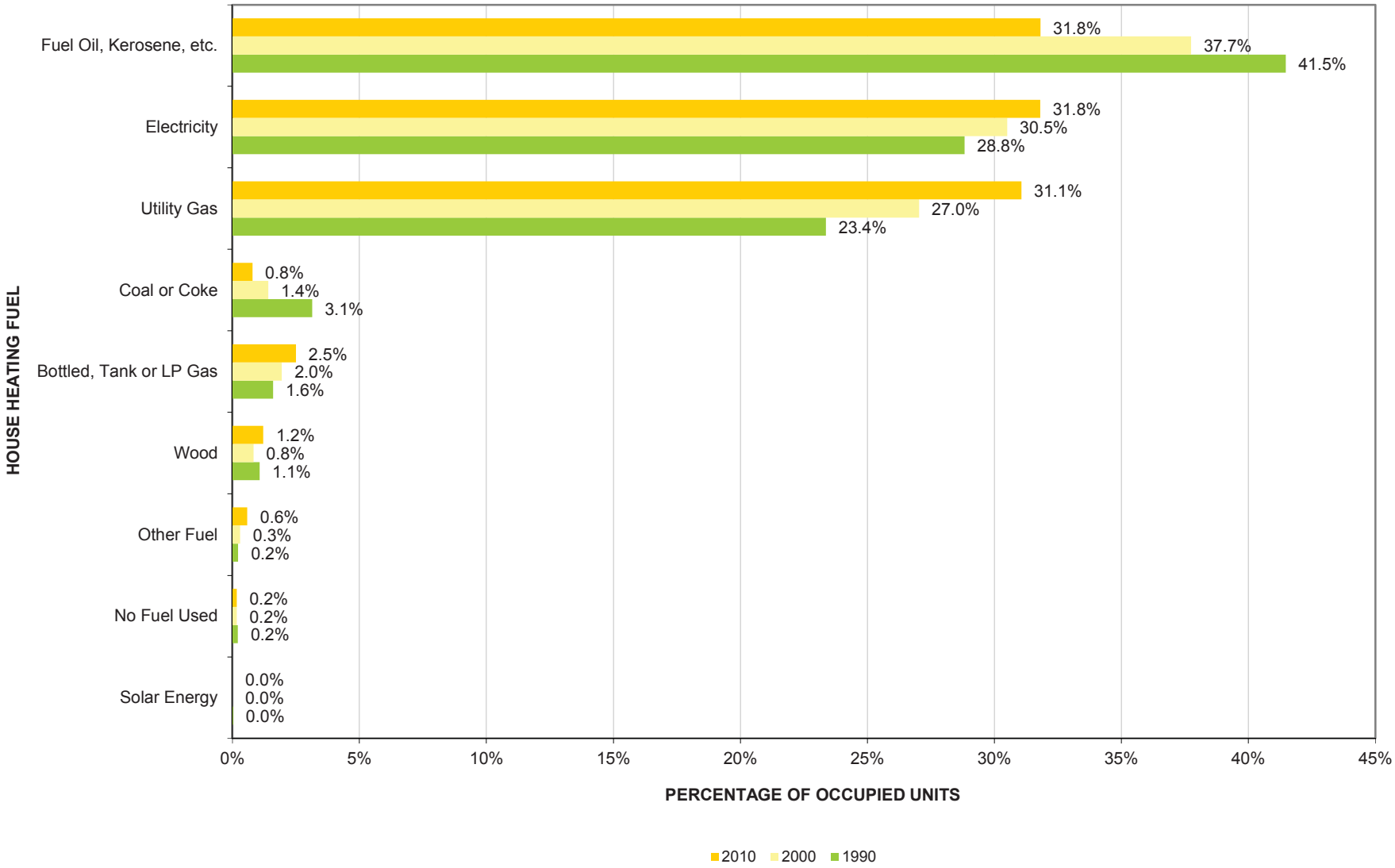
HOUSE HEATING FUEL FOR OCCUPIED UNITS

HOUSE HEATING FUEL FOR OCCUPIED UNITS 1990-2010



SOURCE: 1990 AND 2000 U.S CENSUS, 2010 AMERICAN COMMUNITY SURVEY

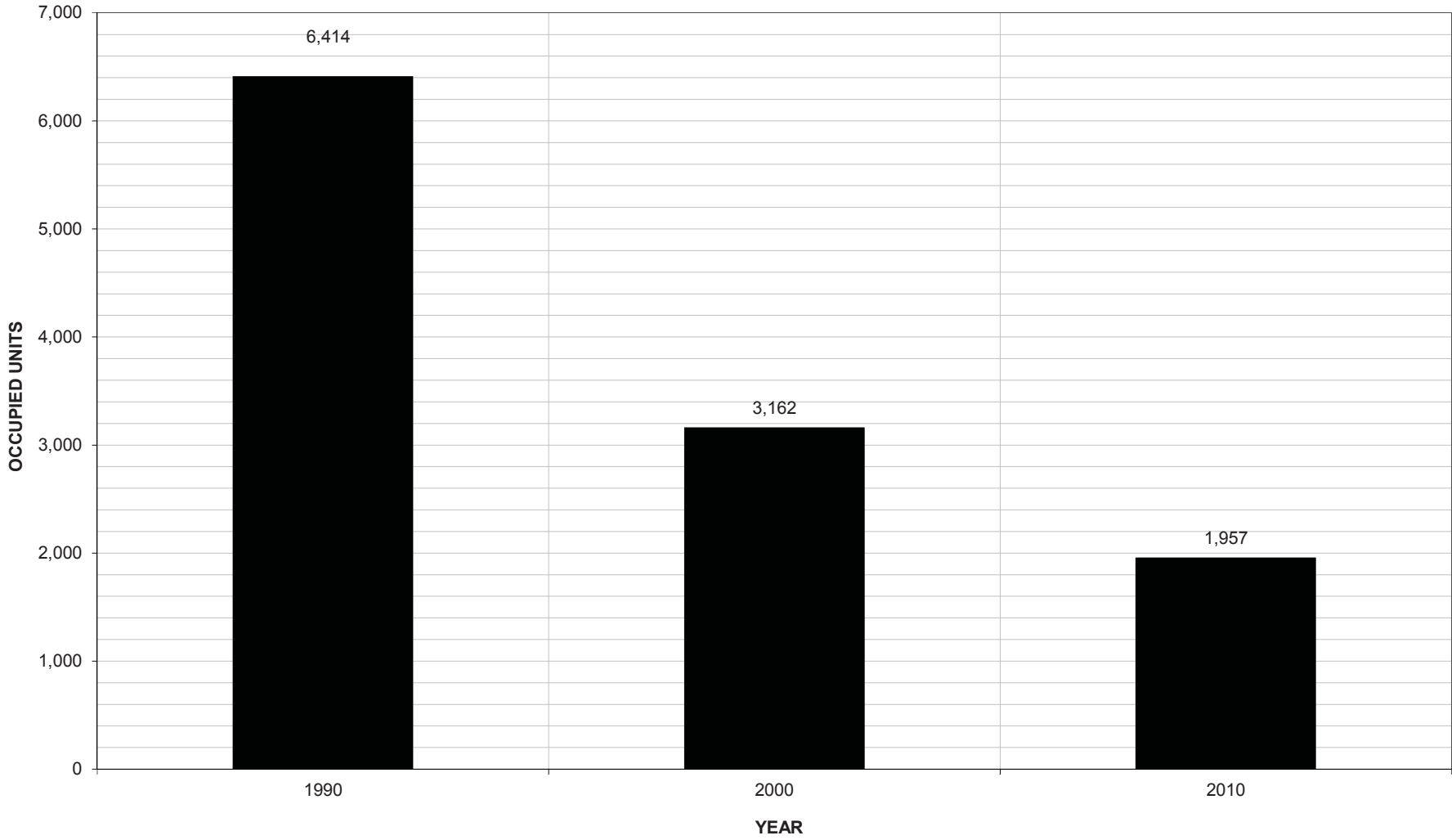
HOUSE HEATING FUEL USAGE BY TYPE IN THE LEHIGH VALLEY 1990-2010



SOURCE: 1990 AND 2000 U.S. CENSUS, 2010 AMERICAN COMMUNITY SURVEY (5-YEAR ESTIMATES)

COAL

OCCUPIED UNITS IN THE LEHIGH VALLEY UTILIZING COAL AS HOUSE HEATING FUEL 1990-2010



SOURCE: 1990 AND 2000 U.S. CENSUS, 2010 AMERICAN COMMUNITY SURVEY (5-YEAR ESTIMATES)

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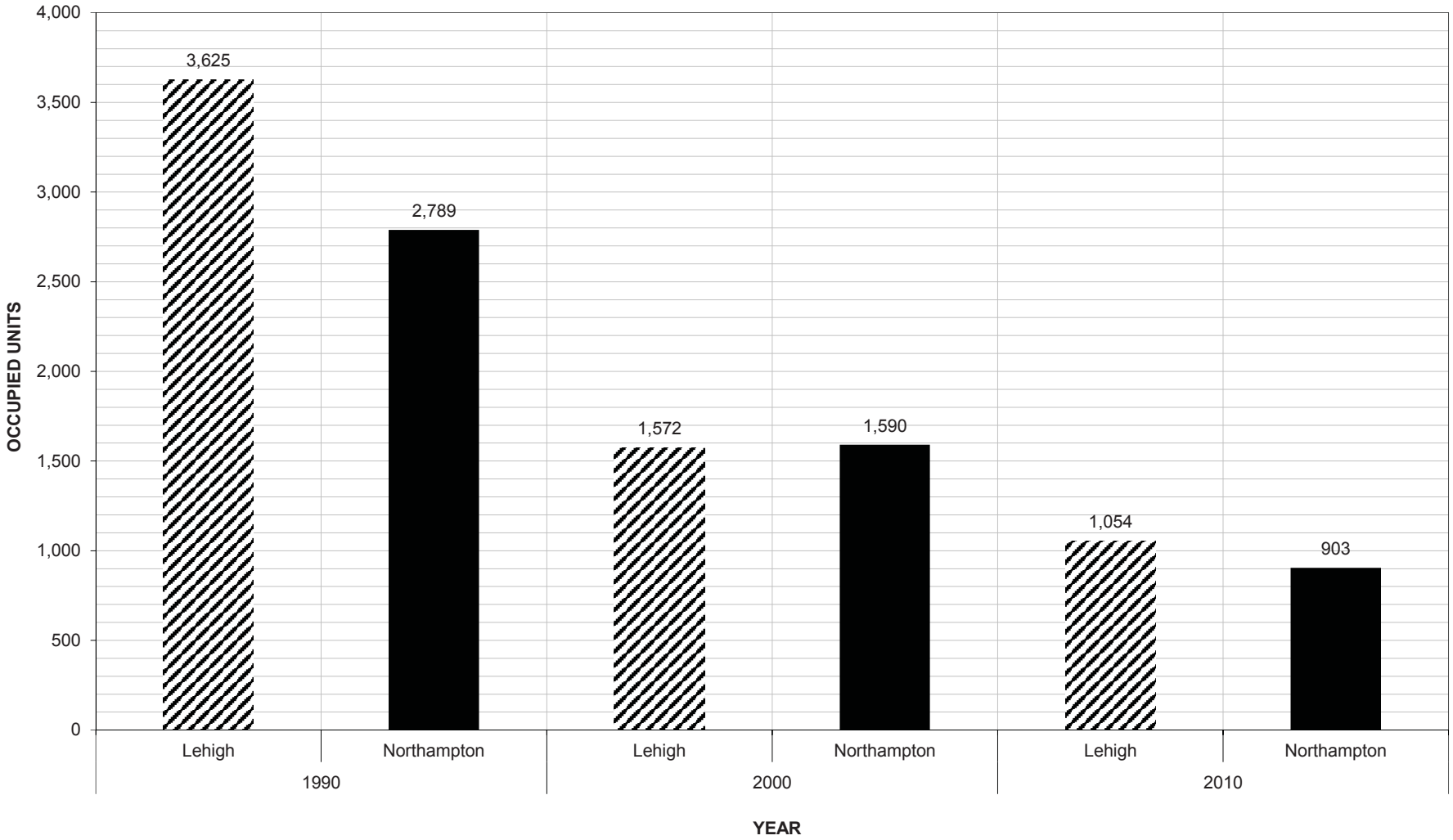
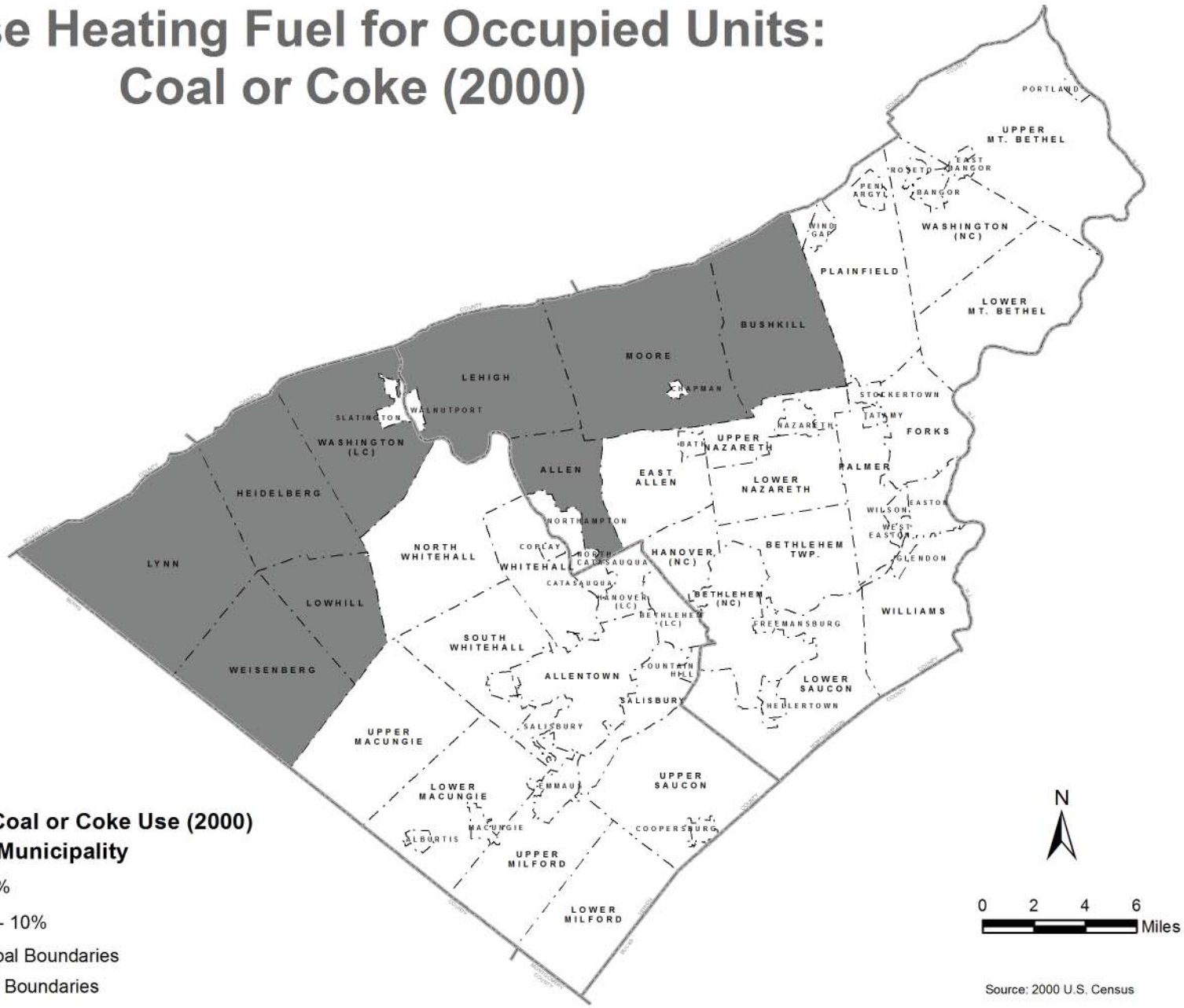
COAL

