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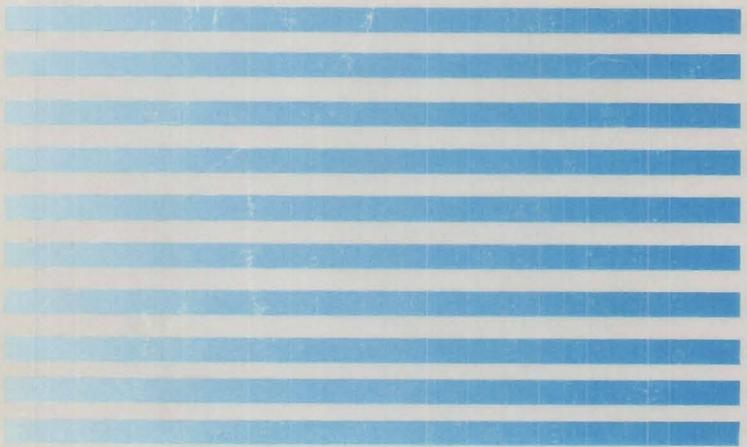
Manufacturing Energy Consumption Survey

Consumption of Energy

1988



Energy Information Administration



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National Energy Information Center, EI-231
Energy Information Administration
Forrestal Building
Room 1F-048
Washington, DC 20585
(202) 586-8800

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Manufacturing Energy Consumption Survey: Consumption of Energy 1988

May 1991

Energy Information Administration
Office of Energy Markets and End Use
U.S. Department of Energy
Washington, DC 20585

This report was prepared by the Energy Information Administration, the independent analytical agency within the Department of Energy. The information contained herein should not be construed as advocating or reflecting any policy position of the Department of Energy or any other organization.

Contacts

General information about Energy Information Administration data on energy consumption can be obtained from Lynda T. Carlson, Director of the Energy End Use Division (202-586-1112).

Specific information regarding the contents of this publication can be obtained from Dwight K. French, Chief of the Transportation and Industrial Branch (202-586-1126), or John L. Preston, Team Leader for the Manufacturing Energy Consumption Survey (202-586-1128). Robert K. Adler (202-586-1134), Jean Paananen (202-586-8952), and Mark Schipper (202-586-1136) are the contacts for estimation, analysis, and table preparation. Hattie Ramseur (202-586-1124) is the contact for related energy consumption publications.

As an outcome of the Department of Energy's National Energy Strategy, an assessment of the needs of users of the Manufacturing Energy Consumption Survey (MECS) is being pursued by the Energy Information Administration. As you read and use the data from this report, please keep this effort in mind.

If you have suggestions to make the data more useful for your needs, please contact John L. Preston, MECS Manager at:

EI-652, Mail Stop 2G-090
1000 Independence Avenue, SW
Washington, DC 20585

Telephone: 202-586-1128
FAX: 202-586-9753

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Executive Summary

Numerous recent events—the crisis in heating oil markets, the Persian Gulf War, the 1990 amendments to the Clean Air Act, the 20th anniversary of Earth Day, the development of the National Energy Strategy—have refocused America's attention on energy. Questions are being asked about the quantities and types of energy consumed by various sectors, how that energy is consumed, and the potential for energy conservation. The Manufacturing Energy Consumption Survey (MECS), conducted by the Energy Information Administration (EIA), provides answers to many of these questions for the manufacturing sector.

About one-third of all energy consumed in the United States is used by manufacturers. According to the 1988 MECS, the most recent year for which data are available, the total primary consumption of energy by manufacturers was about 20.5 quadrillion British thermal units (Btu). Primary consumption is defined in the MECS as the total requirement for end-use energy at the establishment site, regardless of whether it is used to produce heat and power or as a raw material. Several basic observations result from the data collected with the 1988 MECS:

Heat and power production account for 70 percent of energy consumption

Of the total 1988 primary consumption of energy by manufacturers, approximately 14.4 quadrillion Btu (70 percent) was used to produce heat and power. The remaining 6.1 quadrillion Btu of primary energy was used as a raw material to produce thousands of products such as chemicals, fertilizers, pharmaceutical preparations, coke for use in the production of steel, asphalt and road oil to build roads, and various solvents, lubricants, and waxes.

Byproduct fuels account for 23 percent of manufacturers' fuel consumption

Of the 14.4 quadrillion Btu of energy that was consumed by manufacturers to produce heat and power, 3.3 quadrillion Btu (23 percent) were byproducts of nonenergy materials used by manufacturers. The remaining 11.1 quadrillion Btu was purchased from vendors or provided by other offsite sources. The consumption of byproduct energy sources is concentrated in four specific industries. The Petroleum Refining industry consumed waste gas (also called still gas or refinery gas) and petroleum coke. The Paper and Paperboard Mills industries consumed pulping liquor and other wood materials. Finally, the Lumber and Wood Products industry consumed wood waste as a byproduct energy source.

Natural gas meets 29 percent of the energy demand by manufacturers

Manufacturers' primary consumption of natural gas was 5.7 trillion cubic feet (tcf) in 1988. That consumption was the equivalent of 5.9 quadrillion Btu, and met an estimated 29 percent of the primary consumption needs of manufacturers. According to the *Monthly Energy Review*, published by the EIA, total 1988 natural gas consumption in the United States was 18.0 tcf; manufacturers accounted for about 32 percent of that consumption. Only 0.5 tcf of natural gas was consumed as a raw material, and nearly all of that was accounted for by the Chemicals and Allied Products industry, which consumes large quantities of natural gas to produce nitrogenous fertilizers.

40 percent of the coal consumed by manufacturers is used to produce steel

Manufacturers consumed approximately 97.6 million short tons of coal during 1988, or only 11 percent of the total coal consumed in the United States. Of the total consumption by manufacturers, 39.0 million short tons (40 percent) was consumed by the Blast Furnaces and Steel Mills industry to produce coke for use in the production of steel. The rest (58.6 million short tons or 60 percent) was consumed by manufacturers to produce heat and power.

Manufacturers' consumption of petroleum products accounts for only 8 percent of the crude oil processed by refineries

In 1988, manufacturers consumed 406.4 million barrels of petroleum products consisting of residual and distillate fuel oil and liquefied petroleum gases (LPG). Only 8 percent of the total crude oil processed by refineries was used to produce these petroleum products. Moreover, those petroleum products met less than 9 percent of the total primary consumption requirements of manufacturers. The major use of petroleum products by manufacturers was as a raw material—250.4 million barrels were consumed for that purpose—and LPG met 98 percent of that total requirement. LPG was used heavily by the Chemicals and Allied Products industry to produce a wide range of products.

Manufacturers consume natural gas over residual fuel oil by a ratio of 10 to 1

Much of the fuel-burning equipment used by manufacturers is capable of burning more than one energy source. Although natural gas is not fully replaceable by fuel oils, there is some flexibility in the choice of one over the other. Based on heat content, manufacturers' ratio of the primary consumption of natural gas to residual fuel oil was nearly 10 to 1. However, that ratio was not uniform throughout the United States. In the Northeast Census Region, it was about 2 to 1, while in the South Census Region, it was 17 to 1. In the Midwest and West Census Regions, the ratios were 14 to 1, and 9 to 1, respectively.

Handwritten:
 NA 64
 27.2
 1 3.27
 52.17
 17

Manufacturers' choice of fuels depends in part on their prices

The geographic variation in the ratios of natural gas to residual fuel oil is probably due, in part, to regional differences in the prices of those energy sources. In all regions of the country except the South Census Region, the price of residual fuel oil per million Btu was less than the price of natural gas. In the Northeast Census Region, which had the lowest ratio of natural gas to residual fuel oil, manufacturers paid an average of \$2.66 per million Btu for residual fuel oil and \$3.31 for natural gas. In the South Census Region, which had the highest ratio, manufacturers paid \$2.37 per million Btu for residual fuel oil, but only \$2.17 for natural gas.

Manufacturers generate nearly 115 billion kilowatthours of electricity

In 1988, manufacturers purchased 701.0 billion kilowatthours (kWh) of electricity directly from utilities. An additional 27.2 billion kWh was transferred to the consuming manufacturers from other establishments within the same company, or from company-owned electricity generating facilities. Manufacturers also generated 114.8 billion kWh of electricity onsite. From that total pool of electricity—843.0 billion kWh—manufacturers sold or transferred 23.7 billion kWh to other establishments or utilities, resulting in a total net demand of 819.3 billion kWh. Thus, manufacturers generated or cogenerated over 14 percent of their electricity demand.

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 701.0
 27.2
 114.8
 843.0 ✓
 - 23.7
 819.3 ✓
 114.8 / 819.3 = 14%

***South Census Region leads
Nation in the generation of
electricity***

1.1 - 19/88
✓

Net electricity demand in the South Census Region was 356.1 billion kWh. Of that total demand, 71.9 billion kWh (20 percent) was generated or cogenerated onsite. Manufacturers in the South Census Region accounted for 63 percent of the total onsite-generated electricity in the Nation. That high level of electricity generation activity is due, in part, to the heavy concentration of industries in the South that normally consume large quantities of electricity. These industries are Paper and Allied Products, Chemicals and Allied Products, and Petroleum Refining.

Upcoming reports and analyses

The primary purpose of this report is to provide a compilation of statistics that can be used for a wide variety of analyses on energy consumption by manufacturers. The text of this data report highlights some of the information that might be of interest to analysts using the results of the Manufacturing Energy Consumption Survey. Two additional data reports will be issued on fuel-switching capabilities and changes in energy efficiency from 1985 to 1988. In addition, EIA will release a comparative analysis of energy consumption by manufacturers for 1985 and 1988. Finally, additional topics that may be covered by EIA's consumption analyses include:

- Relationship of the consumption of individual energy sources to production in high tech, fast growth industries
- Development of derived state-level estimates of MECS energy consumption data
- Development of derived annual estimates of MECS energy consumption data
- Relationship of energy consumption and emissions in manufacturing
- Preparation for the 1991 MECS—an assessment of user needs.

1. Introduction

This report, *Manufacturing Energy Consumption Survey: Consumption of Energy 1988*, has been prepared by the Energy Use Division, Office of Energy Markets and End Use, Energy Information Administration (EIA).

The EIA is mandated by Congress to be the agency within the Department of Energy that collects, analyzes, and disseminates impartial, comprehensive data about energy—how much is produced, who uses it, and the purposes for which it is used. To comply with that Congressional mandate, the EIA collects energy data from a wide variety of sources covering a range of topics.¹

The estimates in this report are based on data collected on the 1988 Manufacturing Energy Consumption Survey (MECS), Forms 846 (A through C). The EIA conducts this national sample survey of manufacturing energy consumption on a triennial basis. The MECS is the only comprehensive source of national-level data on energy-related information for the manufacturing industries. The MECS was first conducted in 1986 to collect data for 1985. This report presents manufacturing energy consumption and related data for 1988. It is the first of a series that will include future reports on fuel-switching capabilities and changes in energy efficiency. The EIA also conducts energy consumption surveys in the residential, residential transportation, and commercial buildings sectors.

A Guide to the Tables in this Report

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The MECS is conducted by the EIA under the authority of the Federal Energy Administration Act of 1974, Public Law 93-275, as amended, and Section 205 of the Department of Energy Organization Act, Public Law 95-91, as amended by Section 3102 of the Omnibus Budget Reconciliation Act of 1986, Public Law 99-509.

The Industry Division of the Bureau of the Census serves as EIA's data collecting and compiling agent for the MECS. All data reported to the Bureau of the Census are confidential under the provisions of Section 9, Title 13, of the U.S. Code.

The EIA gratefully acknowledges the cooperation of the respondents in supplying the information used to produce the estimates in this report.

¹The EIA conducts numerous energy-related surveys. In general, these surveys can be divided into two broad groups. One group of surveys is directed to the suppliers and marketers of specific energy sources. These surveys measure the quantities of specific fuels produced and/or supplied to the market. These types of surveys are called supply surveys. The results of these supply surveys are combined and published in the *Monthly Energy Review*, and other EIA publications. The second group gathers information on the types of energy used by the end users of energy along with the characteristics of those end users that can be associated with energy use. The MECS belongs to the consumption survey group because it collects information directly from the end users—the manufacturing establishments. There are important differences between the supply and consumption surveys that need to be taken into account in any analysis that uses both data sources. For information on these differences, see Energy Information Administration, *Energy Consumption by End-Use Sector, A Comparison of Measures by Consumption and Supply Surveys*, DOE/EIA-0533 (Washington, DC, April 6, 1990). Appendix A of this report also includes a summary of the differences.

2. Surveying the Manufacturing Division

The Scope of the 1988 MECS

The manufacturing division² of the U.S. economy produces final products that consumers purchase, such as automobiles and household furniture, as well as intermediate products such as automobile engines and upholstery fabric that are used by other manufacturers to produce other final or intermediate products. The division is composed of approximately 350,000 establishments, which serve as the data collection units for the MECS.

A manufacturing establishment is generally at a single physical location and is often called a plant, factory, or mill. Manufacturing establishments use mechanical or chemical processes to transform input materials or substances into new products. They ordinarily use power-driven machines and equipment for handling materials. A manufacturing establishment may also assemble components or perform blending operations. Electric utilities, mining operations, agriculture, forestry and fishery operations, and construction are *not* included in the manufacturing division.

The Sample Design

The estimates in this report are based on data collected from a carefully designed sample of approximately 12,000 manufacturing establishments. The major component of the MECS sample is a subset of the sample for the Annual Survey of Manufactures (ASM) conducted by the Bureau of the Census.³ The MECS sample was specifically designed to produce high-quality estimates of energy consumption and related information for industry categories within the manufacturing division.

Expanded Coverage For 1988 MECS Results in Higher Energy Consumption Estimates

The 1988 MECS was designed to produce estimates of energy consumption and other energy-related activities for the *entire* population of manufacturing establishments. It is important to note that the coverage of the 1988 MECS is more comprehensive than the coverage of the 1985 MECS. The 1985 MECS excluded the energy consumption of very small manufacturing establishments. That change in coverage results in 1988 energy consumption estimates that are *two to three percent higher* over all industries than they would have been if the procedures of the 1985 MECS had been similarly followed for the 1988 MECS. The coverage differential is larger for industries dominated by small businesses (such as printing and publishing) than for industries dominated by relatively few large corporations (such as primary aluminum smelting). See Appendix A for additional details.

The industrial categories in the MECS sample conform to the 1987 Standard Industrial Classification (SIC) system developed by the Office of Management and Budget.⁴ That classification system underlies all establishment-based Federal statistics classified by industry. The SIC system is used to promote the comparability of establishment data describing various facets of the U.S. economy.

The SIC system covers the entire field of economic activities and defines industries in accordance with the composition and structure of the economy. The SIC is a hierarchical classification system in which each level contains increasingly homogeneous categories of industrial activities. The levels of classification in the SIC

²The manufacturing division is one of four divisions comprising the Industrial Sector of the United States economy as defined by the Energy Information Administration. The other three divisions in this sector are agriculture, forestry, and fishing; mining; and construction.

³Appendix A contains a detailed discussion of the procedures followed to select the MECS sample.

⁴Office of Management and Budget, *Standard Industrial Classification Manual, 1987* (Washington, DC, 1987).

system are: division, major group, industry group, and industry. The manufacturing division contains 20 major groups (SIC 20 through 39).

Manufacturing establishments are classified into industries based on the value of production of specific products. If an establishment produces more than one type of product, it is classified according to the value of production of its primary product. For example, an establishment that is primarily engaged in manufacturing paper from wood pulp, and also manufactures paperboard, is classified in the Paper Mills Industry (SIC 2621). It would not be classified in the Paperboard Mills Industry (SIC 2631).

The population of manufacturing establishments was stratified into 30 industry categories to select the MECS sample. These categories are the 20 major manufacturing groups (two-digit SIC) and the 10 specific manufacturing industries (four-digit SIC) that historically have consumed the largest amounts of energy.⁵ That stratification scheme helps to ensure that the characteristics of an industry category are properly represented by the sample. Stratification also helps to control the sampling error which is present in all sample surveys.⁶

Measuring Manufacturing Industries' Energy Consumption

Identifying the types of energy sources⁷ used and measuring their consumption is relatively straightforward for most sectors of the economy. For example, most households consume only commonly known energy sources such as electricity, natural gas, home heating oil, wood for the fireplace, and gasoline. These energy sources are usually purchased from vendors such as utilities, heating oil distributors, and gasoline service stations. They are consumed primarily to provide heat, to cook food, run appliances and automobiles, and so on.

The energy-consuming characteristics of the manufacturing division are much more complex. While manufacturers consume large quantities of the more commonly known energy sources, they also consume a wide variety of unusual energy sources such as rice hulls. Moreover, some materials, which might be thought of as an energy source, are, in fact, not counted as an energy source. The wood consumed to make furniture is an example. In addition, manufacturers not only purchase energy, they also produce it, sell it, and transfer it. Finally, manufacturers use energy to produce heat and power and as a raw material. These complexities require special attention when attempting to measure energy consumption in the manufacturing division.

Manufacturers Use Numerous Unusual Energy Sources

Manufacturers consume large quantities of the commonly known energy sources such as electricity, natural gas, fuel oil, liquefied petroleum gases, coal, and so on. In addition, however, manufacturers consume many energy sources that are not commonly used by other sectors of the economy. The Pulp and Paper Industry, for example, consumes wood chips, bark and wood waste materials produced during the preparation of wood for pulping. The pulping process itself produces an energy source known as pulping liquor, or black liquor, which is also consumed as a fuel. Other unusual energy sources include the off-gases resulting from the production of coke from coal, as well as petroleum coke and still gas produced at petroleum refineries. In addition, certain manufacturers consume biomass (such as rice hulls), packing crates, and other similar materials as energy sources. Finally, some manufacturers produce their own electricity using hydropower, wind power, solar power, and geothermal sources.

⁵Appendix D contains descriptions of the 30 strata included in the MECS.

⁶See Appendix B for more information on the quality of the estimates.

⁷An energy source is defined as a substance such as natural gas, coal, or electricity that is capable of supplying heat or power.

When Is An Energy Source Not An Energy Source?

Some materials, which may be thought of as energy sources, are not counted as energy sources in the manufacturing division. The most obvious example is the crude oil and other refinery inputs consumed by petroleum refineries. Petroleum refineries do not "use up" these inputs. Rather, they convert them to more usable energy products as gasoline, diesel fuel, home heating oil, and so on. These products are then consumed by other sectors of the economy and would be counted as an energy source for those sectors. Including the inputs used by refineries *and* the refined petroleum products consumed by all sectors of the economy would result in double counting when estimating total end-use energy consumption. Therefore, the MECS excludes refinery inputs from its definition of energy consumption.

However, petroleum refineries also produce numerous final products that are not considered by consumers to be energy sources and would not be counted as such. These products include asphalt, road oil, solvents, lubricants, and waxes. The primary inputs to produce these nonenergy products are crude oil and natural gas liquids. Because these refinery inputs are excluded from the MECS' definition of energy consumption, total end-use energy consumption for the U.S. economy would be *undercounted* by an amount equal to the quantity of inputs required to produce these nonenergy products. One solution to this problem would be to *include* the refinery inputs used to produce nonenergy products and *exclude* the inputs used to produce energy products. In the interest of minimizing respondent burden, however, the MECS does not collect quantities of inputs required to produce specific products. However, except for spillage and contamination, the heat content (in Btu) of inputs to the refining process is equal to the heat content of the resulting products. Therefore, the heat content of the nonenergy products can serve as a measure of the heat content of the refinery inputs required to produce them.

EIA's "Monthly Refinery Report"⁸ provides information on the quantities (in barrels) of the nonenergy products shipped by refineries. These physical quantities were converted to energy content (asphalt, for example, has a heat content of 6.636 million Btu per 42 gallon barrel), and the resulting values were used as a surrogate for the quantities of energy used to produce them.

The other excluded "energy source" in the MECS is the enormous quantity of wood consumed to produce paper, build furniture, or manufacture lumber. Wood used as a raw material input is not considered to be an energy source by those manufacturers, even though it could, in fact, be consumed to produce heat and power. For the MECS, wood is considered to be an energy source only when it is consumed to produce heat and power.

Manufacturers Consume Energy To¹⁾ Provide Heat and Power and²⁾ as a Raw Material Input

There are two basic uses of energy in the manufacturing division. The most widely understood use is to produce heat and power, and to generate electricity. In addition, energy may be used as a raw material input to the manufacturing process. Energy consumed as a raw material is frequently called a feedstock, although that terminology most often refers to petroleum-based inputs and natural gas. There are numerous examples of energy being consumed as a raw material. Coal is consumed to produce coke. Natural gas is processed to extract methane, ethane, propane, and butane. These gases, in turn, are frequently used as a fuel (in the form of liquefied petroleum gases, or LPG), or used to produce everything from fertilizers to various pharmaceutical preparations.

Manufacturers Purchase Energy and Produce It Onsite

Regardless of how it is used, there are three ways that an energy source may arrive at an establishment. First, an energy source could be produced offsite and purchased by or transferred to the consuming establishment.

⁸The "Monthly Refinery Report," Form EIA-810, is designed to provide information regarding the balance between the supply (beginning stocks, receipts, and production) and disposition (input, shipments, fuel use and losses, and ending stocks) of refined products.

Most of the commonly known energy sources arrive at the manufacturing site in this manner. Second, it could be produced onsite from the use of other energy source materials. Coke oven gas, for example, is produced as a byproduct when manufacturing coke from coal. Electricity is also generated onsite using natural gas, oil, coal, and other energy source materials as input fuels. Third, energy could be produced onsite from nonenergy materials, or from inputs, such as crude oil, defined as nonenergy materials. For example, the electrolysis of brine (salt water, a nonenergy material) produces chlorine and caustic soda as the main products, and hydrogen (an energy source) as a byproduct. The hydrogen is counted as an energy source produced from a nonenergy material. Other examples arise from the use of crude oil as an input by petroleum refineries, and wood used as an input by pulp and paper mills and other manufacturers of wood products. As mentioned previously, these inputs are not treated as energy sources, and, therefore, by definition, are nonenergy materials. However, petroleum refining produces still gas and petroleum coke (see "Glossary") as byproducts of the refining process. These byproducts are consumed onsite by petroleum refineries, largely for heat and power. Still gas and petroleum coke are considered to be energy sources produced from a nonenergy material. Similarly, pulping liquor, wood chips, bark, and wood waste are consumed as energy sources.

The MECS Uses Three Measures of Energy Consumption

To deal with the complexities of energy consumption by manufacturers, three measures of energy consumption are defined for this report.

- The most restrictive measure of energy consumption is **Offsite-Produced Energy for Heat, Power, and Electricity Generation**. This measure includes only these energy sources that were produced offsite and consumed onsite. Energy sources consumed as a raw material input are excluded, as are all energy sources produced and consumed onsite. Offsite-produced energy consumption is definitionally compatible with the energy use measure in "Fuels and Electric Energy Consumed" supplement to the ASM, which was published by the Bureau of the Census for the years 1974 through 1981.⁹ These MECS estimates of offsite-produced energy consumption appear in Tables 4 and 10 of this report.
- Another measure of energy consumption is **Total Inputs of Energy for Heat, Power, and Electricity Generation**. This measure includes the offsite-produced energy as well as onsite-produced byproduct fuels resulting from the use of other energy sources originally consumed as a raw material input. It also includes the byproduct fuels resulting from the use of nonenergy materials as raw material inputs, and electricity produced from nonmaterial energy inputs. This measure of consumption excludes all energy sources consumed as a raw material input to the manufacturing process. These estimates appear in Tables 3 and 9 and are used to prepare the operating ratios in Tables 6 and 13.
- The most comprehensive measure of energy consumption is **Primary Consumption of Energy for All Purposes**. This measure represents the total energy requirements (including energy used as a raw material input) of manufacturing industries to produce nonenergy products. This measure could be defined as the "first use of energy" at a manufacturing establishment because it excludes any byproduct energy sources that were produced on site as a result of the use of another energy source. However, the byproduct energy sources produced onsite from nonenergy materials (including wood and crude oil, which are defined as nonenergy materials) are included. The estimates of total primary consumption appear in Tables 1 and 7 of this report. The estimates of **Primary Consumption of Energy for Nonfuel Purposes** (i.e., as a raw material input) appear separately in Tables 2 and 8. These tables also include the surrogate measure of the refinery inputs to produce nonenergy products. That value is included in the "Other" column for petroleum refineries in Tables 1, 2, 7, and 8. (See the footnotes to these tables and Appendix A for more information.)

⁹See, for example, U.S. Department of Commerce, Bureau of the Census, *1982 Census of Manufactures, Fuels and Electric Energy Consumed, Part 1, Industry Groups and Industries*. MC82-S-4 (Part 1). (Washington, DC, June 1983.) The Bureau of the Census defines purchased fuels as "...any substance that was purchased or transferred from outside of the defined boundaries of the establishment in which it was consumed, for the production of heat, power, or generated electricity."

Measures of Electricity, Steam, and Hot Water

Net Electricity and Electricity Demand

Accounting for electricity use by manufacturers is also a complex issue. Most manufacturing establishments purchase electricity directly from utilities as do other consumers. In some situations, however, several establishments of the same corporation may be physically located within the same local area. In such cases, it is frequently economical for these establishments to pool their electricity purchases by having one establishment serve as the "central purchaser." In this case, the electricity is transferred from the central purchasing authority to the consuming establishment. Many manufacturers also generate some or nearly all of their own electricity. Onsite generation of electricity can result from cogeneration (i.e., the production of electrical energy and another form of useful energy through the sequential use of energy) and conventional generation. In some cases, manufacturers generate electricity from solar power, wind power, hydropower, and geothermal sources. Finally, some manufacturers sell electricity back to the utility or to other manufacturing establishments. These components are used to develop two distinctly different measures of electricity use for the MECS. These are electricity demand and net electricity consumption.

Electricity demand is the amount of electricity actually consumed onsite, regardless of where or how it was produced. It is a useful measure of electricity consumption without regard to the consumption of other energy sources. Electricity demand is estimated in this report as the sum of electricity purchases, transfers in, and total onsite generation minus the quantities of electricity sold or transferred offsite. These estimates appear in Tables 14 and 15.

Electricity demand, however, is an inappropriate measure for estimating total primary consumption or total inputs of energy because these total estimates are defined as *unduplicated estimates of energy consumption*. Onsite-generated electricity, a component of electricity demand, includes cogeneration, conventional generation, as well as generation by renewable energy sources. Cogeneration and conventional generation use input fuels such as natural gas or coal. These input energy sources are included in the estimates of Total Primary Consumption for All Purposes and Total Inputs of Energy for Heat, Power, and Electricity Generation. To also include the generated electricity would result in double counting. Accordingly, the appropriate unduplicated measure of electricity use is "net electricity."

Net electricity is estimated for each establishment as the sum of purchased electricity, transfers in, and generation from noncombustible renewable resources minus the quantities of electricity sold and transferred offsite. Thus, net electricity excludes the quantities of electricity generated or cogenerated onsite from combustible fuels. The estimates of net electricity appear in the estimates of Total Primary Consumption for All Purposes (Tables 1 and 7) and Total Inputs of Energy for Heat, Power, and Electricity Generation (Tables 3 and 9).

Finally, the estimates of Offsite-Produced Energy for Heat, Power, and Electricity Generation (Tables 4 and 10) include only electricity receipts (that is, purchased electricity and electricity transferred in). This measure was used so that the MECS estimates of offsite-produced energy would be consistent with the Census Bureau's definition of "purchased fuels and electricity."

Net Steam and Hot Water

Accounting for steam and hot water use by manufacturers is similar to accounting for electricity. Many manufacturers generate steam and hot water onsite. These energy sources can be produced in a conventional boiler dedicated to that purpose, or can be produced as a result of electricity cogeneration. In addition, some manufacturers purchase steam and/or hot water from a nearby manufacturer or transfer it from an establishment within the same corporation. A limited number generate steam onsite from noncombustible renewable energy sources (basically geothermal energy). Other manufacturing establishments sell or transfer steam and/or hot water to other establishments.

Because steam and hot water are energy sources, they need to be accounted for in estimates of total energy consumption. Like electricity, however, including the steam and hot water that is produced onsite using other energy inputs would result in double counting. Therefore, for the purposes of this report, steam and hot water are included on a "net" basis, as was electricity. Net steam is calculated as the sum of purchases, transfers in, and generation from renewable energy sources minus the quantities sold and transferred out. Net hot water is calculated in a similar manner. Neither of these estimates include the quantities of steam produced onsite.

The estimates of net steam and net hot water are not shown separately in the MECS. They are included in the "Other" column of Tables 1, 3, 7, and 9. The estimates of Offsite-Produced Energy for Heat, Power, and Electricity Generation (Tables 4 and 10) include the steam and hot water purchased by and transferred to a manufacturing establishment in order to be consistent with the Census Bureau's definition of "purchased fuels and electricity."

Source: Bureau of the Census, 1982 Census of Manufacturing Energy Information Administration, 1985 Manufacturing Energy Consumption Survey, and Table 4 of this report.

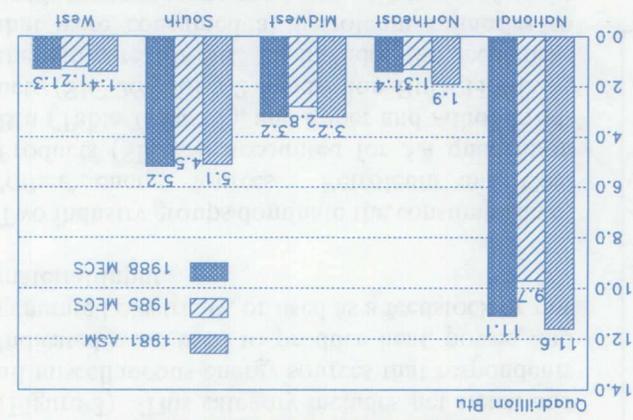


Figure 1. Total Consumption of Offsite-Produced Energy, 1981, 1985, and 1988

Total Offsite-Produced Energy Increased by 14 Percent Between 1985 and 1988

In 1981, the Bureau of the Census estimated that 11.6 quadrillion Btu of purchased fuels and electric energy (offsite-produced energy) were consumed by the manufacturing division (Figure 1). According to the 1985 MECS, this consumption declined to 9.7 quadrillion Btu, for a decrease of 1.9 quadrillion Btu, or 16 percent.¹⁰ The 1988 MECS indicates that the consumption of offsite-produced energy was 11.1 quadrillion Btu, an increase of 1.4 quadrillion Btu from 1985, or 14 percent.

The increased consumption from 1985 to 1988 occurred in all four Census regions. The largest

Offsite-Produced Energy for Heat, Power, and Electricity Generation

The estimates of total primary consumption of energy for all purposes (see Table 1) are the most comprehensive measures of energy consumption presented in this report. This consumption represents a "first use" of energy. The estimates include all offsite-produced energy, all energy consumed as a feedstock or raw material input, and those byproduct fuels resulting from the use of nonenergy materials. The estimates of total inputs of energy for heat, power, and electricity generation (see Table 3) represent the total input energy requirements (excluding feedstock and energy consumed as a raw material) of the manufacturing division, regardless of how that energy was acquired. The consumption estimates include all offsite-produced energy as well as all byproduct fuels produced onsite.

The estimates of offsite-produced energy for heat, power, and electricity generation (see Table 4) include those energy sources that were purchased from vendors such as utilities, or were transferred to the establishment site from central purchasing authorities, usually within the same corporation. The purchased energy sources were delivered to the energy-consuming establishments during 1988, regardless of when they were purchased. This measure of energy consumption is definitionally compatible with the energy use measure in the "Fuels and Electric Energy Consumed" supplement to the Annual Survey of Manufactures (ASM), and, thus, is a continuation of that series. Offsite-produced energy is also a major component of the two more comprehensive measures of energy consumption developed for the MECS—total primary consumption of energy for all purposes and total inputs of energy for heat, power, and electricity generation.

Three separate measures of total energy consumption were developed for the Manufacturing Energy Consumption Survey (MECS). These are: (1) offsite-produced energy for heat, power, and electricity generation; (2) total primary consumption of energy for all purposes; and (3) total inputs of energy for heat, power, and electricity generation. Each of these three measures presents manufacturing energy consumption from a different perspective.

The Measures of Total Energy Consumption

3. Overview of the Findings

¹⁰All percentages in this chapter are calculated from the unrounded estimates appearing in the Detailed Statistics Tables.

increases occurred in the Midwest and South Regions where the consumption of total offsite-produced energy increased from 2.8 to 3.2 quadrillion Btu (15 percent) and 4.5 to 5.2 quadrillion Btu (16 percent), respectively.

The Primary Consumption of Energy for All Purposes

Total Primary Consumption for All Purposes Exceeds 20 Quadrillion Btu in 1988

During 1988, the Primary Consumption of Energy for All Purposes by the manufacturing division was 20.5 quadrillion Btu (Figure 2). The use of energy sources as a feedstock or raw material input accounted for 6.1 quadrillion Btu, or nearly 30 percent of total consumption. That feedstock consumption consisted of 3.3 quadrillion Btu of feedstocks for the production of nonenergy products at petroleum refineries, and 2.9 quadrillion Btu of other feedstocks produced offsite or onsite from nonenergy materials.¹¹

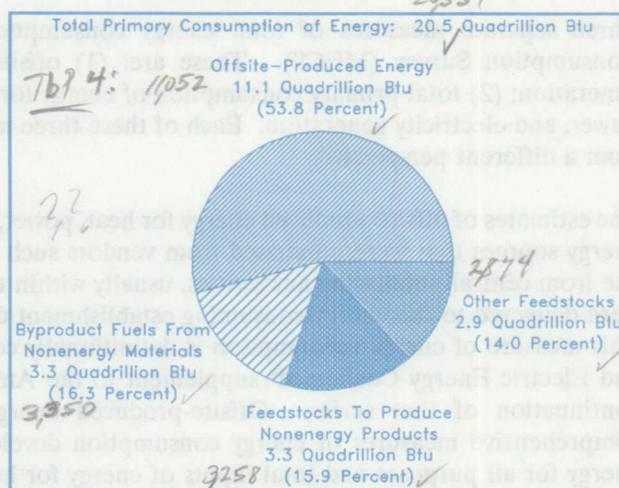
The remaining primary consumption (14.4 quadrillion Btu) was for the production of heat, power, and generated electricity. That consumption consisted of 11.1 quadrillion Btu of offsite-produced energy and 3.3 quadrillion Btu of energy byproducts that resulted from the use of nonenergy materials. These energy byproducts consisted of such energy sources as wood chips, bark, wood waste materials, and pulping liquor produced from wood used as a raw material input, and still gas and petroleum coke, produced as a byproduct of the processing of crude oil at petroleum refineries. As pointed out in the previous chapter, neither wood consumed as a nonenergy raw material, nor crude oil used to produce energy products are considered as energy sources in the MECS.

"Other" Primary Consumption Includes the Raw Material Inputs to Produce Nonenergy Products

The primary consumption of "other" energy sources was 7.7 quadrillion Btu, or 37 percent of total primary consumption of energy for all purposes (Figure 3). This category includes net steam and all miscellaneous energy sources that respondents indicated were used to produce heat, power, and generated electricity, or used as a feedstock or raw material input.