OCCUPIED UNITS IN THE LEHIGH VALLEY UTILIZING COAL AS HOUSE HEATING FUEL BY COUNTY 1990-2010



SOURCE: 1990 AND 2000 U.S. CENSUS, 2010 AMERICAN COMMUNITY SURVEY (5-YEAR ESTIMATES)

House Heating Fuel for Occupied Units: Coal or Coke (2000)

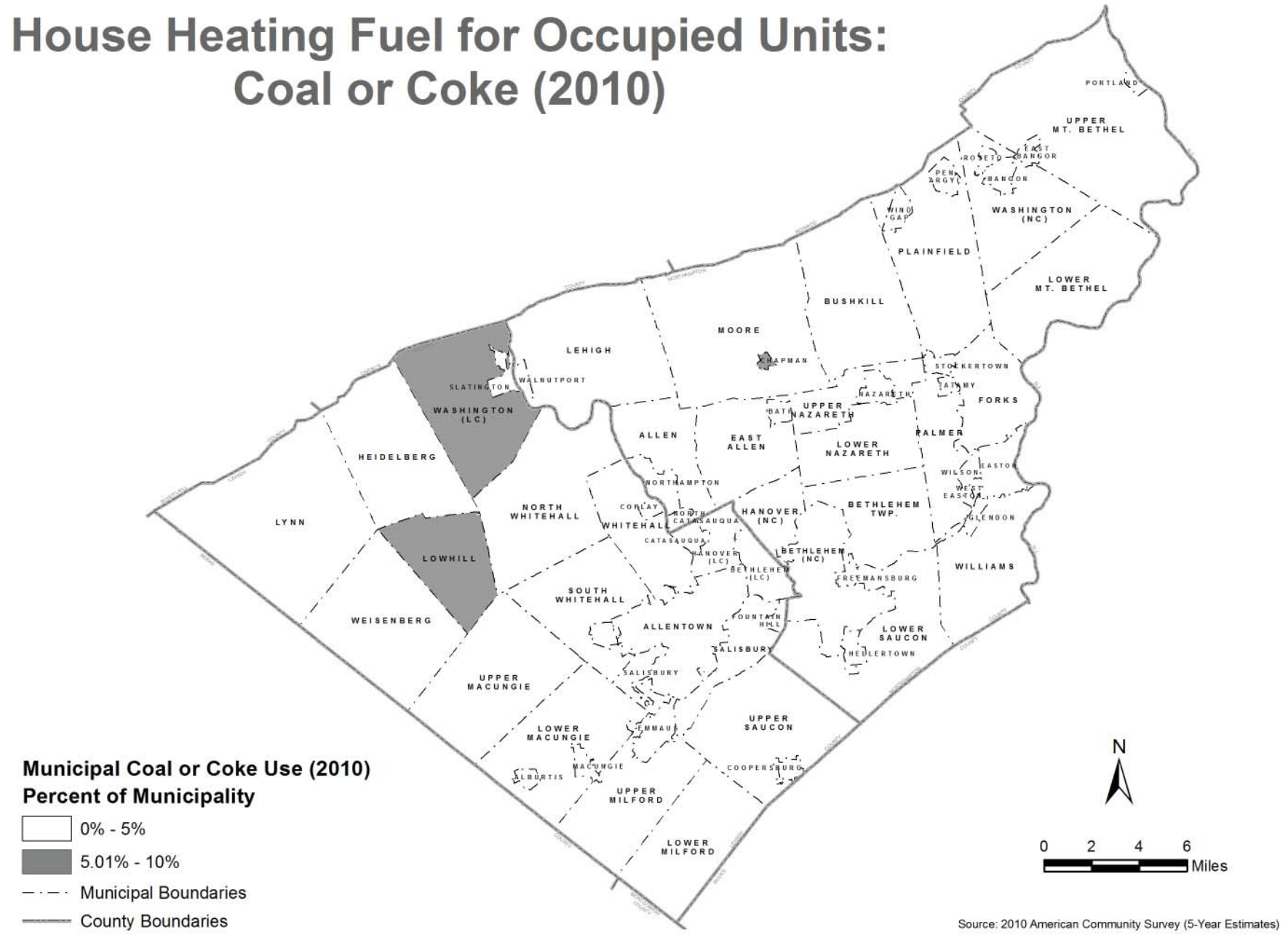


Municipal Coal or Coke Use (2000)
Percent of Municipality

- 0% - 5%
- 5.01% - 10%
- Municipal Boundaries
- County Boundaries

Source: 2000 U.S. Census

House Heating Fuel for Occupied Units: Coal or Coke (2010)



Municipal Coal or Coke Use (2010)
Percent of Municipality

- 0% - 5%
- 5.01% - 10%
- Municipal Boundaries
- County Boundaries

Source: 2010 American Community Survey (5-Year Estimates)

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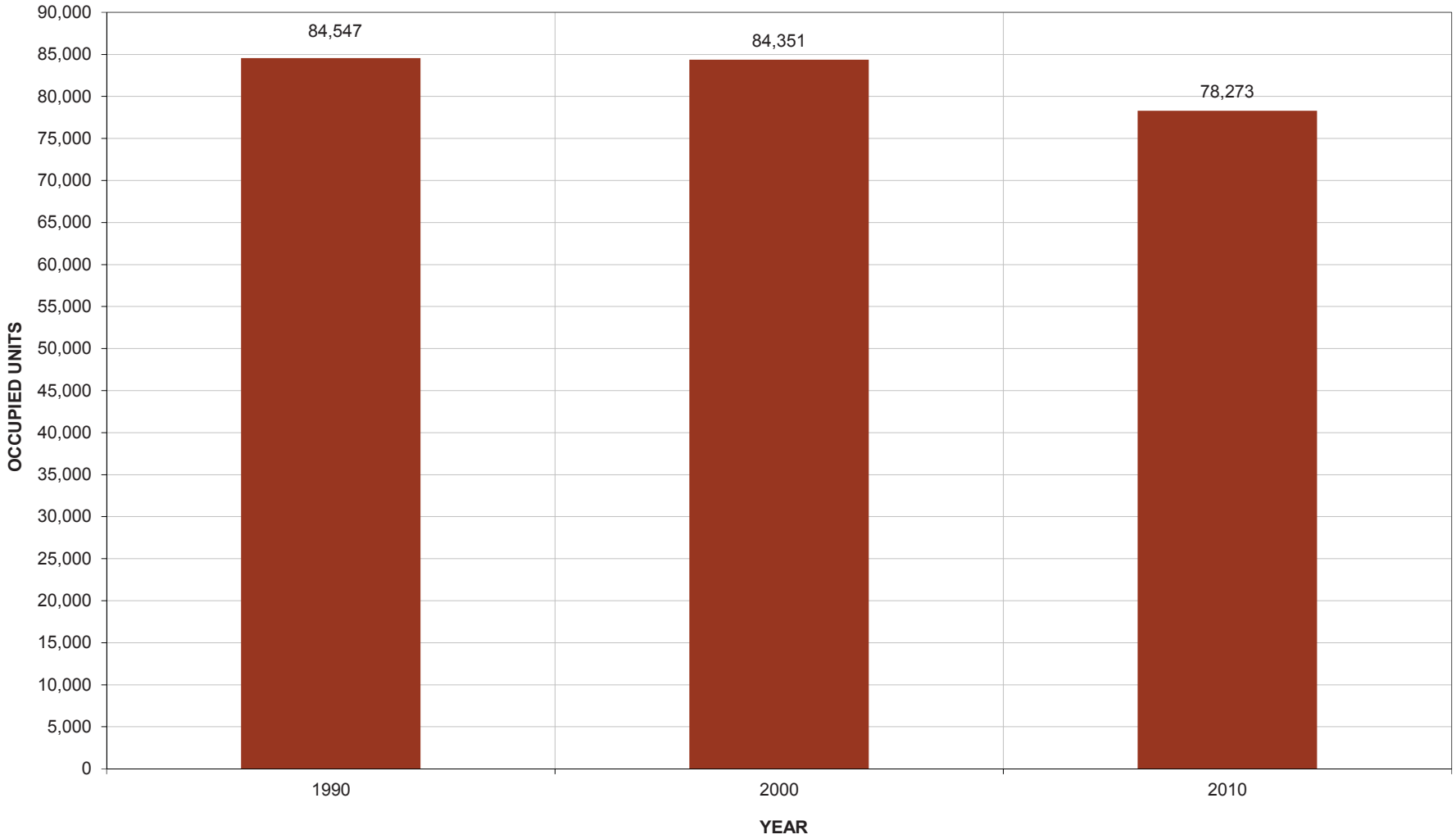
FUEL OIL / KEROSENE

OCCUPIED UNITS IN THE LEHIGH VALLEY UTILIZING FUEL OIL, KEROSENE, ETC. AS HOUSE HEATING FUEL 1990-2010



SOURCE: 1990 AND 2000 U.S. CENSUS, 2010 AMERICAN COMMUNITY SURVEY(5-YEAR ESTIMATES)

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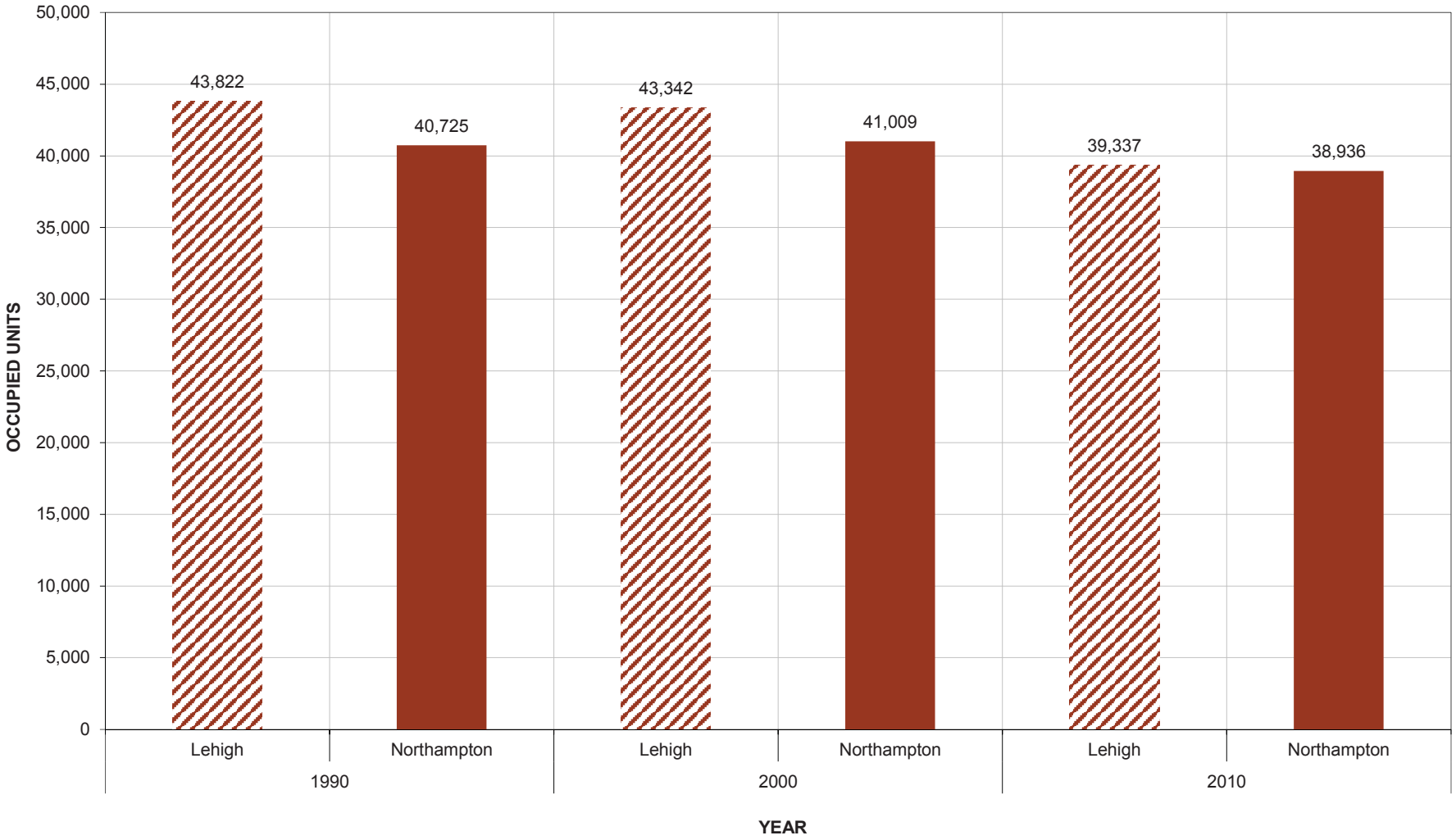
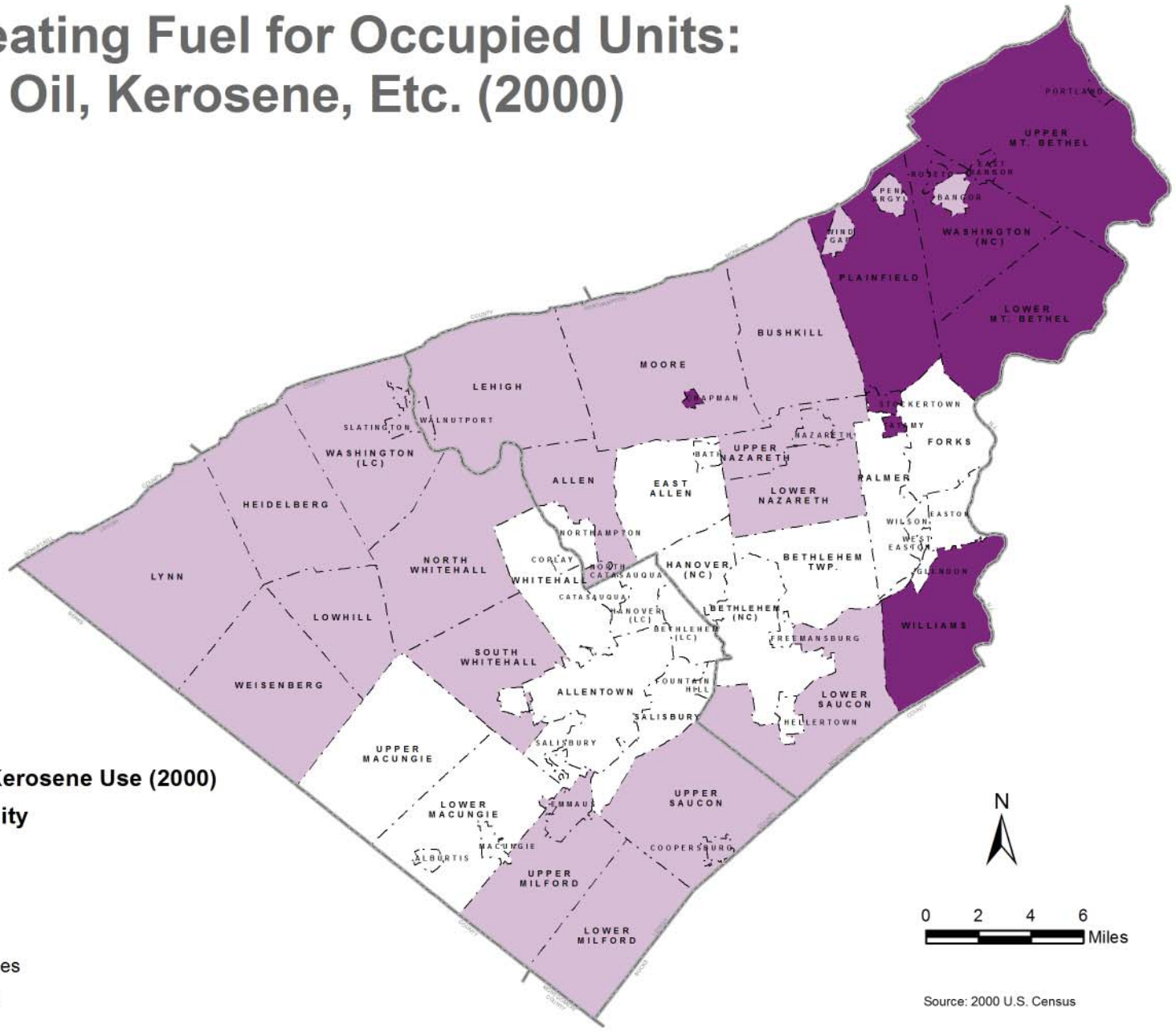
FUEL OIL / KEROSENE