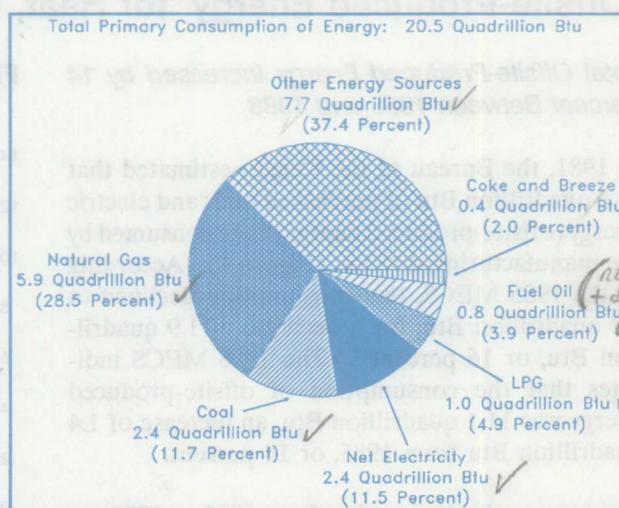
Two industry groups dominate the consumption of "other" energy sources. Petroleum and Coal Products (SIC 29) accounted for 5.4 quadrillion Btu (Table 1, Part 2), and Paper and Allied Products (SIC 26), for 1.2 quadrillion Btu. However, the estimate for SIC 29 includes the feedstocks that were consumed at petroleum refineries to produce nonenergy products. Those feedstocks

Figure 2. Components of Primary Consumption of Energy, 1988



Source: Tables 1, 2, and 4 of this report.

Figure 3. Primary Consumption of Energy Sources, 1988



Source: Table 1 of this report.

¹¹Totals may not equal sum of components due to independent rounding.

(principally crude oil and natural gas liquids) accounted for 3.3 quadrillion Btu. (See "Accounting for Nonenergy Products at Petroleum Refineries" in the previous chapter for an explanation.) Most of the remaining energy sources in the "other" category were consumed as a fuel. These consisted primarily of the wood chips, wood bark, wood waste materials, and pulping liquor consumed by SIC 26, and the various byproduct fuels (still gas, petroleum coke, and so on) consumed by SIC 29.

Natural Gas Accounts for 29 Percent of Total Primary Consumption of Energy



Natural gas was the single energy source used most extensively in 1988 as a fuel or raw material input. The total primary consumption of natural gas was 5.7 trillion cubic feet. This consumption is equivalent to 5.9 quadrillion Btu (Table 1, Part 1), or 29 percent of the total primary consumption of energy by the manufacturing division. Natural gas was consumed mainly as a fuel, with nonfuel consumption accounting for less than 10 percent of total primary natural gas consumption.

Chemical and Allied Products (SIC 28) consumed the largest quantity of natural gas. This major group alone accounted for 2.0 quadrillion Btu, or about 35 percent of total natural gas consumption by the manufacturing division. The next largest major group was Petroleum and Coal Products (SIC 29), which accounted for 0.7 quadrillion Btu, or 12 percent of total primary consumption.

Three Industry Groups Account for 46 Percent of Net Electricity



In 1988, net electricity consumption accounted for 702.9 billion kilowatthours (kWh). This is the equivalent of 2.4 quadrillion Btu¹² and represents 12 percent of the total primary consumption of energy. Net electricity consumption excludes the quantities of electricity cogenerated or conventionally generated onsite (see "Net Electricity and Electricity Demand" in previous chapter) and, therefore, is not equivalent to the demand for electricity.

The Primary Metals Industries (SIC 33) accounted for 149.2 billion kWh of net electricity. Chemicals and Allied Products (SIC 28) consumed 121.9 billion kWh, and Paper and Allied Products, 55.5 billion kWh. Altogether, these three industry groups accounted for 326.6 billion kWh, or 46 percent of the primary consumption of net electricity.

Steel Manufacturers Consume 39 Million Tons of Coal to Produce Coke



The total primary consumption of coal by manufacturers was 97.6 million short tons in 1985. That consumption is the equivalent of 2.4 quadrillion Btu, and represents 12 percent of the total primary consumption of energy. The Steel Works, Blast Furnaces, and Rolling Mills industry (SIC 3312) accounted for 40.5 million short tons of that coal consumption, of which 39.0 million short tons was used as a raw material input for the production of coke. Other major coal-consuming industry groups were Paper and Allied Products (SIC 26), 14.0 million short tons; Chemicals and Allied Products (SIC 28), 13.6 million short tons; and Stone, Clay, Glass, and Concrete Products (SIC 32), 13.0 million short tons. Altogether, these three industry groups along with the Steel Works, Blast Furnaces, and Rolling Mills industry (SIC 3312) consumed 81.2 million short tons of coal, or 83 percent of total coal consumption.

¹²The conversion factor for electricity is 3,412 Btu per kilowatthour. This conversion factor represents the heat content of end-use electricity and excludes line losses.

Liquefied Petroleum Gases Consumed Primarily as a Petrochemical Feedstock



The primary consumption of liquefied petroleum gases¹³ (LPG) by manufacturers was 11.5 billion gallons, or the equivalent of 1.0 quadrillion Btu. This consumption represents 5 percent of the total primary consumption of energy. Most LPG consumption is as a feedstock in Chemicals and Allied Products (SIC 28) to produce plastics materials and resins, industrial organic chemicals, and other products. The total consumption of LPG as a feedstock by SIC 28 was 10.3 billion gallons (Table 3), or 89 percent of the total primary LPG consumption.

Fuel Oil Accounts for Less Than 4 Percent of Total Primary Consumption by Manufacturers



In 1988, manufacturers consumed 93.7 million barrels of residual, and 37.9 million barrels of distillate fuel oil. The consumption of these two energy sources is the equivalent of 0.8 quadrillion Btu, and represents only 4 percent of the total primary consumption of energy. Measured by heat content (Btu), the primary consumption of fuel oil was less than 14 percent of the primary consumption of natural gas. Only a small proportion of fuel oil (about 4 percent) was consumed as a feedstock.

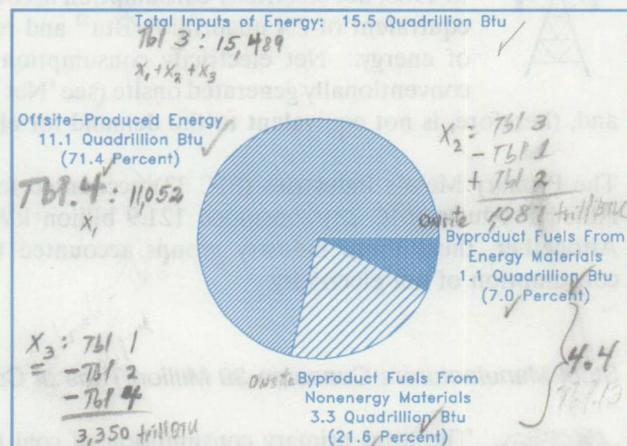
Total Inputs of Energy for Heat, Power, and Electricity Generation

Manufacturers' Total Inputs of Energy for Heat, Power, and Generated Electricity Were 15.5 Quadrillion Btu in 1988

The Total Inputs of Energy for Heat, Power, and Electricity Generation for the manufacturing division in 1988 were 15.5 quadrillion Btu (Figure 4). This measure of consumption represents the total requirements for energy specifically for its energy content by the manufacturing division, regardless of how that energy was acquired.

The largest component of total inputs of energy is offsite-produced energy, that is, energy sources that were purchased or transferred to the establishment site. Offsite-produced energy was 11.1 quadrillion Btu, or 71 percent of the total inputs of energy. The rest of total inputs of energy consisted of byproduct fuels that were produced onsite. Of those byproduct fuels, 3.3 quadrillion Btu originated from non-energy materials. The remaining 1.1 quadrillion Btu of byproduct fuels were produced from other energy sources consumed as a raw material input.

Figure 4. Components of Total Inputs of Energy, 1988



Source: Tables 1 through 4 of this report.

Byproduct Energy Sources Account for 28 Percent of Total Input Energy

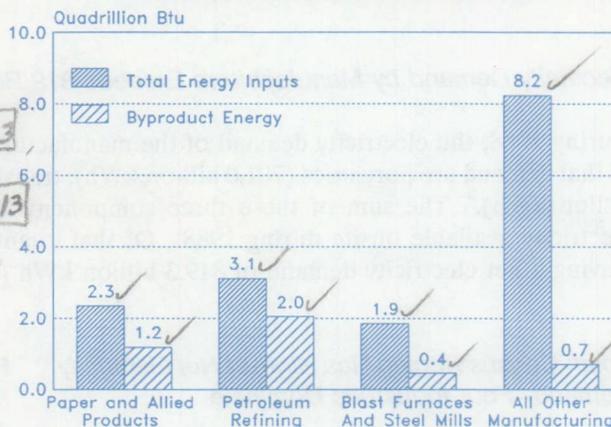
Numerous combustible byproducts serve as input energy sources in the manufacturing division. However, five byproduct energy sources dominate: blast furnace and coke oven gas, petroleum coke, pulping/black liquor, waste gases, and wood chips, bark, and wood waste materials. Altogether, these byproduct energy sources accounted for 4.4 quadrillion Btu (Table 13), or 28 percent of Total Inputs of Energy for Heat, Power, and Electricity Generation.

¹³Liquefied petroleum gases consist of ethane, ethylene, propane, propylene, normal butane, butylene, ethane-propane mixtures, propane-butane mixtures, and isobutane.

Petroleum Refineries Meet 67 Percent of Total Input Energy Requirements with Byproduct Fuels

The Petroleum Refining Industry (SIC 2911) satisfied the largest share of its requirements for total input energy with byproduct fuels. That industry consumed 3.1 quadrillion Btu of total input energy in 1988. Of that total requirement, byproduct energy sources accounted for 2.0 quadrillion Btu, or 67 percent (Figure 5). The principle byproduct energy sources consumed at petroleum refineries were waste gas and petroleum coke. Waste gas, also known as still gas or refinery gas, is produced by distillation, cracking, reforming and other refining processes. It consists of methane, ethane, ethylene, propane, propylene, butanes, butylene, and so on. Petroleum coke is a solid residue, which is the final product of thermal decomposition in the condensation process for cracking crude oil. Refineries consumed 1.5 quadrillion Btu of still gas, and 0.6 quadrillion Btu of petroleum coke.

Figure 5. Consumption of Byproduct Energy Sources by Manufacturers, 1988



Source: Tables 3 and 13 of this report.

Paper Mills Consume 1.2 Quadrillion Btu of Wood Byproducts as Input Energy

Paper and Allied Products (SIC 26) is also a heavy user of byproduct fuels. This major group consumed 2.3 quadrillion Btu of total input energy in 1988. Of that amount, 1.2 quadrillion Btu, or 51 percent, resulted from the use of byproduct fuels. The byproduct fuels consumed by paper manufacturers result from the use of wood as raw material input to produce the pulp. Wood, it will be recalled, is not included as an energy source unless it is consumed onsite as a fuel. Black liquor, produced during the pulping process itself, accounted for over 0.8 quadrillion Btu of byproduct energy. The remaining byproduct energy (0.3 quadrillion Btu) consisted of wood chips, bark, and wood waste.

Steel Mills Consume Coke Oven and Blast Furnace Gases as a Fuel

Finally, Blast Furnaces and Steel Mill (SIC 3312) consumed 1.9 quadrillion Btu of total input energy in 1988. Producing steel in a blast furnace requires large quantities of coke. Many steel mills produce that coke onsite using bituminous coal as a raw material input. The process consists of heating the coal in the absence of air. This process produces coke oven gas, which is used as a byproduct fuel. In addition, the blast furnaces produce a waste gas that serves as a byproduct fuel. In 1988, blast furnace and coke oven gas provided 0.4 quadrillion Btu (23 percent) of the total input energy in SIC 3312.

Electricity Use by Manufacturers

As pointed out previously, the measure of the contribution of electricity to total primary consumption and total input energy is "net electricity." This measure does not represent electricity demand because it excludes the quantities of electricity generated onsite using other energy sources as input fuels. Therefore, the measure of net electricity may be combined with other energy sources to derive total estimates of energy consumption.¹⁴ Electricity demand, on the other hand, cannot be used in the total estimates of energy consumption

¹⁴An alternative approach is to deduct the quantities of input fuels used to generate electricity from the estimates of the consumption of those fuels. For example, the natural gas consumed as a electricity-generating fuel would be deducted from the total estimate of natural gas consumption. The electricity estimate could then reflect electricity demand without fear of duplication. In the interest of minimizing respondent burden, however, estimates of the specific fuels consumed to generate electricity were not collected in the MECS.

because it would result in double counting. However, total demand is a more complete measure of manufacturing electricity requirements than net electricity because it represents final use rather than first use.

Electricity Demand by Manufacturers Exceeds 819 Billion Kilowatthours in 1988

During 1988, the electricity demand of the manufacturing division was 819.3 billion kWh. The components of that demand are purchases (701.0 billion kWh), transfers in (27.2 billion kWh), and onsite generation (114.8 billion kWh). The sum of these three components (843.0 billion kWh) represents the total quantity of electricity available onsite during 1988. Of that quantity, 23.7 billion kWh was sold or transferred offsite, leaving a net electricity demand of 819.3 billion kWh (Table 14).

South Census Region Has Highest Net Electricity Demand—Four Industries Dominate

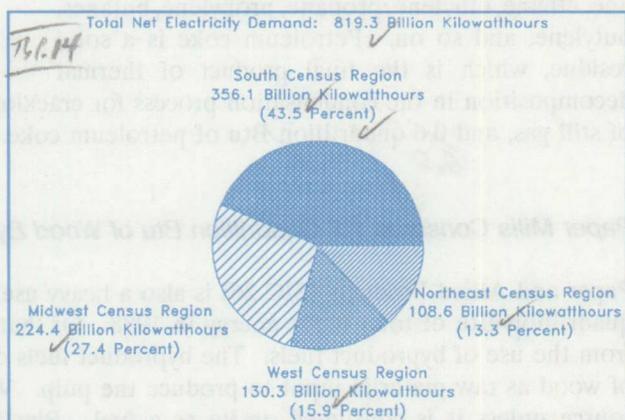
The South Census Region (see map in Appendix E) had the highest net electricity demand, accounting for 356.1 billion kWh, or 44 percent of total electricity demand (Figure 6). Four major groups accounted for 228.1 billion kWh, or 64 percent of that demand. Chemicals and Allied Products (SIC 28) required 104.4 billion kWh; Primary Metal Industries (SIC 33), 48.1 billion kWh; Paper and Allied Products (SIC 26), 48.1 billion kWh; and Textile Mill Products (SIC 22), 27.6 billion kWh.

The Midwest Census Region was second in net electricity demand, with 224.4 billion kWh, or 27 percent of total net electricity demand. Three major groups accounted for 106.7 billion kWh or 47 percent of the total net electricity demand for the region. These industry groups were Primary Metals Industries (SIC 33), which required 55.4 billion kWh; Chemicals and Allied Products (SIC 28), 30.5 billion kWh; and Food and Kindred Products (SIC 20), 20.7 billion kWh.

The West Census Region was third in net electricity demand, requiring 130.3 billion kWh, or 16 percent of total net electricity demand. Four major groups accounted for 74.9 billion kWh, or 57 percent of the total net electricity demand for the region. Primary Metals (SIC 33) had the highest net electricity demand, with 35.4 billion kWh. Of that quantity, the Primary Aluminum Industry (SIC 3334) accounted for 25.6 billion kWh. Paper and Allied Products (SIC 26) accounted for 17.3 billion kWh; Chemicals and Allied Products (SIC 28), 12.2 billion kWh; and Petroleum and Coal Products (SIC 29), 10.1 billion kWh.

Finally, the Northeast Census Region had the lowest net electricity demand—108.6 billion kWh, or 13 percent of total demand. Three major groups accounted for 47.3 billion kWh, or 47 percent of net electricity demand in the this region. Primary Metals Industries (SIC 33) required 19.5 billion kWh; Paper and Allied Products (SIC 26), 14.3 billion kWh; and Chemicals and Allied Products (SIC 28), 13.6 billion kWh.

Figure 6. Net Electricity Demand by Manufacturers for Census Regions, 1988



Source: Table 14 of this report.

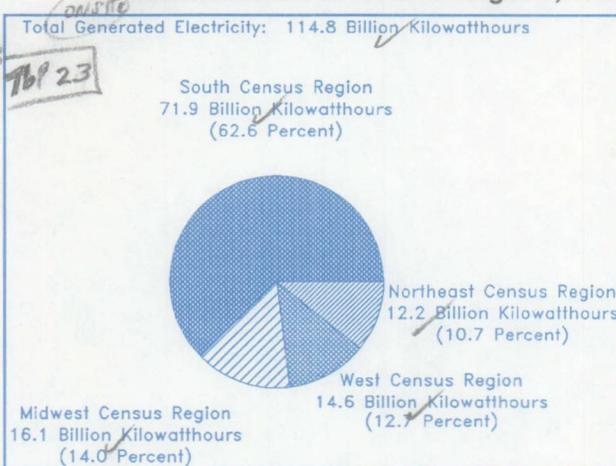
Onsite Electricity Generation Heavily Concentrated in the South Census Region

Figure 7. Onsite-Generated Electricity by Manufacturers for Census Regions, 1988

T6P 14

T6P 23

Manufacturers in the South Census Region not only have the highest net electricity demand (44 percent of total net electricity demand), they also dominate the Nation in the generation of electricity onsite. Of the total quantity of electricity generated onsite (114.8 billion kWh), 71.9 billion kWh or 62 percent was produced by manufacturers located in the South Census Region (Figure 7). Two major groups account for 60.2 billion kWh of onsite-generated electricity: Chemicals and Allied Products (SIC 28) and Paper and Allied Products (SIC 26).



Source: Table 14 of this report.

Cogeneration—Primary Source of Onsite-Generated Electricity

For the purposes of the MECS, electricity cogeneration is defined as the production of electrical energy and another form of useful energy, such as heat or steam, through the sequential use of energy. Cogeneration activities dominate the onsite generation of electricity in the manufacturing division. Of the total quantity of onsite-generated electricity (114.8 billion kWh), cogeneration produced 101.9 billion kWh (Table 22), or 88 percent. Conventional generation accounted for 10.3 billion kWh (8 percent), and generation from renewable energy sources, such as hydropower and solar collectors, accounted for 2.6 billion kWh (2 percent).

**Detailed
Statistics
Tables**

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Revisions to 1988 MECS Estimates

An error was discovered after the 1988 MECS data were published. The nonenergy source shipments at petroleum refineries (see "Feedstocks and Offsite-Produced Fuel at Petroleum Refineries" in this appendix) was miscalculated and, as a result, overestimated. The following corrections should be made to the relevant 1988 MECS tables:

Table B3. Revisions to 1988 MECS Tables
(Estimates in Trillion Btu)

1988 MECS Publication Table 1 (parts 1 and 2)

SIC Code	Industry Groups and Industry	As Published		Revised	
		Total	Other	Total	Other
Northeast					
2911	Petroleum Refining	583	W	546	W
29	Petroleum and Coal Products	598	523	560	485
	Total	2301	675	2263	637
Midwest					
2911	Petroleum Refining	948	W	894	W
29	Petroleum and Coal Products	976	827	923	773
	Total	4778	1011	4724	958
South					
2911	Petroleum Refining	3657	3069	3381	2793
29	Petroleum and Coal Products	3703	3090	3427	2813
	Total	10839	4622	10563	4345
West					
2911	Petroleum Refining	1121	W	1073	W
29	Petroleum and Coal Products	1134	953	1086	905
	Total	2616	1373	2568	1325
United States					
2911	Petroleum Refining	6310	5364	5893	4947
29	Petroleum and Coal Products	6411	5393	5995	4976
	Total	20534	7682	20118	7265

1988 MECS Publication Table 2 (Parts 1 or 2)

NONFUEL

SIC Code	Industry Groups and Industry	As Published		Revised	
		Total	Other	Total	Other
Northeast					
2911	Petroleum Refining	367	367	329	329
29	Petroleum and Coal Products	368	Q	330	Q
	Total	699	W	661	W
Midwest					
2911	Petroleum Refining	482	482	429	429
29	Petroleum and Coal Products	486	Q	432	Q
	Total	1163	W	1109	W
South					
2911	Petroleum Refining	2005	2005	1729	1729
29	Petroleum and Coal Products	Q	Q	Q	Q
	Total	3779	W	3503	W
West					
2911	Petroleum Refining	403	403	355	355
29	Petroleum and Coal Products	410	W	361	W
	Total	491	W	443	W
United States					
2911	Petroleum Refining	3258	3258	2841	2841
29	Petroleum and Coal Products	3290	3285	2874	2868
	Total	6132	3531	5716	3114

1988 MECS Publication Table 7
(Primary Consumption by Economic Characteristic)

Characteristic	As Published		Revised	
	Total	Other	Total	Other
Not Ascertained	3258	3258	2841	2841
Total	20534	7682	20118	7265

1988 MECS Publication Table 8
(Primary Consumption for Nonfuel Use by Economic Characteristic)

Characteristic	As Published		Revised	
	Total	Other	Total	Other
Not Ascertained	3258	3258	2841	2841
Total	6132	3531	5716	3114

Table 1. Total Primary Consumption of Energy for All Purposes by Census Region, Industry Group, and Selected Industries, 1988: Part 1
(Estimates in Btu or Physical Units)

SIC Code ^a	Industry Groups and Industry	Total (trillion Btu)	Net Electricity ^b (million kWh)	Residual Fuel Oil (1000 bbls)	Distillate Fuel Oil (1000 bbls)	Natural Gas (billion cu ft)	LPG (million gallons)	Coal (1000 short tons)	Coke and Breeze (1000 short tons)	Other ^c (trillion Btu)
Total United States										
20	Food and Kindred Products	994	50,208	7,998	5,594	478	110	6,801	144	85
21	Tobacco Products	25	864	217	81	2	3	767	0	1
22	Textile Mill Products	275	29,738	3,024	1,144	91	31	1,760	0	12
23	Apparel and Other Textile Products	54	6,659	311	397	21	9	130	0	1
24	Lumber and Wood Products	407	18,431	458	3,898	34	40	106	0	285
25	Furniture and Fixtures	63	5,651	185	591	22	14	132	0	12
26	Paper and Allied Products	2,366	55,517	28,274	2,175	418	53	14,036	0	1,236
2621	Paper Mills	1,081	28,738	15,571	935	174	23	8,546	0	507
2631	Paperboard Mills	896	10,684	8,515	487	155	5	5,009	0	530
27	Printing and Publishing	116	17,052	117	384	47	18	0	0	4
28	Chemicals and Allied Products	4,360	121,854	19,125	2,992	1,991	10,295	13,642	404	545
2819	Industrial Inorganic Chemicals, nec	288	27,391	1,028	354	131	3	1,461	368	8
2821	Plastics Materials and Resins	567	12,842	1,552	182	202	2,583	1,366	0	49
2869	Industrial Organic Chemicals, nec	1,823	15,428	3,442	737	668	6,700	4,064	Q	384
2873	Nitrogenous Fertilizers	444	2,930	0	24	415	W	0	0	W
29	Petroleum and Coal Products	5,412 5,412	31,124	15,705	4,648	703	642	335	0	5,899
2911	Petroleum Refining ^d	5,412 5,412	29,692	15,034	1,138	666	600	287	0	5,384
30	Rubber and Misc. Plastics Products	253	31,299	2,361	786	107	31	388	0	4
31	Leather and Leather Products	16	1,391	548	169	5	1	61	0	0
32	Stone, Clay and Glass Products	966	33,793	2,299	6,095	455	47	13,009	414	27
3241	Cement, Hydraulic	311	9,802	Q	924	29	0	9,878	127	15
33	Primary Metal Industries	2,875	149,202	7,023	2,640	730	66	42,120	15,589	45
3312	Blast Furnaces and Steel Mills	2,067	40,570	6,542	1,100	431	12	40,544	13,825	18
3334	Primary Aluminum	258	65,818	2	74	19	2	W	W	9
34	Fabricated Metal Products	346	30,952	737	1,221	198	50	418	46	10
35	Industrial Machinery and Equipment	280	33,480	558	1,485	126	32	807	Q	3
36	Electronic and Other Electric Equipment	224	31,852	725	919	82	33	366	96	6
37	Transportation Equipment	350	37,283	2,970	2,003	135	25	1,647	216	9
38	Instruments and Related Products	113	14,344	917	368	31	Q	975	0	2
39	Misc. Manufacturing Industries	41	4,183	195	275	19	7	82	0	1
	Total	20,534 20,534	702,876	93,744	37,865	5,695	11,512	97,582	16,929	-7,682
Northeast Census Region										
20	Food and Kindred Products	90	6,117	W	1,410	41	W	W	0	3
21	Tobacco Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
22	Textile Mill Products	26	1,658	1,067	246	9	9	26	0	2
23	Apparel and Other Textile Products	15	1,330	250	282	7	Q	0	0	0
24	Lumber and Wood Products	26	1,031	Q	Q	5	4	0	0	12
25	Furniture and Fixtures	8	533	71	109	3	Q	0	0	Q
26	Paper and Allied Products	262	8,804	13,419	W	39	21	W	0	90
2621	Paper Mills	221	W	11,307	W	19	16	W	0	80
2631	Paperboard Mills	20	513	783	217	7	1	157	0	0
27	Printing and Publishing	21	3,042	39	297	6	Q	0	0	2
28	Chemicals and Allied Products	179	12,564	W	W	46	104	195	0	24
2819	Industrial Inorganic Chemicals, nec	8	411	438	99	3	0	0	0	0
2821	Plastics Materials and Resins	28	1,250	1,224	98	5	W	W	0	2
2869	Industrial Organic Chemicals, nec	45	2,384	1,968	174	8	15	0	0	14
2873	Nitrogenous Fertilizers	0	17	0	0	0	0	0	0	0
29	Petroleum and Coal Products	598 598	2,708	W	1,119	25	28	W	0	523
2911	Petroleum Refining ^d	598 598	2,115	W	83	22	28	194	0	W
30	Rubber and Misc. Plastics Products	39	5,097	W	464	11	W	W	0	1
31	Leather and Leather Products	W	W	403	116	W	0	Q	0	Q
32	Stone, Clay and Glass Products	154	5,737	990	1,115	85	7	1,320	55	2
3241	Cement, Hydraulic	37	1,312	Q	113	0	0	1,209	52	1
33	Primary Metal Industries	554	18,061	1,475	753	109	25	11,950	1,540	8
3312	Blast Furnaces and Steel Mills	456	7,975	1,059	213	70	4	11,609	1,342	5
3334	Primary Aluminum	W	W	2	7	W	0	1	0	W
34	Fabricated Metal Products	71	5,123	388	786	41	12	35	10	Q
35	Industrial Machinery and Equipment	48	6,721	514	699	15	4	56	0	0
36	Electronic and Other Electric Equipment	57	8,108	515	667	19	11	24	33	1
37	Transportation Equipment	55	4,802	1,702	713	16	4	249	0	Q
38	Instruments and Related Products	52	4,226	842	307	8	1	975	0	1
39	Misc. Manufacturing Industries	W	W	159	202	W	2	65	0	0
	Total	2,901	97,502	35,685	12,002	493	282	16,774	1,839	675

See footnotes at end of table.

Table 1. Total Primary Consumption of Energy for All Purposes by Census Region, Industry Group, and Selected Industries, 1988: Part 1 (Continued)
(Estimates in Btu or Physical Units)

SIC Code ^a	Industry Groups and Industry	Total (trillion Btu)	Net Electricity ^b (million kWh)	Residual Fuel Oil (1000 bbls)	Distillate Fuel Oil (1000 bbls)	Natural Gas (billion cu ft)	LPG (million gallons)	Coal (1000 short tons)	Coke and Breeze (1000 short tons)	Other ^c (trillion Btu)
Midwest Census Region										
20	Food and Kindred Products	412	19,223	1,608	914	203	Q	4,667	78	11
21	Tobacco Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
22	Textile Mill Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
23	Apparel and Other Textile Products	9	925	Q	40	5	Q	Q	0	*
24	Lumber and Wood Products	35	2,000	Q	W	7	W	Q	0	15
25	Furniture and Fixtures	20	1,677	14	104	11	3	45	0	1
26	Paper and Allied Products	327	13,063	W	W	81	9	4,660	0	83
2621	Paper Mills	185	6,369	W	W	37	2	2,947	0	52
2631	Paperboard Mills	78	2,201	251	24	18	1	1,339	0	20
27	Printing and Publishing	50	6,312	Q	Q	28	4	0	0	1
28	Chemicals and Allied Products	546	28,578	W	W	192	1,336	4,079	10	28
2819	Industrial Inorganic Chemicals, nec	58	10,839	W	8	15	*	166	1	W
2821	Plastics Materials and Resins	134	2,934	148	14	20	W	W	0	11
2869	Industrial Organic Chemicals, nec	139	2,445	85	61	49	378	1,835	0	5
2873	Nitrogenous Fertilizers	47	570	0	3	44	*	0	0	Q
29	Petroleum and Coal Products	977	6,718	W	1,625	62	W	W	0	827
2911	Petroleum Refining ^d	948	6,138	6,244	145	49	141	W	0	W
30	Rubber and Misc. Plastics Products	101	11,789	W	78	50	W	W	0	1
31	Leather and Leather Products	5	Q	Q	Q	2	1	Q	0	Q
32	Stone, Clay and Glass Products	297	9,591	61	1,151	126	9	5,118	22	12
3241	Cement, Hydraulic	93	2,677	*	276	4	*	3,108	*	8
33	Primary Metal Industries	1,404	50,509	3,145	831	385	27	19,470	11,011	21
3312	Blast Furnaces and Steel Mills	1,107	18,864	3,139	602	256	7	18,777	9,890	11
3334	Primary Aluminum	W	W	0	6	W	*	W	0	W
34	Fabricated Metal Products	166	14,383	334	219	97	22	358	15	4
35	Industrial Machinery and Equipment	142	14,429	Q	414	68	17	741	Q	1
36	Electronic and Other Electric Equipment	66	7,722	134	41	31	7	204	0	1
37	Transportation Equipment	190	17,574	686	895	76	10	1,329	216	6
38	Instruments and Related Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	11	928	Q	65	6	*	17	0	*
	Total	4,778	208,639	16,710	7,630	1,438	1,669	40,999	11,371	1,012
South Census Region										
20	Food and Kindred Products	266	17,325	1,998	2,133	132	21	794	11	26
21	Tobacco Products	25	855	217	81	2	3	767	0	1
22	Textile Mill Products	240	27,238	1,958	888	77	22	1,734	*	11
23	Apparel and Other Textile Products	27	3,986	Q	75	9	3	113	0	Q
24	Lumber and Wood Products	184	9,128	W	W	14	11	Q	0	128
25	Furniture and Fixtures	33	3,103	100	378	7	9	87	0	10
26	Paper and Allied Products	1,373	21,565	9,956	919	220	17	7,570	0	834
2621	Paper Mills	544	10,901	2,394	484	88	4	3,988	0	309
2631	Paperboard Mills	623	5,006	5,828	115	95	2	3,476	0	392
27	Printing and Publishing	33	5,846	65	40	11	3	0	0	1
28	Chemicals and Allied Products	3,509	69,676	9,796	W	1,883	8,854	9,192	W	488
2819	Industrial Inorganic Chemicals, nec	186	11,711	W	192	104	3	1,120	W	6
2821	Plastics Materials and Resins	403	8,536	180	68	176	W	W	0	35
2869	Industrial Organic Chemicals, nec	1,634	10,728	1,388	502	607	6,307	2,229	Q	362
2873	Nitrogenous Fertilizers	355	1,628	0	20	333	W	0	0	W
29	Petroleum and Coal Products	3,703	14,138	W	715	520	122	W	0	3,090
2911	Petroleum Refining ^d	3,657	13,637	W	143	504	96	W	0	3,069
30	Rubber and Misc. Plastics Products	95	12,064	1,253	214	39	7	109	0	2
31	Leather and Leather Products	W	W	Q	10	W	Q	0	0	Q
32	Stone, Clay and Glass Products	368	13,096	W	3,093	185	18	4,260	Q	10
3241	Cement, Hydraulic	111	3,730	9	299	15	*	3,417	18	5
33	Primary Metal Industries	687	46,380	2,284	625	175	11	9,221	2,970	11
3312	Blast Furnaces and Steel Mills	438	11,152	2,284	273	88	1	8,736	2,384	1
3334	Primary Aluminum	91	22,728	0	42	8	*	W	W	3
34	Fabricated Metal Products	76	7,903	15	159	43	11	25	21	1
35	Industrial Machinery and Equipment	51	7,622	22	Q	20	9	Q	1	1
36	Electronic and Other Electric Equipment	71	9,830	77	184	25	Q	138	63	4
37	Transportation Equipment	63	8,314	554	225	26	6	65	*	1
38	Instruments and Related Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	W	W	33	8	W	Q	0	0	Q
	Total	16,839	283,469	30,984	12,859	3,201	9,147	34,179	3,463	4,622

See footnotes at end of table.

Table 1. Total Primary Consumption of Energy for All Purposes by Census Region, Industry Group, and Selected Industries, 1988: Part 1 (Continued)
(Estimates in Btu or Physical Units)

SIC Code ^a	Industry Groups and Industry	Total (trillion Btu)	Net Electricity ^b (million kWh)	Residual Fuel Oil (1000 bbls)	Distillate Fuel Oil (1000 bbls)	Natural Gas (billion cu ft)	LPG (million gallons)	Coal (1000 short tons)	Coke and Breeze (1000 short tons)	Other ^c (trillion Btu)
West Census Region										
20	Food and Kindred Products	228	7,540	W	1,137	100	W	W	54	45
21	Tobacco Products	0	0	0	0	0	0	0	0	0
22	Textile Mill Products	5	538	0	8	3	Q	0	0	0
23	Apparel and Other Textile Products	2	418	0	0	1	Q	0	0	Q
24	Lumber and Wood Products	181	4,271	Q	1,215	8	W	0	0	130
25	Furniture and Fixtures	NA	NA	NA	NA	NA	NA	NA	NA	NA
26	Paper and Allied Products	384	12,086	W	187	79	6	W	0	228
2621	Paper Mills	131	W	W	47	30	1	W	0	88
2631	Paperboard Mills	178	2,963	1,853	111	37	1	37	0	118
27	Printing and Publishing	11	1,852	0	Q	4	5	0	0	Q
28	Chemicals and Allied Products	126	11,037	W	126	70	1	175	W	4
2819	Industrial Inorganic Chemicals, nec	37	4,429	W	54	9	*	175	W	W
2821	Plastics Materials and Resins	1	123	2	2	1	*	0	0	*
2869	Industrial Organic Chemicals, nec	6	*	0	1	4	*	0	0	2
2873	Nitrogenous Fertilizers	41	717	0	1	37	*	0	0	*
29	Petroleum and Coal Products	7,184	7,560	W	1,188	96	W	0	0	953
2911	Petroleum Refining ^d	7,121	7,802	W	766	90	W	0	0	W
30	Rubber and Misc. Plastics Products	17	2,349	43	Q	8	2	0	0	Q
31	Leather and Leather Products	1	82	0	Q	1	Q	0	0	Q
32	Stone, Clay and Glass Products	146	5,368	W	736	58	13	2,311	W	2
3241	Cement, Hydraulic	70	2,083	114	236	10	*	2,143	58	1
33	Primary Metal Industries	229	34,252	119	431	61	4	1,478	89	6
3312	Blast Furnaces and Steel Mills	66	2,580	60	13	17	*	1,423	10	1
3334	Primary Aluminum	97	25,611	0	19	5	1	10	0	3
34	Fabricated Metal Products	34	3,543	0	57	18	5	0	0	Q
35	Industrial Machinery and Equipment	40	4,707	0	26	22	2	0	0	1
36	Electronic and Other Electric Equipment	30	6,193	0	27	8	*	0	0	1
37	Transportation Equipment	43	6,594	28	170	17	6	4	0	1
38	Instruments and Related Products	23	4,230	*	6	8	*	0	0	1
39	Misc. Manufacturing Industries	2	306	0	Q	1	*	0	0	Q
	Total	2,616	113,265	10,365	5,373	562	434	5,630	457	1,373

^a See Appendices A and D for descriptions of the Standard Industrial Classification system.

^b "Net Electricity" is obtained by summing purchases, transfers in, and generation from noncombustible renewable resources, minus quantities sold and transferred out. It does not include electricity inputs from onsite cogeneration or generation from combustible fuels because that energy has already been included as generating fuel (for example, coal).

^c "Other" includes net steam (the sum of purchases, generation from renewables, and net transfers), and other energy that respondents indicated was used to produce heat and power or as feedstock/raw material inputs. See also Footnote "d."

^d For the petroleum refining industry only, the feedstocks and raw material inputs for the production of nonenergy products (i.e., asphalt, waxes, lubricants, and solvents) and feedstock consumption at adjoining petrochemical plants are included in the "other" column, regardless of type of energy. The remaining columns for the petroleum refining industry include only energy that was consumed for the production of heat and power. The "other" column also includes net steam and other energy that respondents indicated was used in the production of heat and power. Those inputs and feedstocks that were converted to other energy products (e.g., crude oil converted to residual and distillate fuel oils) are excluded. See Appendix A for more information.

* Estimate less than 0.5 rounded to zero.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Q=Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

NA=Not available. Data are included in higher level totals.

Notes: •Totals may not equal sum of components because of independent rounding. •The derived estimates presented in this table are for the primary consumption of energy for heat and power and as feedstocks or raw material inputs. Primary consumption is defined as the consumption of the energy that was originally produced offsite or was produced onsite from input materials not classified as an energy. Examples of the latter are hydrogen produced from the electrolysis of brine; the output of captive (onsite) mines or wells; woodchips, bark, and woodwaste from wood purchased as a raw material input; and waste materials such as wastepaper and packing materials. Primary consumption excludes quantities of energy that are produced from other energy inputs and, therefore, avoids double counting.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey," and Office of Oil and Gas, Petroleum Supply Division, Form EIA-810, "Monthly Refinery Report" for 1988.

Table 1. Total Primary Consumption of Energy for All Purposes by Census Region, Industry Group, and Selected Industries, 1988: Part 2
(Estimates in Trillion Btu)

SIC Code ^a	Industry Groups and Industry	Total	Net Electricity ^b	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal	Coke and Breeze	Other ^c
Total United States										
20	Food and Kindred Products	994	171	50	33	489	10	153	4	85
21	Tobacco Products	25	3	1	•	2	•	17	0	1
22	Textile Mill Products	275	101	19	7	93	3	39	•	12
23	Apparel and Other Textile Products	54	23	2	2	22	1	3	0	1
24	Lumber and Wood Products	407	56	3	23	35	3	2	0	285
25	Furniture and Fixtures	63	19	1	3	23	1	3	0	12
26	Paper and Allied Products	2,366	189	178	13	431	5	315	0	1,236
2621	Paper Mills	1,081	98	98	5	179	2	191	0	507
2631	Paperboard Mills	896	36	54	3	160	•	113	0	530
27	Printing and Publishing	116	58	1	2	49	2	0	0	4
28	Chemicals and Allied Products	4,360	416	120	17	2,049	896	307	10	545
2819	Industrial Inorganic Chemicals, nec	288	93	6	2	135	•	34	9	8
2821	Plastics Materials and Resins	567	44	10	1	207	225	31	0	49
2869	Industrial Organic Chemicals, nec	1,823	53	22	4	687	583	91	Q	384
2873	Nitrogenous Fertilizers	444	10	0	•	427	W	0	0	497 W
29	Petroleum and Coal Products	5,715 8,412	106	99	27	723	56	8	0	5,993
2911	Petroleum Refining ^d	5,293 8,310	101	95	7	685	52	6	0	5,864
30	Rubber and Misc. Plastics Products	253	107	15	5	111	3	9	0	447 4
31	Leather and Leather Products	16	5	3	1	5	•	1	0	•
32	Stone, Clay and Glass Products	966	115	14	36	468	4	291	10	27
3241	Cement, Hydraulic	311	33	Q	5	30	•	221	3	15
33	Primary Metal Industries	2,875	509	44	15	751	6	1,118	387	45
3312	Blast Furnaces and Steel Mills	2,067	138	41	6	444	1	1,080	338	18
3334	Primary Aluminum	258	225	•	•	20	•	W	W	9
34	Fabricated Metal Products	346	106	5	7	204	4	9	1	10
35	Industrial Machinery and Equipment	280	114	3	9	129	3	18	Q	3
36	Electronic and Other Electric Equipment	224	109	5	5	85	3	9	2	6
37	Transportation Equipment	350	127	19	12	139	2	37	5	9
38	Instruments and Related Products	113	49	6	2	32	Q	22	0	2
39	Misc. Manufacturing Industries	41	14	1	2	20	1	2	0	745 1
	Total	2,618 29,584	2,398	589	221	5,860	1,002	2,363	420	2,882
Northeast Census Region										
20	Food and Kindred Products	90	21	W	8	42	W	W	0	3
21	Tobacco Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
22	Textile Mill Products	26	6	7	1	9	1	1	0	2
23	Apparel and Other Textile Products	15	5	2	2	7	Q	0	0	•
24	Lumber and Wood Products	26	4	Q	Q	5	•	0	0	12
25	Furniture and Fixtures	8	2	•	1	3	Q	0	0	Q
26	Paper and Allied Products	282	30	84	W	40	2	W	0	90
2621	Paper Mills	221	W	71	W	20	1	W	0	80
2631	Paperboard Mills	20	2	5	1	8	•	4	0	•
27	Printing and Publishing	21	10	•	2	7	Q	0	0	2
28	Chemicals and Allied Products	179	43	W	W	47	9	4	0	24
2819	Industrial Inorganic Chemicals, nec	8	1	3	1	3	•	•	0	•
2821	Plastics Materials and Resins	28	4	8	1	5	W	W	0	2
2869	Industrial Organic Chemicals, nec	45	8	12	1	8	1	0	0	14
2873	Nitrogenous Fertilizers	•	•	0	•	•	0	0	0	•
29	Petroleum and Coal Products	-598	9	W	7	26	2	W	0	523
2911	Petroleum Refining ^d	583	7	W	•	23	2	4	0	W
30	Rubber and Misc. Plastics Products	39	17	W	3	12	W	W	0	1
31	Leather and Leather Products	W	W	3	1	W	•	Q	0	Q
32	Stone, Clay and Glass Products	154	20	6	6	87	1	30	1	2
3241	Cement, Hydraulic	37	4	Q	1	•	•	27	1	1
33	Primary Metal Industries	554	62	9	4	112	2	319	38	8
3312	Blast Furnaces and Steel Mills	456	27	7	1	72	•	311	33	5
3334	Primary Aluminum	W	W	•	•	W	•	•	0	W
34	Fabricated Metal Products	71	17	2	5	42	1	1	•	Q
35	Industrial Machinery and Equipment	48	23	3	4	16	•	1	0	•
36	Electronic and Other Electric Equipment	57	28	3	4	19	1	1	1	1
37	Transportation Equipment	55	16	11	4	17	•	6	0	Q
38	Instruments and Related Products	52	14	5	2	8	•	22	0	1
39	Misc. Manufacturing Industries	W	W	1	1	W	•	2	0	•
	Total	2,301	333	224	70	508	23	428	41	675

See footnotes at end of table.

Table 1. Total Primary Consumption of Energy for All Purposes by Census Region, Industry Group, and Selected Industries, 1988: Part 2 (Continued)
(Estimates in Trillion Btu)

SIC Code ^a	Industry Groups and Industry	Total	Net Electricity ^b	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal	Coke and Breeze	Other ^c
Midwest Census Region										
20	Food and Kindred Products	412	66	10	5	209	Q	105	2	11
21	Tobacco Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
22	Textile Mill Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
23	Apparel and Other Textile Products	9	3	Q	*	5	Q	Q	0	*
24	Lumber and Wood Products	35	7	Q	W	7	W	Q	0	15
25	Furniture and Fixtures	20	6	*	1	11	*	1	0	1
26	Paper and Allied Products	327	45	W	W	83	1	105	0	83
2621	Paper Mills, nec	185	22	W	W	38	*	66	0	52
2631	Paperboard Mills	76	8	2	*	17	*	30	0	20
27	Printing and Publishing	50	22	Q	Q	27	*	0	0	1
28	Chemicals and Allied Products	546	98	W	W	197	116	92	*	28
2819	Industrial Inorganic Chemicals, nec	58	37	W	*	15	*	4	*	W
2821	Plastics Materials and Resins	134	10	1	*	20	W	W	0	11
2869	Industrial Organic Chemicals, nec	139	8	1	*	50	33	41	0	5
2873	Nitrogenous Fertilizers	47	2	0	*	45	*	0	0	Q
29	Petroleum and Coal Products	977	23	W	9	63	W	W	0	827
2911	Petroleum Refining ^d	948	21	39	1	50	12	W	0	W
30	Rubber and Misc. Plastics Products	101	40	W	*	51	W	W	0	1
31	Leather and Leather Products	5	Q	Q	Q	2	*	Q	0	Q
32	Stone, Clay and Glass Products	297	33	*	7	130	1	114	1	12
3241	Cement, Hydraulic	93	9	*	2	4	*	69	*	8
33	Primary Metal Industries	1,404	172	20	5	396	2	515	273	21
3312	Blast Furnaces and Steel Mills	1,107	64	20	4	264	1	498	245	11
3334	Primary Aluminum	W	W	0	*	W	*	W	0	W
34	Fabricated Metal Products	166	49	2	1	100	2	8	*	4
35	Industrial Machinery and Equipment	142	49	Q	2	70	1	17	Q	1
36	Electronic and Other Electric Equipment	66	26	1	*	32	1	5	0	1
37	Transportation Equipment	190	60	4	5	78	1	30	5	6
38	Instruments and Related Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	11	3	Q	*	6	*	*	0	*
	Total	4,776	712	105	44	1,480	145	998	282	1,012
South Census Region										
20	Food and Kindred Products	266	59	13	12	135	2	18	*	26
21	Tobacco Products	25	3	1	*	2	*	17	0	1
22	Textile Mill Products	240	93	12	5	79	2	39	*	11
23	Apparel and Other Textile Products	27	14	Q	*	10	*	3	0	Q
24	Lumber and Wood Products	184	31	W	W	15	1	Q	0	128
25	Furniture and Fixtures	33	11	1	2	7	1	2	0	10
26	Paper and Allied Products	1,373	74	63	5	227	1	170	0	834
2621	Paper Mills	544	37	15	3	91	*	89	0	309
2631	Paperboard Mills	623	17	37	1	98	*	78	0	392
27	Printing and Publishing	33	20	*	*	11	*	0	0	1
28	Chemicals and Allied Products	3,509	238	62	W	1,732	770	207	W	488
2819	Industrial Inorganic Chemicals, nec	186	40	W	1	107	*	28	W	6
2821	Plastics Materials and Resins	403	29	1	*	181	W	W	0	35
2869	Industrial Organic Chemicals, nec	1,634	37	9	3	625	549	50	Q	362
2873	Nitrogenous Fertilizers	355	6	0	*	343	W	0	0	W
29	Petroleum and Coal Products	3,769	48	W	4	536	11	W	0	3,090
2911	Petroleum Refining ^d	3,657	47	W	1	519	8	W	0	3,069
30	Rubber and Misc. Plastics Products	95	41	8	1	40	1	2	0	2
31	Leather and Leather Products	W	W	Q	*	W	Q	0	0	Q
32	Stone, Clay and Glass Products	368	45	W	18	191	2	95	Q	10
3241	Cement, Hydraulic	111	13	*	2	15	*	78	*	5
33	Primary Metal Industries	687	158	14	4	181	1	245	74	11
3312	Blast Furnaces and Steel Mills	438	38	14	2	91	*	233	59	1
3334	Primary Aluminum	91	78	0	*	8	*	W	W	3
34	Fabricated Metal Products	78	27	*	1	44	1	1	1	1
35	Industrial Machinery and Equipment	51	26	*	Q	21	1	Q	*	1
36	Electronic and Other Electric Equipment	71	34	*	1	25	Q	3	2	4
37	Transportation Equipment	63	28	3	1	26	*	2	*	1
38	Instruments and Related Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	W	W	*	*	W	Q	0	0	Q
	Total	10,839	967	195	75	3,294	796	805	86	4,822

See footnotes at end of table.

Table 1. Total Primary Consumption of Energy for All Purposes by Census Region, Industry Group, and Selected Industries, 1988: Part 2 (Continued)
(Estimates in Trillion Btu)

SIC Code ^a	Industry Groups and Industry	Total	Net Electricity ^b	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal	Coke and Breeze	Other ^c
West Census Region										
20	Food and Kindred Products	226	28	W	7	103	W	W	1	45
21	Tobacco Products	0	0	0	0	0	0	0	0	0
22	Textile Mill Products	5	2	0	*	3	Q	0	0	*
23	Apparel and Other Textile Products	2	1	0	0	1	Q	0	0	Q
24	Lumber and Wood Products	161	15	Q	7	8	W	0	0	130
25	Furniture and Fixtures	NA	NA	NA	NA	NA	NA	NA	NA	NA
26	Paper and Allied Products	384	41	W	1	81	*	W	0	228
2621	Paper Mills	131	W	W	*	31	*	W	0	66
2631	Paperboard Mills	178	10	10	1	38	*	1	0	118
27	Printing and Publishing	11	6	0	Q	4	*	0	0	Q
28	Chemicals and Allied Products	126	38	W	1	72	*	4	W	4
2819	Industrial Inorganic Chemicals, nec	37	15	W	*	10	*	4	W	W
2821	Plastics Materials and Resins	1	*	*	*	1	*	0	0	*
2869	Industrial Organic Chemicals, nec	6	*	0	*	4	*	0	0	2
2873	Nitrogenous Fertilizers	41	2	0	*	39	*	0	0	*
29	Petroleum and Coal Products	1,134	26	W	7	99	W	0	0	953
2911	Petroleum Refining ^d	1,121	27	W	4	93	W	0	0	W
30	Rubber and Misc. Plastics Products	17	8	*	Q	8	*	0	0	Q
31	Leather and Leather Products	1	*	0	Q	1	Q	0	0	Q
32	Stone, Clay and Glass Products	146	18	W	4	60	1	52	W	2
3241	Cement, Hydraulic	70	7	1	1	10	*	48	1	1
33	Primary Metal Industries	229	117	1	3	62	*	39	2	6
3312	Blast Furnaces and Steel Mills	66	9	*	*	18	*	38	*	1
3334	Primary Aluminum	97	87	0	*	6	*	*	0	3
34	Fabricated Metal Products	34	12	0	*	18	*	0	0	Q
35	Industrial Machinery and Equipment	40	16	0	*	23	*	0	0	1
36	Electronic and Other Electric Equipment	30	21	0	*	8	*	0	0	1
37	Transportation Equipment	43	22	*	1	18	1	*	0	1
38	Instruments and Related Products	23	14	*	*	8	*	0	0	1
39	Misc. Manufacturing Industries	2	1	0	Q	1	*	0	0	Q
	Total	2,616	386	65	31	579	38	133	11	1,373

^a See Appendices A and D for descriptions of the Standard Industrial Classification system.

^b "Net Electricity" is obtained by summing purchases, transfers in, and generation from noncombustible renewable resources, minus quantities sold and transferred out. It does not include electricity inputs from onsite cogeneration or generation from combustible fuels because that energy has already been included as generating fuel (for example, coal).

^c "Other" includes net steam (the sum of purchases, generation from renewables, and net transfers), and other energy that respondents indicated was used to produce heat and power or as feedstock/raw material inputs. See also Footnote "d."

^d For the petroleum refining industry only, the feedstocks and raw material inputs for the production of nonenergy products (i.e., asphalt, waxes, lubricants, and solvents) and feedstock consumption at adjoining petrochemical plants are included in the "other" column, regardless of type of energy. The remaining columns for the petroleum refining industry include only energy that was consumed for the production of heat and power. The "other" column also includes net steam and other energy that respondents indicated was used in the production of heat and power. Those inputs and feedstocks that were converted to other energy products (e.g., crude oil converted to residual and distillate fuel oils) are excluded. See Appendix A for more information.

* Estimate less than 0.5 rounded to zero.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Q=Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

NA=Not available. Data are included in higher level totals.

Notes: •Totals may not equal sum of components because of independent rounding. •The derived estimates presented in this table are for the primary consumption of energy for heat and power and as feedstocks or raw material inputs. Primary consumption is defined as the consumption of the energy that was originally produced offsite or was produced onsite from input materials not classified as an energy. Examples of the latter are hydrogen produced from the electrolysis of brine; the output of captive (onsite) mines or wells; woodchips, bark, and woodwaste from wood purchased as a raw material input; and waste materials such as wastepaper and packing materials. Primary consumption excludes quantities of energy that are produced from other energy inputs and, therefore, avoids double counting.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey," and Office of Oil and Gas, Petroleum Supply Division, Form EIA-810, "Monthly Refinery Report" for 1988.

Table 2. Total Primary Consumption of Combustible Energy for Nonfuel Purposes by Census Region, Industry Group, and Selected Industries, 1988
(Estimates in Btu or Physical Units)

SIC Code ^a	Industry Groups and Industry	Total (trillion Btu)	Residual Fuel Oil (1000 bbls)	Distillate Fuel Oil (1000 bbls)	Natural Gas (billion cu ft)	LPG (million gallons)	Coal (1000 short tons)	Coke and Breeze (1000 short tons)	Other ^b (trillion Btu)
Total United States									
20	Food and Kindred Products	4	Q	Q	2	Q	5	W	Q
21	Tobacco Products	1	0	0	0	3	0	0	1
22	Textile Mill Products	•	0	•	•	•	0	0	•
23	Apparel and Other Textile Products	Q	0	0	0	0	0	0	Q
24	Lumber and Wood Products	4	0	Q	Q	1	0	0	4
25	Furniture and Fixtures	Q	0	0	0	0	0	0	Q
26	Paper and Allied Products	22	0	Q	3	•	0	0	19
2621	Paper Mills	2	0	W	2	0	0	0	W
2631	Paperboard Mills	18	0	9	Q	•	0	0	18
27	Printing and Publishing	1	0	0	1	0	0	0	Q
28	Chemicals and Allied Products	1,678	3,434	427	526	10,251	492	358	199
2819	Industrial Inorganic Chemicals, nec	22	0	W	W	•	W	W	2
2821	Plastics Materials and Resins	294	0	•	W	2,570	0	0	W
2869	Industrial Organic Chemicals, nec	811	0	332	81	6,663	0	Q	143
2873	Nitrogenous Fertilizers	258	0	0	247	W	0	0	W
29	Petroleum and Coal Products	2,874 2,296	Q	Q	1	Q	44	0	8,295 2,848
2911	Petroleum Refining ^c	2,841 3,258	0	0	0	0	0	0	3,258 2,841
30	Rubber and Misc. Plastics Products	1	W	•	•	W	13	0	•
31	Leather and Leather Products	Q	0	Q	0	0	0	0	Q
32	Stone, Clay and Glass Products	6	0	82	4	1	Q	Q	•
3241	Cement, Hydraulic	•	0	32	•	•	0	0	•
33	Primary Metal Industries	1,106	788	93	10	Q	39,470	671	16
3312	Blast Furnaces and Steel Mills	1,064	788	56	6	0	38,971	260	2
3334	Primary Aluminum	12	0	0	0	0	W	W	8
34	Fabricated Metal Products	3	0	Q	2	Q	1	7	1
35	Industrial Machinery and Equipment	4	0	Q	3	•	1	0	•
36	Electronic and Other Electric Equipment	8	0	1	1	1	42	87	4
37	Transportation Equipment	3	0	W	1	1	1	Q	1
38	Instruments and Related Products	1	0	•	•	Q	0	0	1
39	Misc. Manufacturing Industries	•	0	0	•	1	0	0	Q
	Total	5,711 6,132	4,239	1,196	554	10,286	40,070	1,184	9,531 5,114
245									
Northeast Census Region									
20	Food and Kindred Products	Q	0	Q	Q	Q	0	0	0
21	Tobacco Products	NA	NA	NA	NA	NA	NA	NA	NA
22	Textile Mill Products	•	0	•	•	0	0	0	•
23	Apparel and Other Textile Products	0	0	0	0	0	0	0	0
24	Lumber and Wood Products	Q	0	0	0	0	0	0	Q
25	Furniture and Fixtures	0	0	0	0	0	0	0	0
26	Paper and Allied Products	1	0	Q	Q	Q	0	0	•
2621	Paper Mills	•	0	W	•	0	0	0	•
2631	Paperboard Mills	0	0	0	0	0	0	0	0
27	Printing and Publishing	Q	0	0	0	0	0	0	Q
28	Chemicals and Allied Products	10	0	Q	•	W	0	0	W
2819	Industrial Inorganic Chemicals, nec	•	0	0	0	0	0	0	•
2821	Plastics Materials and Resins	W	0	0	•	W	0	0	•
2869	Industrial Organic Chemicals, nec	1	0	4	0	12	0	0	•
2873	Nitrogenous Fertilizers	0	0	0	0	0	0	0	0
29	Petroleum and Coal Products	868	0	Q	0	Q	44	0	Q
2911	Petroleum Refining ^c	367	0	0	0	0	0	0	367
30	Rubber and Misc. Plastics Products	•	0	•	Q	Q	0	0	•
31	Leather and Leather Products	Q	0	Q	0	0	0	0	Q
32	Stone, Clay and Glass Products	Q	0	Q	Q	•	0	0	•
3241	Cement, Hydraulic	•	0	0	0	0	0	0	•
33	Primary Metal Industries	316	0	Q	Q	•	11,574	158	1
3312	Blast Furnaces and Steel Mills	311	0	•	0	0	11,570	29	•
3334	Primary Aluminum	W	0	0	0	0	1	0	W
34	Fabricated Metal Products	•	0	Q	•	Q	0	0	Q
35	Industrial Machinery and Equipment	•	0	Q	•	Q	0	0	Q
36	Electronic and Other Electric Equipment	2	0	Q	Q	0	1	25	•
37	Transportation Equipment	•	0	•	Q	•	0	0	•
38	Instruments and Related Products	Q	0	0	Q	0	0	0	•
39	Misc. Manufacturing Industries	Q	0	0	Q	1	0	0	•
	Total	699	0	Q	3	W	11,619	183	W

See footnotes at end of table.

Table 2. Total Primary Consumption of Combustible Energy for Nonfuel Purposes by Census Region, Industry Group, and Selected Industries, 1988 (Continued)
(Estimates in Btu or Physical Units)

SIC Code ^a	Industry Groups and Industry	Total (trillion Btu)	Residual Fuel Oil (1000 bbls)	Distillate Fuel Oil (1000 bbls)	Natural Gas (billion cu ft)	LPG (million gallons)	Coal (1000 short tons)	Coke and Breeze (1000 short tons)	Other ^b (trillion Btu)
Midwest Census Region									
20	Food and Kindred Products	2	0	Q	1	Q	Q	W	Q
21	Tobacco Products	NA	NA	NA	NA	NA	NA	NA	NA
22	Textile Mill Products	NA	NA	NA	NA	NA	NA	NA	NA
23	Apparel and Other Textile Products	Q	0	0	0	0	0	0	Q
24	Lumber and Wood Products	Q	0	Q	Q	0	0	0	0
25	Furniture and Fixtures	Q	0	0	0	0	0	0	Q
26	Paper and Allied Products	8	0	6	W	Q	0	0	W
2621	Paper Mills	1	0	W	*	0	0	0	W
2631	Paperboard Mills	7	0	Q	Q	Q	0	0	7
27	Printing and Publishing	Q	0	0	Q	0	0	0	Q
28	Chemicals and Allied Products	155	0	Q	34	W	Q	W	1
2819	Industrial Inorganic Chemicals, nec	W	0	0	*	0	0	0	W
2821	Plastics Materials and Resins	W	0	0	Q	W	0	0	*
2869	Industrial Organic Chemicals, nec	46	0	5	13	377	0	0	*
2873	Nitrogenous Fertilizers	17	0	0	17	0	0	0	0
29	Petroleum and Coal Products	487	W	Q	Q	0	0	0	Q
2911	Petroleum Refining	483	0	0	0	0	0	0	483
30	Rubber and Misc. Plastics Products	1	W	Q	*	Q	13	0	Q
31	Leather and Leather Products	0	0	0	0	0	0	0	0
32	Stone, Clay and Glass Products	*	0	Q	*	*	Q	Q	*
3241	Cement, Hydraulic	*	0	W	*	*	0	0	*
33	Primary Metal Industries	504	788	15	9	Q	17,808	282	6
3312	Blast Furnaces and Steel Mills	486	788	7	6	0	17,565	115	1
3334	Primary Aluminum	W	0	0	0	0	W	0	W
34	Fabricated Metal Products	2	0	6	1	Q	1	0	Q
35	Industrial Machinery and Equipment	2	0	Q	1	*	0	0	*
36	Electronic and Other Electric Equipment	Q	0	*	Q	*	0	0	*
37	Transportation Equipment	2	0	W	*	W	1	Q	1
38	Instruments and Related Products	NA	NA	NA	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	*	0	0	*	0	0	0	*
	Total	1,163	790	468	49	W	17,928	306	W
South Census Region									
20	Food and Kindred Products	1	0	W	1	Q	0	0	*
21	Tobacco Products	1	0	0	0	3	0	0	1
22	Textile Mill Products	*	0	0	*	*	0	0	*
23	Apparel and Other Textile Products	Q	0	0	0	0	0	0	Q
24	Lumber and Wood Products	*	0	Q	0	Q	0	0	*
25	Furniture and Fixtures	Q	0	0	0	0	0	0	Q
26	Paper and Allied Products	13	0	*	W	*	0	0	W
2621	Paper Mills	1	0	0	1	0	0	0	*
2631	Paperboard Mills	11	0	0	0	*	0	0	11
27	Printing and Publishing	*	0	0	Q	0	0	0	Q
28	Chemicals and Allied Products	1,481	3,434	W	469	8,836	389	W	193
2819	Industrial Inorganic Chemicals, nec	14	0	W	W	*	W	W	W
2821	Plastics Materials and Resins	204	0	*	W	W	0	0	W
2869	Industrial Organic Chemicals, nec	761	0	323	68	6,304	0	Q	141
2873	Nitrogenous Fertilizers	224	0	0	214	W	0	0	W
29	Petroleum and Coal Products	Q	0	Q	0	Q	0	0	Q
2911	Petroleum Refining	2,065	0	0	0	0	0	0	2,065
30	Rubber and Misc. Plastics Products	*	0	*	*	*	0	0	*
31	Leather and Leather Products	0	0	0	0	0	0	0	0
32	Stone, Clay and Glass Products	5	0	W	4	*	0	Q	*
3241	Cement, Hydraulic	*	0	W	0	Q	0	0	*
33	Primary Metal Industries	243	0	58	*	Q	W	W	W
3312	Blast Furnaces and Steel Mills	229	0	48	*	0	W	W	*
3334	Primary Aluminum	5	0	0	0	0	W	W	2
34	Fabricated Metal Products	1	0	*	Q	0	0	7	*
35	Industrial Machinery and Equipment	1	0	0	1	Q	1	0	Q
36	Electronic and Other Electric Equipment	6	0	Q	*	*	40	62	4
37	Transportation Equipment	*	0	1	Q	Q	0	0	*
38	Instruments and Related Products	NA	NA	NA	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	Q	0	0	Q	0	0	0	Q
	Total	3,779	3,434	481	477	8,856	W	409	W

See footnotes at end of table.

Table 2. Total Primary Consumption of Combustible Energy for Nonfuel Purposes by Census Region, Industry Group, and Selected Industries, 1988 (Continued)
(Estimates in Btu or Physical Units)

SIC Code ^a	Industry Groups and Industry	Total (trillion Btu)	Residual Fuel Oil (1000 bbls)	Distillate Fuel Oil (1000 bbls)	Natural Gas (billion cu ft)	LPG (million gallons)	Coal (1000 short tons)	Coke and Breeze (1000 short tons)	Other ^b (trillion Btu)
West Census Region									
20	Food and Kindred Products	1	Q	Q	Q	Q	5	W	*
21	Tobacco Products	0	0	0	0	0	0	0	0
22	Textile Mill Products	0	0	0	0	0	0	0	0
23	Apparel and Other Textile Products	0	0	0	0	0	0	0	0
24	Lumber and Wood Products	4	0	19	Q	1	0	0	4
25	Furniture and Fixtures	NA	NA	NA	NA	NA	NA	NA	NA
26	Paper and Allied Products	*	0	3	*	*	0	0	*
2621	Paper Mills	0	0	0	0	0	0	0	0
2631	Paperboard Mills	*	0	3	0	*	0	0	*
27	Printing and Publishing	0	0	0	0	0	0	0	0
28	Chemicals and Allied Products	32	0	0	22	0	0	W	W
2819	Industrial Inorganic Chemicals, nec	W	0	0	*	0	0	W	*
2821	Plastics Materials and Resins	*	0	0	*	0	0	0	0
2869	Industrial Organic Chemicals, nec	2	0	0	0	0	0	0	2
2873	Nitrogenous Fertilizers	17	0	0	16	0	0	0	0
29	Petroleum and Coal Products	409	Q	Q	Q	0	0	0	W
2911	Petroleum Refining ^c	403	0	0	0	0	0	0	403
30	Rubber and Misc. Plastics Products	Q	0	0	0	0	0	0	Q
31	Leather and Leather Products	Q	0	0	0	0	0	0	Q
32	Stone, Clay and Glass Products	*	0	13	*	*	0	0	Q
3241	Cement, Hydraulic	*	0	0	0	0	0	0	*
33	Primary Metal Industries	42	0	2	0	Q	W	W	W
3312	Blast Furnaces and Steel Mills	38	0	0	0	0	W	W	*
3334	Primary Aluminum	3	0	0	0	0	10	0	3
34	Fabricated Metal Products	Q	0	0	0	0	0	0	Q
35	Industrial Machinery and Equipment	Q	0	Q	Q	Q	0	0	Q
36	Electronic and Other Electric Equipment	Q	0	0	0	0	0	0	Q
37	Transportation Equipment	Q	0	Q	Q	Q	0	0	Q
38	Instruments and Related Products	*	0	0	*	0	0	0	Q
39	Misc. Manufacturing Industries	0	0	0	0	0	0	0	0
	Total	490	Q	84	25	2	W	267	W

^a See Appendices A and D for descriptions of the Standard Industrial Classification system.

^b "Other" includes all other energy that respondents indicated was used for nonfuel purposes, i.e., as petrochemical feedstocks or raw material inputs. See also Footnote "c."

^c For the petroleum refining industry only, the feedstocks and raw material inputs for the production of nonenergy products (i.e., asphalt, waxes, lubricants, and solvents) and feedstock consumption at adjoining petrochemical plants are included in the "other" column, regardless of type of energy. Those inputs and feedstocks that were converted to energy products (e.g., crude oil converted to residual and distillate fuel oils) are excluded. See Appendix A for more information.

* Estimate less than 0.5 rounded to zero.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Q=Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

NA=Not available. Data are included in higher level totals.

Notes: •Totals may not equal sum of components because of independent rounding. •The derived estimates presented in this table are for the primary consumption of energy as feedstocks or raw material inputs. Primary consumption is defined as the consumption of the energy that was originally produced offsite or was produced onsite from input materials not classified as an energy. Examples of the latter are hydrogen produced from the electrolysis of brine; the output of captive (onsite) mines or wells; woodchips, bark, and woodwaste from wood purchased as a raw material input; and waste materials such as wastepaper and packing materials. Primary consumption excludes quantities of energy that are produced from other energy inputs and therefore avoids double counting.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey," and Office of Oil and Gas, Petroleum Supply Division, Form EIA-810, "Monthly Refinery Report" for 1988.

Table 3. Total Inputs of Energy for Heat, Power, and Electricity Generation by Census Region, Industry Group, and Selected Industries, 1988
(Estimates in Btu or Physical Units)

SIC Code ^a	Industry Groups and Industry	Total (trillion Btu)	Net Electricity ^b (million kWh)	Residual Fuel Oil (1000 bbls)	Distillate Fuel Oil (1000 bbls)	Natural Gas (billion cu ft)
Total United States						
20	Food and Kindred Products	996	50,206	W	W	473
21	Tobacco Products	24	864	217	81	2
22	Textile Mill Products	275	29,738	3,024	1,144	90
23	Apparel and Other Textile Products	54	6,659	311	397	21
24	Lumber and Wood Products	404	16,431	458	3,835	34
25	Furniture and Fixtures	63	5,851	185	591	22
26	Paper and Allied Products	2,347	55,517	28,274	2,139	415
2621	Paper Mills	1,080	28,736	15,571	932	173
2631	Paperboard Mills	879	10,684	8,515	458	155
27	Printing and Publishing	115	17,052	117	384	47
28	Chemicals and Allied Products	2,862	121,854	16,596	2,654	1,465
2819	Industrial Inorganic Chemicals, nec	273	27,391	1,026	W	W
2821	Plastics Materials and Resins	284	12,842	W	248	W
2869	Industrial Organic Chemicals, nec	1,096	15,428	3,916	424	587
2873	Nitrogenous Fertilizers	193	2,930	0	24	168
29	Petroleum and Coal Products	3,122	31,124	15,703	4,359	702
2911	Petroleum Refining	3,052	29,692	15,034	1,138	666
30	Rubber and Misc. Plastics Products	252	31,299	W	785	107
31	Leather and Leather Products	16	1,391	548	169	5
32	Stone, Clay and Glass Products	1,000	33,793	2,299	6,013	451
3241	Cement, Hydraulic	338	9,802	Q	892	29
33	Primary Metal Industries	2,622	149,202	6,239	2,547	720
3312	Blast Furnaces and Steel Mills	1,855	40,570	5,754	1,045	425
3334	Primary Aluminum	246	65,818	2	74	19
34	Fabricated Metal Products	343	30,952	737	1,202	197
35	Industrial Machinery and Equipment	276	33,480	556	1,476	123
36	Electronic and Other Electric Equipment	215	31,852	725	917	82
37	Transportation Equipment	349	37,283	2,970	W	134
38	Instruments and Related Products	113	14,344	917	368	31
39	Misc. Manufacturing Industries	41	4,183	195	275	19
	Total	15,489	702,876	90,413	36,766	5,141
Northeast Census Region						
20	Food and Kindred Products	90	6,117	W	1,334	41
21	Tobacco Products	NA	NA	NA	NA	NA
22	Textile Mill Products	26	1,658	1,067	246	9
23	Apparel and Other Textile Products	15	1,330	250	282	7
24	Lumber and Wood Products	26	1,031	Q	Q	5
25	Furniture and Fixtures	8	533	71	109	3
26	Paper and Allied Products	281	8,804	13,419	W	W
2621	Paper Mills	221	W	11,307	W	19
2631	Paperboard Mills	20	513	783	217	7
27	Printing and Publishing	21	3,042	39	297	6
28	Chemicals and Allied Products	170	12,584	W	W	46
2819	Industrial Inorganic Chemicals, nec	8	411	438	99	3
2821	Plastics Materials and Resins	W	1,250	1,224	164	5
2869	Industrial Organic Chemicals, nec	44	2,364	1,968	170	8
2873	Nitrogenous Fertilizers	.	W	0	.	.
29	Petroleum and Coal Products	230	2,708	W	1,115	25
2911	Petroleum Refining	217	2,115	W	83	22
30	Rubber and Misc. Plastics Products	39	5,097	W	484	11
31	Leather and Leather Products	W	W	403	116	W
32	Stone, Clay and Glass Products	158	5,737	990	1,105	84
3241	Cement, Hydraulic	42	1,312	Q	113	.
33	Primary Metal Industries	355	18,061	1,475	734	108
3312	Blast Furnaces and Steel Mills	262	7,975	1,059	212	70
3334	Primary Aluminum	W	W	2	7	W
34	Fabricated Metal Products	70	5,123	388	774	41
35	Industrial Machinery and Equipment	47	6,721	514	693	15
36	Electronic and Other Electric Equipment	56	8,108	515	666	18
37	Transportation Equipment	55	4,802	1,702	713	16
38	Instruments and Related Products	52	4,226	842	307	8
39	Misc. Manufacturing Industries	W	W	159	202	W
	Total	1,726	97,502	35,685	11,906	490

See footnotes at end of table.