OCCUPIED UNITS IN THE LEHIGH VALLEY UTILIZING FUEL OIL, KEROSENE, ETC. AS HOUSE HEATING FUEL BY COUNTY 1990-2010



SOURCE: 1990 AND 2000 U.S. CENSUS, 2010 AMERICAN COMMUNITY SURVEY(5-YEAR ESTIMATES)

House Heating Fuel for Occupied Units: Fuel Oil, Kerosene, Etc. (2000)



Municipal Fuel Oil, Kerosene Use (2000)

Percent of Municipality

- 0% - 40%
- 40.01% - 60%
- 60.01% - 100%
- Municipal Boundaries
- County Boundaries

Source: 2000 U.S. Census

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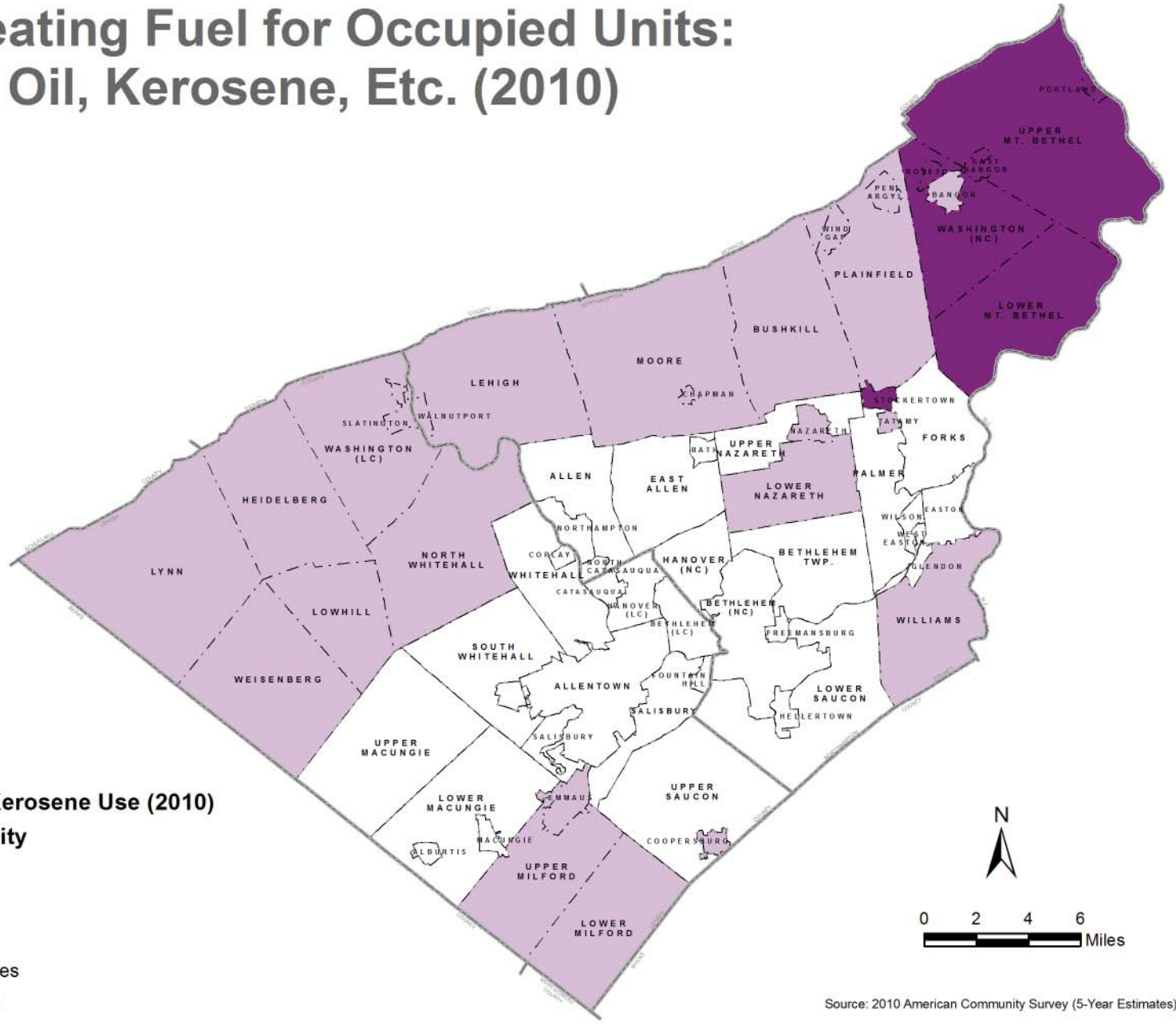
House Heating Fuel for Occupied Units: Fuel Oil, Kerosene, Etc. (2010)



Municipal Fuel Oil, Kerosene Use (2010)
Percent of Municipality

- 0% - 40%
- 40.01% - 60%
- 60.01% - 100%
- Municipal Boundaries
- County Boundaries

N

0 2 4 6 Miles

Source: 2010 American Community Survey (5-Year Estimates)

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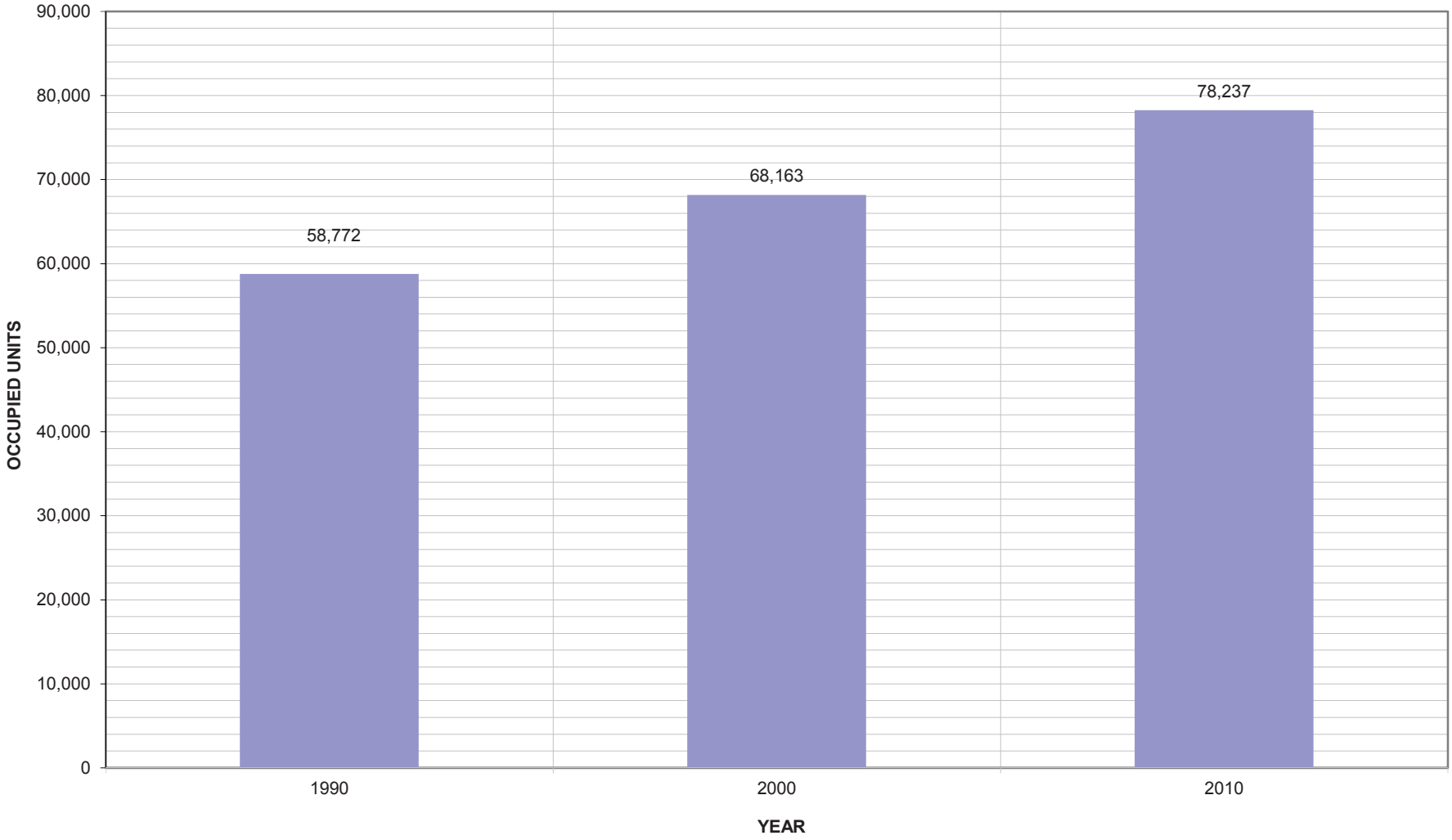
ELECTRICITY

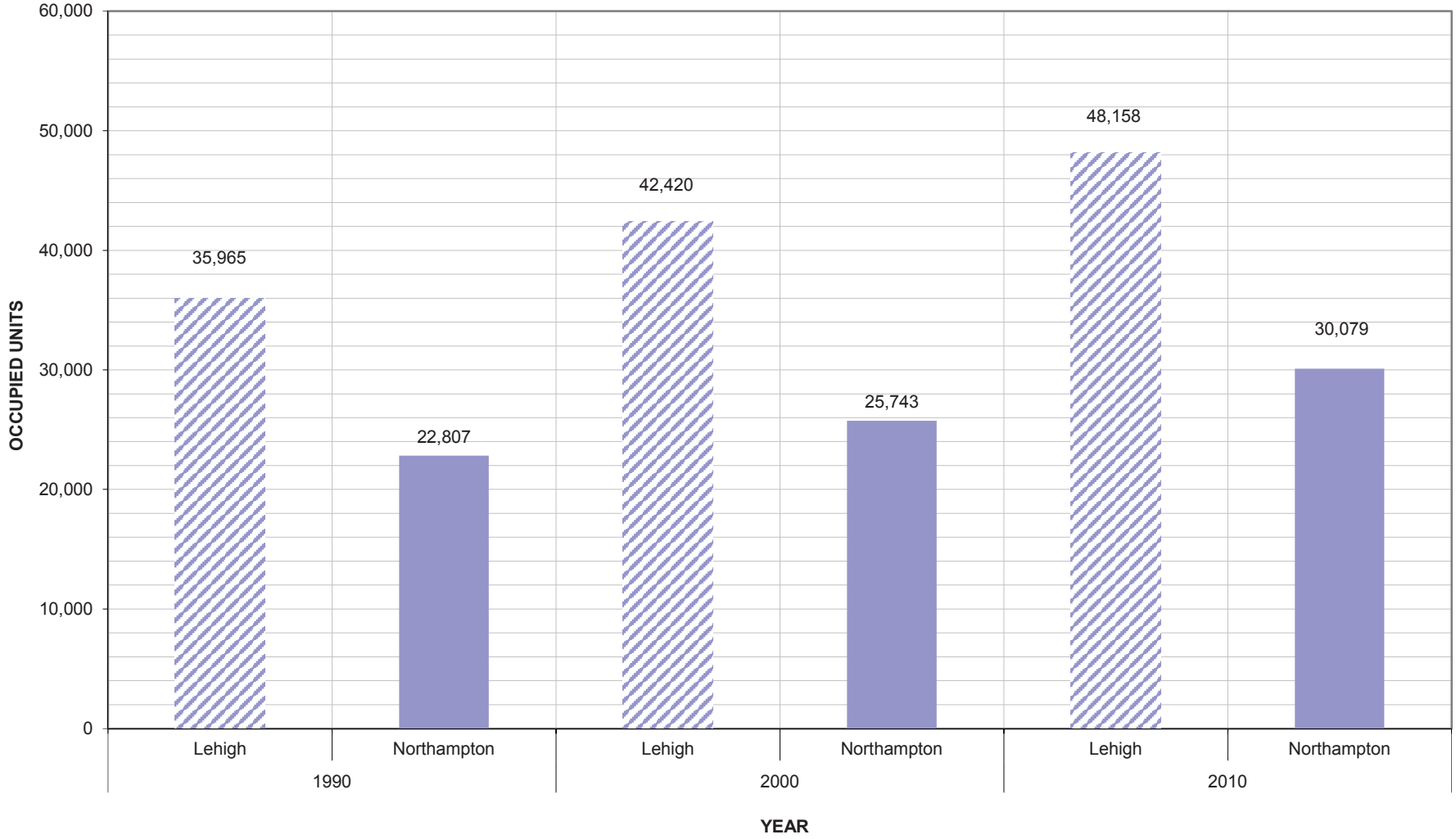
OCCUPIED UNITS IN THE LEHIGH VALLEY UTILIZING ELECTRICITY AS HOUSE HEATING FUEL 1990-2010



SOURCE: 1990 AND 2000 U.S. CENSUS, 2010 AMERICAN COMMUNITY SURVEY(5-YEAR ESTIMATES)