Table 3. Total Inputs of Energy for Heat, Power, and Electricity Generation by Census Region, Industry Group, and Selected Industries, 1988 (Continued)
(Estimates in Btu or Physical Units)

SIC Code ^a	Industry Groups and Industry	LPG (million gallons)	Coal (1000 short tons)	Coke & Breeze (1000 short tons)	Other ^b (trillion Btu))
Total United States					
20	Food and Kindred Products	W	6,796	W	90
21	Tobacco Products	1	767	0	*
22	Textile Mill Products	31	1,760	*	12
23	Apparel and Other Textile Products	9	130	0	1
24	Lumber and Wood Products	39	106	0	282
25	Furniture and Fixtures	14	132	0	12
26	Paper and Allied Products	53	14,036	0	1,221
2621	Paper Mills	23	8,546	0	508
2631	Paperboard Mills	5	5,009	0	513
27	Printing and Publishing	18	0	0	4
28	Chemicals and Allied Products	44	13,150	119	519
2819	Industrial Inorganic Chemicals, nec	3	W	W	14
2821	Plastics Materials and Resins	13	1,366	0	54
2869	Industrial Organic Chemicals, nec	8	4,064	0	321
2873	Nitrogenous Fertilizers	*	0	0	10
29	Petroleum and Coal Products	628	292	0	2,109
2911	Petroleum Refining	600	287	0	2,106
30	Rubber and Misc. Plastics Products	W	375	0	4
31	Leather and Leather Products	1	61	0	*
32	Stone, Clay and Glass Products	47	13,007	390	67
3241	Cement, Hydraulic	*	9,876	127	42
33	Primary Metal Industries	60	2,650	31,539	470
3312	Blast Furnaces and Steel Mills	12	1,573	29,987	456
3334	Primary Aluminum	2	0	0	1
34	Fabricated Metal Products	49	417	39	9
35	Industrial Machinery and Equipment	32	806	Q	2
36	Electronic and Other Electric Equipment	33	324	9	2
37	Transportation Equipment	24	1,646	W	9
38	Instruments and Related Products	Q	975	0	2
39	Misc. Manufacturing Industries	6	82	0	1
	Total	1,226	57,512	32,456	4,817
106 Total Btu Northeast Census Region					
20	Food and Kindred Products	W	W	0	3
21	Tobacco Manufactures	NA	NA	NA	NA
22	Textile Mill Products	9	26	0	2
23	Apparel and Other Textile Products	Q	0	0	*
24	Lumber and Wood Products	4	0	0	12
25	Furniture and Fixtures	Q	0	0	Q
26	Paper and Allied Products	21	W	0	W
2621	Paper Mills	16	W	0	80
2631	Paperboard Mills	1	157	0	*
27	Printing and Publishing	Q	0	0	2
28	Chemicals and Allied Products	W	195	0	W
2819	Industrial Inorganic Chemicals, nec	*	*	0	*
2821	Plastics Materials and Resins	W	W	0	2
2869	Industrial Organic Chemicals, nec	4	0	0	14
2873	Nitrogenous Fertilizers	0	0	0	*
29	Petroleum and Coal Products	28	W	0	W
2911	Petroleum Refining	28	194	0	W
30	Rubber and Misc. Plastics Products	W	W	0	1
31	Leather and Leather Products	*	Q	0	Q
32	Stone, Clay and Glass Products	7	1,320	55	8
3241	Cement, Hydraulic	*	1,209	52	6
33	Primary Metal Industries	25	376	3,243	78
3312	Blast Furnaces and Steel Mills	4	38	3,174	75
3334	Primary Aluminum	*	0	0	*
34	Fabricated Metal Products	12	35	10	Q
35	Industrial Machinery and Equipment	4	56	0	*
36	Electronic and Other Electric Equipment	11	23	8	1
37	Transportation Equipment	3	249	0	Q
38	Instruments and Related Products	1	975	0	1
39	Misc. Manufacturing Industries	2	65	0	*
	Total	W	5,155	3,316	W

See footnotes at end of table.

Table 3. Total Inputs of Energy for Heat, Power, and Electricity Generation by Census Region, Industry Group, and Selected Industries, 1988 (Continued)
(Estimates in Btu or Physical Units)

SIC Code*	Industry Groups and Industry	Total (trillion Btu)	Net Electricity* (million kWh)	Residual Fuel Oil (1000 bbls)	Distillate Fuel Oil (1000 bbls)	Natural Gas (billion cu ft)
Midwest Census Region						
20	Food and Kindred Products	411	19,223	1,608	W	202
21	Tobacco Products	NA	NA	NA	NA	NA
22	Textile Mill Products	NA	NA	NA	NA	NA
23	Apparel and Other Textile Products	9	925	Q	40	5
24	Lumber and Wood Products	35	2,000	Q	W	7
25	Furniture and Fixtures	20	1,677	14	104	11
26	Paper and Allied Products	320	13,063	W	W	80
2621	Paper Mills	185	6,369	W	W	37
2631	Paperboard Mills	69	2,201	251	19	16
27	Printing and Publishing	50	6,312	Q	Q	28
28	Chemicals and Allied Products	395	28,578	W	W	158
2819	Industrial Inorganic Chemicals, nec	W	10,839	W	8	W
2821	Plastics Materials and Resins	W	2,934	148	14	20
2869	Industrial Organic Chemicals, nec	93	2,445	85	58	36
2873	Nitrogenous Fertilizers	31	570	0	3	27
29	Petroleum and Coal Products	490	6,718	W	1,381	61
2911	Petroleum Refining	465	6,138	W	145	49
30	Rubber and Misc. Plastics Products	101	11,789	W	78	49
31	Leather and Leather Products	5	Q	Q	Q	2
32	Stone, Clay and Glass Products	320	9,591	61	W	126
3241	Cement, Hydraulic	109	2,677	*	W	4
33	Primary Metal Industries	1,428	50,509	2,361	816	376
3312	Blast Furnaces and Steel Mills	1,149	18,864	2,352	595	250
3334	Primary Aluminum	W	W	0	6	W
34	Fabricated Metal Products	165	14,383	334	212	96
35	Industrial Machinery and Equipment	140	14,429	Q	411	67
36	Electronic and Other Electric Equipment	85	7,722	134	41	31
37	Transportation Equipment	188	17,574	688	W	78
38	Instruments and Related Products	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	10	928	Q	65	6
	Total	4,174	208,639	15,924	7,163	1,389
South Census Region						
20	Food and Kindred Products	270	17,325	1,998	W	131
21	Tobacco Products	24	855	217	81	2
22	Textile Mill Products	240	27,238	1,956	888	76
23	Apparel and Other Textile Products	27	3,986	Q	75	9
24	Lumber and Wood Products	184	9,128	W	W	14
25	Furniture and Fixtures	33	3,103	100	378	7
26	Paper and Allied Products	1,362	21,565	9,956	919	W
2621	Paper Mills	543	10,901	2,394	484	87
2631	Paperboard Mills	612	5,006	5,828	115	95
27	Printing and Publishing	33	5,846	85	40	10
28	Chemicals and Allied Products	2,199	69,678	7,267	1,132	1,214
2819	Industrial Inorganic Chemicals, nec	176	11,711	W	W	W
2821	Plastics Materials and Resins	209	8,536	W	68	W
2869	Industrial Organic Chemicals, nec	955	10,728	1,863	197	539
2873	Nitrogenous Fertilizers	137	1,626	0	20	119
29	Petroleum and Coal Products	1,678	14,138	W	W	520
2911	Petroleum Refining	1,652	13,637	W	143	504
30	Rubber and Misc. Plastics Products	95	12,064	1,253	214	39
31	Leather and Leather Products	W	W	Q	10	W
32	Stone, Clay and Glass Products	373	13,096	W	W	182
3241	Cement, Hydraulic	116	3,730	9	W	15
33	Primary Metal Industries	615	46,380	2,284	568	175
3312	Blast Furnaces and Steel Mills	380	11,152	2,284	225	88
3334	Primary Aluminum	86	22,728	0	42	8
34	Fabricated Metal Products	75	7,903	15	159	43
35	Industrial Machinery and Equipment	50	7,622	22	Q	19
36	Electronic and Other Electric Equipment	64	9,830	77	183	25
37	Transportation Equipment	63	8,314	554	224	26
38	Instruments and Related Products	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	W	W	33	8	W
	Total	7,419	283,469	28,454	12,408	2,724

See footnotes at end of table.

Table 3. Total Inputs of Energy for Heat, Power, and Electricity Generation by Census Region, Industry Group, and Selected Industries, 1988 (Continued)
(Estimates in Btu or Physical Units)

SIC Code ^a	Industry Groups and Industry	LPG (million gallons)	Coal (1000 short tons)	Coke & Breeze (1000 short tons)	Other ^a (trillion Btu)
Midwest Census Region					
20	Food and Kindred Products	Q	4,667	W	11
21	Tobacco Products	NA	NA	NA	NA
22	Textile Mill Products	NA	NA	NA	NA
23	Apparel and Other Textile Products	Q	Q	0	•
24	Lumber and Wood Products	W	Q	0	15
25	Furniture and Fixtures	3	45	0	1
26	Paper and Allied Products	9	4,660	0	W
2621	Paper Mills	2	2,947	0	52
2631	Paperboard Mills	1	1,339	0	13
27	Printing and Publishing	4	0	0	1
28	Chemicals and Allied Products	W	3,978	W	W
2819	Industrial Inorganic Chemicals, nec	•	166	W	•
2821	Plastics Materials and Resins	W	W	0	W
2869	Industrial Organic Chemicals, nec	1	1,835	0	5
2873	Nitrogenous Fertilizers	•	0	0	Q
29	Petroleum and Coal Products	W	W	0	342
2911	Petroleum Refining	W	W	0	W
30	Rubber and Misc. Plastics Products	W	W	0	1
31	Leather and Leather Products	1	Q	0	Q
32	Stone, Clay and Glass Products	9	5,116	W	W
3241	Cement, Hydraulic	•	3,108	•	W
33	Primary Metal Industries	21	1,662	21,397	279
3312	Blast Furnaces and Steel Mills	7	1,212	20,443	274
3334	Primary Aluminum	•	0	0	1
34	Fabricated Metal Products	21	357	15	3
35	Industrial Machinery and Equipment	17	741	Q	1
36	Electronic and Other Electric Equipment	7	204	0	1
37	Transportation Equipment	W	1,328	W	5
38	Instruments and Related Products	NA	NA	NA	NA
39	Misc. Manufacturing Industries	•	17	0	•
	Total	W	23,071	21,733	W
South Census Region					
20	Food and Kindred Products	W	794	11	31
21	Tobacco Products	1	767	0	•
22	Textile Mill Products	21	1,734	•	11
23	Apparel and Other Textile Products	3	113	0	Q
24	Lumber and Wood Products	11	Q	0	128
25	Furniture and Fixtures	9	87	0	10
26	Paper and Allied Products	17	7,570	0	W
2621	Paper Mills	4	3,988	0	309
2631	Paperboard Mills	2	3,476	0	381
27	Printing and Publishing	3	0	0	1
28	Chemicals and Allied Products	W	8,804	W	W
2819	Industrial Inorganic Chemicals, nec	3	W	W	W
2821	Plastics Materials and Resins	3	W	0	W
2869	Industrial Organic Chemicals, nec	3	2,229	0	300
2873	Nitrogenous Fertilizers	•	0	0	9
29	Petroleum and Coal Products	108	W	0	1,066
2911	Petroleum Refining	96	W	0	1,064
30	Rubber and Misc. Plastics Products	6	109	0	2
31	Leather and Leather Products	Q	0	0	Q
32	Stone, Clay and Glass Products	18	4,260	Q	19
3241	Cement, Hydraulic	•	3,417	18	W
33	Primary Metal Industries	11	W	6,032	W
3312	Blast Furnaces and Steel Mills	1	W	5,559	W
3334	Primary Aluminum	•	0	0	•
34	Fabricated Metal Products	11	25	14	1
35	Industrial Machinery and Other Equipment	9	Q	1	1
36	Electronic and Other Electric Equipment	Q	98	Q	•
37	Transportation Equipment	6	65	•	2
38	Instruments and Related Products	NA	NA	NA	NA
39	Misc. Manufacturing Industries	Q	0	0	1
	Total	291	W	6,408	W

See footnotes at end of table.

Table 3. Total Inputs of Energy for Heat, Power, and Electricity Generation by Census Region, Industry Group, and Selected Industries, 1988 (Continued)
(Estimates in Btu or Physical Units)

SIC Code ^a	Industry Groups and Industry	Total (trillion Btu)	Net Electricity ^b (million kWh)	Residual Fuel Oil (1000 bbls)	Distillate Fuel Oil (1000 bbls)	Natural Gas (billion cu ft)
West Census Region						
20	Food and Kindred Products	225	7,540	W	1,128	100
21	Tobacco Products	0	0	0	0	0
22	Textile Mill Products	5	538	0	8	3
23	Apparel and Other Textile Products	2	418	0	0	1
24	Lumber and Wood Products	158	4,271	Q	1,197	8
25	Furniture and Fixtures	NA	NA	NA	NA	NA
26	Paper and Allied Products	384	12,086	W	183	78
2621	<i>Paper Mills</i>	131	W	W	47	30
2631	<i>Paperboard Mills</i>	178	2,963	1,653	107	37
27	Printing and Publishing	11	1,852	0	Q	4
28	Chemicals and Allied Products	98	11,037	W	126	48
2819	<i>Industrial Inorganic Chemicals, nec</i>	W	4,429	W	54	9
2821	<i>Plastics Materials and Resins</i>	1	123	2	2	1
2869	<i>Industrial Organic Chemicals, nec</i>	5	*	0	1	4
2873	<i>Nitrogenous Fertilizers</i>	25	717	0	1	21
29	Petroleum and Coal Products	724	7,560	W	W	95
2911	<i>Petroleum Refining</i>	718	7,802	W	766	90
30	Rubber and Misc. Plastics Products	17	2,349	43	Q	8
31	Leather and Leather Products	1	82	0	Q	1
32	Stone, Clay and Glass Products	149	5,368	W	723	58
3241	<i>Cement, Hydraulic</i>	71	2,083	114	236	10
33	Primary Metal Industries	224	34,252	119	429	61
3312	<i>Blast Furnaces and Steel Mills</i>	64	2,580	60	13	17
3334	<i>Primary Aluminum</i>	93	25,611	0	19	5
34	Fabricated Metal Products	34	3,543	0	57	18
35	Industrial Machinery and Equipment	39	4,707	0	26	21
36	Electronic and Other Electric Equipment	30	6,193	0	27	8
37	Transportation Equipment	42	6,594	28	W	17
38	Instruments and Related Products	23	4,230	*	6	8
39	Misc. Manufacturing Industries	2	306	0	Q	1
	Total	2,171	113,265	10,350	5,289	538

See footnotes at end of table.

Table 3. Total Inputs of Energy for Heat, Power, and Electricity Generation by Census Region, Industry Group, and Selected Industries, 1988 (Continued)
(Estimates in Btu or Physical Units)

SIC Code ^a	Industry Groups and Industry	LPG (million gallons)	Coal (1000 short tons)	Coke & Breeze (1000 short tons)	Other ^b (trillion Btu)
West Census Region					
20	Food and Kindred Products	W	W	W	45
21	Tobacco Products	0	0	0	0
22	Textile Mill Products	Q	0	0	•
23	Apparel and Other Textile Products	Q	0	0	Q
24	Lumber and Wood Products	W	0	0	127
25	Furniture and Fixtures	NA	NA	NA	NA
26	Paper and Allied Products	5	W	0	W
2621	<i>Paper Mills</i>	1	W	0	67
2631	<i>Paperboard Mills</i>	1	37	0	119
27	Printing and Publishing	5	0	0	Q
28	Chemicals and Allied Products	1	175	W	W
2819	<i>Industrial Inorganic Chemicals, nec</i>	•	175	W	W
2821	<i>Plastics Materials and Resins</i>	•	0	0	•
2869	<i>Industrial Organic Chemicals, nec</i>	•	0	0	2
2873	<i>Nitrogenous Fertilizers</i>	•	0	0	•
29	Petroleum and Coal Products	W	0	0	W
2911	<i>Petroleum Refining</i>	W	0	0	W
30	Rubber and Misc. Plastics Products	2	0	0	Q
31	Leather and Leather Products	Q	0	0	Q
32	Stone, Clay and Glass Products	13	2,311	W	W
3241	<i>Cement, Hydraulic</i>	•	2,143	58	2
33	Primary Metal Industries	3	W	867	W
3312	<i>Blast Furnaces and Steel Mills</i>	•	W	810	W
3334	<i>Primary Aluminum</i>	1	0	0	•
34	Fabricated Metal Products	5	0	0	Q
35	Industrial Machinery and Equipment	2	0	0	1
36	Electronic and Other Electric Equipment	•	0	0	Q
37	Transportation Equipment	W	4	0	1
38	Instruments and Related Products	•	0	0	1
39	Misc. Manufacturing Industries	•	0	0	Q
	Total	432	W	1,000	W

^a See Appendices A and D for descriptions of the Standard Industrial Classification system. See Appendix A.

^b "Net Electricity" is obtained by summing purchases, transfers in, and generation from noncombustible renewable resources, minus quantities sold and transferred out. It does not include electricity inputs from onsite cogeneration or generation from combustible fuels because that energy has already been included as generating fuel (for example, coal).

^c "Other" includes net steam (the sum of purchases, generation from renewables, and net transfers), and other energy that respondents indicated was used to produce heat and power.

^d Estimate less than 0.5 rounded to zero.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Q=Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

NA=Not available. Data are included in higher level totals.

Notes: •Totals may not equal sum of components because of independent rounding. •The estimates presented in this table are for the total consumption of energy for the production of heat and power, regardless of where the energy was produced. Specifically, the estimates include the quantities of energy that were originally produced offsite and purchased by or transferred to the establishment, plus those that were produced onsite from other energy or input materials not classified as energy, or were extracted from captive (onsite) mines or wells.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey."

Table 4. Total Consumption of Offsite-Produced Energy for Heat, Power and Electricity Generation by Census Region, Industry Group, and Selected Industries, 1988
(Estimates in Btu or Physical Units)

SIC Code*	Industry Groups and Industry	Total (trillion Btu)	Electricity ^b (million kWh)	Residual Fuel Oil (1000 bbls)	Distillate Fuel Oil (1000 bbls)	Natural Gas (billion cu ft)	LPG (million gallons)	Coal (1000 short tons)	Coke and Breeze (1000 short tons)	Other ^c (trillion Btu)
Total United States										
20	Food and Kindred Products	948	51,890	W	W	473	W	6,796	W	35
21	Tobacco Products	28	1,454	217	81	2	1	787	0	*
22	Textile Mill Products	278	29,684	3,024	1,144	90	31	1,760	*	13
23	Apparel and Other Textile Products	54	6,664	311	397	21	9	130	0	1
24	Lumber and Wood Products	199	19,953	458	3,835	34	39	108	0	65
25	Furniture and Fixtures	54	5,687	185	591	22	14	132	0	3
26	Paper and Allied Products	1,409	61,015	28,274	2,139	415	53	14,036	0	263
2621	Paper Mills	686	31,184	15,571	932	173	23	8,546	0	105
2631	Paperboard Mills	501	13,486	8,515	458	155	5	5,009	0	125
27	Printing and Publishing	115	17,066	117	384	47	18	0	0	4
28	Chemicals and Allied Products	2,568	129,927	15,691	2,565	1,460	43	12,915	48	215
2819	Industrial Inorganic Chemicals, nec	260	27,676	1,026	W	W	3	W	W	5
2821	Plastics Materials and Resins	258	13,259	W	182	W	13	1,366	0	29
2869	Industrial Organic Chemicals, nec	924	19,452	3,442	405	582	8	4,064	0	143
2873	Nitrogenous Fertilizers	186	2,958	0	24	168	*	0	0	3
29	Petroleum and Coal Products	1,070	34,172	6,143	3,844	700	115	292	0	155
2911	Petroleum Refining	997	32,243	5,475	630	666	88	287	0	150
30	Rubber and Misc. Plastics Products	251	31,305	W	785	107	W	375	0	4
31	Leather and Leather Products	16	1,390	548	169	5	1	61	0	*
32	Stone, Clay and Glass Products	959	34,017	2,299	6,013	451	47	12,961	390	26
3241	Cement, Hydraulic	310	9,861	Q	892	29	*	9,829	127	15
33	Primary Metal Industries	1,773	150,834	6,235	2,547	719	60	2,650	14,919	29
3312	Blast Furnaces and Steel Mills	1,007	42,328	5,754	1,045	425	12	1,573	13,366	16
3334	Primary Aluminum	246	65,973	2	74	19	2	0	0	1
34	Fabricated Metal Products	343	31,051	737	1,202	197	49	417	39	8
35	Industrial Machinery and Equipment	278	33,894	556	1,476	123	32	806	Q	3
36	Electronic and Other Electric Equipment	215	31,878	725	917	82	33	324	9	2
37	Transportation Equipment	350	37,965	2,970	W	134	24	1,646	W	9
38	Instruments and Related Products	112	14,339	917	368	31	Q	975	0	1
39	Misc. Manufacturing Industries	40	4,183	195	275	19	6	82	0	1
	Total	11,052	728,168	79,945	36,161	5,132	713	57,229	15,765	837
Northeast Census Region										
20	Food and Kindred Products	90	6,146	W	1,334	41	W	W	0	3
21	Tobacco Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
22	Textile Mill Products	26	1,629	1,067	246	9	9	28	0	2
23	Apparel and Other Textile Products	15	1,330	250	282	7	Q	0	0	*
24	Lumber and Wood Products	19	1,254	Q	Q	5	4	0	0	Q
25	Furniture and Fixtures	6	535	71	109	3	Q	0	0	Q
26	Paper and Allied Products	223	8,999	13,419	W	W	21	W	0	W
2621	Paper Mills	169	W	11,307	W	19	16	W	0	27
2631	Paperboard Mills	20	531	783	217	7	1	157	0	*
27	Printing and Publishing	21	3,049	39	297	6	Q	0	0	2
28	Chemicals and Allied Products	168	12,745	W	W	46	W	195	0	W
2819	Industrial Inorganic Chemicals, nec	8	411	438	99	3	*	*	0	*
2821	Plastics Materials and Resins	W	1,281	1,224	98	5	W	W	0	2
2869	Industrial Organic Chemicals, nec	44	2,448	1,968	170	8	4	0	0	13
2873	Nitrogenous Fertilizers	*	17	0	*	*	0	0	0	*
29	Petroleum and Coal Products	71	3,161	1,558	1,078	25	4	W	0	14
2911	Petroleum Refining	58	2,568	1,426	46	22	4	194	0	W
30	Rubber and Misc. Plastics Products	39	5,101	W	464	11	W	W	0	Q
31	Leather and Leather Products	W	W	403	116	W	*	Q	0	Q
32	Stone, Clay and Glass Products	152	5,892	990	1,105	84	7	1,274	55	2
3241	Cement, Hydraulic	36	1,312	Q	113	*	*	1,162	52	1
33	Primary Metal Industries	236	18,444	1,475	734	107	25	376	1,382	4
3312	Blast Furnaces and Steel Mills	144	8,342	1,059	212	69	4	38	1,313	2
3334	Primary Aluminum	W	W	2	7	W	*	0	0	*
34	Fabricated Metal Products	70	5,125	388	774	41	12	35	10	Q
35	Industrial Machinery and Equipment	47	6,782	514	693	15	4	56	0	*
36	Electronic and Other Electric Equipment	56	8,128	515	666	18	11	23	8	1
37	Transportation Equipment	55	4,882	1,702	713	16	3	249	0	1
38	Instruments and Related Products	52	4,222	842	307	8	1	975	0	*
39	Misc. Manufacturing Industries	W	W	159	202	W	2	65	0	*
	Total	1,371	99,264	33,195	11,803	489	W	5,108	1,455	W

See footnotes at end of table.

Table 4. Total Consumption of Offsite-Produced Energy for Heat, Power and Electricity Generation by Census Region, Industry Group, and Selected Industries, 1988 (Continued)
(Estimates in Btu or Physical Units)

SIC Code ^a	Industry Groups and Industry	Total (trillion Btu)	Electricity ^b (million kWh)	Residual Fuel Oil (1000 bbls)	Distillate Fuel Oil (1000 bbls)	Natural Gas (billion cu ft)	LPG (million gallons)	Coal (1000 short tons)	Coke and Breeze (1000 short tons)	Other ^c (trillion Btu)
Midwest Census Region										
20	Food and Kindred Products	411	19,483	1,608	W	202	Q	4,667	W	10
21	Tobacco Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
22	Textile Mill Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
23	Apparel and Other Textile Products	9	930	Q	40	5	Q	Q	0	*
24	Lumber and Wood Products	25	2,000	Q	W	7	W	Q	0	4
25	Furniture and Fixtures	19	1,712	14	104	11	3	45	0	*
26	Paper and Allied Products	288	13,326	W	W	80	9	4,660	0	24
2621	Paper Mills	148	6,519	W	W	37	2	2,947	0	14
2631	Paperboard Mills	64	2,205	251	19	16	1	1,339	0	7
27	Printing and Publishing	50	6,313	Q	Q	26	4	0	0	1
28	Chemicals and Allied Products	386	28,694	W	W	157	W	3,976	W	21
2819	Industrial Inorganic Chemicals, nec	W	10,839	W	8	W	*	166	1	*
2821	Plastics Materials and Resins	W	2,943	148	14	20	W	W	0	W
2869	Industrial Organic Chemicals, nec	91	2,478	85	56	36	*	1,835	0	4
2873	Nitrogenous Fertilizers	30	570	0	3	27	*	0	0	Q
29	Petroleum and Coal Products	130	6,778	2,448	1,316	61	27	W	0	18
2911	Petroleum Refining	105	6,196	2,274	80	49	21	W	0	W
30	Rubber and Misc. Plastics Products	100	11,789	W	78	49	W	W	0	1
31	Leather and Leather Products	5	Q	Q	Q	2	1	Q	0	Q
32	Stone, Clay and Glass Products	297	9,615	61	W	126	9	5,116	W	W
3241	Cement, Hydraulic	93	2,696	*	W	4	*	3,108	*	W
33	Primary Metal Industries	906	51,834	2,357	816	376	21	1,662	10,729	17
3312	Blast Furnaces and Steel Mills	626	19,901	2,352	595	250	7	1,212	9,775	12
3334	Primary Aluminum	W	W	0	6	W	*	0	0	1
34	Fabricated Metal Products	165	14,474	334	212	96	21	357	15	3
35	Industrial Machinery and Equipment	142	14,737	Q	411	67	17	741	Q	2
36	Electronic and Other Electric Equipment	65	7,723	134	41	31	7	204	0	1
37	Transportation Equipment	190	18,125	686	W	75	W	1,328	W	6
38	Instruments and Related Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	10	928	Q	65	6	*	17	0	*
	Total	3,198	211,658	11,949	7,098	1,388	W	23,071	11,065	W
South Census Region										
20	Food and Kindred Products	253	17,515	1,998	W	130	W	794	11	15
21	Tobacco Products	26	1,445	217	81	2	1	787	0	*
22	Textile Mill Products	241	27,214	1,956	888	78	21	1,734	*	11
23	Apparel and Other Textile Products	27	3,986	Q	75	9	3	113	0	Q
24	Lumber and Wood Products	78	9,210	W	W	14	11	Q	0	22
25	Furniture and Fixtures	25	3,103	100	378	7	9	87	0	2
26	Paper and Allied Products	694	24,357	9,956	919	W	17	7,570	0	W
2621	Paper Mills	285	12,228	2,394	484	87	4	3,988	0	46
2631	Paperboard Mills	320	6,330	5,828	115	95	2	3,476	0	65
27	Printing and Publishing	33	5,846	65	40	10	3	0	0	1
28	Chemicals and Allied Products	1,920	77,026	6,363	1,109	1,209	W	8,568	W	172
2819	Industrial Inorganic Chemicals, nec	165	11,992	W	W	W	3	W	W	4
2821	Plastics Materials and Resins	185	8,911	W	68	W	3	W	0	W
2869	Industrial Organic Chemicals, nec	785	14,474	1,388	179	535	3	2,229	0	125
2873	Nitrogenous Fertilizers	131	1,646	0	20	119	*	0	0	3
29	Petroleum and Coal Products	692	16,040	935	641	519	26	W	0	90
2911	Petroleum Refining	668	15,507	694	79	504	14	W	0	89
30	Rubber and Misc. Plastics Products	95	12,065	1,253	214	39	6	109	0	2
31	Leather and Leather Products	W	W	Q	10	W	Q	0	0	Q
32	Stone, Clay and Glass Products	364	13,098	W	W	182	18	4,260	Q	10
3241	Cement, Hydraulic	111	3,730	9	W	15	*	3,417	18	W
33	Primary Metal Industries	443	46,303	2,284	568	175	11	W	2,749	W
3312	Blast Furnaces and Steel Mills	210	11,504	2,284	225	88	1	W	2,277	W
3334	Primary Aluminum	86	22,738	0	42	8	*	0	0	*
34	Fabricated Metal Products	75	7,903	15	159	43	11	25	14	1
35	Industrial Machinery and Equipment	50	7,622	22	Q	19	9	Q	1	1
36	Electronic and Other Electric Equipment	64	9,830	77	183	25	Q	98	Q	*
37	Transportation Equipment	63	8,364	554	224	26	6	65	*	1
38	Instruments and Related Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	W	W	33	8	W	Q	0	0	Q
	Total	5,177	296,328	26,338	12,313	2,717	208	W	3,054	W

See footnotes at end of table.

Table 4. Total Consumption of Offsite-Produced Energy for Heat, Power and Electricity Generation by Census Region, Industry Group, and Selected Industries, 1988 (Continued)
(Estimates in Btu or Physical Units)

SIC Code ^a	Industry Groups and Industry	Total (trillion Btu)	Electricity ^b (million kWh)	Residual Fuel Oil (1000 bbls)	Distillate Fuel Oil (1000 bbls)	Natural Gas (billion cu ft)	LPG (million gallons)	Coal (1000 short tons)	Coke and Breeze (1000 short tons)	Other ^c (trillion Btu)
West Census Region										
20	Food and Kindred Products	192	8,566	W	1,128	100	W	W	W	8
21	Tobacco Products	0	0	0	0	0	0	0	0	0
22	Textile Mill Products	5	538	0	8	3	Q	0	0	•
23	Apparel and Other Textile Products	2	418	0	0	1	Q	0	0	Q
24	Lumber and Wood Products	78	7,489	Q	1,197	8	W	0	0	35
25	Furniture and Fixtures	NA	NA	NA	NA	NA	NA	NA	NA	NA
26	Paper and Allied Products	224	14,333	W	183	78	5	W	0	W
2621	Paper Mills	84	W	W	47	30	1	W	0	17
2631	Paperboard Mills	97	4,421	1,653	107	37	1	37	0	33
27	Printing and Publishing	11	1,858	0	Q	4	5	0	0	Q
28	Chemicals and Allied Products	95	11,462	W	126	48	1	175	W	W
2819	Industrial Inorganic Chemicals, nec	W	4,433	W	54	9	•	175	W	•
2821	Plastics Materials and Resins	1	123	2	2	1	•	0	0	•
2869	Industrial Organic Chemicals, nec	4	53	0	1	4	•	0	0	•
2873	Nitrogenous Fertilizers	24	725	0	1	21	•	0	0	•
29	Petroleum and Coal Products	177	8,192	1,202	810	95	58	0	0	33
2911	Petroleum Refining	166	7,971	1,080	424	90	49	0	0	32
30	Rubber and Misc. Plastics Products	16	2,349	43	Q	8	2	0	0	Q
31	Leather and Leather Products	1	82	0	Q	1	Q	0	0	Q
32	Stone, Clay and Glass Products	146	5,412	W	723	58	13	2,311	W	W
3241	Cement, Hydraulic	70	2,123	114	236	10	•	2,143	58	1
33	Primary Metal Industries	187	34,253	119	429	61	3	W	58	W
3312	Blast Furnaces and Steel Mills	28	2,580	60	13	17	•	W	1	W
3334	Primary Aluminum	93	25,611	0	19	5	1	0	0	•
34	Fabricated Metal Products	34	3,548	0	57	18	5	0	0	Q
35	Industrial Machinery and Equipment	39	4,754	0	26	21	2	0	0	1
36	Electronic and Other Electric Equipment	30	6,197	0	27	8	•	0	0	Q
37	Transportation Equipment	42	6,594	W	W	17	W	4	0	1
38	Instruments and Related Products	23	4,230	•	8	8	•	0	0	1
39	Misc. Manufacturing Industries	2	306	0	Q	1	•	0	0	Q
	Total	1,306	120,918	8,464	4,947	538	145	W	191	W

^a See Appendices A and D for descriptions of the Standard Industrial Classification system.

^b "Electricity" consists of quantities of electricity that were purchased or transferred in, and is equivalent to "purchased electricity" as defined in the *Annual Survey of Manufactures*.

^c "Other" includes all other energy that was purchased or transferred in and not shown elsewhere.

• Estimate less than 0.5 rounded to zero.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Q=Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

NA=Not available. Data are included in higher level totals.