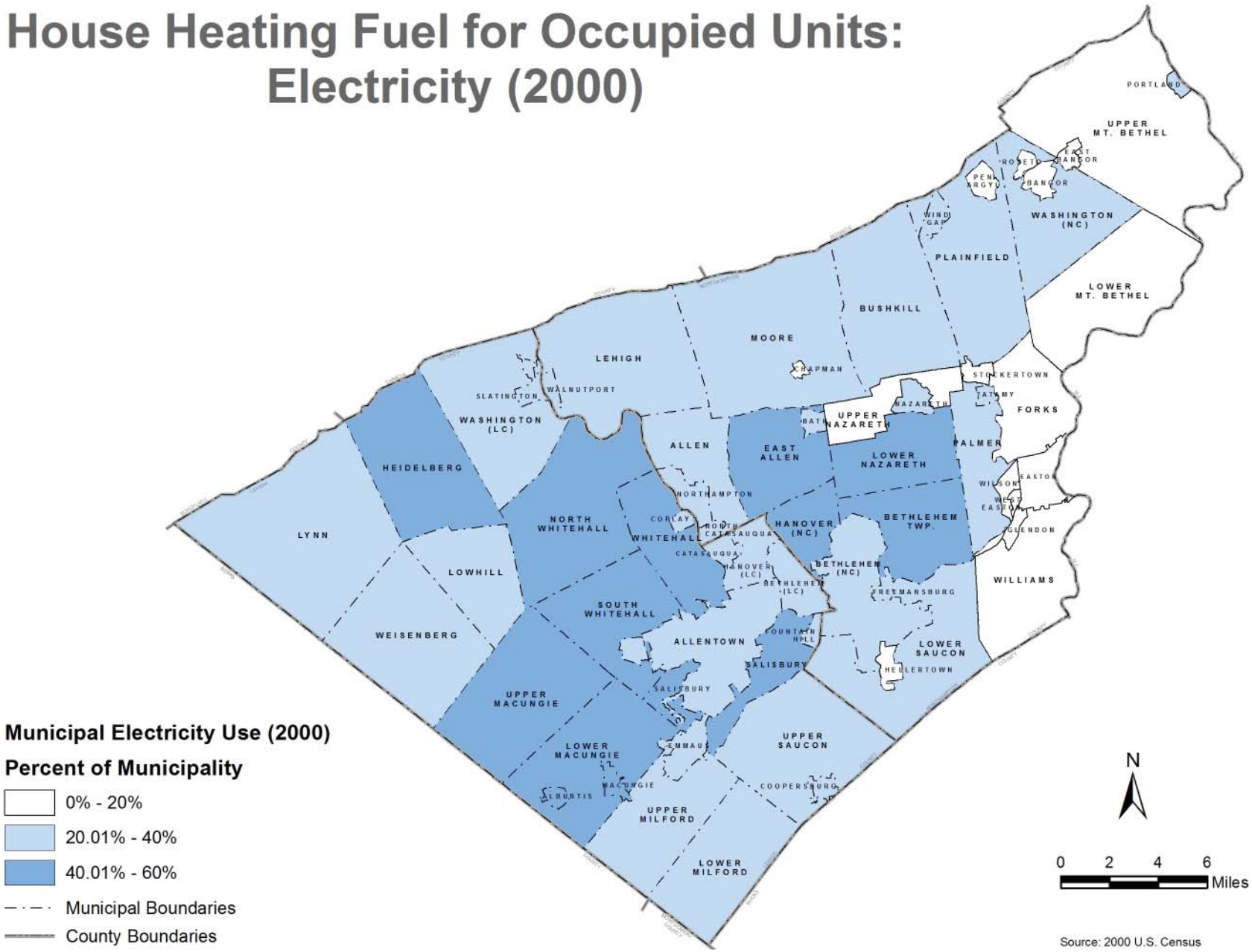
ELECTRICITY

OCCUPIED UNITS IN THE LEHIGH VALLEY UTILIZING ELECTRICITY AS HOUSE HEATING FUEL BY COUNTY 1990-2010



SOURCE: 1990 AND 2000 U.S. CENSUS, 2010 AMERICAN COMMUNITY SURVEY (5-YEAR ESTIMATES)

House Heating Fuel for Occupied Units: Electricity (2000)



Municipal Electricity Use (2000)

Percent of Municipality

- 0% - 20%
- 20.01% - 40%
- 40.01% - 60%
- Municipal Boundaries
- County Boundaries

Source: 2000 U.S. Census

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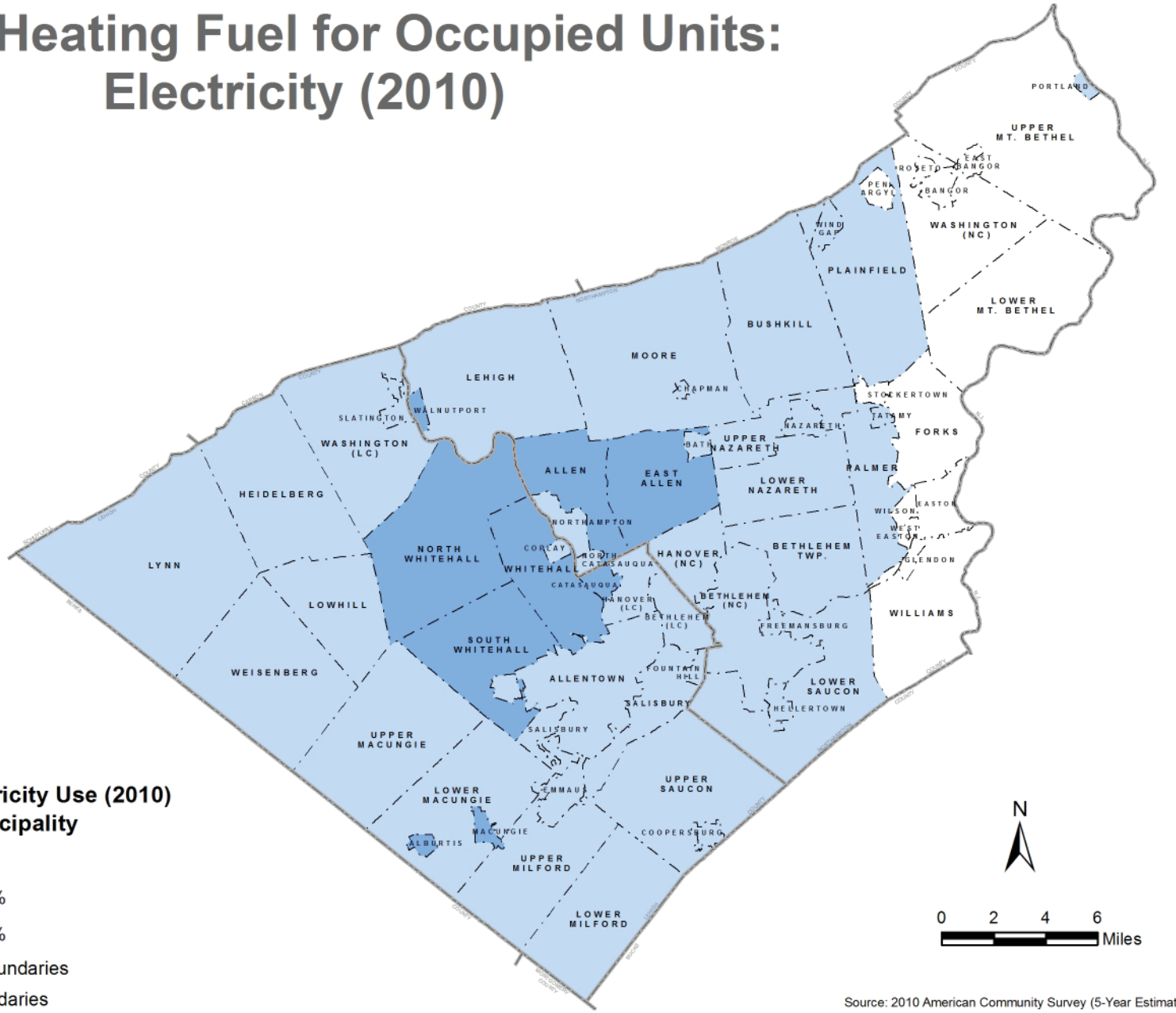
House Heating Fuel for Occupied Units: Electricity (2010)



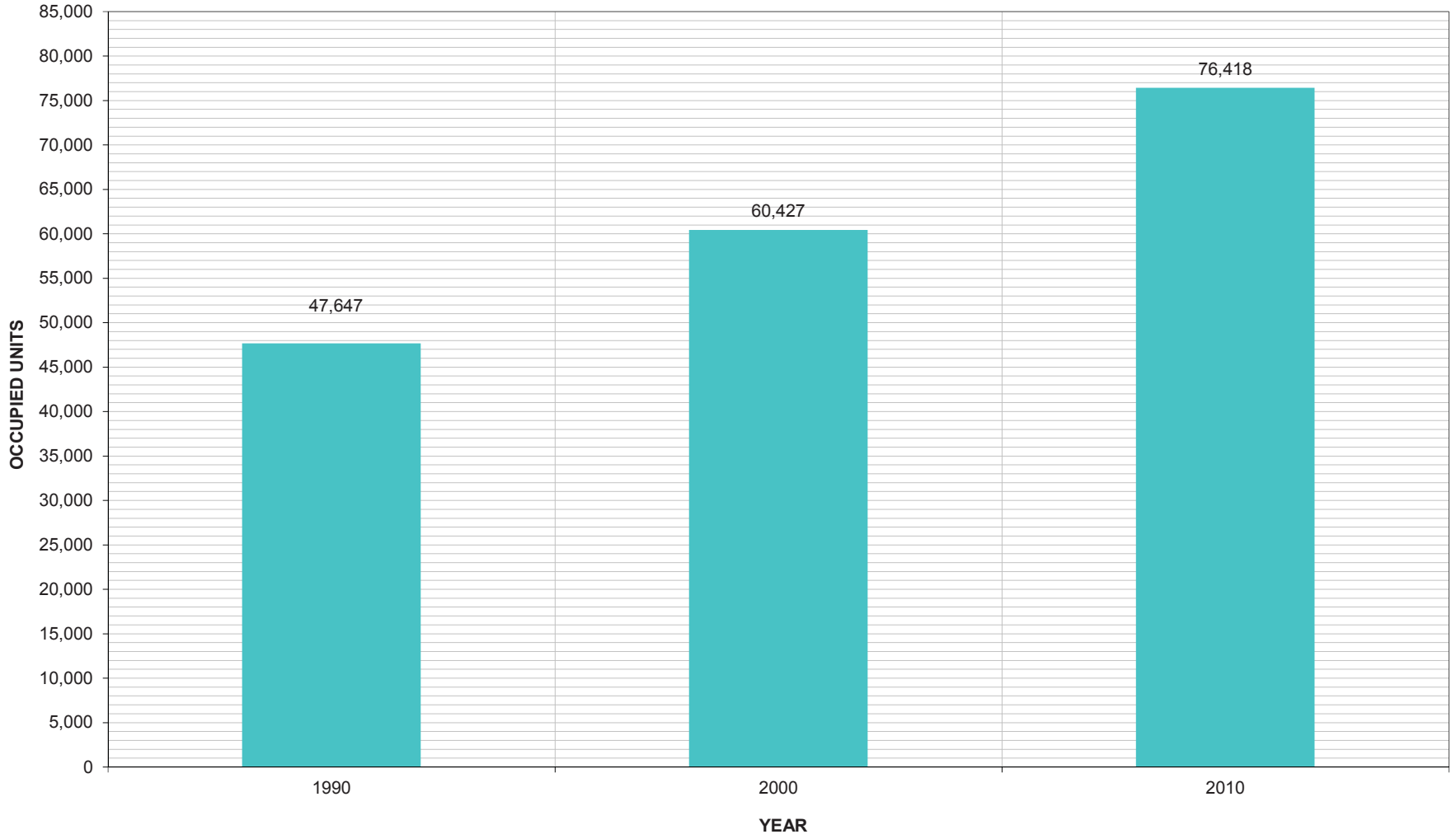
Municipal Electricity Use (2010)
Percent of Municipality

- 0% - 20%
- 20.01% - 40%
- 40.01% - 60%
- Municipal Boundaries
- County Boundaries

Source: 2010 American Community Survey (5-Year Estimates)

NATURAL GAS / UTILITY GAS

OCCUPIED UNITS IN THE LEHIGH VALLEY UTILIZING NATURAL GAS AS HOUSE HEATING FUEL 1990-2010



SOURCE: 1990 AND 2000 U.S. CENSUS, 2010 AMERICAN COMMUNITY SURVEY(5-YEAR ESTIMATES)

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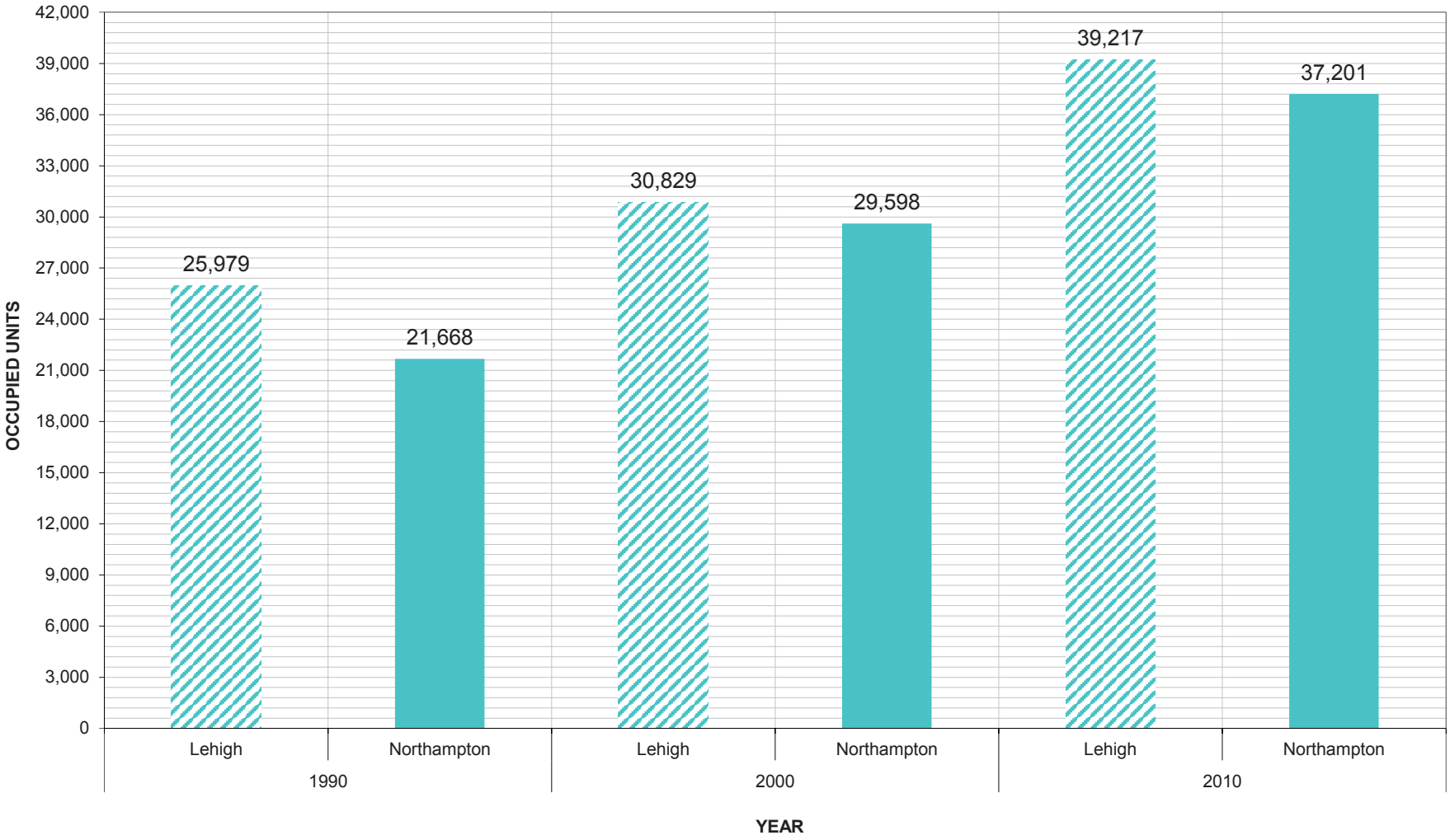
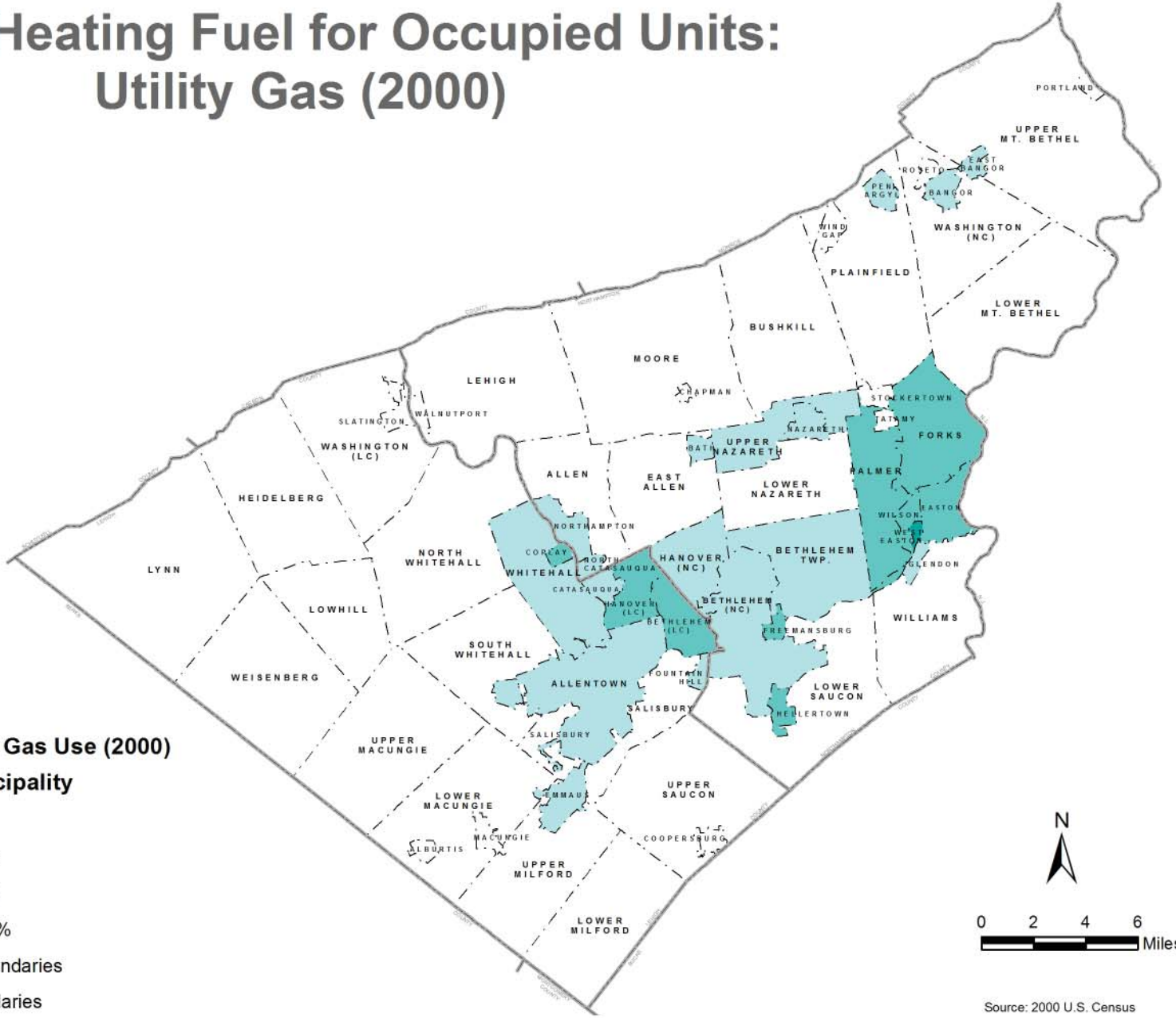
NATURAL GAS / UTILITY GAS

OCCUPIED UNITS IN THE LEHIGH VALLEY UTILIZING NATURAL GAS AS HOUSE HEATING FUEL BY COUNTY 1990-2010



SOURCE: 1990 AND 2000 U.S. CENSUS, 2010 AMERICAN COMMUNITY SURVEY(5-YEAR ESTIMATES)

House Heating Fuel for Occupied Units: Utility Gas (2000)



Municipal Utility Gas Use (2000)

Percent of Municipality

- 0% - 20%
- 20.01% - 40%
- 40.01% - 60%
- 60.01% - 100%
- Municipal Boundaries
- County Boundaries

Source: 2000 U.S. Census

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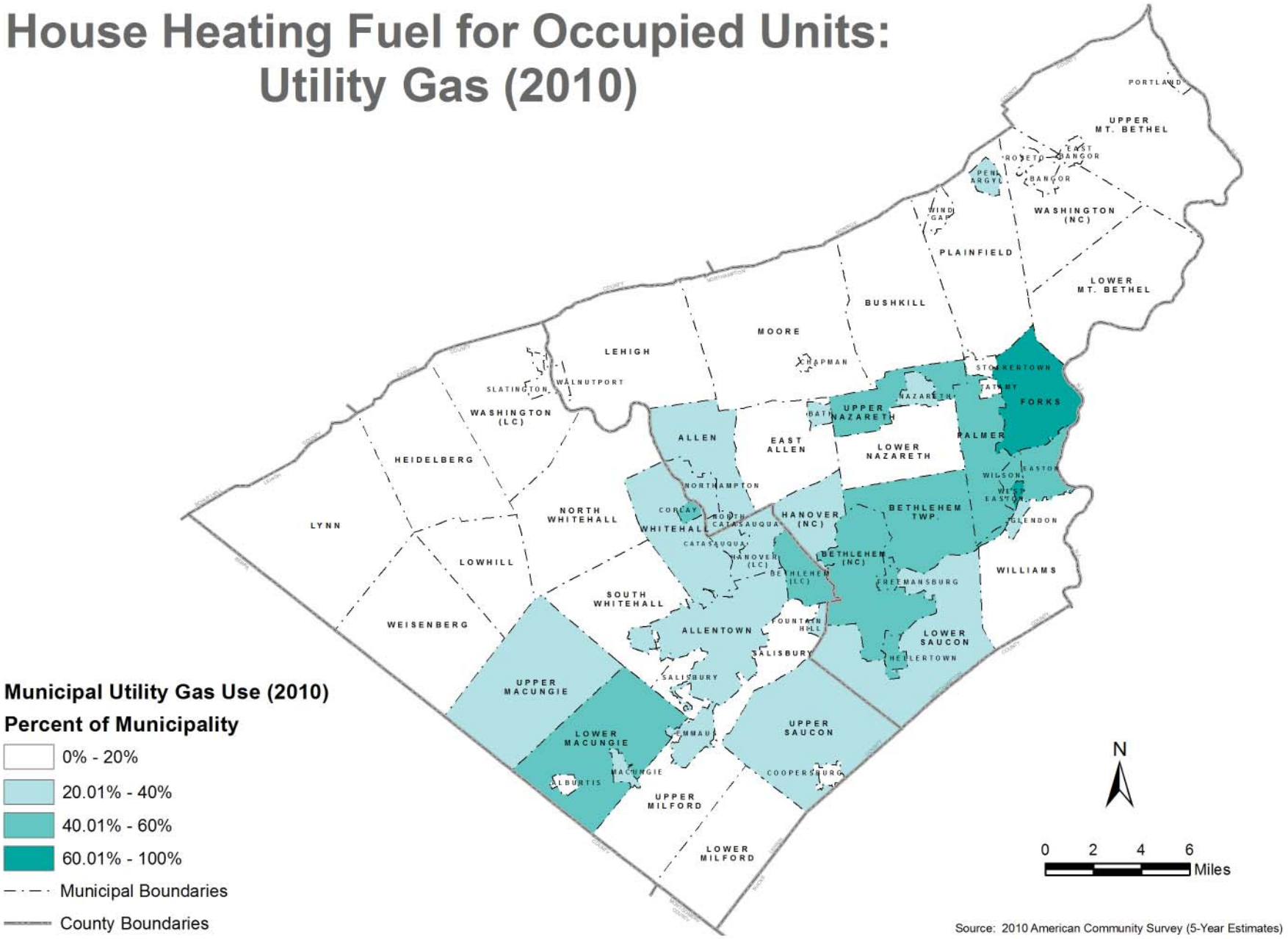
House Heating Fuel for Occupied Units: Utility Gas (2010)



Municipal Utility Gas Use (2010)

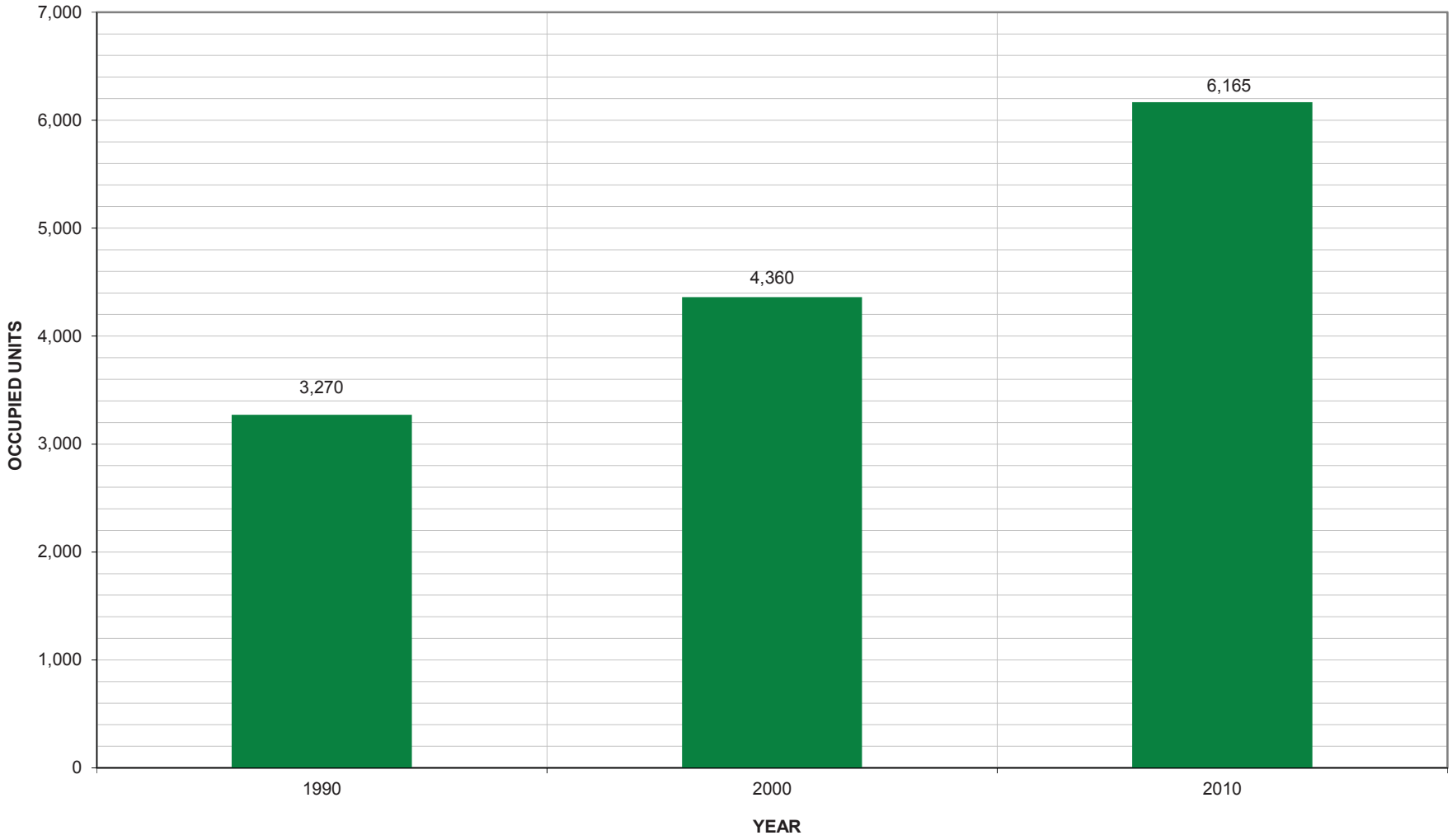
Percent of Municipality

- 0% - 20%
- 20.01% - 40%
- 40.01% - 60%
- 60.01% - 100%
- Municipal Boundaries
- County Boundaries

Source: 2010 American Community Survey (5-Year Estimates)

PROPANE / BOTTLED, TANK OR LP GAS

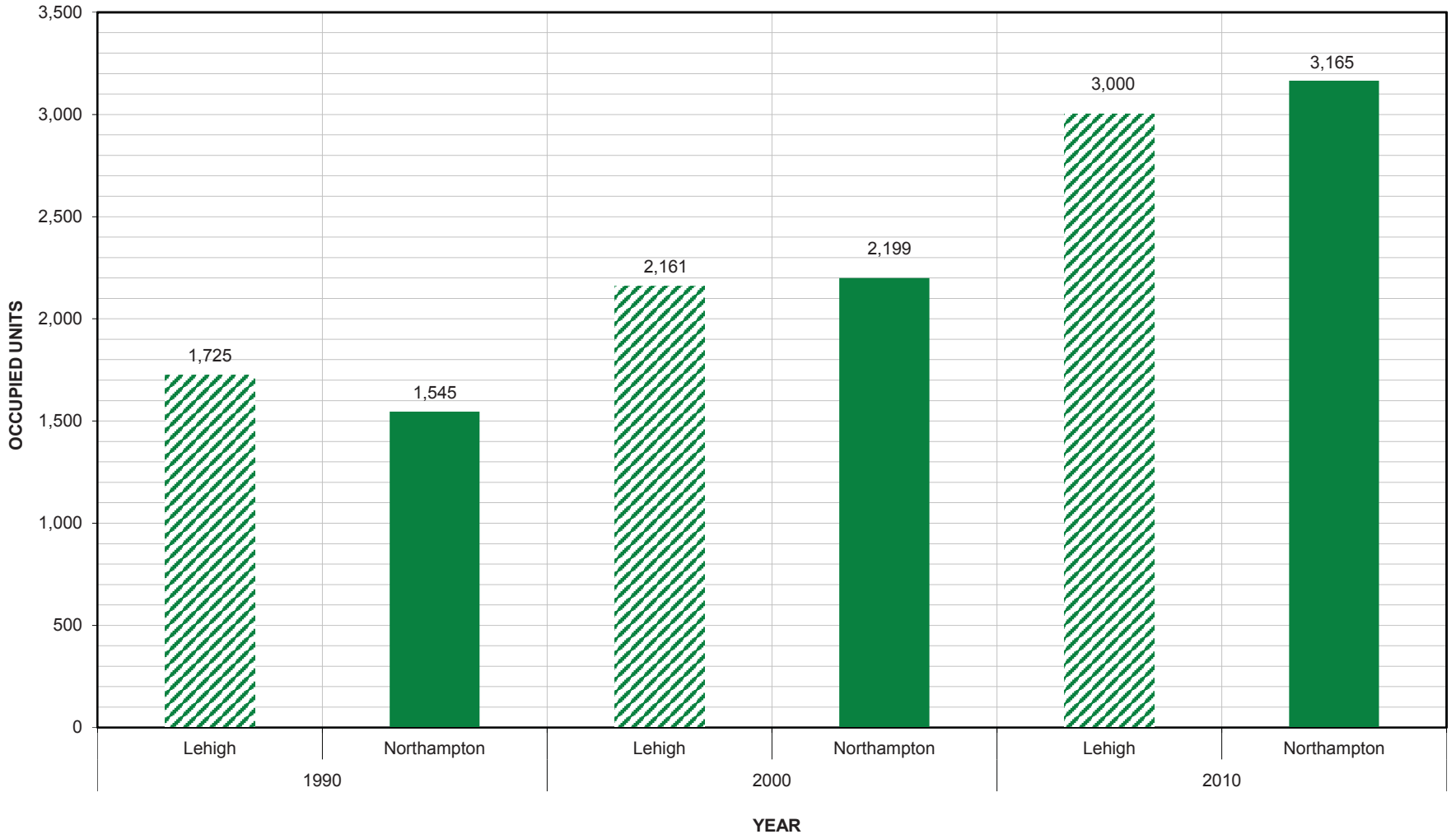
OCCUPIED UNITS IN THE LEHIGH VALLEY UTILIZING BOTTLED, TANK OR LP GAS AS HOUSE HEATING FUEL 1990-2010