Notes: •Totals may not equal sum of components because of independent rounding. •The derived estimates presented in this table represent the consumption of energy originally produced offsite, acquired as a result of a purchase or transfer and consumed onsite for the production of heat and power. This definition is consistent with the definition of "purchased" fuels and electric energy used by the Bureau of the Census in the preparation of "Fuels and Electric Energy Consumed," of the *Annual Survey of Manufactures*, for 1974 through 1981. See Appendix A.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey."

Table 5. Shell Storage Capacity of Selected Petroleum Products by Industry Group and Selected Industries, 1988
(Thousand Liquid Barrels)

SIC Code*	Industry Groups and Industry	Residual Fuel Oil	Distillate Fuel Oil	LPG
20	Food and Kindred Products	2,382	1,971	545
21	Tobacco Products	187	35	5
22	Textile Mill Products	1,117	411	346
23	Apparel and Other Textile Products	81	335	39
24	Lumber and Wood Products	Q	686	185
25	Furniture and Fixtures	111	195	135
26	Paper and Allied Products	4,344	1,053	181
2621	<i>Paper Mills</i>	2,087	352	39
2631	<i>Paperboard Mills</i>	1,493	347	17
27	Printing and Publishing	91	172	153
28	Chemicals and Allied Products	5,035	2,118	83,268
2819	<i>Industrial Inorganic Chemicals, nec</i>	467	234	50
2821	<i>Plastics Materials and Resins</i>	449	256	8,522
2869	<i>Industrial Organic Chemicals, nec</i>	1,093	652	72,287
2873	<i>Nitrogenous Fertilizers</i>	84	31	10
29	Petroleum and Coal Products	209	Q	37
2911	<i>Petroleum Refining</i>	NA	NA	NA
30	Rubber and Misc. Plastics Products	1,155	556	160
31	Leather and Leather Products	Q	172	7
32	Stone, Clay and Glass Products	815	3,737	675
3241	<i>Cement, Hydraulic</i>	215	247	9
33	Primary Metal Industries	4,392	2,586	926
3312	<i>Blast Furnaces and Steel Mills</i>	4,178	1,083	104
3334	<i>Primary Aluminum</i>	W	148	65
34	Fabricated Metal Products	422	785	560
35	Industrial Machinery and Equipment	343	900	449
36	Electronic and Other Electric Equipment	310	709	385
37	Transportation Equipment	718	768	376
38	Instruments and Related Products	286	270	55
39	Misc. Manufacturing Industries	42	129	45
	Total	22,206	21,158	88,531

* See Appendices A and D for descriptions of the Standard Industrial Classification system.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Q=Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

NA=Not available. Data included in higher level totals.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey."

TOTAL MANUFACTURING
ENERGY

Table 6. Selected Energy Operating Ratios by Census Region, Industry Group, and Selected Industries, 1988

SIC Code ^a	Industry Groups and Industry	Consumption per Employee (million Btu)	Consumption per Dollar of Value Added (thousand Btu)	Consumption per Dollar of Value of Shipments (thousand Btu)	Major Byproducts ^b as a Percent of Consumption (percent)	Fuel Oil ^c as a Percent of Natural Gas (percent)
Total United States						
20	Food and Kindred Products	694.4	7.6	2.8	0.0	W
21	Tobacco Products	579.8	1.4	1.0	0.0	78.5
22	Textile Mill Products	451.0	10.8	4.4	0.0	27.6
23	Apparel and Other Textile Products	42.3	1.3	0.7	0.0	19.5
24	Lumber and Wood Products	550.9	13.0	5.5	0.0	72.3
25	Furniture and Fixtures	131.1	3.1	1.7	0.0	20.3
26	Paper and Allied Products	3,497.5	36.7	17.2	35.5	44.5
2621	Paper Mills	8,438.4	64.4	32.8	30.8	58.2
2631	Paperboard Mills	15,726.2	96.3	52.6	40.5	35.1
27	Printing and Publishing	73.3	1.3	0.9	0.0	6.2
28	Chemicals and Allied Products	3,601.0	22.4	11.6	9.2	7.9
2819	Industrial Inorganic Chemicals, nec	3,729.6	33.1	19.7	2.5	W
2821	Plastics Materials and Resins	5,065.6	23.8	9.7	5.9	W
2869	Industrial Organic Chemicals, nec	11,056.6	45.7	21.3	19.9	4.5
2873	Nitrogenous Fertilizers	35,881.4	192.1	81.2	2.1	0.1
29	Petroleum and Coal Products	28,414.2	127.0	23.7	48.3	17.2
2911	Petroleum Refining	41,320.5	143.4	25.2	49.4	14.8
30	Rubber and Misc. Plastics Products	328.6	5.6	2.9	0.2	W
31	Leather and Leather Products	108.1	3.3	1.5	0.0	92.5
32	Stone, Clay and Glass Products	2,036.5	29.5	16.3	0.0	10.7
3241	Cement, Hydraulic	18,424.1	150.7	79.3	0.0	26.8
33	Primary Metal Industries	3,781.9	45.9	17.6	16.5	7.3
3312	Blast Furnaces and Steel Mills	9,721.1	95.9	39.8	23.2	9.7
3334	Primary Aluminum	13,077.9	65.3	30.8	0.0	2.2
34	Fabricated Metal Products	251.1	4.4	2.2	0.0	5.7
35	Industrial Machinery and Equipment	145.0	2.0	1.1	0.0	9.6
36	Electronic and Electric Equipment	143.6	2.2	1.2	0.0	11.8
37	Transportation Equipment	192.7	2.4	1.0	0.0	W
38	Instruments and Related Products	103.9	1.3	0.9	0.0	24.7
39	Misc. Manufacturing Industries	110.4	2.2	1.2	0.0	14.4
	All Manufacturing	868.1	12.1	5.7	19.6	14.8
Northeast Census Region						
20	Food and Kindred Products	480.2	4.4	1.9	0.0	W
21	Tobacco Products	NA	NA	NA	NA	NA
22	Textile Mill Products	341.8	8.5	3.9	0.0	86.9
23	Apparel and Other Textile Products	43.3	1.4	0.6	0.0	48.0
24	Lumber and Wood Products	279.5	6.8	3.4	0.0	Q
25	Furniture and Fixtures	145.7	3.2	2.0	0.0	36.0
26	Paper and Allied Products	2,171.4	25.8	12.0	W	W
2621	Paper Mills	5,799.5	55.8	25.9	19.0	W
2631	Paperboard Mills	5,082.9	63.7	30.9	0.0	81.2
27	Printing and Publishing	56.3	1.0	0.7	0.0	30.1
28	Chemicals and Allied Products	834.8	5.3	3.2	0.2	W
2819	Industrial Inorganic Chemicals, nec	1,318.4	13.1	6.0	0.0	109.7
2821	Plastics Materials and Resins	W	W	W	W	173.5
2869	Industrial Organic Chemicals, nec	2,120.4	14.5	7.3	0.4	163.6
2873	Nitrogenous Fertilizers	5,409.6	106.7	27.2	0.0	0.3
29	Petroleum and Coal Products	14,987.5	115.6	18.1	W	W
2911	Petroleum Refining	29,998.6	168.5	20.5	W	W
30	Rubber and Misc. Plastics Products	295.3	5.3	2.7	1.2	W
31	Leather and Leather Products	W	W	W	0.0	W
32	Stone, Clay and Glass Products	1,634.1	23.1	13.8	0.0	14.6
3241	Cement, Hydraulic	16,829.6	126.9	64.5	0.0	1,464.2
33	Primary Metal Industries	2,125.8	29.2	11.1	19.5	12.2
3312	Blast Furnaces and Steel Mills	5,692.3	62.7	26.2	W	11.0
3334	Primary Aluminum	W	W	W	0.0	W
34	Fabricated Metal Products	266.8	4.7	2.7	0.0	16.6
35	Industrial Machinery and Equipment	117.2	1.6	1.0	0.0	47.4
36	Electronic and Electric Equipment	142.1	2.2	1.3	0.0	38.2
37	Transportation Equipment	199.5	2.7	1.4	0.0	89.0
38	Instruments and Related Products	133.5	1.6	1.1	0.0	87.8
39	Misc. Manufacturing Industries	W	W	W	0.0	W
	All Manufacturing	453.1	6.5	3.5	12.9	58.2

See footnotes at end of table.

Table 6. Selected Energy Operating Ratios by Census Region, Industry Group, and Selected Industries, 1988 (Continued)

SIC Code*	Industry Groups and Industry	Consumption per Employee (million Btu)	Consumption per Dollar of Value Added (thousand Btu)	Consumption per Dollar of Value of Shipments (thousand Btu)	Major Byproducts ^b as a Percent of Consumption (percent)	Fuel Oil ^c as a Percent of Natural Gas (percent)
Midwest Census Region						
20	Food and Kindred Products	895.4	8.8	2.9	0.1	W
21	Tobacco Products	NA	NA	NA	NA	NA
22	Textile Mill Products	NA	NA	NA	NA	NA
23	Apparel and Other Textile Products	75.8	1.0	0.5	0.0	10.7
24	Lumber and Wood Products	329.1	9.9	4.3	0.0	W
25	Furniture and Fixtures	150.3	2.7	1.5	0.0	6.3
26	Paper and Allied Products	1,467.1	17.0	7.4	W	W
2621	Paper Mills	5,059.5	49.8	22.0	18.1	W
2631	Paperboard Mills	8,373.5	61.0	36.2	6.0	10.1
27	Printing and Publishing	92.9	1.6	1.0	0.0	0.8
28	Chemicals and Allied Products	2,047.3	13.2	7.2	W	W
2819	Industrial Inorganic Chemicals, nec	W	W	W	0.0	W
2821	Plastics Materials and Resins	W	W	W	W	5.0
2869	Industrial Organic Chemicals, nec	5,705.4	35.2	16.5	0.2	2.3
2873	Nitrogenous Fertilizers	34,048.2	237.2	99.8	3.1	0.1
29	Petroleum and Coal Products	17,918.6	95.9	20.0	53.4	W
2911	Petroleum Refining	36,848.1	120.0	22.2	56.3	W
30	Rubber and Misc. Plastics Products	332.3	6.4	3.0	0.0	W
31	Leather and Leather Products	139.9	3.8	1.8	0.0	38.7
32	Stone, Clay and Glass Products	2,288.9	30.9	17.4	0.0	W
3241	Cement, Hydraulic	20,398.6	163.9	90.9	0.0	W
33	Primary Metal Industries	4,632.1	59.8	23.1	18.1	5.1
3312	Blast Furnaces and Steel Mills	11,983.2	116.0	46.0	22.4	7.1
3334	Primary Aluminum	W	W	W	0.0	W
34	Fabricated Metal Products	286.9	4.8	2.4	0.0	3.4
35	Industrial Machinery and Equipment	175.2	2.4	1.4	0.0	3.6
36	Electronic and Other Electric Equipment	163.4	2.5	1.3	0.0	3.4
37	Transportation Equipment	287.2	3.0	1.0	0.0	W
38	Instruments and Related Products	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	129.4	2.2	1.3	0.0	6.5
	All Manufacturing	793.6	10.5	4.6	13.7	9.9
South Census Region						
20	Food and Kindred Products	530.4	6.7	2.5	0.0	W
21	Tobacco Products	582.3	1.4	1.0	0.0	81.0
22	Textile Mill Products	468.9	11.4	4.5	0.0	22.2
23	Apparel and Other Textile Products	38.0	1.5	0.8	0.0	5.5
24	Lumber and Wood Products	636.5	18.4	6.3	0.0	W
25	Furniture and Fixtures	130.6	3.7	1.8	0.0	39.1
26	Paper and Allied Products	5,806.3	53.0	26.8	43.2	W
2621	Paper Mills	12,672.8	74.2	43.1	39.8	20.0
2631	Paperboard Mills	18,006.0	100.5	55.6	44.2	36.0
27	Printing and Publishing	73.2	1.4	0.9	0.0	6.0
28	Chemicals and Allied Products	6,315.0	35.9	17.1	W	4.2
2819	Industrial Inorganic Chemicals, nec	3,963.8	36.8	22.2	W	W
2821	Plastics Materials and Resins	7,091.0	28.6	11.1	W	W
2869	Industrial Organic Chemicals, nec	15,578.0	52.4	24.2	22.8	2.3
2873	Nitrogenous Fertilizers	44,301.5	193.8	85.0	2.0	0.1
29	Petroleum and Coal Products	34,693.3	135.1	24.7	47.9	W
2911	Petroleum Refining	43,977.1	145.0	25.7	48.6	W
30	Rubber and Misc. Plastics Products	389.5	5.7	3.1	0.1	22.8
31	Leather and Leather Products	W	W	W	0.0	W
32	Stone, Clay and Glass Products	1,912.3	31.3	16.6	0.0	W
3241	Cement, Hydraulic	17,714.3	162.1	82.7	0.0	W
33	Primary Metal Industries	3,808.8	44.7	16.5	W	9.8
3312	Blast Furnaces and Steel Mills	9,148.0	84.6	38.6	23.4	17.3
3334	Primary Aluminum	14,272.2	55.0	28.2	0.0	2.9
34	Fabricated Metal Products	230.3	4.6	1.8	0.0	2.3
35	Industrial Machinery and Equipment	124.2	1.9	0.9	0.0	10.8
36	Electronic and Other Electric Equipment	152.6	2.3	1.1	0.0	6.1
37	Transportation Equipment	149.4	2.0	0.8	0.0	18.2
38	Instruments and Related Products	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	W	W	W	0.0	W
	All Manufacturing	1,252.6	18.2	8.1	23.3	9.0

See footnotes at end of table.

Table 6. Selected Energy Operating by Census Region, Industry Group, and Selected Industries, 1988 (Continued)

SIC Code ^a	Industry Groups and Industry	Consumption per Employee (million Btu)	Consumption per Dollar of Value Added (thousand Btu)	Consumption per Dollar of Value of Shipments (thousand Btu)	Major Byproducts ^b as a Percent of Consumption (percent)	Fuel Oil ^c as a Percent of Natural Gas (percent)
West Census Region						
20	Food and Kindred Products	831.2	9.4	3.7	0.0	W
21	Tobacco Products	0.0	0.0	0.0	0.0	0.0
22	Textile Mill Products	474.7	9.5	3.2	0.0	1.7
23	Apparel and Other Textile Products	25.0	1.0	0.5	0.0	0.0
24	Lumber and Wood Products	650.9	11.7	5.5	0.0	98.3
25	Furniture and Fixtures	NA	NA	NA	NA	NA
26	Paper and Allied Products	4,327.5	45.2	20.8	W	W
2621	<i>Paper Mills</i>	12,548.1	74.5	37.2	35.4	W
2631	<i>Paperboard Mills</i>	18,230.6	111.4	56.6	45.6	29.3
27	Printing and Publishing	54.1	0.9	0.6	0.0	Q
28	Chemicals and Allied Products	1,979.1	21.2	11.1	W	W
2819	<i>Industrial Inorganic Chemicals, nec</i>	W	W	W	W	W
2821	<i>Plastics Materials and Resins</i>	827.2	3.5	1.3	0.0	3.4
2869	<i>Industrial Organic Chemicals, nec</i>	5,105.8	35.9	19.0	0.0	0.1
2873	<i>Nitrogenous Fertilizers</i>	19,044.2	150.5	58.1	1.2	0.0
29	Petroleum and Coal Products	38,486.2	143.1	27.3	W	W
2911	<i>Petroleum Refining</i>	43,660.3	151.8	28.3	W	W
30	Rubber and Misc. Plastics Products	193.0	3.4	1.8	0.0	5.7
31	Leather and Leather Products	89.9	1.9	1.0	0.0	0.3
32	Stone, Clay and Glass Products	2,506.3	31.5	16.6	0.0	W
3241	<i>Cement, Hydraulic</i>	17,953.2	133.7	70.3	0.0	21.1
33	Primary Metal Industries	3,958.1	30.6	12.3	W	5.2
3312	<i>Blast Furnaces and Steel Mills</i>	8,682.6	82.5	35.9	W	2.6
3334	<i>Primary Aluminum</i>	12,919.8	67.9	32.6	0.0	1.9
34	Fabricated Metal Products	164.0	2.7	1.9	0.0	1.8
35	Industrial Machinery and Equipment	129.3	1.5	0.8	0.0	Q
36	Electronic and Other Electric Equipment	104.6	1.4	1.0	0.0	1.9
37	Transportation Equipment	93.0	1.3	0.7	0.0	W
38	Instruments and Related Products	74.6	1.0	0.7	0.0	0.5
39	Misc. Manufacturing Industries	39.5	1.0	0.5	0.0	Q
	All Manufacturing	761.0	10.5	5.4	23.5	17.3

^a See Appendices A and D for descriptions of the Standard Industrial Classification system.

^b "Major Byproduct" fuels include coke oven and blast furnace gas (produced primarily in the blast furnace industry, SIC 3312); still gas (produced primarily in refineries, SIC 2911); and pulping liquor (produced primarily in pulp and paper mills, SIC 2611 and 2621).

^c "Fuel Oil" includes distillate and residual.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Q=Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

NA=Not available. Data are included in higher level totals.

Note: Operating ratios were calculated using the input energy estimates reported in Table 2.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey," and Bureau of the Census, Industry Division, data files for the "1988 Annual Survey of Manufactures" and the "1987 Census of Manufactures."

Table 7. Total Primary Consumption of Energy for All Purposes by Economic Characteristics of the Establishment, 1988
(Estimates in Btu or Physical Units)

Economic Characteristics ^a	Total (trillion Btu)	Net Electricity ^b (million kWh)	Residual Fuel Oil (1000 bbls)	Distillate Fuel Oil (1000 bbls)	Natural Gas (billion cu ft)	LPG (million gallons)	Coal (1000 short tons)	Coke and Breeze (1000 short tons)	Other ^c (trillion Btu)
Value of Shipments and Receipts (million dollars)									
Under 20	1,576	124,742	7,723	16,705	663	261	4,584	857	173
20-49	1,698	107,914	12,258	6,692	716	224	9,058	521	239
50-99	1,637	89,298	11,673	4,434	680	171	12,891	741	192
100-249	2,727	125,474	16,560	2,932	1,061	1,360	15,894	752	573
250-499	3,124	130,485	22,598	3,189	712	2,837	14,788	942	1,176
500 and Over	6,514	124,964	22,931	3,913	1,863	6,658	40,367	13,115	2,071
Not ascertained ^d	3,256	0	0	0	0	0	0	0	3,256 2,841
Total	20,534 20,534	702,876	93,744	37,865	5,695	11,512	97,582	16,929	7,682 7,265
Employment Size									
Under 50	680	52,920	1,644	11,298	313	168	729	125	67
50-99	821	45,874	7,515	4,294	375	82	3,366	298	116
100-249	2,506	118,774	15,704	7,071	1,022	1,197	12,853	869	490
250-499	3,100	121,648	16,134	5,189	1,030	2,458	12,032	734	981
500-999	4,030	161,860	19,819	4,210	1,192	2,983	16,377	791	1,427
1,000 and Over	6,140	201,800	32,929	5,803	1,763	4,623	52,226	14,113	1,343
Not ascertained ^d	3,256	0	0	0	0	0	0	0	3,256
Total	20,534	702,876	93,744	37,865	5,695	11,512	97,582	16,929	7,682

^a Value of Shipments and Receipts and Employment Size were supplied by the Bureau of the Census.

^b "Net Electricity" is obtained by summing purchases, transfers in, and generation from noncombustible renewable resources, minus quantities sold and transferred out. It does not include electricity inputs from onsite cogeneration or generation from combustible fuels because that energy has already been included as generating fuel (for example, coal).

^c "Other" includes net steam (the sum of purchases, generation from renewables, and net transfers), and other energy that respondents indicated was used to produce heat and power or as feedstock/raw material inputs. See also Footnote "d."

^d The entry in the "Not ascertained" row and the "Other" column consists of the feedstocks and raw material inputs that were consumed by petroleum refineries for the production of nonenergy products (i.e., asphalt, waxes, lubricants, and solvents), as well as feedstock consumption at adjoining petrochemical plants. That entry includes all of those inputs, regardless of type. Those inputs that were converted to other energy products by petroleum refineries (e.g., crude oil converted to residual and distillate fuel oils) are excluded. The quantities of energy consumed by petroleum refineries for the production of heat and power are included in the appropriate "Value of Shipments and Receipts" or "Employment Size" rows. See Appendix A for more information.

Notes: •Totals may not equal sum of components because of independent rounding. •The derived estimates presented in this table are for the primary consumption of energy for heat and power and as feedstocks or raw material inputs. Primary consumption is defined as the consumption of the energy that was originally produced offsite or was produced onsite from input materials not classified as an energy. Examples of the latter are hydrogen produced from the electrolysis of brine; the output of captive (onsite) mines or wells; woodchips, bark, and woodwaste from wood purchased as a raw material input; and waste materials such as wastepaper and packing materials. Primary consumption excludes quantities of energy that are produced from other energy inputs and, therefore, avoids double counting.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey," the Office of Oil and Gas, Petroleum Supply Division, Form EIA-810, "Monthly Refinery Report" for 1988, and Bureau of the Census, Industry Division, data files for the "1988 Annual Survey of Manufactures" and the "1987 Census of Manufactures."

Table 8. Total Primary Consumption of Combustible Energy for Nonfuel Purposes by Economic Characteristics of the Establishment, 1988
(Estimates in Btu or Physical Units)

Economic Characteristics ^a	Total (trillion Btu)	Residual Fuel Oil (1000 bbls)	Distillate Fuel Oil (1000 bbls)	Natural Gas (billion cu ft)	LPG (million gallons)	Coal (1000 short tons)	Coke and Breeze (1000 short tons)	Other ^b (trillion Btu)
Value of Shipments and Receipts (million dollars)								
Under 20	61	Q	562	19	23	486	103	14
20-49	130	2,202	66	64	60	789	143	20
50-99	252	W	103	76	56	4,467	303	42
100-249	430	Q	58	175	1,273	W	W	11
250-499	510	W	327	81	2,691	W	94	139
500 and Over	1,491	W	79	141	6,182	28,116	W	48
Not ascertained ^c	2,256	0	0	0	0	0	0	2,256
Total	5,716 5,716	4,239	1,196	554	10,286	40,070	1,164	2,504 3,114
Employment Size								
Under 50	50	Q	430	32	24	161	Q	7
50-99	95	2,689	182	42	Q	30	Q	30
100-249	318	W	W	155	916	1,207	273	35
250-499	478	0	357	122	2,241	2,224	200	91
500-999	609	Q	34	121	2,762	6,509	541	57
1,000 and Over	1,324	W	W	82	4,327	29,940	85	52
Not ascertained ^c	8,256	0	0	0	0	0	0	8,256
Total	8,132 8,132	4,239	1,196	554	10,286	40,070	1,164	8,531

^a Value of Shipments and Receipts and Employment Size were supplied by the Bureau of the Census. See Appendix A.

^b "Other" includes all other energy that respondents indicated was used for nonfuel purposes, i.e., as petrochemical feedstocks or raw material inputs. See also Footnote "c."

^c The entry in the "Not ascertained" row and the "Other" column consists of the feedstocks and raw material inputs that were consumed by petroleum refineries for the production of nonenergy products (i.e., asphalt, waxes, lubricants, and solvents) as well as nonfuel consumption at adjoining petrochemical plants. That entry includes all of those inputs, regardless of type. Those inputs that were converted to other energy products by petroleum refineries (e.g., crude oil converted to residual and distillate fuel oils) are excluded. See Appendix A for more information.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Q=Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

Notes: •Totals may not equal sum of components because of independent rounding. •The derived estimates presented in this table are for the primary consumption of energy as feedstocks or raw material inputs. Primary consumption is defined as the consumption of energy that was originally produced offsite or was produced onsite from input materials not classified as an energy. Examples of the latter are hydrogen produced from the electrolysis of brine; the output of captive (onsite) mines or wells; woodchips, bark, and woodwaste from wood purchased as a raw material input; and waste materials such as wastepaper and packing materials. Primary consumption excludes quantities of energy that are produced from other energy inputs and, therefore, avoids double counting.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey" and Bureau of the Census, Industry Division, data files for the "1988 Annual Survey of Manufactures" and the "1987 Census of Manufactures."

Table 9. Total Inputs of Energy for Heat, Power, and Electricity Generation by Economic Characteristics of the Establishment, 1988
(Estimates in Btu or Physical Units)

Economic Characteristics ^a	Total (trillion Btu)	Net Electricity ^b (million kWh)	Residual Fuel Oil (1000 bbls)	Distillate Fuel Oil (1000 bbls)	Natural Gas (billion cu ft)	LPG (million gallons)	Coal (1000 short tons)	Coke and Breeze (1000 short tons)	Other ^c (trillion Btu)
Value of Shipments and Receipts (million dollars)									
Under 20	1,535	124,742	6,568	16,147	645	237	4,098	754	180
20-49	1,598	107,914	10,057	6,825	652	164	8,269	378	248
50-99	1,422	89,298	11,928	4,405	605	115	8,424	465	184
100-249	2,375	125,474	16,548	2,874	886	87	11,516	1,131	620
250-499	2,685	130,485	22,916	2,863	631	146	12,954	2,078	1,075
500 and Over	5,874	124,964	22,397	3,852	1,722	477	12,251	27,651	2,510
Total	15,489	702,876	90,413	36,766	5,141	1,226	57,512	32,456	4,817
Employment Size									
Under 50	637	52,920	1,642	10,868	281	143	566	100	67
50-99	743	45,874	4,871	4,117	332	67	3,336	Q	103
100-249	2,230	118,774	14,994	7,025	868	281	11,646	596	497
250-499	2,665	121,648	16,353	4,898	908	217	9,808	534	931
500-999	3,537	161,860	20,445	4,176	1,071	222	9,868	1,109	1,463
1,000 and Over	5,676	201,800	32,109	5,681	1,681	296	22,286	29,860	1,758
Total	15,489	702,876	90,413	36,766	5,141	1,226	57,512	32,456	4,817

^a Value of Shipments and Receipts and Employment Size were supplied by the Bureau of the Census. See Appendix A.

^b "Net Electricity" is obtained by summing purchases, transfers in, and generation from noncombustible renewable resources, minus quantities sold and transferred out. It does not include electricity inputs from onsite cogeneration or generation from combustible fuels because that energy has already been included as generating fuel (for example, coal).

^c "Other" includes net steam (the sum of purchases, generation from renewables, and net transfers), and other energy that respondents indicated was used to produce heat and power.

Q=Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

Notes: •Totals may not equal sum of components because of independent rounding. •The estimates presented in this table are for the total consumption of energy for the production of heat and power, regardless of where the energy was produced. Specifically, the estimates include the quantities of energy that were originally produced offsite and purchased by or transferred to the establishment, plus those that were produced onsite from other energy or from input material not classified as energy, or were extracted from captive (onsite) mines or wells.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey" and Bureau of the Census, Industry Division, data files for the "1988 Annual Survey of Manufactures" and the "1987 Census of Manufactures."

Table 10. Total Consumption of Offsite-Produced Energy for Heat, Power, and Electricity Generation by Economic Characteristics of the Establishment, 1988
(Estimates in Btu or Physical Units)

Economic Characteristics ^a	Total (trillion Btu)	Electricity ^b (million kWh)	Residual Fuel Oil (1000 bbls)	Distillate Fuel Oil (1000 bbls)	Natural Gas (billion cu ft)	LPG (million gallons)	Coal (1000 short tons)	Coke and Breeze (1000 short tons)	Other ^c (trillion Btu)
Value of Shipments and Receipts (million dollars)									
Under 20	1,427	125,210	6,471	16,131	644	233	4,008	754	72
20-49	1,417	112,267	9,984	6,620	650	138	7,986	378	64
50-99	1,326	90,820	11,379	4,299	604	114	8,424	438	89
100-249	1,921	131,225	15,993	2,852	885	77	11,516	299	173
250-499	1,785	134,208	20,219	2,592	630	54	12,954	848	220
500 and Over	3,175	134,438	15,899	3,666	1,719	98	12,251	13,048	219
Total	11,052	728,168	79,945	36,161	5,132	713	57,229	15,765	837
Employment Size									
Under 50	595	53,105	1,551	10,857	280	113	568	100	28
50-99	688	46,336	4,665	3,924	332	66	3,336	257	48
100-249	1,851	126,161	12,615	6,853	866	166	11,599	596	122
250-499	1,912	124,309	14,232	4,804	906	135	9,572	534	197
500-999	2,262	165,974	17,791	4,065	1,070	125	9,868	250	220
1,000 and Over	3,745	212,283	29,090	5,659	1,677	108	22,286	14,028	222
Total	11,052	728,168	79,945	36,161	5,132	713	57,229	15,765	837

^a Value of Shipments and Receipts and Employment Size were supplied by the Bureau of the Census. See Appendix A.

^b "Electricity" consists of quantities of electricity that were purchased or transferred in, and is equivalent to "purchased electricity" in the *Annual Survey of Manufactures*.

^c "Other" includes all other energy that was purchased or transferred in and not shown elsewhere.

Q Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

Notes: •Totals may not equal sum of components because of independent rounding. •The derived estimates presented in this table represent the consumption of energy originally produced offsite, acquired as a result of a purchase or transfer and consumed onsite for the production of heat and power. This definition is consistent with the definition of "purchased" fuels and electric energy used by the Bureau of the Census in the preparation of "Fuels and Electric Energy Consumed," of the *Annual Survey of Manufactures*, 1974 through 1981. See Appendix A.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey" and Bureau of the Census, Industry Division, data files for the "1988 Annual Survey of Manufactures" and the "1987 Census of Manufactures."

Table 11. Shell Storage Capacity of Petroleum Products by Selected Characteristics of the Establishment, 1988
(Thousand Liquid Barrels)

Selected Characteristics	Residual Fuel Oil	Distillate Fuel Oil	LPG
Census Region			
Northeast	4,838	8,079	705
Midwest	5,451	4,843	9,501
South	10,209	6,346	77,780
West	1,708	2,091	545
Total	22,206	21,158	88,531
Value of Shipments and Receipts* (million dollars)			
Under 20	1,879	5,126	1,403
20-49	2,413	2,892	1,362
50-99	3,158	6,144	1,099
100-249	4,245	2,775	2,914
250-499	4,788	2,024	10,038
500 and Over	5,923	2,197	71,716
Total	22,206	21,158	88,531
Employment Size*			
Under 50	448	6,112	455
50-99	1,289	1,414	456
100-249	2,758	3,160	3,929
250-499	3,410	3,012	5,746
500-999	4,808	3,612	12,587
1,000 and Over	9,694	3,849	65,357
Total	22,206	21,158	88,531

* Value of Shipments and Receipts and Employment Size data were supplied by the Bureau of the Census. See Appendix A.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Q=Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey", and Bureau of the Census, Industry Division, data files for the "1988 Annual Survey of Manufactures" and the "1987 Census of Manufactures."

Table 12. Selected Energy Operating Ratios by Economic Characteristics of the Establishment, 1988

Economic Characteristics ^a	Consumption per Employee (million Btu)	Consumption per Dollar of Value Added (thousand Btu)	Consumption per Dollar of Value of Shipments (thousand Btu)	Major Byproducts ^b as a Percent of Consumption (percent)	Fuel Oil ^c as a Percent of Natural Gas (percent)
Value of Shipments and Receipts (million dollars)					
Under 20	219.2	5.1	2.7	2.2	20.4
20-49	487.3	8.4	4.0	0.8	15.2
50-99	703.1	9.9	4.6	3.4	16.2
100-249	1,177.0	12.3	6.1	15.5	13.2
250-499	2,401.9	20.1	9.4	28.1	24.8
500 and Over	2,446.6	18.3	7.7	31.0	9.2
All Manufacturing	868.1	12.1	5.7	19.6	14.8
Employment Size					
Under 50	297.9	6.0	2.9	5.8	25.5
50-99	414.7	7.4	3.4	4.0	16.0
100-249	596.7	10.3	4.7	8.2	15.1
250-499	892.6	12.6	6.0	21.0	14.1
500-999	1404.4	17.4	8.4	26.8	13.9
1,000 and Over	1215.1	12.9	6.1	22.6	13.6
All Manufacturing	868.1	12.1	5.7	19.6	14.8

^a Value of Shipments and Receipts and Employment Size were supplied by the Bureau of the Census. See Appendix A.

^b "Major Byproduct" fuels include coke oven and blast furnace gas (produced primarily in the blast furnace industry, SIC 3312); still gas (produced primarily in refineries, SIC 2911); and pulping liquor (produced primarily in pulp and paper mills, SIC 2611 and 2621).

^c "Fuel Oil" includes distillate and residual.

Note: Operating ratios were calculated using the input energy estimates reported in Table 2.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey," and Bureau of the Census, Industry Division, data files for the "1988 Annual Survey of Manufactures" and the "1987 Census of Manufactures."

Table 14. Components of Total Electricity Demand by Census Region, Industry Group, and Selected Industries, 1988
(Million Kilowatthours)

SIC Code ^a	Industry Groups and Industry	Purchases	Transfers In ^b	Total Onsite Generation ^c	Sales and/or Transfers Offsite	Net Demand for Electricity ^d
Total United States						
20	Food and Kindred Products	51,411	279	4,180	1,108	54,762
21	Tobacco Products	1,454	0	W	W	W
22	Textile Mill Products	29,529	155	414	18	30,079
23	Apparel and Other Textile Products	6,664	0	Q	Q	6,672
24	Lumber and Wood Products	19,591	Q	2,438	1,267	21,124
25	Furniture and Fixtures	5,667	0	29	39	5,678
26	Paper and Allied Products	60,066	949	44,255	7,066	98,184
2621	Paper Mills	30,543	641	24,914	4,147	51,951
2631	Paperboard Mills	13,486	0	15,540	2,586	26,441
27	Printing and Publishing	17,066	0	Q	Q	17,124
28	Chemicals and Allied Products	117,446	12,480	38,130	7,374	160,683
2819	Industrial Inorganic Chemicals, nec	W	W	2,084	W	W
2821	Plastics Materials and Resins	W	W	3,264	391	16,132
2869	Industrial Organic Chemicals, nec	17,891	1,561	20,088	3,463	36,078
2873	Nitrogenous Fertilizers	2,958	0	W	W	3,476
29	Petroleum and Coal Products	34,145	Q	11,717	2,797	43,091
2911	Petroleum Refining	W	W	11,205	2,392	41,066
30	Rubber and Misc. Plastics Products	31,153	Q	192	Q	31,486
31	Leather and Leather Products	1,390	0	6	Q	1,395
32	Stone, Clay and Glass Products	W	W	676	150	34,543
3241	Cement, Hydraulic	9,861	0	W	W	10,370
33	Primary Metal Industries	138,916	11,918	9,529	2,013	158,350
3312	Blast Furnaces and Steel Mills	38,899	3,429	6,939	1,699	47,568
3334	Primary Aluminum	W	W	•	W	W
34	Fabricated Metal Products	30,665	385	W	W	31,108
35	Industrial Machinery and Equipment	33,860	Q	278	418	33,754
36	Electronic and Other Electric Equipment	31,762	116	24	26	31,877
37	Transportation Equipment	W	W	667	744	37,887
38	Instruments and Related Products	14,177	Q	W	Q	W
39	Misc. Manufacturing Industries	4,183	0	Q	0	4,190
	Total	700,965	27,203	114,834	23,741	819,262
Northeast Census Region						
20	Food and Kindred Products	W	W	147	29	6,264
21	Tobacco Products	NA	NA	NA	NA	NA
22	Textile Mill Products	1,629	0	W	W	1,673
23	Apparel and Other Textile Products	1,330	0	Q	0	1,339
24	Lumber and Wood Products	1,179	Q	W	Q	W
25	Furniture and Fixtures	535	0	W	Q	W
26	Paper and Allied Products	W	W	6,841	1,582	14,258
2621	Paper Mills	W	W	6,172	1,496	10,740
2631	Paperboard Mills	531	0	334	25	840
27	Printing and Publishing	3,049	0	W	W	3,043
28	Chemicals and Allied Products	W	W	992	172	13,565
2819	Industrial Inorganic Chemicals, nec	W	W	W	0	W
2821	Plastics Materials and Resins	1,281	0	W	W	1,388
2869	Industrial Organic Chemicals, nec	2,352	96	W	W	2,775
2873	Nitrogenous Fertilizers	17	0	0	0	17
29	Petroleum and Coal Products	W	0	W	W	3,669
2911	Petroleum Refining	2,568	0	W	W	3,075
30	Rubber and Misc. Plastics Products	5,101	0	W	Q	W
31	Leather and Leather Products	W	0	W	Q	464
32	Stone, Clay and Glass Products	W	W	59	Q	5,865
3241	Cement, Hydraulic	1,312	0	0	0	1,312
33	Primary Metal Industries	W	W	W	W	19,472
3312	Blast Furnaces and Steel Mills	W	W	886	W	W
3334	Primary Aluminum	W	0	0	W	W
34	Fabricated Metal Products	5,125	0	68	Q	5,191
35	Industrial Machinery and Equipment	6,751	Q	W	W	6,729
36	Electronic and Other Electric Equipment	8,089	Q	W	W	8,113
37	Transportation Equipment	4,882	0	W	W	W
38	Instruments and Related Products	4,087	Q	W	Q	W
39	Misc. Manufacturing Industries	W	0	Q	0	W
	Total	97,561	1,703	12,233	2,941	108,556

See footnotes at end of table.