SOURCE: 1990 AND 2000 U.S. CENSUS, 2010 AMERICAN COMMUNITY SURVEY (5-YEAR ESTIMATES)

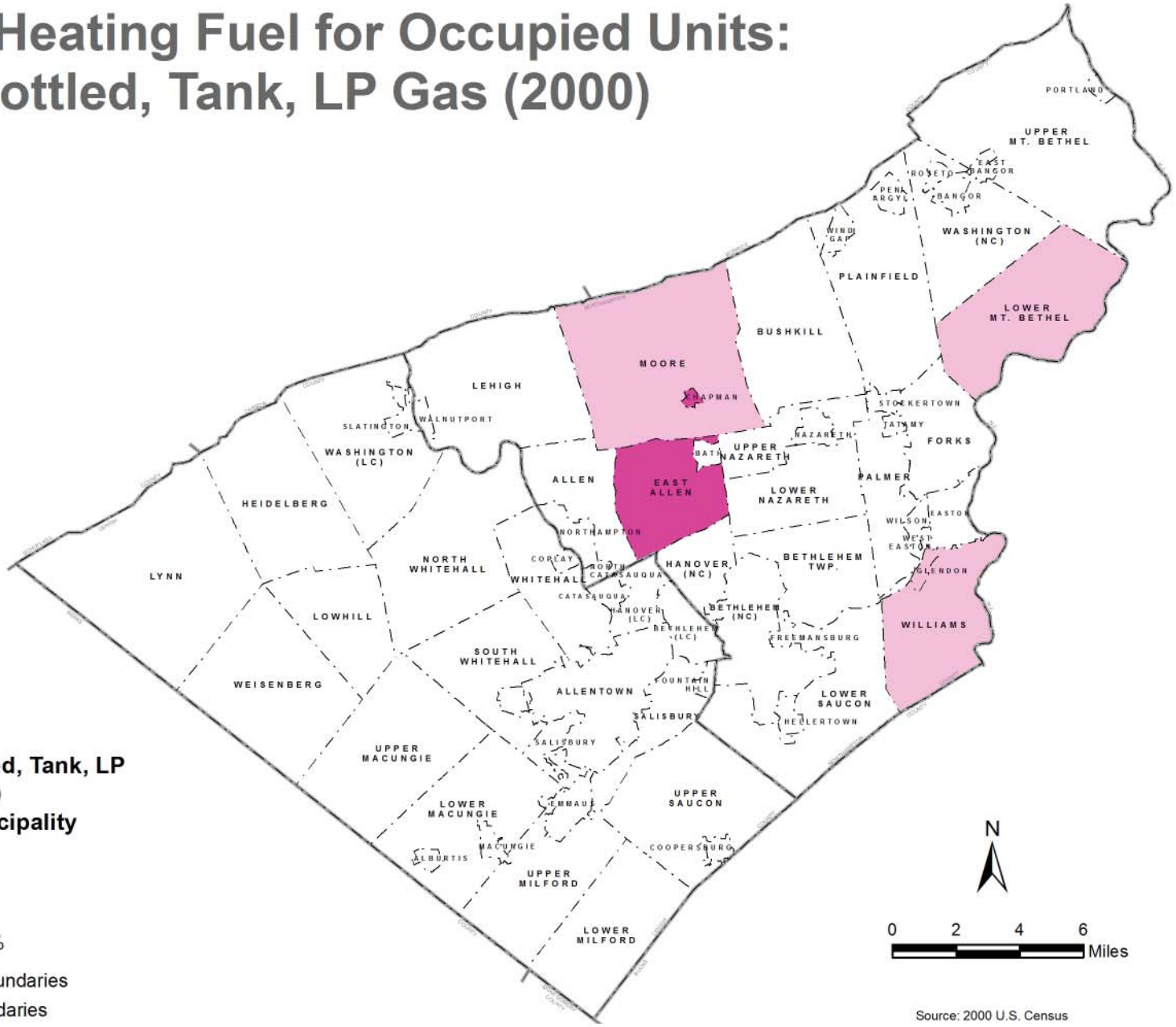
PROPANE / BOTTLED, TANK OR LP GAS

OCCUPIED UNITS IN THE LEHIGH VALLEY UTILIZING BOTTLED, TANK OR LP GAS AS HOUSE HEATING FUEL BY COUNTY 1990-2010



SOURCE: 1990 AND 2000 U.S. CENSUS, 2010 AMERICAN COMMUNITY SURVEY (5-YEAR ESTIMATES)

House Heating Fuel for Occupied Units: Bottled, Tank, LP Gas (2000)



Municipal Bottled, Tank, LP Gas Use (2000)
Percent of Municipality

- 0% - 5%
- 5.01% - 10%
- 10.01% - 20%
- Municipal Boundaries
- County Boundaries

Source: 2000 U.S. Census

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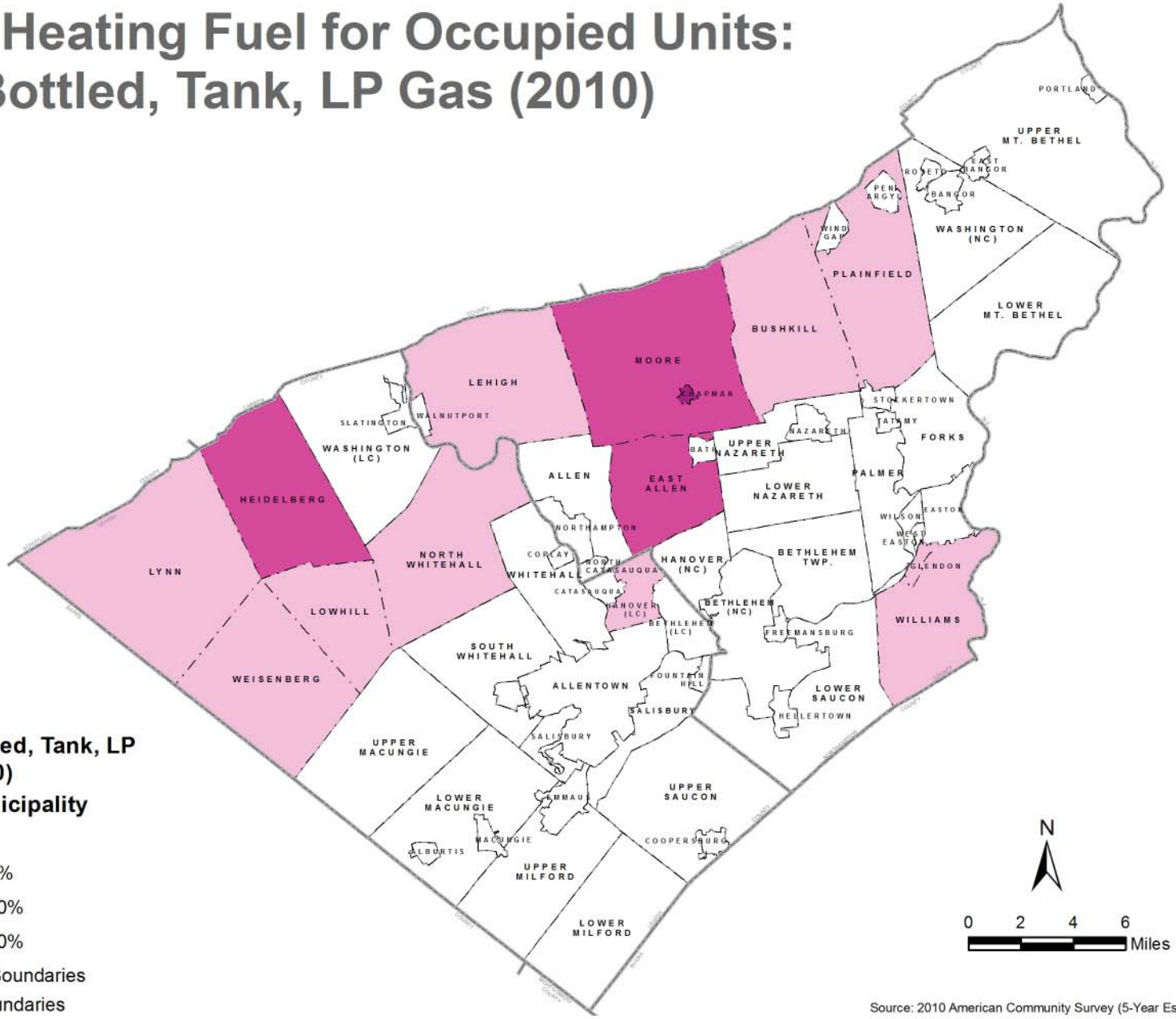
House Heating Fuel for Occupied Units: Bottled, Tank, LP Gas (2010)



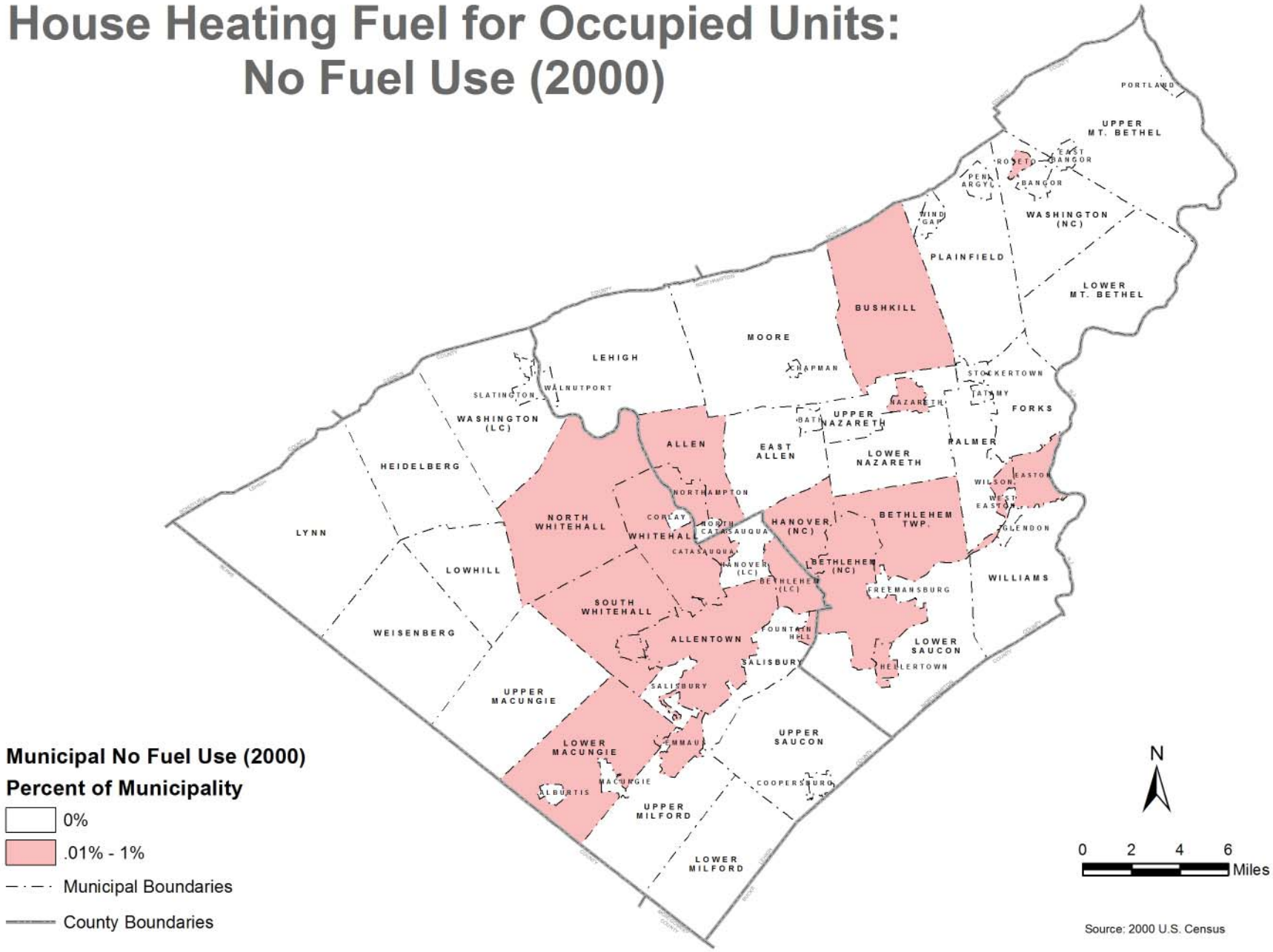
Municipal Bottled, Tank, LP Gas Use (2010)

Percent of Municipality

- 0% - 5%
- 5.01% - 10%
- 10.01% - 20%
- 20.01% - 40%
- Municipal Boundaries
- County Boundaries

Source: 2010 American Community Survey (5-Year Estimates)

House Heating Fuel for Occupied Units: No Fuel Use (2000)