Table 14. Components of Total Electricity Demand by Census Region, Industry Group, and Selected Industries, 1988 (Continued)
(Million Kilowatthours)

SIC Code ^a	Industry Groups and Industry	Purchases	Transfers In ^b	Total Onsite Generation ^c	Sales and/or Transfers Offsite	Net Demand for Electricity ^d
Midwest Census Region						
20	Food and Kindred Products	19,294	169	1,486	215	20,734
21	Tobacco Products	NA	NA	NA	NA	NA
22	Textile Mill Products	NA	NA	NA	NA	NA
23	Apparel and Other Textile Products	930	0	Q	Q	928
24	Lumber and Wood Products	2,000	0	W	0	W
25	Furniture and Fixtures	1,712	0	4	34	1,682
26	Paper and Allied Products	W	W	5,883	636	18,573
2621	Paper Mills	W	W	4,496	W	W X
2631	Paperboard Mills	2,205	0	896	13	3,088 X
27	Printing and Publishing	6,313	0	Q	Q	6,319
28	Chemicals and Allied Products	17,801	10,893	1,948	111	30,531
2819	Industrial Inorganic Chemicals, nec	W	W	W	0	W X
2821	Plastics Materials and Resins	2,943	0	W	W	3,599 X
2869	Industrial Organic Chemicals, nec	2,139	339	952	28	3,402 X
2873	Nitrogenous Fertilizers	570	0	W	0	W X
29	Petroleum and Coal Products	6,778	0	W	W	7,765
2911	Petroleum Refining	6,196	0	W	W	7,181 X
30	Rubber and Misc. Plastics Products	11,664	Q	68	0	11,857
31	Leather and Leather Products	Q	0	4	0	W
32	Stone, Clay and Glass Products	9,615	0	W	W	9,860
3241	Cement, Hydraulic	2,696	0	W	W	2,941 X
33	Primary Metal Industries	44,045	7,789	4,894	1,288	55,439
3312	Blast Furnaces and Steel Mills	W	W	4,369	1,009	23,261 X
3334	Primary Aluminum	W	W	*	W	W X
34	Fabricated Metal Products	14,190	284	W	W	14,435
35	Industrial Machinery and Equipment	14,733	4	201	309	14,829
36	Electronic and Other Electric Equipment	7,648	76	W	Q	7,728
37	Transportation Equipment	W	W	W	616	W
38	Instruments and Related Products	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	928	0	*	0	928
	Total	191,803	19,856	16,082	3,389	224,352
South Census Region						
20	Food and Kindred Products	W	W	772	182	18,105
21	Tobacco Products	1,445	0	W	W	W
22	Textile Mill Products	27,059	155	W	W	27,564
23	Apparel and Other Textile Products	3,986	0	0	0	3,986
24	Lumber and Wood Products	9,172	Q	66	Q	9,191
25	Furniture and Fixtures	3,103	0	W	*	W
26	Paper and Allied Products	24,295	Q	26,337	2,595	48,100
2621	Paper Mills	W	W	12,139	1,271	23,097 X
2631	Paperboard Mills	6,330	0	11,965	1,202	17,092 X
27	Printing and Publishing	5,846	0	Q	0	5,846
28	Chemicals and Allied Products	W	W	33,894	6,532	104,387
2819	Industrial Inorganic Chemicals, nec	11,992	*	2,023	259	13,756 X
2821	Plastics Materials and Resins	W	W	2,465	351	11,025 X
2869	Industrial Organic Chemicals, nec	13,348	1,126	18,526	3,215	29,785 X
2873	Nitrogenous Fertilizers	1,646	0	W	W	1,982 X
29	Petroleum and Coal Products	16,020	Q	7,321	1,775	21,586
2911	Petroleum Refining	15,507	0	7,246	1,743	21,010 X
30	Rubber and Misc. Plastics Products	12,039	Q	W	W	12,069
31	Leather and Leather Products	W	0	W	0	290
32	Stone, Clay and Glass Products	13,085	12	35	Q	13,132
3241	Cement, Hydraulic	3,730	0	0	0	3,730 X
33	Primary Metal Industries	W	W	2,116	349	48,070
3312	Blast Furnaces and Steel Mills	W	W	W	338	W X
3334	Primary Aluminum	W	W	0	W	W X
34	Fabricated Metal Products	7,903	0	28	*	7,931
35	Industrial Machinery and Equipment	7,622	0	12	0	7,634
36	Electronic and Other Electric Equipment	9,830	0	W	W	9,835
37	Transportation Equipment	8,364	0	W	W	8,329
38	Instruments and Related Products	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	W	0	*	0	W
	Total	291,380	4,968	71,897	12,150	358,075

See footnotes at end of table.

Table 14. Components of Total Electricity Demand by Census Region, Industry Group, and Selected Industries, 1988 (Continued)
(Million Kilowatthours)

SIC Code ^a	Industry Groups and Industry	Purchases	Transfers In ^b	Total Onsite Generation ^c	Sales and/or Transfers Offsite	Net Demand for Electricity ^d
West Census Region						
20	Food and Kindred Products	8,499	Q	1,774	682	9,658
21	Tobacco Products	0	0	0	0	0
22	Textile Mill Products	538	0	0	0	538
23	Apparel and Other Textile Products	418	0	*	0	418
24	Lumber and Wood Products	7,240	Q	2,186	1,104	8,570
25	Furniture and Fixtures	NA	NA	NA	NA	NA
26	Paper and Allied Products	14,275	59	5,193	2,274	17,253
2621	Paper Mills	W	0	2,107	W	W
2631	Paperboard Mills	4,421	0	2,345	1,345	5,421
27	Printing and Publishing	1,858	0	W	Q	1,918
28	Chemicals and Allied Products	W	W	1,296	559	12,199
2819	Industrial Inorganic Chemicals, nec	W	W	W	W	4,474
2821	Plastics Materials and Resins	123	0	0	0	123
2869	Industrial Organic Chemicals, nec	53	0	W	W	116
2873	Nitrogenous Fertilizers	725	0	W	W	W
29	Petroleum and Coal Products	W	W	2,424	544	10,071
2911	Petroleum Refining	W	W	1,990	163	9,799
30	Rubber and Misc. Plastics Products	2,349	0	W	0	W
31	Leather and Leather Products	W	0	0	0	W
32	Stone, Clay and Glass Products	5,408	Q	W	W	5,688
3241	Cement, Hydraulic	2,123	0	W	W	2,387
33	Primary Metal Industries	34,099	Q	W	W	35,369
3312	Blast Furnaces and Steel Mills	W	W	W	W	2,805
3334	Primary Aluminum	25,811	0	0	0	25,611
34	Fabricated Metal Products	3,447	101	W	W	3,552
35	Industrial Machinery and Equipment	4,754	0	W	W	4,762
36	Electronic and Other Electric Equipment	6,197	0	W	W	6,202
37	Transportation Equipment	6,594	0	114	0	6,707
38	Instruments and Related Products	4,203	27	W	0	W
39	Misc. Manufacturing Industries	306	0	0	0	306
	Total	120,242	676	14,622	5,260	130,279

^a See Appendices A and D for descriptions of the Standard Industrial Classification system.

^b "Transfers In" are the quantities purchased by a central purchasing agent or other establishment of the same company.

^c "Onsite Generation" includes cogeneration, generation by renewable energy sources, and conventional generation by combustible fuels.

^d "Net Demand" is the sum of purchases, transfers in, and total onsite generation, minus sales and transfers offsite. It is the total amount of electricity used. It is not comparable to net electricity which excludes electricity generated onsite by combustible energy sources. Relative Standard Errors for Net Demand could not be calculated due to sampling methodology.

* Estimate less than 0.5 rounded to zero.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Q=Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

NA=Not available. Data are included in higher level totals.

Note: Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey."

Table 15. Components of Total Electricity Demand by Economic Characteristics of the Establishment, 1988
(Million Kilowatthours)

Economic Characteristics ^a	Purchases	Transfers In ^b	Onsite Generation ^c	Sales/Transfers Offsite	Net Demand ^d
Value of Shipments and Receipts (million dollars)					
Under 20	124,847	563	1,158	385	125,984
20-49	111,267	1,000	4,207	1,983	114,491
50-99	90,208	612	6,900	2,097	95,712
100-249	131,040	185	25,115	5,892	150,448
250-499	116,478	17,731	30,488	4,499	160,196
500 and Over	127,326	7,113	46,676	8,886	172,429
Total	700,965	27,203	114,834	23,741	819,262
Employment Size					
Under 50	52,710	396	477	252	53,330
50-99	45,523	813	1,034	365	47,005
100-249	125,426	735	9,798	4,797	131,162
250-499	123,356	953	16,365	3,298	137,376
500-999	164,486	1,488	27,387	4,349	189,011
1,000 and Over	189,465	22,818	59,774	10,680	261,377
Total	700,965	27,203	114,834	23,741	819,262

^a Value of Shipments and Receipts and Employment Size were supplied by the Bureau of the Census.

^b "Transfers In" are the quantities purchased by a central purchasing agent or other establishment of the same company.

^c "Onsite Generation" includes cogeneration, generation by renewable energy sources, and conventional generation by combustible fuels.

^d "Net Demand" is the sum of purchases, transfers in, and total onsite generation, minus sales and transfers offsite. It is the total amount of electricity used. It is not comparable to net electricity which excludes electricity generated onsite by combustible energy sources. Relative standard errors for net demand could not be calculated due to sampling methodology.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey," and Bureau of the Census, Industry Division, data files for the "1988 Annual Survey of Manufactures" and the "1987 Census of Manufactures."

Table 16. Quantity of Electricity Purchased from Utility and Nonutility Suppliers by Industry Group and Selected Industries, 1988
(Million Kilowatthours)

SIC Code ^a	Industry Groups and Industry	Total Purchased	Utility Supplier ^b	Nonutility Supplier ^c
20	Food and Kindred Products	51,411	51,324	87
21	Tobacco Products	1,454	1,454	0
22	Textile Mill Products	29,529	29,529	0
23	Apparel and Other Textile Products	6,664	6,664	0
24	Lumber and Wood Products	19,591	19,115	476
25	Furniture and Fixtures	5,687	W	W
26	Paper and Allied Products	60,066	59,989	77
2621	<i>Paper Mills</i>	30,543	W	W
2631	<i>Paperboard Mills</i>	13,486	13,476	11
27	Printing and Publishing	17,066	17,010	Q
28	Chemicals and Allied Products	117,446	116,752	694
2819	<i>Industrial Inorganic Chemicals, nec</i>	W	W	12
2821	<i>Plastics Materials and Resins</i>	W	13,117	W
2869	<i>Industrial Organic Chemicals, nec</i>	17,891	17,885	7
2873	<i>Nitrogenous Fertilizers</i>	2,958	W	W
29	Petroleum and Coal Products	34,145	W	W
2911	<i>Petroleum Refining</i>	W	31,874	W
30	Rubber and Misc. Plastics Products	31,153	31,153	0
31	Leather and Leather Products	1,390	1,387	Q
32	Stone, Clay and Glass Products	W	W	W
3241	<i>Cement, Hydraulic</i>	9,861	W	W
33	Primary Metal Industries	138,916	138,551	365
3312	<i>Blast Furnaces and Steel Mills</i>	39,899	W	W
3334	<i>Primary Aluminum</i>	W	W	0
34	Fabricated Metal Products	30,665	30,592	Q
35	Industrial Machinery and Equipment	33,860	33,860	0
36	Electronic and Other Electric Equipment	31,762	31,762	0
37	Transportation Equipment	W	W	100
38	Instruments and Related Products	14,177	14,177	0
39	Misc. Manufacturing Industries	4,163	4,163	0
	Total	700,965	698,286	2,679

^a See Appendices A and D for descriptions of the Standard Classification system.

^b A "Utility" is a company that produces and/or delivers electricity and/or natural gas, and is legally obligated to provide service to the public within its franchise area.

^c Includes independent power producers, small power producers, and cogenerators not located at the establishment site.

W-Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Q-Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

Note: Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey."

Table 17. Quantity of Electricity Purchased from Utility and Nonutility Suppliers by Selected Characteristics of the Establishment, 1988
(Million Kilowatthours)

Selected Characteristics	Total Purchased	Utility Supplier ^a	Nonutility Supplier ^b
Census Region			
Northeast	97,561	97,402	159
Midwest	191,803	191,599	203
South	291,360	290,810	550
West	120,242	118,476	1,766
Total	700,965	698,286	2,679
Value of Shipments and Receipts^c (million dollars)			
Under 20	124,647	124,133	515
20-49	111,267	110,691	576
50-99	90,208	89,724	484
100-249	131,040	130,674	366
250-499	116,478	W	W
500 and Over	127,326	W	W
Total	700,965	698,286	2,679
Employment Size^c			
Under 50	52,710	52,526	184
50-99	45,523	W	W
100-249	125,426	124,681	745
250-499	123,356	122,919	437
500-999	164,486	163,421	1,064
1,000 and Over	189,465	W	W
Total	700,965	698,286	2,679

^a A "Utility" is a company that produces and/or delivers electricity and/or natural gas, and is legally obligated to provide service to the public within its franchise area.

^b Includes independent power producers, small power producers, and cogenerators not located at the establishment site.

^c Value of Shipments and Receipts and Employment Size were supplied by the Bureau of the Census.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Note: Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey," and the Bureau of the Census, Industry Division, data files for the "1988 Annual Survey of Manufactures" and the "1987 Census of Manufactures."

Table 18. Quantity of Steam Purchased from Utility and Nonutility Suppliers by Industry Group and Selected Industries, 1988
(Billion Btu)

SIC Code ^a	Industry Groups and Industry	Steam		
		Total Purchased	Utility Supplier ^b	Nonutility Supplier ^c
20	Food and Kindred Products	14,676	11,853	2,823
21	Tobacco Products	W	W	0
22	Textile Mill Products	7,799	4,434	3,365
23	Apparel and Other Textile Products	253	Q	Q
24	Lumber and Wood Products	7,864	Q	6,400
25	Furniture and Fixtures	Q	Q	0
26	Paper and Allied Products	20,084	12,719	7,365
2621	Paper Mills	10,636	6,768	3,868
2631	Paperboard Mills	5,477	4,412	1,065
27	Printing and Publishing	1,710	1,601	Q
28	Chemicals and Allied Products	61,777	27,228	34,550
2819	Industrial Inorganic Chemicals, nec	520	75	445
2821	Plastics Materials and Resins	6,720	4,433	2,287
2869	Industrial Organic Chemicals, nec	34,995	18,305	16,689
2873	Nitrogenous Fertilizers	193	W	W
29	Petroleum and Coal Products	48,988	27,327	21,661
2911	Petroleum Refining	48,596	27,327	21,268
30	Rubber and Misc. Plastics Products	1,848	819	1,029
31	Leather and Leather Products	Q	0	Q
32	Stone, Clay and Glass Products	205	17	188
3241	Cement, Hydraulic	0	0	0
33	Primary Metal Industries	10,082	2,285	7,797
3312	Blast Furnaces and Steel Mills	W	W	W
3334	Primary Aluminum	0	0	0
34	Fabricated Metal Products	2,728	1,598	Q
35	Industrial Machinery and Equipment	283	231	Q
36	Electronic and Other Electric Equipment	516	516	0
37	Transportation Equipment	5,210	1,505	3,705
38	Instruments and Related Products	Q	Q	0
39	Misc. Manufacturing Industries	155	Q	Q
	Total	184,581	94,138	90,444

^a See Appendices A and D for descriptions of the Standard Industrial Classification system.

^b A "Utility" is a company that produces and/or delivers electricity and/or natural gas, and is legally obligated to provide service to the public within its franchise area.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Q=Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

Note: Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey."

Table 19. Quantity of Steam Purchased from Utility and Nonutility Suppliers by Selected Characteristics of the Establishment, 1988
(Billion Btu)

Selected Characteristics	Steam		
	Total Purchased	Utility Supplier ^a	Nonutility Supplier ^a
Census Region			
Northeast	29,849	19,844	9,805
Midwest	37,211	25,160	12,051
South	93,306	37,580	55,726
West	24,415	11,553	12,862
Total	184,581	94,136	90,444
Value of Shipments and Receipts^c (million dollars)			
Under 20	15,252	7,962	7,290
20-49	14,753	7,748	7,005
50-99	20,902	10,155	10,447
100-249	29,570	12,095	17,475
250-499	40,211	6,984	33,226
500 and Over	64,192	49,192	15,001
Total	184,581	94,136	90,444
Employment Size^d			
Under 50	4,147	Q	1,810
50-99	10,738	4,064	6,674
100-249	37,907	23,198	14,709
250-499	35,053	9,053	26,001
500-999	49,257	26,147	23,110
1,000 and Over	47,479	29,338	18,141
Total	184,581	94,136	90,444

^a A "Utility" is a company that produces and/or delivers electricity and/or natural gas, and is legally obligated to provide service to the public within its franchise area.

^b Includes independent power producers, small power producers, and cogenerators not located at the establishment site.

Q=Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

Note: Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey," and the Bureau of the Census, Industry Division, data files for the "1988 Annual Survey of Manufactures" and the "1987 Census of Manufactures."

Table 20. Quantity of Electricity Sold to Utility and Nonutility Purchasers by Industry Group and Selected Industries, 1988
(Million Kilowatthours)

SIC Code ^a	Industry Groups and Industry	Total Sold	Utility Purchaser ^b	Nonutility Purchaser ^c
20	Food and Kindred Products	1,108	769	339
21	Tobacco Products	W	W	W
22	Textile Mill Products	18	W	W
23	Apparel and Other Textile Products	Q	Q	0
24	Lumber and Wood Products	1,287	1,183	Q
25	Furniture and Fixtures	39	Q	34
26	Paper and Allied Products	7,088	5,828	1,260
2621	<i>Paper Mills</i>	4,147	3,225	922
2631	<i>Paperboard Mills</i>	2,586	2,329	257
27	Printing and Publishing	Q	Q	0
28	Chemicals and Allied Products	7,374	6,236	1,138
2819	<i>Industrial Inorganic Chemicals, nec</i>	W	37	W
2821	<i>Plastics Materials and Resins</i>	391	369	22
2869	<i>Industrial Organic Chemicals, nec</i>	3,463	2,751	712
2873	<i>Nitrogenous Fertilizers</i>	W	W	0
29	Petroleum and Coal Products	2,797	1,521	1,277
2911	<i>Petroleum Refining</i>	2,382	1,107	1,275
30	Rubber and Misc. Plastics Products	Q	Q	Q
31	Leather and Leather Products	Q	Q	0
32	Stone, Clay and Glass Products	150	87	62
3241	<i>Cement, Hydraulic</i>	W	W	0
33	Primary Metal Industries	2,013	652	1,361
3312	<i>Blast Furnaces and Steel Mills</i>	1,699	616	1,083
3334	<i>Primary Aluminum</i>	W	W	W
34	Fabricated Metal Products	W	Q	85
35	Industrial Machinery and Equipment	418	Q	414
36	Electronic and Other Electric Equipment	28	12	14
37	Transportation Equipment	744	162	582
38	Instruments and Related Products	Q	Q	0
39	Misc. Manufacturing Industries	0	0	0
	Total	23,741	17,078	6,665

^a See Appendices A and D for descriptions of the Standard Industrial Classification system.

^b A "Utility" is a company that produces and/or delivers electricity and/or natural gas, and is legally obligated to provide service to the public within its franchise area.

^c Includes independent power producers, small power producers, and cogenerators not located at the establishment site.

W-Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Q-Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

Note: Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey."

Table 21. Quantity of Electricity Sold to Utility and Nonutility Purchasers by Selected Characteristics of the Establishment, 1988
(Million Kilowatthours)

Selected Characteristics	Total Sold	Utility Purchaser ^a	Nonutility Purchaser ^b
Census Region			
Northeast	2,941	2,558	383
Midwest	3,389	636	2,753
South	12,150	8,969	3,182
West	5,260	4,913	347
Total	23,741	17,076	6,665
Value of Shipments and Receipts^c (million dollars)			
Under 20	385	Q	Q
20-49	1,983	1,760	222
50-99	2,097	1,792	305
100-249	5,892	4,941	951
250-499	4,499	3,275	1,223
500 and Over	8,886	5,058	3,828
Total	23,741	17,076	6,665
Employment Size^c			
Under 50	252	W	W
50-99	365	W	W
100-249	4,797	4,442	354
250-499	3,298	2,501	797
500-999	4,349	2,954	1,395
1,000 and Over	10,680	6,622	4,057
Total	23,741	17,076	6,665

^a A "Utility" is a company that produces and/or delivers electricity and/or natural gas, and is legally obligated to provide service to the public within its franchise area.

^b Includes independent power producers, small power producers, and cogenerators not located at the establishment site.

^c Value of Shipments and Receipts and Employment Size were supplied by the Bureau of the Census.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Q=Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

Note: Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey," and the Bureau of the Census, Industry Division, data files for the "1988 Annual Survey of Manufactures" and the "1987 Census of Manufactures."

Table 22. Components of Onsite Electricity Generation by Industry Group and Selected Industries, 1988
(Million Kilowatthours)

SIC Code ^a	Industry Groups and Industry	Total	Cogeneration	Renewables	Other ^b
20	Food and Kindred Products	4,180	3,698	W	W
21	Tobacco Products	W	W	0	0
22	Textile Mill Products	414	303	71	40
23	Apparel and Other Textile Products	Q	0	0	Q
24	Lumber and Wood Products	2,438	2,370	Q	33
25	Furniture and Fixtures	29	28	0	Q
26	Paper and Allied Products	44,255	40,284	1,951	2,020
2621	Paper Mills	24,914	22,357	1,794	763
2631	Paperboard Mills	15,540	14,392	W	W
27	Printing and Publishing	Q	W	0	W
28	Chemicals and Allied Products	38,130	34,718	0	3,412
2819	Industrial Inorganic Chemicals, nec	2,064	W	0	W
2821	Plastics Materials and Resins	3,264	3,028	0	237
2869	Industrial Organic Chemicals, nec	20,088	W	0	W
2873	Nitrogenous Fertilizers	W	519	0	W
29	Petroleum and Coal Products	11,717	10,946	0	771
2911	Petroleum Refining	11,205	10,435	0	770
30	Rubber and Misc. Plastics Products	192	102	Q	84
31	Leather and Leather Products	6	W	W	3
32	Stone, Clay and Glass Products	676	649	0	27
3241	Cement, Hydraulic	W	W	0	0
33	Primary Metal Industries	9,529	6,048	W	W
3312	Blast Furnaces and Steel Mills	6,939	4,960	0	1,979
3334	Primary Aluminum	*	0	0	*
34	Fabricated Metal Products	W	W	0	82
35	Industrial Machinery and Equipment	278	217	W	W
36	Electronic and Other Electric Equipment	24	W	0	W
37	Transportation Equipment	667	417	W	W
38	Instruments and Related Products	W	W	11	W
39	Misc. Manufacturing Industries	Q	0	Q	Q
	Total	114,834	101,907	2,594	10,334

^a See Appendices A and D for descriptions of the Standard Industrial Classification system.

^b "Other" is that electricity obtained from a generator fueled by combustible energy sources such as diesel or fuel oil.

* Estimate less than 0.5 rounded to zero.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Q=Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

Note: Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-848, "1988 Manufacturing Energy Consumption Survey."

Table 23. Components of Onsite Electricity Generation by Selected Characteristics of the Establishment, 1988
(Million Kilowatthours)

Selected Characteristics	Total	Cogeneration	Renewables	Other ^a
Census Region				
Northeast	12,233	9,233	1,477	1,523
Midwest	16,082	13,104	441	2,538
South	71,897	66,441	W	W
West	14,822	13,129	W	W
Total	114,834	101,907	2,594	10,334
Value of Shipments and Receipts^b (million dollars)				
Under 20	1,158	594	W	W
20-49	4,207	3,617	106	484
50-99	6,990	5,777	674	538
100-249	25,115	22,500	576	2,038
250-499	30,488	27,748	1,066	1,674
500 and Over	46,876	41,670	W	W
Total	114,834	101,907	2,594	10,334
Employment Size^b				
Under 50	477	268	41	168
50-99	1,034	800	20	214
100-249	9,798	8,840	179	778
250-499	16,365	14,729	775	861
500-999	27,387	23,585	433	3,369
1,000 and Over	59,774	53,684	1,148	4,944
Total	114,834	101,907	2,594	10,334

^a "Other" is that electricity obtained from a generator fueled by combustible energy sources such as diesel or fuel oil.

^b Value of Shipments and Receipts and Employment Size were supplied by the Bureau of the Census.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Note: Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey," and the Bureau of the Census, Industry Division, data files for the "1988 Annual Survey of Manufactures" and the "1987 Census of Manufactures."

Table 24. Quantity of Electricity Generated Onsite by Establishments Interconnected with A Utility and/or Designated As A Qualifying Facility by Industry Group and Selected Industries, 1988
(Million Kilowatthours)

SIC Code ^a	Industry Groups and Industry	Total Generated Onsite	Interconnected With A Utility ^b	Designated As A Qualifying Facility ^c
20	Food and Kindred Products	4,180	2,303	1,698
21	Tobacco Products	W	W	W
22	Textile Mill Products	414	228	W
23	Apparel and Other Textile Products	Q	*	0
24	Lumber and Wood Products	2,438	2,327	1,398
25	Furniture and Fixtures	29	19	W
26	Paper and Allied Products	44,255	28,534	18,689
2621	<i>Paper Mills</i>	24,914	17,791	10,172
2631	<i>Paperboard Mills</i>	15,540	7,999	7,637
27	Printing and Publishing	Q	W	W
28	Chemicals and Allied Products	38,130	32,120	26,539
2819	<i>Industrial Inorganic Chemicals, nec</i>	2,094	862	W
2821	<i>Plastics Materials and Resins</i>	3,284	2,131	1,191
2869	<i>Industrial Organic Chemicals, nec</i>	20,088	18,840	17,935
2873	<i>Nitrogenous Fertilizers</i>	W	W	W
29	Petroleum and Coal Products	11,717	8,421	5,940
2911	<i>Petroleum Refining</i>	11,205	7,915	5,433
30	Rubber and Misc. Plastics Products	192	108	47
31	Leather and Leather Products	6	W	W
32	Stone, Clay and Glass Products	676	618	W
3241	<i>Cement, Hydraulic</i>	W	563	W
33	Primary Metal Industries	9,529	5,875	2,348
3312	<i>Blast Furnaces and Steel Mills</i>	6,939	4,225	2,153
3334	<i>Primary Aluminum</i>	*	0	0
34	Fabricated Metal Products	W	W	W
35	Industrial Machinery and Equipment	278	97	W
36	Electronic and Other Electric Equipment	24	W	W
37	Transportation Equipment	667	518	240
38	Instruments and Related Products	W	W	W
39	Misc. Manufacturing Industries	Q	Q	0
	Total	114,834	83,205	59,146

^a See Appendices A and D for descriptions of the Standard Industrial Classification system.

^b An establishment is interconnected with a utility if it has the capability to deliver electricity to the grid as well as receive electricity from it.

^c A "Qualifying Facility" (QF) must meet requirements of the Public Utility Regulatory Policies Act (PURPA) of 1978. See Glossary.

* Estimate less than 0.5 rounded to zero.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Q=Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey."

Table 25. Quantity of Electricity Generated Onsite by Establishments Interconnected with A Utility and/or Designated As A Qualifying Facility by Selected Characteristics of the Establishment, 1988
(Million Kilowatthours)

Selected Characteristics	Total Generated Onsite	Interconnected With A Utility ^a	Designated As A Qualifying Facility ^b
Census Region			
Northeast	12,233	8,913	5,868
Midwest	16,082	8,020	3,352
South	71,897	54,306	41,264
West	14,622	11,966	8,662
Total	114,834	83,205	59,146
Value of Shipments and Receipts^c (million dollars)			
Under 20	1,158	363	291
20-49	4,207	2,907	2,256
50-99	6,990	5,173	2,839
100-249	25,115	17,934	10,705
250-499	30,488	19,040	11,964
500 and Over	46,876	37,789	31,092
Total	114,834	83,205	59,146
Employment Size^c			
Under 50	477	255	W
50-99	1,034	441	W
100-249	9,798	7,478	5,047
250-499	16,365	10,862	7,077
500-999	27,387	18,028	10,724
1,000 and Over	59,774	46,141	35,682
Total	114,834	83,205	59,146

^a An establishment is interconnected with a utility if it has the capability to deliver electricity to the grid as well as receive electricity from it.

^b A "Qualifying Facility" (QF) must meet requirements of the Public Utility Regulatory Policies Act (PURPA) of 1978. See Glossary.

^c Value of Shipments and Receipts and Employment Size were supplied by the Bureau of the Census.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Note: Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey," and the Bureau of the Census, Industry Division, data files for the "1988 Annual Survey of Manufactures" and the "1987 Census of Manufactures."

Table 26. Total Quantity of Selected Energy Sources Purchased by Census Region, Industry Group, and Selected Industries, 1988
(Estimates in Btu or Physical Units)

SIC Code ^a	Industry Groups and Industry	Total (trillion Btu)	Electricity (million kWh)	Residual Fuel Oil (1000 bbls)	Distillate Fuel Oil (1000 bbls)	Natural Gas (billion cu ft)	LPG (million gallons)	Coal (1000 short tons)	Coke and Breeze (1000 short tons)	Other ^b (trillion Btu)
Total United States										
20	Food and Kindred Products	929	51,411	W	W	475	W	6,727	W	17
21	Tobacco Products	27	1,454	221	81	2	3	762	0	1
22	Textile Mill Products	267	29,529	3,025	1,148	91	32	1,791	•	4
23	Apparel and Other Textile Products	53	6,664	311	397	21	9	136	0	Q
24	Lumber and Wood Products	206	19,591	W	4,017	34	40	W	0	72
25	Furniture and Fixtures	54	5,687	180	800	22	14	120	0	3
26	Paper and Allied Products	1,384	60,066	28,141	2,195	418	53	13,715	0	244
2621	Paper Mills	666	30,543	15,508	940	174	23	8,284	0	91
2631	Paperboard Mills	500	13,486	8,446	473	155	5	4,971	0	125
27	Printing and Publishing	114	17,066	116	386	48	18	0	0	2
28	Chemicals and Allied Products	3,950	117,446	19,123	2,741	1,965	10,212	13,079	404	188
2819	Industrial Inorganic Chemicals, nec	248	W	1,009	W	W	3	W	W	5
2821	Plastics Materials and Resins	416	W	W	186	W	1,270	1,338	0	13
2869	Industrial Organic Chemicals, nec	1,677	17,891	3,469	492	651	8,188	4,049	Q	118
2873	Nitrogenous Fertilizers	445	2,958	0	24	415	W	0	0	W
29	Petroleum and Coal Products	945	34,145	523	3,499	691	40	336	0	28
2911	Petroleum Refining	797	W	0	•	656	•	W	0	W
30	Rubber and Misc. Plastics Products	250	31,153	W	784	107	W	387	0	2
31	Leather and Leather Products	15	1,390	519	171	5	1	61	0	•
32	Stone, Clay and Glass Products	995	W	W	6,274	454	48	12,637	418	26
3241	Cement, Hydraulic	325	9,861	Q	929	29	•	9,587	132	15
33	Primary Metal Industries	2,511	138,916	6,468	2,626	710	66	35,810	9,799	28
3312	Blast Furnaces and Steel Mills	1,718	38,899	5,983	1,062	417	12	34,213	7,842	6
3334	Primary Aluminum	255	W	W	77	W	2	80	W	8
34	Fabricated Metal Products	338	30,665	691	1,214	195	51	423	46	6
35	Industrial Machinery and Equipment	280	33,860	554	1,482	124	32	818	Q	3
36	Electronic and Other Electric Equipment	226	31,762	726	919	81	33	316	96	4
37	Transportation Equipment	325	W	2,959	W	115	24	1,534	W	4
38	Instruments and Related Products	109	14,177	943	W	31	Q	W	0	1
39	Misc. Manufacturing Industries	41	4,183	196	271	19	7	84	0	1
	Total	13,017	700,965	77,662	36,938	5,607	10,827	89,672	11,145	635
Northeast Census Region										
20	Food and Kindred Products	89	W	W	1,411	41	W	W	0	1
21	Tobacco Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
22	Textile Mill Products	25	1,629	1,078	W	9	9	W	0	•
23	Apparel and Other Textile Products	15	1,330	250	282	7	Q	0	0	Q
24	Lumber and Wood Products	19	1,179	Q	Q	W	W	0	0	Q
25	Furniture and Fixtures	6	535	68	109	3	Q	0	0	Q
26	Paper and Allied Products	213	W	13,371	W	W	21	W	0	W
2621	Paper Mills	160	W	11,252	W	19	16	W	0	20
2631	Paperboard Mills	19	531	782	W	7	1	W	0	•
27	Printing and Publishing	20	3,049	W	298	6	Q	0	0	W
28	Chemicals and Allied Products	161	W	W	W	46	W	189	0	W
2819	Industrial Inorganic Chemicals, nec	8	W	437	W	3	•	•	0	•
2821	Plastics Materials and Resins	W	1,281	1,219	99	5	W	W	0	•
2869	Industrial Organic Chemicals, nec	W	2,352	W	172	W	W	0	0	•
2873	Nitrogenous Fertilizers	•	W	0	0	•	0	0	0	•
29	Petroleum and Coal Products	49	W	Q	1,036	W	Q	W	0	Q
2911	Petroleum Refining	34	2,568	0	0	20	0	194	0	0
30	Rubber and Misc. Plastics Products	39	5,101	W	464	12	W	W	0	1
31	Leather and Leather Products	W	W	403	116	W	•	Q	0	•
32	Stone, Clay and Glass Products	156	W	973	1,126	84	7	1,316	58	W
3241	Cement, Hydraulic	39	1,312	Q	113	•	•	1,194	W	1
33	Primary Metal Industries	542	W	1,469	W	103	25	11,989	W	5
3312	Blast Furnaces and Steel Mills	441	W	W	W	64	W	11,618	W	W
3334	Primary Aluminum	W	W	W	W	W	•	W	0	W
34	Fabricated Metal Products	69	5,125	392	787	41	12	W	W	•
35	Industrial Machinery and Equipment	46	6,751	509	700	14	W	W	0	•
36	Electronic and Other Electric Equipment	57	8,089	516	668	19	11	W	W	•
37	Transportation Equipment	54	4,882	1,708	W	16	4	W	0	•
38	Instruments and Related Products	48	4,087	841	W	8	1	W	0	•
39	Misc. Manufacturing Industries	W	W	160	198	W	2	W	0	Q
	Total	1,632	97,561	31,693	11,986	483	W	16,627	W	W

See footnotes at end of table.