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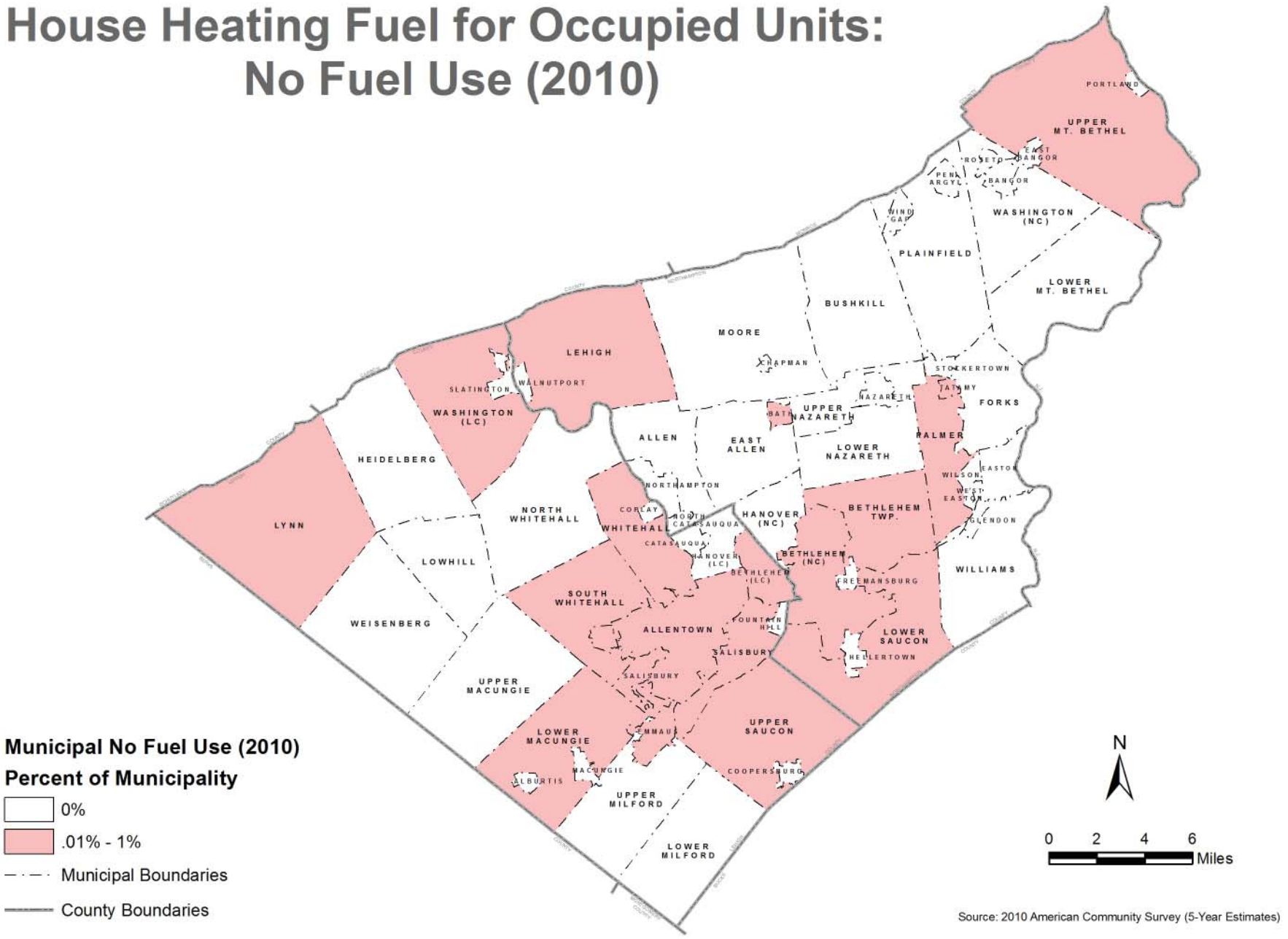
House Heating Fuel for Occupied Units: No Fuel Use (2010)



Municipal No Fuel Use (2010)

Percent of Municipality

- 0%
- .01% - 1%
- Municipal Boundaries
- County Boundaries

N

0 2 4 6 Miles

Source: 2010 American Community Survey (5-Year Estimates)

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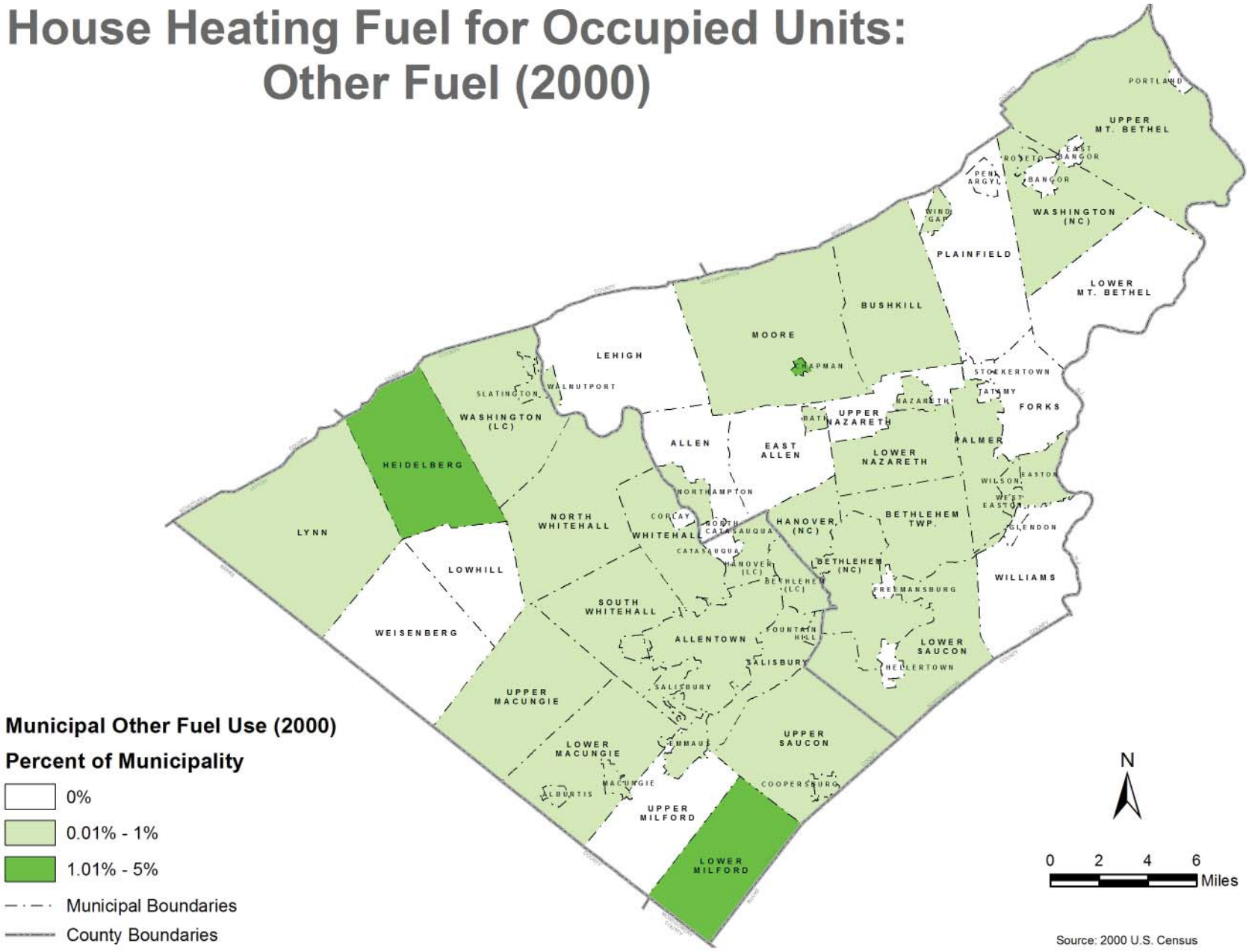
House Heating Fuel for Occupied Units: Other Fuel (2000)



Municipal Other Fuel Use (2000)

Percent of Municipality

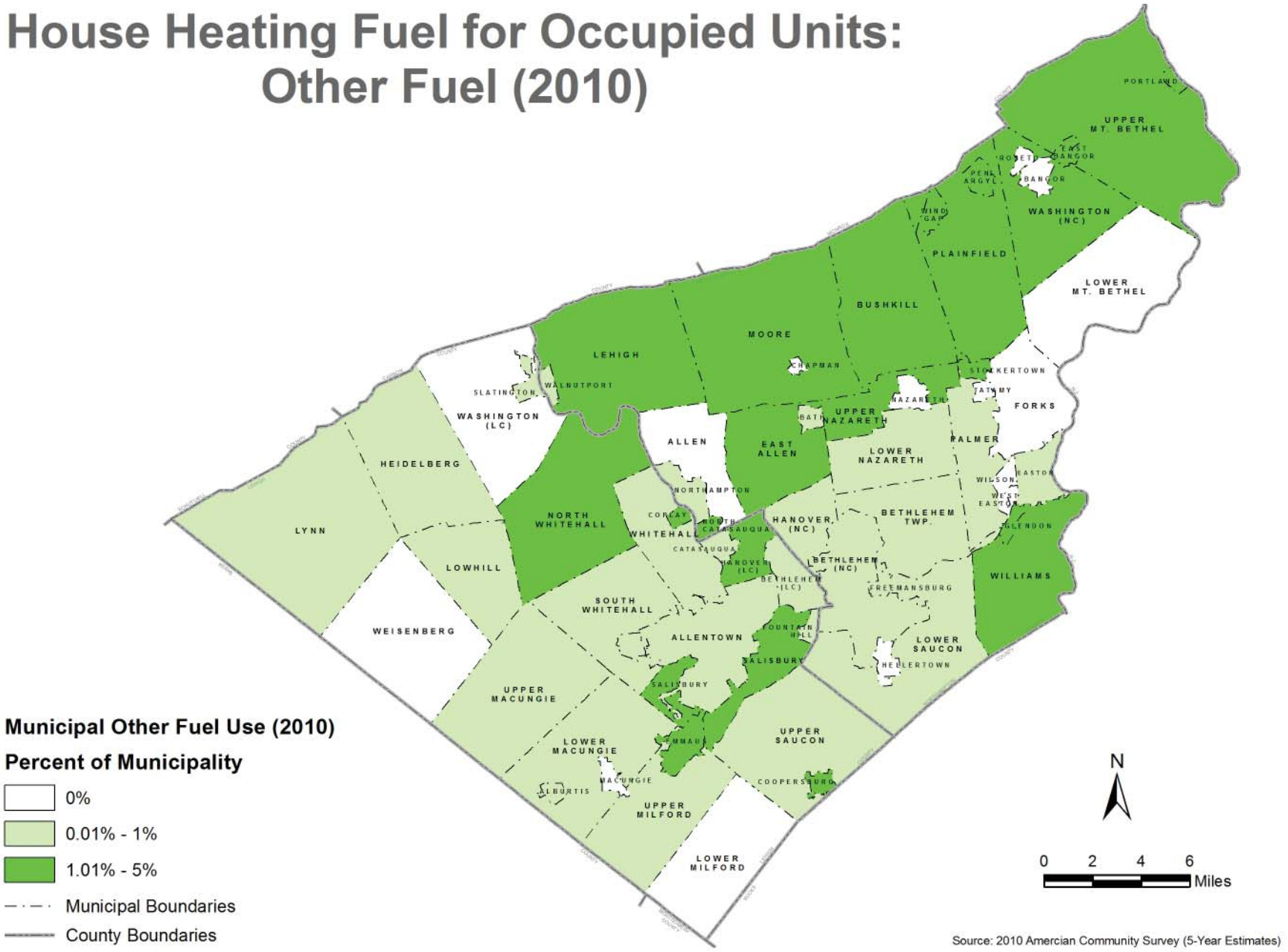
- 0%
- 0.01% - 1%
- 1.01% - 5%
- Municipal Boundaries
- County Boundaries

N

0 2 4 6 Miles

Source: 2000 U.S. Census

House Heating Fuel for Occupied Units: Other Fuel (2010)



Municipal Other Fuel Use (2010)

Percent of Municipality

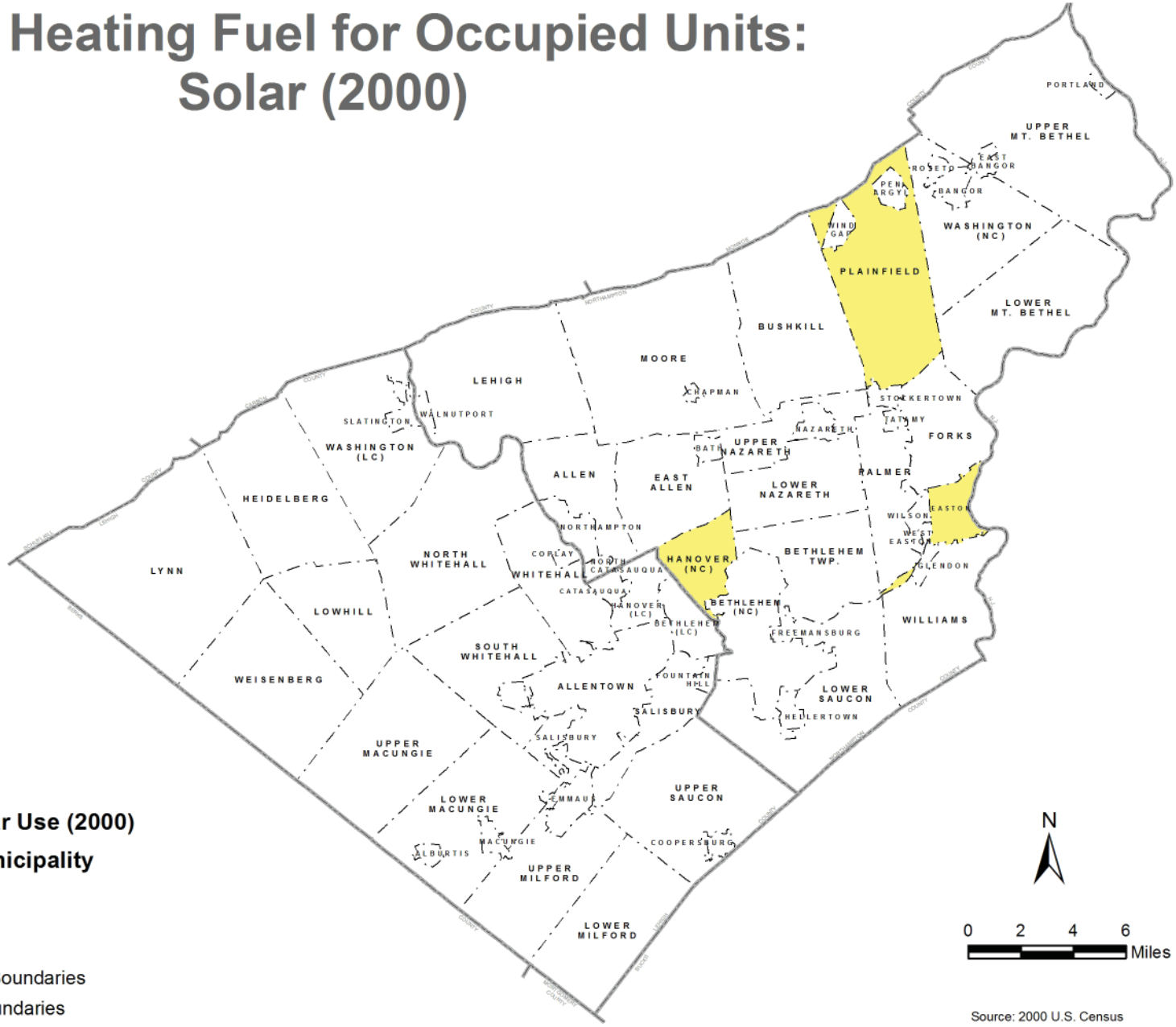
- 0%
- 0.01% - 1%
- 1.01% - 5%
- Municipal Boundaries
- County Boundaries