Table 26. Total Quantity of Selected Energy Sources Purchased by Census Region, Industry Group, and Selected Industries, 1988 (Continued)
(Estimates in Btu or Physical Units)

SIC Code*	Industry Groups and Industry	Total (trillion Btu)	Electricity (million kWh)	Residual Fuel Oil (1000 bbls)	Distillate Fuel Oil (1000 bbls)	Natural Gas (billion cu ft)	LPG (million gallons)	Coal (1000 short tons)	Coke and Breeze (1000 short tons)	Other ^b (trillion Btu)
Midwest Census Region										
20	Food and Kindred Products	403	19,294	1,812	W	203	Q	4,636	W	2
21	Tobacco Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
22	Textile Mill Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
23	Apparel and Other Textile Products	9	930	Q	40	5	Q	Q	0	Q
24	Lumber and Wood Products	27	2,000	Q	W	7	W	Q	0	6
25	Furniture and Fixtures	19	1,712	W	105	11	3	W	0	*
26	Paper and Allied Products	263	W	W	W	81	9	4,478	0	23
2621	Paper Mills	141	W	W	W	37	2	2,775	0	11
2631	Paperboard Mills	68	2,205	250	25	16	1	1,350	0	12
27	Printing and Publishing	50	6,313	Q	Q	26	4	0	0	1
28	Chemicals and Allied Products	441	17,801	W	W	191	W	3,833	W	14
2819	Industrial Inorganic Chemicals, nec	W	W	W	11	W	*	148	0	W
2821	Plastics Materials and Resins	W	2,943	152	W	20	W	W	0	W
2869	Industrial Organic Chemicals, nec	135	2,139	W	W	54	W	1,834	0	W
2873	Nitrogenous Fertilizers	W	570	0	3	W	*	0	0	Q
29	Petroleum and Coal Products	99	6,778	Q	1,479	62	Q	W	0	Q
2911	Petroleum Refining	W	6,198	0	0	W	0	W	0	0
30	Rubber and Misc. Plastics Products	100	11,864	W	W	49	W	W	0	1
31	Leather and Leather Products	5	Q	Q	Q	2	1	Q	0	*
32	Stone, Clay and Glass Products	315	9,615	68	W	125	9	4,848	W	W
3241	Cement, Hydraulic	102	2,696	*	W	4	*	2,927	*	W
33	Primary Metal Industries	1,087	44,045	2,968	784	371	27	14,870	5,103	8
3312	Blast Furnaces and Steel Mills	814	W	2,960	W	247	W	14,187	3,982	2
3334	Primary Aluminum	W	W	0	6	W	*	W	0	W
34	Fabricated Metal Products	161	14,190	W	211	95	22	363	W	2
35	Industrial Machinery and Equipment	143	14,733	Q	409	68	17	748	Q	1
36	Electronic and Other Electric Equipment	64	7,646	134	42	30	7	197	0	*
37	Transportation Equipment	167	W	670	W	59	W	1,229	W	2
38	Instruments and Related Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	10	928	Q	W	6	*	W	0	*
	Total	3,384	191,803	10,261	7,531	1,401	W	35,557	5,464	W
South Census Region										
20	Food and Kindred Products	251	W	2,011	W	132	W	787	W	11
21	Tobacco Products	27	1,445	221	81	2	3	762	0	1
22	Textile Mill Products	234	27,059	1,947	W	76	22	W	*	4
23	Apparel and Other Textile Products	27	3,986	Q	74	9	3	118	0	Q
24	Lumber and Wood Products	75	9,172	W	W	14	11	Q	0	18
25	Furniture and Fixtures	26	3,103	W	388	7	9	W	0	3
26	Paper and Allied Products	690	24,295	9,865	932	W	17	7,453	0	W
2621	Paper Mills	282	W	W	488	88	4	3,921	0	44
2631	Paperboard Mills	318	6,330	5,740	120	95	2	3,426	0	84
27	Printing and Publishing	33	5,846	W	W	11	W	0	0	W
28	Chemicals and Allied Products	3,221	W	W	1,219	1,658	W	8,881	W	166
2819	Industrial Inorganic Chemicals, nec	178	11,992	W	W	W	2	W	W	4
2821	Plastics Materials and Resins	302	W	W	71	W	717	W	0	W
2869	Industrial Organic Chemicals, nec	1,505	13,348	1,414	259	586	7,863	2,215	Q	112
2873	Nitrogenous Fertilizers	356	1,646	0	21	333	W	0	0	W
29	Petroleum and Coal Products	647	16,020	W	W	W	Q	W	0	20
2911	Petroleum Refining	565	15,507	0	*	492	*	W	0	W
30	Rubber and Misc. Plastics Products	94	12,039	1,254	215	39	7	109	0	Q
31	Leather and Leather Products	W	W	Q	W	W	Q	0	0	Q
32	Stone, Clay and Glass Products	374	13,085	W	W	186	18	4,180	Q	10
3241	Cement, Hydraulic	113	3,730	W	W	15	*	3,338	W	W
33	Primary Metal Industries	641	W	W	666	175	11	W	W	W
3312	Blast Furnaces and Steel Mills	397	W	W	285	88	1	W	W	W
3334	Primary Aluminum	88	W	0	W	8	*	W	W	W
34	Fabricated Metal Products	76	7,903	W	158	43	11	W	W	1
35	Industrial Machinery and Equipment	51	7,622	23	Q	20	9	Q	W	1
36	Electronic and Other Electric Equipment	76	9,830	78	182	25	Q	W	W	3
37	Transportation Equipment	60	8,364	W	224	23	6	W	*	1
38	Instruments and Related Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	W	W	W	W	W	Q	0	0	Q
	Total	6,636	291,360	28,443	12,653	3,159	W	W	3,801	W

See footnotes at end of table.

Table 26. Total Quantity of Selected Energy Sources Purchased by Census Region, Industry Group, and Selected Industries, 1988 (Continued)
(Estimates in Btu or Physical Units)

SIC Code ^a	Industry Groups and Industry	Total (trillion Btu)	Electricity (million kWh)	Residual Fuel Oil (1000 bbls)	Distillate Fuel Oil (1000 bbls)	Natural Gas (billion cu ft)	LPG (million gallons)	Coal (1000 short tons)	Coke and Breeze (1000 short tons)	Other ^b (trillion Btu)
West Census Region										
20	Food and Kindred Products	186	8,499	W	1,169	99	W	W	W	3
21	Tobacco Products	0	0	0	0	0	0	0	0	0
22	Textile Mill Products	5	538	0	8	3	Q	0	0	*
23	Apparel and Other Textile Products	2	418	0	0	1	Q	0	0	Q
24	Lumber and Wood Products	85	7,240	Q	1,228	8	W	0	0	43
25	Furniture and Fixtures	NA	NA	NA	NA	NA	NA	NA	NA	NA
26	Paper and Allied Products	217	14,275	W	190	79	6	W	0	W
2621	Paper Mills	83	W	W	47	30	1	W	0	16
2631	Paperboard Mills	95	4,421	1,674	W	37	1	W	0	30
27	Printing and Publishing	11	1,858	0	Q	4	W	0	0	Q
28	Chemicals and Allied Products	128	W	W	125	69	1	W	W	W
2819	Industrial Inorganic Chemicals, nec	W	W	W	54	9	*	W	W	W
2821	Plastics Materials and Resins	1	123	W	W	1	*	0	0	*
2869	Industrial Organic Chemicals, nec	W	53	0	W	W	*	0	0	W
2873	Nitrogenous Fertilizers	W	725	0	*	W	*	0	0	*
29	Petroleum and Coal Products	151	W	Q	W	100	Q	0	0	4
2911	Petroleum Refining	W	W	0	0	W	0	0	0	W
30	Rubber and Misc. Plastics Products	16	2,349	W	Q	8	2	0	0	Q
31	Leather and Leather Products	W	W	0	Q	W	Q	0	0	Q
32	Stone, Clay and Glass Products	149	5,408	W	808	58	13	2,295	W	W
3241	Cement, Hydraulic	70	2,123	W	238	10	*	2,127	W	1
33	Primary Metal Industries	241	34,099	W	W	61	4	W	68	W
3312	Blast Furnaces and Steel Mills	67	W	W	13	17	*	W	W	W
3334	Primary Aluminum	108	25,611	0	19	5	1	10	0	3
34	Fabricated Metal Products	32	3,447	0	57	16	5	0	0	Q
35	Industrial Machinery and Equipment	40	4,754	0	W	22	W	0	0	1
36	Electronic and Other Electric Equipment	30	6,197	0	27	8	*	0	0	*
37	Transportation Equipment	43	6,594	W	W	17	W	W	0	*
38	Instruments and Related Products	23	4,203	*	7	W	*	0	0	*
39	Misc. Manufacturing Industries	2	306	0	Q	1	*	0	0	Q
	Total	1,366	120,242	7,464	4,768	563	99	W	W	W

^a See Appendices A and D for descriptions of the Standard Industrial Classification system.

^b Other energy sources include such combustible energy sources as wood waste, hydrogen or waste oils and tars.

* Estimate less than 0.5 rounded to zero.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Q=Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

NA=Not available. Data are included in higher level totals.

Note: "Purchases" exclude quantities that are transferred in from other establishments of the same company, quantities purchased by a central purchasing office offsite, and quantities for which payment is made in-kind.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey."

Table 27. Total Quantities of Selected Energy Sources Purchased by Economic Characteristics of the Establishment, 1988
(Estimates in Btu or Physical Units)

Economic Characteristics ^a	Total (trillion Btu)	Electricity (million kWh)	Residual Fuel Oil (1000 bbls)	Distillate Fuel Oil (1000 bbls)	Natural Gas (billion cu ft)	LPG (million gallons)	Coal (1000 short tons)	Coke & Breeze (1000 short tons)	Other ^b (trillion Btu)
Value of Shipments and Receipts (million dollars)									
Under 20	1,457	124,647	7,488	16,979	656	253	4,313	852	56
20-49	1,535	111,267	12,077	6,763	709	194	8,593	498	71
50-99	1,600	90,208	11,172	4,460	675	171	12,543	737	94
100-249	2,307	131,040	15,567	2,882	1,053	1,394	15,757	755	139
250-499	2,046	116,478	18,993	2,330	704	2,461	14,602	972	192
500 and Over	4,073	127,326	12,566	3,523	1,811	6,355	33,864	7,333	83
Total	13,017	700,965	77,862	36,938	5,607	10,827	89,672	11,145	635
Employment Size									
Under 50	622	52,710	1,356	11,503	305	130	658	123	20
50-99	828	45,523	7,261	3,911	371	317	3,294	298	52
100-249	2,096	125,426	11,894	6,835	1,017	717	12,492	842	111
250-499	2,200	123,356	13,018	4,917	1,005	2,447	11,675	728	118
500-999	2,655	164,486	16,652	4,015	1,197	1,556	15,822	792	171
1,000 and Over	4,617	189,465	27,682	5,757	1,712	5,660	45,731	8,362	164
Total	13,017	700,965	77,862	36,938	5,607	10,827	89,672	11,145	635

^a Value of Shipments and Receipts and Employment Size were supplied by the Bureau of the Census.

^b Other energy sources include such combustible energy sources as wood waste, hydrogen or waste oils and tars.

Note: Totals may not equal sum of components because of independent rounding.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey," and the Bureau of the Census, Industry Division, data files for the "1988 Annual Survey of Manufactures" and the "1987 Census of Manufactures."

Table 28. Total Expenditures for Selected Purchased Energy Sources by Census Region, Industry Group, and Selected Industries, 1988
(Million Dollars)

SIC Code ^a	Industry Groups and Industry	Total	Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal	Coke and Breeze	Other ^b
Total United States										
20	Food and Kindred Products	4,783	2,621	W	W	1,420	W	232	W	69
21	Tobacco Products	129	69	4	2	8	10	35	0	1
22	Textile Mill Products	1,931	1,404	53	27	317	13	78	*	11
23	Apparel and Other Textile Products	585	458	6	12	92	5	7	0	Q
24	Lumber and Wood Products	1,484	1,077	W	122	125	19	W	0	107
25	Furniture and Fixtures	478	347	4	18	88	8	6	0	9
26	Paper and Allied Products	4,948	2,433	417	51	1,068	28	549	0	337
2621	Paper Mills	2,326	1,139	236	21	420	10	328	0	142
2631	Paperboard Mills	1,352	492	115	8	355	3	205	0	156
27	Printing and Publishing	1,338	1,094	2	10	196	10	0	0	15
28	Chemicals and Allied Products	15,156	4,257	300	69	3,981	4,662	480	42	1,191
2819	Industrial Inorganic Chemicals, nec	980	W	19	W	W	2	W	W	65
2821	Plastics Materials and Resins	2,015	W	W	5	W	925	51	0	46
2869	Industrial Organic Chemicals, nec	6,108	644	52	12	1,259	3,268	131	Q	667
2873	Nitrogenous Fertilizers	920	104	0	1	792	W	0	0	W
29	Petroleum and Coal Products	3,330	1,446	10	93	1,483	14	16	0	147
2911	Petroleum Refining	2,844	W	0	*	1,373	*	W	0	W
30	Rubber and Misc. Plastics Products	2,145	1,677	W	20	349	W	20	0	15
31	Leather and Leather Products	120	87	8	5	17	1	3	0	*
32	Stone, Clay and Glass Products	3,682	W	W	184	1,282	21	432	21	106
3241	Cement, Hydraulic	868	414	Q	24	62	*	323	4	35
33	Primary Metal Industries	10,102	4,926	93	64	2,018	28	1,674	1,021	219
3312	Blast Furnaces and Steel Mills	5,199	1,524	84	26	1,141	4	1,587	762	24
3334	Primary Aluminum	1,752	W	W	2	W	1	14	W	134
34	Fabricated Metal Products	2,696	1,818	14	34	721	28	19	7	38
35	Industrial Machinery and Equipment	2,486	1,900	11	38	459	18	29	Q	26
36	Electronic and Other Electric Equipment	2,149	1,724	12	23	266	17	12	8	63
37	Transportation Equipment	2,721	W	54	W	411	11	70	W	33
38	Instruments and Related Products	1,066	874	16	W	120	1	W	0	6
39	Misc. Manufacturing Industries	377	274	4	8	74	4	4	0	8
	Total	61,681	32,141	1,225	1,002	14,515	4,962	3,707	1,131	2,406
Northeast Census Region										
20	Food and Kindred Products	621	W	W	38	141	W	W	0	6
21	Tobacco Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
22	Textile Mill Products	183	111	18	W	36	4	W	0	1
23	Apparel and Other Textile Products	163	116	5	9	29	Q	0	0	Q
24	Lumber and Wood Products	145	86	Q	Q	W	W	0	0	Q
25	Furniture and Fixtures	60	40	1	3	13	Q	0	0	1
26	Paper and Allied Products	915	W	211	W	W	10	W	0	W
2621	Paper Mills	608	W	176	W	54	7	W	0	43
2631	Paperboard Mills	77	30	13	W	20	1	W	0	*
27	Printing and Publishing	284	229	W	8	33	Q	0	0	W
28	Chemicals and Allied Products	1,001	W	W	W	147	W	8	0	W
2819	Industrial Inorganic Chemicals, nec	43	W	8	W	10	*	*	0	*
2821	Plastics Materials and Resins	W	67	21	2	16	W	W	0	1
2869	Industrial Organic Chemicals, nec	W	72	W	4	W	W	0	0	8
2873	Nitrogenous Fertilizers	2	W	0	0	1	0	0	0	*
29	Petroleum and Coal Products	281	W	Q	25	W	Q	W	0	Q
2911	Petroleum Refining	186	108	0	0	54	0	7	0	0
30	Rubber and Misc. Plastics Products	434	351	W	11	49	W	W	0	3
31	Leather and Leather Products	W	W	6	3	W	*	Q	0	*
32	Stone, Clay and Glass Products	691	W	16	29	269	3	45	3	W
3241	Cement, Hydraulic	116	61	Q	3	1	*	41	W	4
33	Primary Metal Industries	1,697	W	23	W	307	11	537	W	24
3312	Blast Furnaces and Steel Mills	1,128	W	W	W	188	W	520	W	W
3334	Primary Aluminum	W	W	W	W	W	*	W	0	W
34	Fabricated Metal Products	569	341	9	21	172	7	W	W	6
35	Industrial Machinery and Equipment	515	422	10	15	62	W	W	0	2
36	Electronic and Other Electric Equipment	588	478	9	17	72	5	W	W	4
37	Transportation Equipment	433	310	31	W	53	2	W	0	4
38	Instruments and Related Products	362	269	14	W	30	1	W	0	1
39	Misc. Manufacturing Industries	W	W	3	5	W	2	W	0	Q
	Total	9,128	5,360	529	300	1,647	W	727	W	W

See footnotes at end of table.

Table 28. Total Expenditures for Selected Purchased Energy Sources by Census Region, Industry Group, and Selected Industries, 1988 (Continued)
(Million Dollars)

SIC Code*	Industry Groups and Industry	Total	Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal	Coke and Breeze	Other ^b
Midwest Census Region										
20	Food and Kindred Products	1,776	918	24	W	580	Q	156	W	13
21	Tobacco Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
22	Textile Mill Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
23	Apparel and Other Textile Products	83	59	Q	1	19	Q	Q	0	Q
24	Lumber and Wood Products	190	119	Q	W	28	W	Q	0	16
25	Furniture and Fixtures	138	90	W	4	40	2	W	0	1
26	Paper and Allied Products	1,075	W	W	W	235	6	173	0	42
2621	Paper Mills	500	W	W	W	97	1	109	0	18
2631	Paperboard Mills	214	88	4	•	41	•	52	0	20
27	Printing and Publishing	503	395	•	Q	99	2	0	0	4
28	Chemicals and Allied Products	1,708	740	W	W	478	W	135	W	40
2819	Industrial Inorganic Chemicals, nec	W	W	W	•	W	•	5	0	W
2821	Plastics Materials and Resins	W	117	2	W	54	W	W	0	W
2869	Industrial Organic Chemicals, nec	350	89	W	W	113	W	58	0	W
2873	Nitrogenous Fertilizers	W	21	0	•	W	•	0	0	•
29	Petroleum and Coal Products	490	275	Q	41	160	Q	W	0	5
2911	Petroleum Refining	W	241	0	0	W	0	W	0	0
30	Rubber and Misc. Plastics Products	800	606	W	W	160	W	W	0	9
31	Leather and Leather Products	45	Q	Q	Q	7	•	Q	0	•
32	Stone, Clay and Glass Products	1,036	443	1	W	358	5	151	W	W
3241	Cement, Hydraulic	228	110	•	W	11	•	84	•	W
33	Primary Metal Industries	4,268	1,784	39	20	1,069	11	718	533	49
3312	Blast Furnaces and Steel Mills	2,614	W	39	W	680	W	682	381	9
3334	Primary Aluminum	W	W	0	•	W	•	W	0	W
34	Fabricated Metal Products	1,212	829	W	6	326	11	15	W	11
35	Industrial Machinery and Equipment	1,116	810	Q	10	244	8	26	Q	12
36	Electronic and Other Electric Equipment	510	391	2	1	101	3	8	0	3
37	Transportation Equipment	1,270	W	13	W	209	W	58	W	12
38	Instruments and Related Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	87	59	Q	W	23	•	W	0	2
	Total	16,518	9,206	158	202	4,172	W	1,458	563	W
South Census Region										
20	Food and Kindred Products	1,450	W	33	W	391	W	32	W	28
21	Tobacco Products	128	69	4	2	8	10	35	0	1
22	Textile Mill Products	1,691	1,256	35	W	262	9	W	•	9
23	Apparel and Other Textile Products	302	251	Q	2	41	1	6	0	1
24	Lumber and Wood Products	694	541	W	W	47	5	Q	0	43
25	Furniture and Fixtures	240	184	W	10	29	5	W	0	Q
26	Paper and Allied Products	2,161	965	137	23	W	9	306	0	W
2621	Paper Mills	913	W	W	10	195	2	157	0	66
2631	Paperboard Mills	792	245	76	3	205	1	144	0	115
27	Printing and Publishing	391	334	W	W	48	W	0	0	W
28	Chemicals and Allied Products	11,902	W	W	30	3,208	W	328	W	1,101
2819	Industrial Inorganic Chemicals, nec	661	365	W	W	W	1	W	W	47
2821	Plastics Materials and Resins	1,436	W	W	2	W	687	W	0	W
2869	Industrial Organic Chemicals, nec	5,547	480	19	7	1,111	3,185	73	Q	636
2873	Nitrogenous Fertilizers	718	62	0	1	632	W	0	0	W
29	Petroleum and Coal Products	1,825	613	W	W	W	Q	W	0	Q
2911	Petroleum Refining	1,636	583	0	•	968	•	W	0	W
30	Rubber and Misc. Plastics Products	714	555	24	6	112	3	5	0	3
31	Leather and Leather Products	W	W	Q	W	W	•	0	0	Q
32	Stone, Clay and Glass Products	1,368	577	W	W	486	8	150	12	33
3241	Cement, Hydraulic	305	141	W	W	27	•	118	W	W
33	Primary Metal Industries	2,748	W	W	16	479	5	W	W	W
3312	Blast Furnaces and Steel Mills	1,251	W	W	7	232	1	W	W	W
3334	Primary Aluminum	655	W	0	W	23	•	W	W	W
34	Fabricated Metal Products	573	399	W	5	148	6	W	W	11
35	Industrial Machinery and Equipment	490	390	•	Q	74	6	Q	W	7
36	Electronic and Other Electric Equipment	627	471	1	5	80	Q	W	W	53
37	Transportation Equipment	519	406	W	5	81	3	W	•	12
38	Instruments and Related Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	W	W	W	W	W	Q	0	0	Q
	Total	28,177	12,277	424	358	7,063	W	W	390	W

See footnotes at end of table.

Table 28. Total Expenditures for Selected Purchased Energy Sources by Census Region, Industry Group, and Selected Industries, 1988 (Continued)
(Million Dollars)

SIC Code ^a	Industry Groups and Industry	Total	Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal	Coke and Breeze	Other ^b
West Census Region										
20	Food and Kindred Products	918	440	W	35	308	W	W	W	22
21	Tobacco Products	0	0	0	0	0	0	0	0	0
22	Textile Mill Products	33	21	0	•	12	Q	0	0	•
23	Apparel and Other Textile Products	37	33	0	0	3	Q	0	0	Q
24	Lumber and Wood Products	455	330	2	40	28	W	0	0	37
25	Furniture and Fixtures	NA	NA	NA	NA	NA	NA	NA	NA	NA
26	Paper and Allied Products	794	458	W	4	205	3	W	0	W
2621	Paper Mills	306	W	W	1	75	1	W	0	15
2631	Paperboard Mills	269	128	23	W	89	1	W	0	21
27	Printing and Publishing	158	138	0	Q	17	W	0	0	Q
28	Chemicals and Allied Products	545	W	W	4	149	•	W	W	W
2819	Industrial Inorganic Chemicals, nec	W	W	W	2	22	•	W	W	W
2821	Plastics Materials and Resins	12	9	W	W	3	•	0	0	•
2869	Industrial Organic Chemicals, nec	W	2	0	W	W	•	0	0	W
2873	Nitrogenous Fertilizers	W	20	0	•	W	•	0	0	•
29	Petroleum and Coal Products	734	W	Q	W	250	Q	0	0	26
2911	Petroleum Refining	W	W	0	0	W	0	0	0	W
30	Rubber and Misc. Plastics Products	196	185	W	Q	28	1	0	0	Q
31	Leather and Leather Products	W	W	0	Q	W	Q	0	0	Q
32	Stone, Clay and Glass Products	587	273	W	24	168	5	88	W	W
3241	Cement, Hydraulic	220	102	W	7	23	•	81	W	4
33	Primary Metal Industries	1,369	1,033	W	W	163	2	W	10	W
3312	Blast Furnaces and Steel Mills	206	W	W	•	42	•	W	W	W
3334	Primary Aluminum	779	698	0	1	16	•	3	0	61
34	Fabricated Metal Products	341	249	0	1	76	3	0	0	Q
35	Industrial Machinery and Equipment	364	278	0	W	79	W	0	0	5
36	Electronic and Other Electric Equipment	423	384	0	1	33	•	0	0	3
37	Transportation Equipment	500	416	W	W	68	W	W	0	5
38	Instruments and Related Products	333	295	•	•	W	•	0	0	4
39	Misc. Manufacturing Industries	28	23	0	Q	5	•	0	0	Q
	Total	7,859	5,298	114	141	1,634	48	W	W	W

^a See Appendices A and D for descriptions of the Standard Industrial Classification system.

^b Other energy sources include such combustible energy sources as wood waste, hydrogen or waste oils and tars.

• Estimate less than 0.5 rounded to zero.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Q=Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

NA=Not available. Data are included in higher level totals.

Note: •Totals may not equal sum of components because of independent rounding. •To minimize respondent burden, quantities of petroleum based products (e.g., residual and distillate fuel oil and LPG) purchased, and associated expenditures, were not collected from the Refinery Industry, SIC 2911. These products are produced by petroleum refineries rather than purchased by them.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey."

Table 29. Total Expenditures for Selected Purchased Energy Sources by Economic Characteristics of the Establishment, 1988
(Million Dollars)

Economic Characteristics ^a	Total	Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal	Coke & Breeze	Other ^b
Value of Shipments and Receipts (million dollars)									
Under 20	11,355	7,638	123	490	2,376	135	171	95	267
20-49	8,762	5,599	198	173	2,092	89	320	60	180
50-99	7,414	4,162	181	120	1,888	88	478	80	338
100-249	10,054	5,189	242	74	2,507	872	624	81	349
250-499	9,113	4,191	286	60	1,694	1,221	578	105	900
500 and Over	14,983	5,361	195	84	3,958	2,556	1,537	710	373
Total	61,681	32,141	1,225	1,002	14,515	4,962	3,707	1,131	2,406
Employment Size									
Under 50	4,700	3,036	25	332	1,066	63	30	16	117
50-99	4,470	2,637	111	108	1,123	90	112	19	234
100-249	10,955	6,252	197	183	2,763	583	459	96	307
250-499	10,860	5,713	206	131	2,597	1,211	461	88	363
500-999	12,352	6,432	257	110	2,933	988	631	86	762
1,000 and Over	18,344	8,071	430	138	4,034	2,026	2,014	828	624
Total	61,681	32,141	1,225	1,002	14,515	4,962	3,707	1,131	2,406

^a Value of Shipments and Receipts and Employment Size were supplied by the Bureau of the Census.

^b Other energy sources include such combustible energy sources as wood waste, hydrogen or waste oils and tars.

Note: •Totals may not equal sum of components because of independent rounding. •To minimize respondent burden, quantities of petroleum based products (e.g., residual and distillate fuel oil, and LPG) purchased, and associated expenditures, were not collected from the Refinery Industry, SIC 2911. These products are produced by petroleum refineries rather than purchased by them.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey," and the Bureau of the Census, Industry Division, data files for the "1988 Annual Survey of Manufactures" and the "1987 Census of Manufactures."

Table 30. Average Prices of Selected Purchased Energy Sources by Census Region, Industry Group, and Selected Industries, 1988: Part 1
(Dollars per Physical Unit)

SIC Code ^a	Industry Groups and Industry	Electricity (kWh)	Residual Fuel Oil (gallon)	Distillate Fuel Oil (gallon)	Natural Gas (1000 cu ft)	LPG (gallon)	Coal (short ton)
Total United States							
20	Food and Kindred Products	0.051	W	W	2.991	W	34.47
21	Tobacco Products	0.048	0.390	0.490	3.558	3.586	45.66
22	Textile Mill Products	0.048	0.416	0.556	3.501	0.399	43.45
23	Apparel and Other Textile Products	0.069	0.468	0.711	4.304	0.589	51.21
24	Lumber and Wood Products	0.055	W	0.723	3.679	0.468	W
25	Furniture and Fixtures	0.061	0.470	0.852	4.010	0.539	48.73
26	Paper and Allied Products	0.040	0.353	0.549	2.554	0.521	40.05
2621	Paper Mills	0.037	0.362	0.534	2.416	0.443	39.55
2631	Paperboard Mills	0.036	0.325	0.414	2.283	0.534	41.25
27	Printing and Publishing	0.064	0.466	0.632	4.127	0.576	0.00
28	Chemicals and Allied Products	0.036	0.373	0.596	2.026	0.457	36.68
2819	Industrial Inorganic Chemicals, nec	W	0.438	W	W	0.503	W
2821	Plastics Materials and Resins	W	W	0.624	W	0.728	38.34
2869	Industrial Organic Chemicals, nec	0.036	0.357	0.591	1.933	0.399	32.48
2873	Nitrogenous Fertilizers	0.035	0.000	0.632	1.910	W	0.00
29	Petroleum and Coal Products	0.042	0.454	0.633	2.146	0.341	46.43
2911	Petroleum Refining	W	0.000	1.035	2.094	W	W
30	Rubber and Misc. Plastics Products	0.054	W	0.602	3.246	W	50.79
31	Leather and Leather Products	0.062	0.371	0.636	3.604	0.591	43.79
32	Stone, Clay and Glass Products	W	W	0.698	2.825	0.436	34.19
3241	Cement, Hydraulic	0.042	0.326	0.616	2.132	0.682	33.73
33	Primary Metal Industries	0.035	0.343	0.580	2.842	0.423	46.75
3312	Blast Furnaces and Steel Mills	0.039	0.335	0.575	2.739	0.365	46.38
3334	Primary Aluminum ^b	W	W	0.655	W	0.382	174.56
34	Fabricated Metal Products	0.059	0.474	0.661	3.704	0.554	43.94
35	Industrial Machinery and Equipment	0.056	0.452	0.606	3.703	0.580	35.32
36	Electronic and Other Electric Equipment	0.054	0.406	0.606	3.534	0.506	39.06
37	Transportation Equipment	W	0.431	W	3.577	0.478	45.96
38	Instruments and Related Products	0.062	0.409	W	3.849	0.554	W
39	Misc. Manufacturing Industries	0.065	0.430	0.690	3.850	0.665	45.96
	Total	0.046	0.375	0.646	2.589	0.458	41.34
Northeast Census Region							
20	Food and Kindred Products	W	W	0.634	3.479	W	W
21	Tobacco Products	NA	NA	NA	NA	NA	NA
22	Textile Mill Products	0.068	0.401	W	3.866	0.388	W
23	Apparel and Other Textile Products	0.087	0.466	0.736	4.438	0.835	0.00
24	Lumber and Wood Products	0.073	0.373	0.842	W	W	0.00
25	Furniture and Fixtures	0.076	0.449	0.670	4.324	0.705	0.00
26	Paper and Allied Products	W	0.375	W	W	0.459	W
2621	Paper Mills	W	0.372	W	2.793	0.428	W
2631	Paperboard Mills	0.057	0.395	W	2.745	0.454	W
27	Printing and Publishing	0.075	W	0.607	5.237	0.638	0.00
28	Chemicals and Allied Products	W	W	W	3.198	W	43.08
2819	Industrial Inorganic Chemicals, nec	W	0.423	W	3.549	0.815	48.14
2821	Plastics Materials and Resins	0.052	0.410	0.586	3.242	W	W
2869	Industrial Organic Chemicals, nec	0.031	W	0.588	W	W	0.00
2873	Nitrogenous Fertilizers	W	0.000	0.000	3.244	0.000	0.00
29	Petroleum and Coal Products	W	0.456	0.569	W	0.878	W
2911	Petroleum Refining	0.042	0.000	0.000	2.636	0.000	36.27
30	Rubber and Misc. Plastics Products	0.069	W	0.571	4.220	W	W
31	Leather and Leather Products	W	0.373	0.636	W	0.788	42.57
32	Stone, Clay and Glass Products	W	0.395	0.611	3.196	0.464	34.18
3241	Cement, Hydraulic	0.046	0.351	0.644	4.319	0.906	33.92
33	Primary Metal Industries	W	0.368	W	2.989	0.437	44.82
3312	Blast Furnaces and Steel Mills	W	W	W	2.926	W	44.73
3334	Primary Aluminum ^b	W	W	W	W	0.603	W
34	Fabricated Metal Products	0.066	0.529	0.641	4.204	0.615	W
35	Industrial Machinery and Equipment	0.062	0.453	0.519	4.462	W	W
36	Electronic and Other Electric Equipment	0.059	0.415	0.590	3.844	0.449	W
37	Transportation Equipment	0.064	0.435	W	3.329	0.475	W
38	Instruments and Related Products	0.066	0.408	W	3.836	0.775	W
39	Misc. Manufacturing Industries	W	0.439	0.633	W	0.648	W
	Total	0.055	0.397	0.597	3.409	W	43.75

See footnotes at end of table.