N

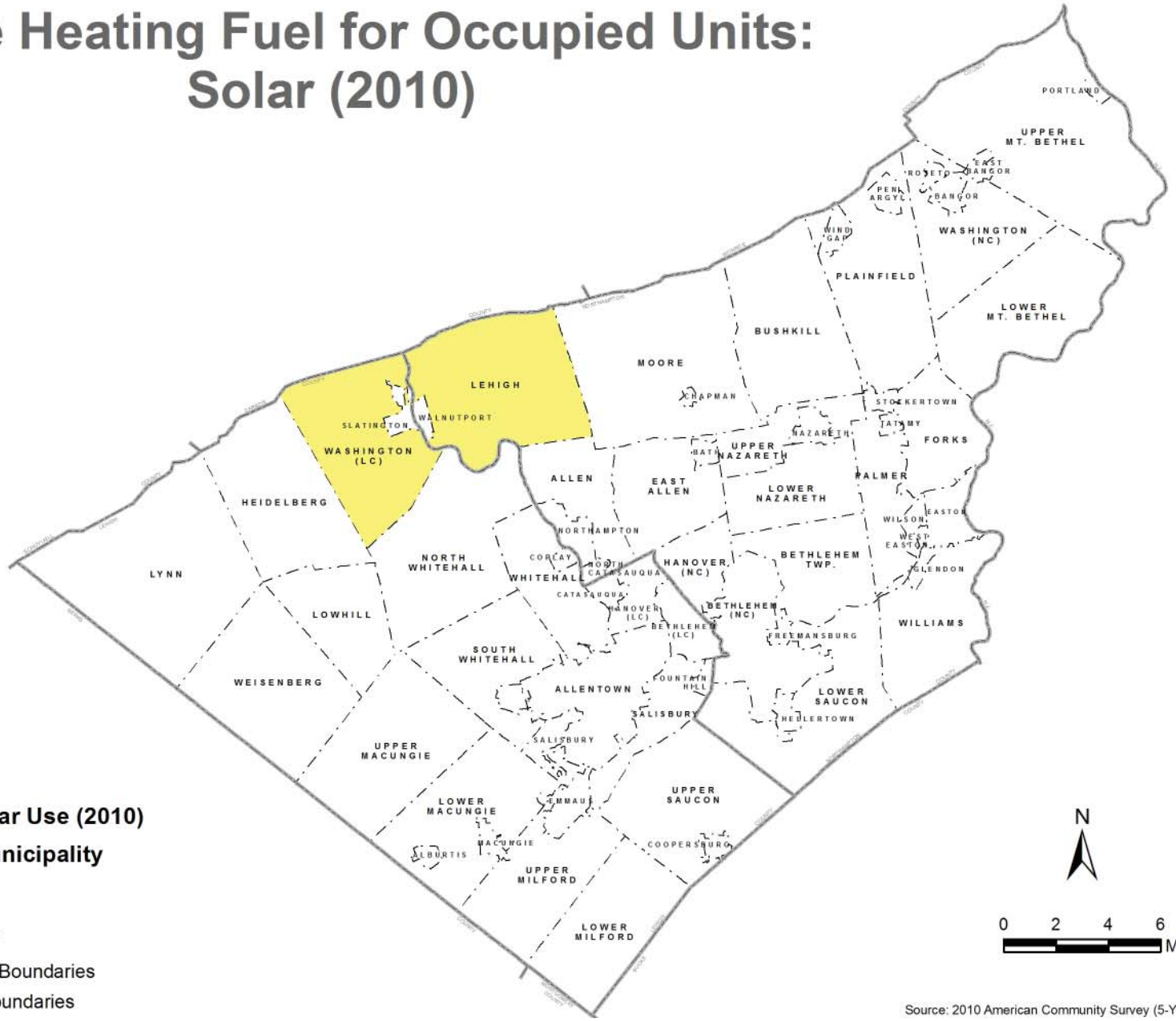
0 2 4 6 Miles

Source: 2010 Amercian Community Survey (5-Year Estimates)

House Heating Fuel for Occupied Units: Solar (2000)



House Heating Fuel for Occupied Units: Solar (2010)



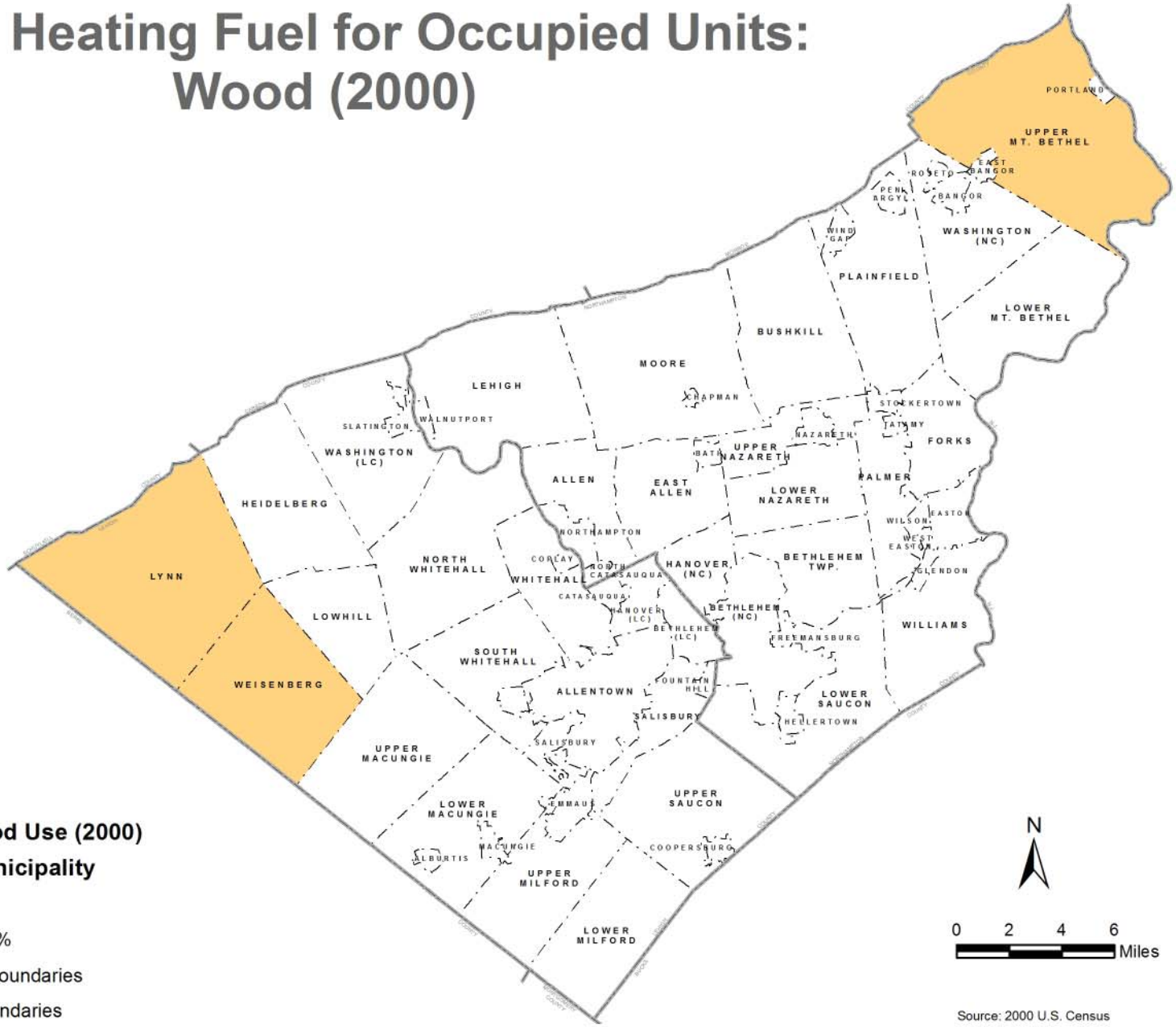
Municipal Solar Use (2010)

Percent of Municipality

- 0%
- .01% - 1%
- Municipal Boundaries
- County Boundaries

Source: 2010 American Community Survey (5-Year Estimates)

House Heating Fuel for Occupied Units: Wood (2000)



Municipal Wood Use (2000)

Percent of Municipality

- 0% - 5%
- 5.01% - 10%
- Municipal Boundaries
- County Boundaries

N

0 2 4 6 Miles

Source: 2000 U.S. Census

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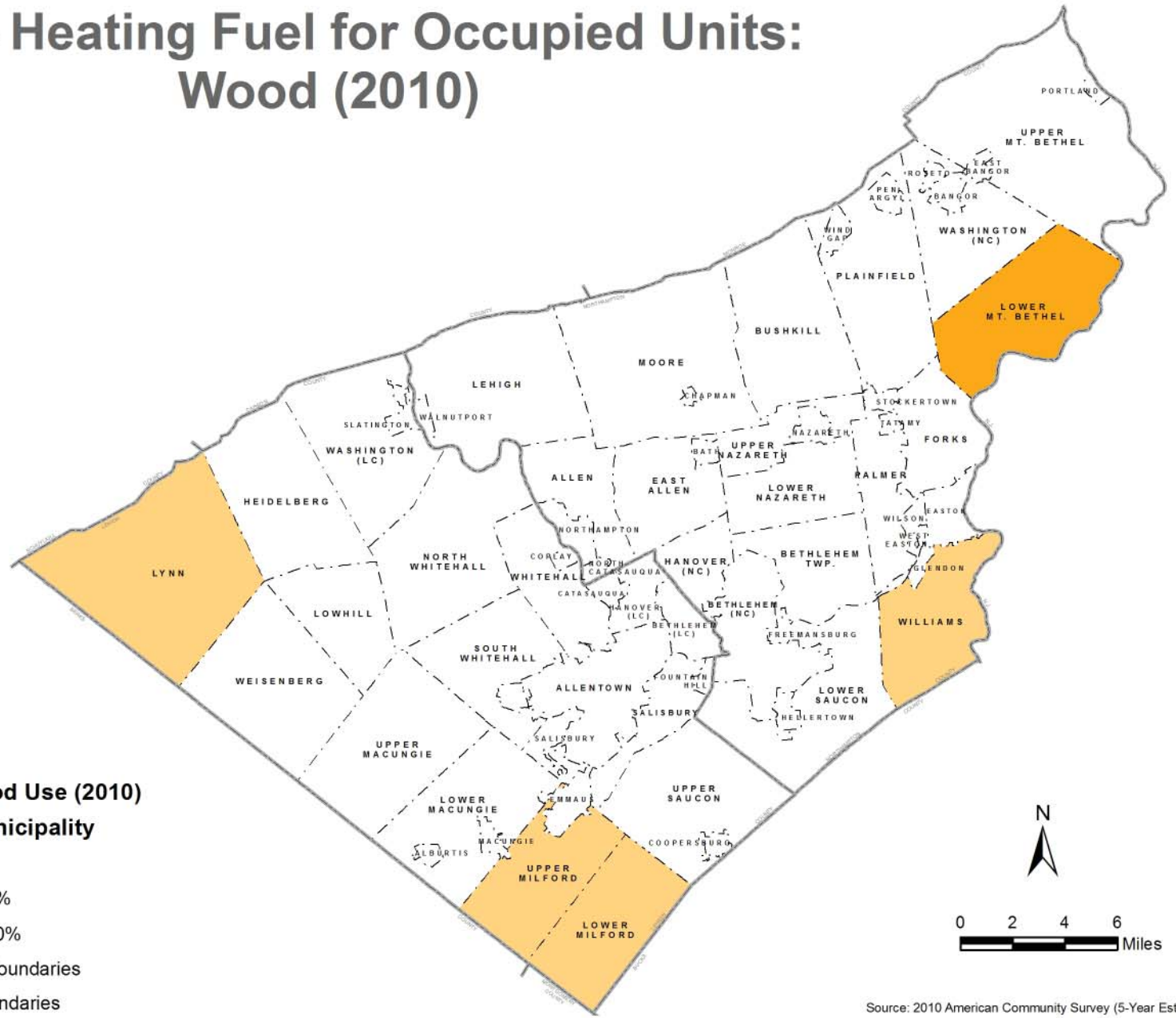
House Heating Fuel for Occupied Units: Wood (2010)



Municipal Wood Use (2010)

Percent of Municipality

- 0% - 5%
- 5.01% - 10%
- 10.01% - 20%
- Municipal Boundaries
- County Boundaries

Source: 2010 American Community Survey (5-Year Estimates)

HEAT CALCULATOR

FUEL TYPE	FUEL UNIT	FUEL PRICE PER	FUEL HEAT CONTENT PER UNIT (Btu)	FUEL PRICE PER MILLION Btu (dollars)	HEATING APPLIANCE TYPE	TYPE OF EFFICIENCY RATING 4	EFFICIENCY RATING OR ESTIMATE 5	APPROX. EFFICIENCY (%)	FUEL COST PER MILLION Btu (dollars)
FUEL OIL (#2)	Gallon	4.04	138,690	$29.12	Furnace or Boiler	AFUE	78.0	78%	**$37.33**
ELECTRICITY	KiloWatt-hour	0.117	3,412	$34.22	Furnace or Boiler	Estimate	98.0	98%	**$34.92**
					Air-Source Heat Pump 6	HSPF 6	8.2	240%	**$14.24**
					Geothermal Heat Pump	COP	3.3	330%	**$10.37**
					Baseboard/Room Heater	Estimate	100.0	100%	**$34.22**
NATURAL GAS 1	Therm 2	$0.75	100,000	$7.54	Furnace or Boiler	AFUE	82.0	82%	**$9.19**
					Room Heater (Vented)	AFUE	65.0	65%	**$11.60**
					Room Heater (Unvented)	Estimate	100.0	100%	**$7.54**
PROPANE	Gallon	$2.27	91,333	$24.82	Furnace or Boiler	AFUE	78.0	78%	**$31.82**
					Room Heater (Vented)	AFUE	65.0	65%	**$38.18**
WOOD 3	Cord	$200.00	22,000,000	$9.09	Non-Catalytic, Room Heater	EPA	63.0	63%	**$14.43**
					Catalytic, Room Heater	EPA	72.0	72%	**$12.63**
PELLETS	Ton	$250.00	16,500,000	$15.15	Room Heater	EPA	78.0	78%	**$19.43**
CORN (kernels) 3	Ton	$200.00	14,000,000	$14.29	Room Heater	EPA	78.0	78%	**$18.32**
KEROSENE	Gallon	$4.41	135,000	$32.65	Room Heater (Vented)	Estimate	80.0	80%	**$40.81**
COAL (Anthracite)	Ton	$200.00	25,000,000	$8.00	Furnace/Boiler/Stove	Estimate	75.0	75%	**$10.67**

SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION

1 Natural gas is typically sold to residential customers in units of "therms," but may be sold in units of hundreds of cubic feet (ccf).

2 One therm = 100,000 Btu, and is equivalent to about 97.847 cubic feet (or 0.978 ccf), when there are 1,022 Btu per cf.
To convert prices in $/Mcf ($ per 1,000 cubic feet) to $ per therm, divide the $/Mcf price price by 10.22 .

3 The heat content for a cord of wood varies by tree species and is greatly affected by moisture content; 20 million Btu per cord is a rough approximation.
The heat content of a unit (ton or bushel) of corn can also vary widely; see reference for Corn Burning Stoves in Efficiency Info tab/worksheet.
Wood and corn prices can vary substantially depending on type of wood and level of retail service.

4 For definitions of Efficiency Ratings and referrals to where they can be obtained, click on the EFFICIENCY INFO tab below.
Some types of heaters do not have efficiency ratings; the ratings in the yellow cells are comparable estimates for new appliances with basic features.

5 The default values are the approximate minimum efficiency standards set by the U.S. Department Energy in effect when this calculator was last updated.
Standards vary by type of heating appliance. Consult DOE for standards; see links in Efficiency Info worksheet below.
Estimated “ratings” are provided for heating equipment for which there are no DOE standards.

6 Air-Source Heat Pump Ratings: The actual heating efficiency and seasonal performance of a "conventional" air-source heat pump may vary significantly from its rated heating season performance factor (HSPF). Below is a procedure for determining an adjusted HSPF for your location *for an air-source heat pump that uses only electric resistance heating as the auxillary heat source* . There are so-called "dual-fuel" or "hybrid" heat pump systems that are basically a heat pump integrated with a forced-air combustion appliance that uses natural gas, fuel oil, or propane. In general, these systems use the heat pump for heating until outside temperatures reach the low 40's/high 30's (F), then switch to the combustion appliance for heating. The adjustment below does not apply to those types of hybrid heat pump/combustion appliance heating systems.
See the Technical Note for Air Source Heat Pumps in the EFFICIENCY INFO tab below for details on how the adjusted HSPF is calculated.

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