Table 30. Average Prices of Selected Purchased Energy Sources by Census Region, Industry Group, and Selected Industries, 1988: Part 1 (Continued)
(Dollars per Physical Unit)

SIC Code*	Industry Groups and Industry	Electricity (kWh)	Residual Fuel Oil (gallon)	Distillate Fuel Oil (gallon)	Natural Gas (1000 cu ft)	LPG (gallon)	Coal (short ton)
Midwest Census Region							
20	Food and Kindred Products	0.048	0.360	W	2.853	0.391	33.76
21	Tobacco Products	NA	NA	NA	NA	NA	NA
22	Textile Mill Products	NA	NA	NA	NA	NA	NA
23	Apparel and Other Textile Products	0.063	0.483	0.664	3.942	0.447	54.57
24	Lumber and Wood Products	0.060	0.420	W	4.173	W	44.77
25	Furniture and Fixtures	0.053	W	0.833	3.726	0.520	W
26	Paper and Allied Products	W	W	W	2.913	0.625	38.56
2621	Paper Mills	W	W	W	2.644	0.561	39.18
2631	Paperboard Mills	0.040	0.378	0.472	2.521	0.729	38.40
27	Printing and Publishing	0.063	0.420	0.899	3.780	0.523	0.00
28	Chemicals and Allied Products	0.042	W	W	2.491	W	35.22
2819	Industrial Inorganic Chemicals, nec	W	W	0.738	W	0.679	32.46
2821	Plastics Materials and Resins	0.040	0.375	W	2.714	W	W
2869	Industrial Organic Chemicals, nec	0.042	W	W	2.091	W	31.80
2873	Nitrogenous Fertilizers	0.037	0.000	0.695	W	0.492	0.00
29	Petroleum and Coal Products	0.041	0.366	0.855	2.589	0.353	W
2911	Petroleum Refining	0.039	0.000	0.000	W	0.000	W
30	Rubber and Misc. Plastics Products	0.052	W	W	3.246	W	W
31	Leather and Leather Products	0.062	0.426	0.622	3.484	0.460	97.14
32	Stone, Clay and Glass Products	0.046	0.382	W	2.854	0.532	31.18
3241	Cement, Hydraulic	0.041	0.835	W	2.438	0.591	28.55
33	Primary Metal Industries	0.041	0.316	0.607	2.881	0.390	48.31
3312	Blast Furnaces and Steel Mills	W	0.316	W	2.751	W	48.07
3334	Primary Aluminum*	W	0.000	0.689	W	0.303	W
34	Fabricated Metal Products	0.058	W	0.696	3.445	0.513	42.28
35	Industrial Machinery and Equipment	0.055	0.491	0.596	3.592	0.482	34.52
36	Electronic and Other Electric Equipment	0.051	0.360	0.699	3.400	0.485	38.08
37	Transportation Equipment	W	0.447	W	3.523	W	47.57
38	Instruments and Related Products	NA	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	0.064	0.481	W	3.715	0.742	W
	Total	0.048	0.367	0.640	2.978	W	41.01
South Census Region							
20	Food and Kindred Products	W	0.393	W	2.971	W	41.00
21	Tobacco Products	0.047	0.390	0.490	3.577	3.586	45.66
22	Textile Mill Products	0.046	0.425	W	3.431	0.402	W
23	Apparel and Other Textile Products	0.063	0.458	0.641	4.360	0.511	50.72
24	Lumber and Wood Products	0.059	W	W	3.306	0.447	46.55
25	Furniture and Fixtures	0.059	W	0.598	4.098	0.512	W
26	Paper and Allied Products	0.040	0.330	0.588	W	0.515	41.05
2621	Paper Mills	W	W	0.498	2.208	0.424	40.11
2631	Paperboard Mills	0.039	0.314	0.599	2.147	0.514	42.12
27	Printing and Publishing	0.057	W	W	4.292	W	0.00
28	Chemicals and Allied Products	W	W	0.586	1.935	W	36.89
2819	Industrial Inorganic Chemicals, nec	0.030	W	W	W	0.442	W
2821	Plastics Materials and Resins	W	W	0.666	W	0.958	W
2869	Industrial Organic Chemicals, nec	0.036	0.327	0.635	1.898	0.405	33.04
2873	Nitrogenous Fertilizers	0.037	0.000	0.815	1.901	W	0.00
29	Petroleum and Coal Products	0.038	W	W	W	0.326	W
2911	Petroleum Refining	W	0.000	1.035	1.968	W	W
30	Rubber and Misc. Plastics Products	0.046	0.448	0.629	2.880	0.491	42.67
31	Leather and Leather Products	W	0.289	W	W	0.631	0.00
32	Stone, Clay and Glass Products	0.044	W	W	2.820	0.423	35.93
3241	Cement, Hydraulic	0.038	W	W	1.853	0.702	35.33
33	Primary Metal Industries	W	W	0.583	2.729	0.437	W
3312	Blast Furnaces and Steel Mills	W	W	0.607	2.629	0.699	W
3334	Primary Aluminum*	W	0.000	W	2.807	0.339	W
34	Fabricated Metal Products	0.050	W	0.761	3.445	0.548	W
35	Industrial Machinery and Equipment	0.051	0.410	0.800	3.695	0.662	40.03
36	Electronic and Other Electric Equipment	0.048	0.424	0.811	3.255	0.547	W
37	Transportation Equipment	0.049	W	0.561	3.562	0.466	W
38	Instruments and Related Products	NA	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	W	W	W	W	0.662	0.00
	Total	0.042	0.355	0.674	2.236	W	W

See footnotes at end of table.

Table 30. Average Prices of Selected Purchased Energy Sources by Census Region, Industry Group, and Selected Industries, 1988: Part 1 (Continued)
(Dollars per Physical Unit)

SIC Code ^a	Industry Groups and Industry	Electricity (kWh)	Residual Fuel Oil (gallon)	Distillate Fuel Oil (gallon)	Natural Gas (1000 cu ft)	LPG (gallon)	Coal (short ton)
West Census Region							
20	Food and Kindred Products	0.052	W	0.711	3.100	W	W
21	Tobacco Products	0.000	0.000	0.000	0.000	0.000	0.00
22	Textile Mill Products	0.039	0.000	0.580	4.092	0.778	0.00
23	Apparel and Other Textile Products	0.079	0.000	0.000	4.753	1.135	0.00
24	Lumber and Wood Products	0.046	0.372	0.768	3.652	W	0.00
25	Furniture and Fixtures	NA	NA	NA	NA	NA	NA
26	Paper and Allied Products	0.032	W	0.455	2.606	0.597	W
2621	Paper Mills	W	W	0.586	2.506	0.495	W
2631	Paperboard Mills	0.029	0.324	W	2.440	0.558	W
27	Printing and Publishing	0.073	0.000	0.707	4.195	W	0.00
28	Chemicals and Allied Products	W	W	0.721	2.155	0.649	W
2819	Industrial Inorganic Chemicals, nec	W	W	0.672	2.412	0.626	W
2821	Plastics Materials and Resins	0.072	W	W	4.315	0.951	0.00
2869	Industrial Organic Chemicals, nec	0.047	0.000	W	W	0.984	0.00
2873	Nitrogenous Fertilizers	0.028	0.000	0.955	W	0.492	0.00
29	Petroleum and Coal Products	W	0.627	W	2.509	0.354	0.00
2911	Petroleum Refining	W	0.000	0.000	W	0.000	0.00
30	Rubber and Misc. Plastics Products	0.070	W	0.640	3.656	0.592	0.00
31	Leather and Leather Products	W	0.000	1.154	W	0.679	0.00
32	Stone, Clay and Glass Products	0.051	W	0.716	2.882	0.373	37.39
3241	Cement, Hydraulic	0.048	W	0.651	2.385	0.877	38.22
33	Primary Metal Industries	0.030	W	W	2.685	0.543	W
3312	Blast Furnaces and Steel Mills	W	W	0.642	2.435	0.680	W
3334	Primary Aluminum ^b	0.027	0.000	0.672	2.950	0.433	275.98
34	Fabricated Metal Products	0.072	0.000	0.527	4.633	0.603	0.00
35	Industrial Machinery and Equipment	0.058	0.000	W	3.579	W	0.00
36	Electronic and Other Electric Equipment	0.062	0.000	0.825	4.166	0.951	0.00
37	Transportation Equipment	0.063	W	W	4.021	W	W
38	Instruments and Related Products	0.070	0.346	0.813	W	0.641	0.00
39	Misc. Manufacturing Industries	0.074	0.000	0.703	4.623	0.789	0.00
	Total	0.044	0.363	0.703	2.900	0.489	W

^a See Appendices A and D for description of the Standard Industrial Classification system.

^b The price estimates for coal for SIC 3334 includes anthracite coal for the production of carbon anodes. Because of the high cost of transporting anthracite from the East Coast to the West and South, the prices of coal in those regions are extremely high.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

NA=Not available. Data are included in higher level totals.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey."

Table 30. Average Prices of Selected Purchased Energy Sources by Census Region, Industry Group, and Selected Industries, 1988: Part 2
(Dollars per Million Btu)

SIC Code ^a	Industry Groups and Industry	Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal
Total United States							
20	Food and Kindred Products	14.94	W	W	2.91	W	1.54
21	Tobacco Products	13.96	2.61	3.54	3.46	41.21	2.04
22	Textile Mill Products	13.93	2.78	4.01	3.40	4.59	1.94
23	Apparel and Other Textile Products	20.16	3.13	5.13	4.18	6.77	2.28
24	Lumber and Wood Products	16.10	W	5.22	3.58	5.38	W
25	Furniture and Fixtures	17.88	3.14	4.70	3.90	6.19	2.18
26	Paper and Allied Products	11.87	2.36	3.96	2.48	5.98	1.78
2621	<i>Paper Mills</i>	10.93	2.42	3.85	2.35	5.10	1.77
2631	<i>Paperboard Mills</i>	10.69	2.17	2.99	2.22	6.14	1.83
27	Printing and Publishing	18.78	3.11	4.56	4.01	6.62	0.00
28	Chemicals and Allied Products	10.62	2.49	4.30	1.97	5.25	1.63
2819	<i>Industrial Inorganic Chemicals, nec</i>	W	2.93	W	W	5.78	W
2821	<i>Plastics Materials and Resins</i>	W	W	4.50	W	8.37	1.71
2869	<i>Industrial Organic Chemicals, nec</i>	10.54	2.39	4.28	1.88	4.59	1.45
2873	<i>Nitrogenous Fertilizers</i>	10.27	0.00	4.55	1.86	W	0.00
29	Petroleum and Coal Products	12.41	3.03	4.56	2.09	3.92	2.03
2911	<i>Petroleum Refining</i>	W	0.00	7.46	2.04	0.00	W
30	Rubber and Misc. Plastics Products	15.78	W	4.34	3.15	W	2.26
31	Leather and Leather Products	18.24	2.48	4.59	3.50	6.79	1.96
32	Stone, Clay and Glass Products	W	W	5.04	2.75	5.01	1.53
3241	<i>Cement, Hydraulic</i>	12.30	2.18	4.44	2.07	7.84	1.51
33	Primary Metal Industries	10.39	2.29	4.18	2.76	4.87	1.76
3312	<i>Blast Furnaces and Steel Mills</i>	11.48	2.24	4.14	2.66	4.20	1.74
3334	<i>Primary Aluminum^b</i>	W	W	4.72	W	4.39	6.69
34	Fabricated Metal Products	17.38	3.17	4.77	3.60	6.37	1.94
35	Industrial Machinery and Equipment	16.45	3.02	4.38	3.60	6.67	1.58
36	Electronic and Other Electric Equipment	15.91	2.71	4.37	3.43	5.81	1.68
37	Transportation Equipment	W	2.88	W	3.48	5.50	2.05
38	Instruments and Related Products	18.06	2.73	W	3.74	6.37	W
39	Misc. Manufacturing Industries	19.19	2.87	4.98	3.74	7.65	1.82
	Total	13.44	2.50	4.66	2.52	5.27	1.72
Northeast Census Region							
20	Food and Kindred Products	W	W	4.57	3.38	W	W
21	Tobacco Products	NA	NA	NA	NA	NA	NA
22	Textile Mill Products	19.88	2.68	W	3.76	4.46	W
23	Apparel and Other Textile Products	25.52	3.11	5.31	4.31	9.59	0.00
24	Lumber and Wood Products	21.43	2.49	4.63	W	W	0.00
25	Furniture and Fixtures	22.14	3.00	4.83	4.20	8.10	0.00
26	Paper and Allied Products	W	2.51	W	W	5.27	W
2621	<i>Paper Mills</i>	W	2.49	W	2.71	4.92	W
2631	<i>Paperboard Mills</i>	16.58	2.64	W	2.67	5.21	W
27	Printing and Publishing	21.98	W	4.38	5.09	7.34	0.00
28	Chemicals and Allied Products	W	W	W	3.11	W	1.92
2819	<i>Industrial Inorganic Chemicals, nec</i>	W	2.83	W	3.45	9.37	2.15
2821	<i>Plastics Materials and Resins</i>	15.33	2.74	4.22	3.15	W	W
2869	<i>Industrial Organic Chemicals, nec</i>	8.95	W	4.24	W	W	0.00
2873	<i>Nitrogenous Fertilizers</i>	W	0.00	0.00	3.15	0.00	0.00
29	Petroleum and Coal Products	W	3.05	4.10	W	10.09	W
2911	<i>Petroleum Refining</i>	12.27	0.00	0.00	2.56	0.00	1.62
30	Rubber and Misc. Plastics Products	20.15	W	4.12	4.10	W	W
31	Leather and Leather Products	W	2.49	4.59	W	9.06	1.90
32	Stone, Clay and Glass Products	W	2.64	4.41	3.11	5.34	1.53
3241	<i>Cement, Hydraulic</i>	13.53	2.35	4.64	4.20	10.41	1.51
33	Primary Metal Industries	W	2.46	W	2.90	5.03	1.68
3312	<i>Blast Furnaces and Steel Mills</i>	W	W	W	2.84	W	1.67
3334	<i>Primary Aluminum^b</i>	W	W	W	W	6.93	W
34	Fabricated Metal Products	19.48	3.53	4.62	4.09	7.07	W
35	Industrial Machinery and Equipment	18.31	3.02	3.74	4.34	W	W
36	Electronic and Other Electric Equipment	17.31	2.77	4.25	3.74	5.16	W
37	Transportation Equipment	18.62	2.91	W	3.23	5.46	W
38	Instruments and Related Products	19.32	2.72	W	3.73	8.91	W
39	Misc. Manufacturing Industries	W	2.94	4.57	W	7.44	W
	Total	16.10	2.66	4.30	3.31	W	1.71

See footnotes at end of table.

Table 30. Average Prices of Selected Purchased Energy Sources by Census Region, Industry Group, and Selected Industries, 1988: Part 2 (Continued)
(Dollars per Million Btu)

SIC Code ^a	Industry Groups and Industry	Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal
Midwest Census Region							
20	Food and Kindred Products	13.94	2.40	W	2.77	4.49	1.50
21	Tobacco Products	NA	NA	NA	NA	NA	NA
22	Textile Mill Products	NA	NA	NA	NA	NA	NA
23	Apparel and Other Textile Products	18.53	3.23	4.79	3.83	5.14	2.44
24	Lumber and Wood Products	17.48	2.81	W	4.06	W	2.00
25	Furniture and Fixtures	15.45	W	6.01	3.62	5.97	W
26	Paper and Allied Products	W	W	W	2.83	7.19	1.72
2621	Paper Mills	W	W	W	2.57	6.45	1.75
2631	Paperboard Mills	11.72	2.53	3.41	2.45	6.38	1.69
27	Printing and Publishing	18.34	2.80	6.48	3.67	8.01	0.00
28	Chemicals and Allied Products	12.18	W	W	2.42	W	1.57
2819	Industrial Inorganic Chemicals, nec	W	W	5.32	W	7.80	1.45
2821	Plastics Materials and Resins	11.62	2.50	W	2.64	W	W
2869	Industrial Organic Chemicals, nec	12.19	W	W	2.03	W	1.42
2873	Nitrogenous Fertilizers	10.73	0.00	5.01	W	5.66	0.00
29	Petroleum and Coal Products	11.90	2.44	4.73	2.52	4.06	W
2911	Petroleum Refining	11.39	0.00	0.00	W	0.00	W
30	Rubber and Misc. Plastics Products	15.23	W	W	3.15	W	W
31	Leather and Leather Products	18.14	2.84	4.49	3.37	5.28	4.35
32	Stone, Clay and Glass Products	13.51	2.55	W	2.77	6.12	1.40
3241	Cement, Hydraulic	11.95	5.58	W	2.37	6.80	1.28
33	Primary Metal Industries	11.94	2.11	4.38	2.80	4.48	1.83
3312	Blast Furnaces and Steel Mills	W	2.11	W	2.67	W	1.82
3334	Primary Aluminum ^b	W	0.00	4.97	W	3.48	W
34	Fabricated Metal Products	17.13	W	5.02	3.35	5.89	1.87
35	Industrial Machinery and Equipment	16.12	3.28	4.30	3.49	5.54	1.54
36	Electronic and Other Electric Equipment	15.00	2.40	5.04	3.30	5.57	1.81
37	Transportation Equipment	W	2.98	W	3.42	W	2.12
38	Instruments and Related Products	NA	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	18.62	3.22	W	3.61	8.53	W
	Total	14.07	2.45	4.61	2.89	W	1.70
South Census Region							
20	Food and Kindred Products	W	2.62	W	2.89	W	1.83
21	Tobacco Products	13.92	2.61	3.54	3.48	41.21	2.04
22	Textile Mill Products	13.61	2.84	W	3.33	4.62	W
23	Apparel and Other Textile Products	18.43	3.06	4.62	4.24	5.87	2.26
24	Lumber and Wood Products	17.30	W	W	3.21	5.14	2.08
25	Furniture and Fixtures	17.39	W	4.31	3.98	5.89	W
26	Paper and Allied Products	11.64	2.21	4.24	W	5.92	1.83
2621	Paper Mills	W	W	3.59	2.15	4.87	1.80
2631	Paperboard Mills	11.37	2.10	4.32	2.09	5.91	1.88
27	Printing and Publishing	16.73	W	W	4.17	W	0.00
28	Chemicals and Allied Products	W	W	4.22	1.88	W	1.64
2819	Industrial Inorganic Chemicals, nec	8.91	W	W	W	5.08	W
2821	Plastics Materials and Resins	W	W	4.80	W	11.01	W
2869	Industrial Organic Chemicals, nec	10.55	2.19	4.58	1.84	4.65	1.48
2873	Nitrogenous Fertilizers	10.98	0.00	4.43	1.85	W	0.00
29	Petroleum and Coal Products	11.22	W	W	W	3.74	W
2911	Petroleum Refining	W	0.00	7.46	1.91	0.00	W
30	Rubber and Misc. Plastics Products	13.51	2.99	4.53	2.80	5.65	1.91
31	Leather and Leather Products	W	1.93	W	W	7.25	0.00
32	Stone, Clay and Glass Products	12.93	W	W	2.55	4.86	1.80
3241	Cement, Hydraulic	11.11	W	W	1.80	8.07	1.58
33	Primary Metal Industries	W	W	4.20	2.65	5.02	W
3312	Blast Furnaces and Steel Mills	W	W	4.37	2.55	8.04	W
3334	Primary Aluminum ^b	W	0.00	W	2.73	3.90	W
34	Fabricated Metal Products	14.79	W	5.49	3.35	6.30	W
35	Industrial Machinery and Equipment	15.01	2.74	5.77	3.59	7.84	1.78
36	Electronic and Other Electric Equipment	14.04	2.83	4.40	3.16	6.28	W
37	Transportation Equipment	14.23	W	4.04	3.46	5.36	W
38	Instruments and Related Products	NA	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	W	W	W	W	7.61	0.00
	Total	12.35	2.37	4.86	2.17	W	W

See footnotes at end of table.

Table 30. Average Prices of Selected Purchased Energy Sources by Census Region, Industry Group, and Selected Industries, 1988: Part 2 (Continued)
(Dollars per Million Btu)

SIC Code ^a	Industry Groups and Industry	Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal
West Census Region							
20	Food and Kindred Products	15.16	W	5.12	3.01	W	W
21	Tobacco Products	0.00	0.00	0.00	0.00	0.00	0.00
22	Textile Mill Products	11.57	0.00	4.04	3.98	8.94	0.00
23	Apparel and Other Textile Products	23.27	0.00	0.00	4.82	13.04	0.00
24	Lumber and Wood Products	13.34	2.48	5.54	3.55	W	0.00
25	Furniture and Fixtures	NA	NA	NA	NA	NA	NA
26	Paper and Allied Products	9.41	W	3.28	2.53	6.86	W
2621	Paper Mills	W	W	4.23	2.44	5.69	W
2631	Paperboard Mills	8.50	2.18	W	2.37	6.41	W
27	Printing and Publishing	21.47	0.00	5.10	4.08	W	0.00
28	Chemicals and Allied Products	W	W	5.20	2.09	7.48	W
2819	Industrial Inorganic Chemicals, nec	W	W	4.84	2.34	7.20	W
2821	Plastics Materials and Resins	20.99	W	W	4.19	10.94	0.00
2869	Industrial Organic Chemicals, nec	13.74	0.00	W	W	11.08	0.00
2873	Nitrogenous Fertilizers	8.23	0.00	6.88	W	5.65	0.00
29	Petroleum and Coal Products	W	4.19	W	2.44	4.07	0.00
2911	Petroleum Refining	W	0.00	0.00	W	0.00	0.00
30	Rubber and Misc. Plastics Products	20.60	W	4.82	3.55	6.80	0.00
31	Leather and Leather Products	W	0	8.32	W	7.80	0.00
32	Stone, Clay and Glass Products	14.81	W	5.16	2.80	4.29	1.67
3241	Cement, Hydraulic	14.08	W	4.70	2.32	10.09	1.70
33	Primary Metal Industries	8.88	W	W	2.61	6.25	W
3312	Blast Furnaces and Steel Mills	W	W	4.63	2.37	7.82	W
3334	Primary Aluminum ^b	7.99	0	4.85	2.87	4.97	10.61
34	Fabricated Metal Products	21.20	0	3.80	4.50	6.93	0.00
35	Industrial Machinery and Equipment	17.13	0	W	3.48	W	0.00
36	Electronic and Other Electric Equipment	18.17	0	5.95	4.05	10.93	0.00
37	Transportation Equipment	18.49	W	W	3.91	W	W
38	Instruments and Related Products	20.59	2.31	4.42	W	7.36	0.00
39	Misc. Manufacturing Industries	21.55	0.00	5.07	4.49	9.06	0.00
	Total	12.91	2.42	5.07	2.82	5.83	W

^a See Appendices A and D for description of the Standard Industrial Classification system.

^b The price estimates for coal for SIC 3334 includes anthracite coal for the production of carbon anodes. Because of the high cost of transporting anthracite from the East Coast to the West and South, the prices of coal in those regions are extremely high.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

NA=Not available. Data are included in higher level totals.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey."

Table 31. Average Prices of Selected Purchased Energy Sources by Economic Characteristics of the Establishment, 1988

Economic Characteristics ^a	Electricity (dollars per kWh)	Residual Fuel Oil (dollars per gallon)	Distillate Fuel Oil (dollars per gallon)	Natural Gas (dollars per 1000 cu ft)	LPG (dollars per gallons)	Coal (dollars per short tons)
Value of Shipments and Receipts (million dollars)						
Under 20	0.061	0.390	0.688	3.62	0.535	39.54
20-49	0.050	0.391	0.609	2.95	0.460	37.29
50-99	0.046	0.386	0.642	2.80	0.517	38.09
100-249	0.040	0.370	0.611	2.38	0.626	39.58
250-499	0.036	0.359	0.610	2.41	0.498	39.58
500 and Over	0.042	0.370	0.571	2.19	0.402	45.37
All Manufacturing	0.046	0.375	0.646	2.59	0.458	41.34
Employment Size						
Under 50	0.058	0.435	0.687	3.50	0.487	46.01
50-99	0.058	0.365	0.658	3.03	0.284	33.90
100-249	0.050	0.393	0.636	2.72	0.814	36.71
250-499	0.046	0.377	0.635	2.58	0.495	39.48
500-999	0.039	0.367	0.651	2.45	0.635	39.90
1,000 and Over	0.043	0.370	0.571	2.36	0.358	44.05
All Manufacturing	0.046	0.375	0.646	2.59	0.458	41.34

	Electricity (dollars per million Btu)	Residual Fuel Oil (dollars per million Btu)	Distillate Fuel Oil (dollars per million Btu)	Natural Gas (dollars per million Btu)	LPG (dollars per million Btu)	Coal (dollars per million Btu)
Value of Shipments and Receipts (million dollars)						
Under 20	17.97	2.60	4.96	3.52	6.15	1.74
20-49	14.73	2.61	4.39	2.87	5.29	1.63
50-99	13.51	2.58	4.63	2.72	5.94	1.59
100-249	11.61	2.47	4.41	2.31	7.19	1.68
250-499	10.56	2.40	4.39	2.34	5.70	1.72
500 and Over	12.35	2.47	4.11	2.12	4.62	1.80
All Manufacturing	13.44	2.50	4.66	2.52	5.27	1.72
Employment Size						
Under 50	16.87	2.91	4.95	3.40	5.59	1.96
50-99	17.01	2.44	4.74	2.94	3.27	1.51
100-249	14.61	2.63	4.59	2.64	9.35	1.61
250-499	13.57	2.52	4.58	2.51	5.69	1.70
500-999	11.47	2.45	4.70	2.38	7.30	1.65
1,000 and Over	12.49	2.47	4.12	2.29	4.11	1.78
All Manufacturing	13.44	2.50	4.66	2.52	5.27	1.72

^a Value of Shipments and Receipts and Employment Size data were supplied by the Bureau of the Census. See Appendix A.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey," and the Bureau of the Census, Industry Division, data files for the "1988 Annual Survey of Manufactures" and the "1987 Census of Manufacturing."

Relative Standard Errors

Table 32. Relative Standard Errors for Table 1, Parts 1 and 2 of Detailed Statistics Section (Percent)

SIC Code*	Industry Groups and Industry	Total	Net Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal	Coke and Breeze	Other
Total United States										
20	Food and Kindred Products	4	4	9	11	3	28	11	15	23
21	Tobacco Products	10	12	10	18	12	14	14	0	18
22	Textile Mill Products	4	4	6	18	5	12	9	*	15
23	Apparel and Other Textile Products	11	10	33	22	16	37	44	0	39
24	Lumber and Wood Products	10	13	29	22	12	15	42	0	13
25	Furniture and Fixtures	8	8	23	33	8	19	28	0	19
26	Paper and Allied Products	3	3	4	9	3	8	4	0	4
2621	Paper Mills	3	3	5	5	3	7	4	0	4
2631	Paperboard Mills	5	6	7	17	6	8	7	0	5
27	Printing and Publishing	7	7	28	20	8	23	0	0	18
28	Chemicals and Allied Products	5	4	9	9	5	11	6	16	9
2819	Industrial Inorganic Chemicals, nec	7	13	10	13	9	15	11	17	10
2821	Plastics Materials and Resins	7	5	9	20	11	9	11	0	18
2869	Industrial Organic Chemicals, nec	11	11	16	16	11	16	15	Q	12
2873	Nitrogenous Fertilizers	9	7	0	11	9	W	0	0	W
29	Petroleum and Coal Products	2	4	6	17	5	7	10	0	2
2911	Petroleum Refining	2	4	6	11	5	7	10	0	2
30	Rubber and Misc. Plastics Products	4	5	9	15	5	14	14	0	15
31	Leather and Leather Products	14	22	31	31	12	25	50	0	*
32	Stone, Clay and Glass Products	3	3	16	25	4	10	6	33	11
3241	Cement, Hydraulic	5	5	Q	6	9	*	6	18	15
33	Primary Metal Industries	4	3	7	8	3	14	6	6	6
3312	Blast Furnaces and Steel Mills	5	4	8	5	4	14	6	7	9
3334	Primary Aluminum	6	6	23	8	6	8	W	W	7
34	Fabricated Metal Products	5	5	19	14	6	12	12	22	24
35	Industrial Machinery and Equipment	6	5	16	18	9	15	15	Q	17
36	Electronic and Other Electric Equipment	4	5	13	16	5	31	15	24	19
37	Transportation Equipment	5	5	12	11	6	13	9	21	12
38	Instruments and Related Products	10	7	14	28	9	Q	39	0	19
39	Misc. Manufacturing Industries	8	8	18	18	11	36	38	0	29
	Total	2	2	3	6	2	10	3	6	2
Northeast Census Region										
20	Food and Kindred Products	7	9	W	19	8	W	W	0	25
21	Tobacco Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
22	Textile Mill Products	9	12	12	27	15	30	34	0	33
23	Apparel and Other Textile Products	28	30	39	29	43	Q	0	0	*
24	Lumber and Wood Products	30	32	Q	Q	32	33	0	0	50
25	Furniture and Fixtures	20	17	39	37	22	Q	0	0	Q
26	Paper and Allied Products	4	5	5	W	7	9	W	0	7
2621	Paper Mills	5	W	6	W	8	9	W	0	6
2631	Paperboard Mills	11	11	19	35	15	27	24	0	*
27	Printing and Publishing	13	14	39	24	20	Q	0	0	33
28	Chemicals and Allied Products	7	11	W	W	9	21	14	0	18
2819	Industrial Inorganic Chemicals, nec	12	12	15	43	12	*	*	0	*
2821	Plastics Materials and Resins	10	10	11	33	13	W	W	0	17
2869	Industrial Organic Chemicals, nec	14	21	25	13	16	30	0	0	24
2873	Nitrogenous Fertilizers	*	28	0	*	*	0	0	0	*
29	Petroleum and Coal Products	4	12	W	41	14	17	W	0	3
2911	Petroleum Refining	4	13	W	12	15	17	12	0	W
30	Rubber and Misc. Plastics Products	9	11	W	22	13	W	W	0	31
31	Leather and Leather Products	W	W	38	32	W	*	Q	0	Q
32	Stone, Clay and Glass Products	6	6	26	19	9	18	10	17	25
3241	Cement, Hydraulic	11	10	Q	12	*	*	10	18	18
33	Primary Metal Industries	8	6	14	19	6	25	13	19	15
3312	Blast Furnaces and Steel Mills	10	6	15	10	7	15	13	21	15
3334	Primary Aluminum	W	W	23	21	W	*	16	0	W
34	Fabricated Metal Products	15	9	20	19	23	21	30	43	Q
35	Industrial Machinery and Equipment	10	12	17	24	13	32	35	0	*
36	Electronic and Other Electric Equipment	9	9	16	21	11	27	32	29	29
37	Transportation Equipment	14	17	18	16	16	40	23	0	Q
38	Instruments and Related Products	19	13	15	33	14	29	39	0	32
39	Misc. Manufacturing Industries	W	W	19	21	W	24	47	0	*
	Total	3	3	4	8	4	10	9	18	3

See footnotes at end of table.

Table 32. Relative Standard Errors for Table 1, Parts 1 and 2 of Detailed Statistics Section (Continued) (Percent)

SIC Code*	Industry Groups and Industry	Total	Net Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal	Coke and Breeze	Other
Midwest Census Region										
20	Food and Kindred Products	7	5	10	21	5	Q	15	26	20
21	Tobacco Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
22	Textile Mill Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
23	Apparel and Other Textile Products	20	19	Q	40	23	Q	Q	0	*
24	Lumber and Wood Products	19	19	Q	W	21	W	Q	0	28
25	Furniture and Fixtures	13	16	35	30	13	34	46	0	33
26	Paper and Allied Products	4	5	W	W	5	14	6	0	8
2621	Paper Mills	5	4	W	W	5	5	6	0	7
2631	Paperboard Mills	10	10	34	19	10	12	10	0	18
27	Printing and Publishing	10	10	Q	Q	12	24	0	0	28
28	Chemicals and Allied Products	7	11	W	W	8	16	9	26	10
2819	Industrial Inorganic Chemicals, nec	18	27	W	10	10	*	18	29	W
2821	Plastics Materials and Resins	15	10	15	12	10	W	W	0	18
2869	Industrial Organic Chemicals, nec	16	16	29	26	21	31	17	0	25
2873	Nitrogenous Fertilizers	15	15	0	16	15	*	0	0	Q
29	Petroleum and Coal Products	4	7	W	36	8	W	W	0	3
2911	Petroleum Refining	4	8	11	15	8	11	W	0	W
30	Rubber and Misc. Plastics Products	7	7	W	26	9	W	W	0	27
31	Leather and Leather Products	27	Q	Q	Q	18	44	Q	0	Q
32	Stone, Clay and Glass Products	6	5	37	22	6	16	12	25	18
3241	Cement, Hydraulic	9	9	*	11	12	*	9	*	25
33	Primary Metal Industries	5	5	10	8	5	23	8	7	10
3312	Blast Furnaces and Steel Mills	6	5	10	8	6	20	8	8	13
3334	Primary Aluminum	W	W	0	14	W	*	W	0	W
34	Fabricated Metal Products	6	6	35	18	6	20	13	35	21
35	Industrial Machinery and Equipment	7	7	Q	19	7	24	16	Q	25
36	Electronic and Other Electric Equipment	7	7	29	20	7	27	22	0	19
37	Transportation Equipment	7	7	14	18	9	22	10	21	15
38	Instruments and Related Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	13	14	Q	40	15	*	38	0	*
	Total	2	3	8	10	2	13	5	7	3
South Census Region										
20	Food and Kindred Products	6	7	15	22	6	22	11	41	26
21	Tobacco Products	10	12	10	18	12	14	14	0	18
22	Textile Mill Products	4	4	7	22	5	11	9	*	17
23	Apparel and Other Textile Products	12	11	Q	40	15	33	50	0	Q
24	Lumber and Wood Products	13	11	W	W	21	17	Q	0	16
25	Furniture and Fixtures	12	11	31	49	14	25	30	0	21
26	Paper and Allied Products	4	5	6	15	5	18	5	0	4
2621	Paper Mills	4	6	7	8	5	8	6	0	5
2631	Paperboard Mills	6	7	8	8	8	9	9	0	6
27	Printing and Publishing	12	13	43	24	16	29	0	0	25
28	Chemicals and Allied Products	6	5	12	W	6	13	7	W	10
2819	Industrial Inorganic Chemicals, nec	8	15	W	9	11	20	14	W	11
2821	Plastics Materials and Resins	8	7	14	24	12	W	W	0	24
2869	Industrial Organic Chemicals, nec	12	14	18	22	12	17	24	Q	13
2873	Nitrogenous Fertilizers	10	10	0	13	10	W	0	0	W
29	Petroleum and Coal Products	3	6	W	26	6	15	W	0	2
2911	Petroleum Refining	3	6	W	12	6	12	W	0	2
30	Rubber and Misc. Plastics Products	6	7	11	22	8	13	24	0	23
31	Leather and Leather Products	W	W	Q	42	W	Q	0	0	Q
32	Stone, Clay and Glass Products	6	5	W	48	6	16	10	Q	19
3241	Cement, Hydraulic	10	9	17	10	16	*	12	28	13
33	Primary Metal Industries	6	6	15	13	7	14	9	12	13
3312	Blast Furnaces and Steel Mills	8	6	15	9	8	11	10	15	13
3334	Primary Aluminum	9	9	0	12	9	*	W	W	12
34	Fabricated Metal Products	8	10	41	33	10	22	28	35	25
35	Industrial Machinery and Equipment	9	9	31	Q	10	22	Q	47	32
36	Electronic and Other Electric Equipment	8	8	35	19	8	Q	23	33	27
37	Transportation Equipment	6	8	20	19	6	14	19	*	24
38	Instruments and Related Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	W	W	46	42	W	Q	0	0	Q
	Total	3	2	5	13	4	12	4	11	2

See footnotes at end of table.

Table 32. Relative Standard Errors for Table 1, Parts 1 and 2 of Detailed Statistics Section (Continued)
(Percent)

SIC Code*	Industry Groups and Industry	Total	Net Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal	Coke and Breeze	Other
West Census Region										
20	Food and Kindred Products	10	9	W	21	8	W	W	11	39
21	Tobacco Products	0	0	0	0	0	0	0	0	0
22	Textile Mill Products	25	49	0	23	21	Q	0	0	*
23	Apparel and Other Textile Products	33	37	0	0	38	Q	0	0	Q
24	Lumber and Wood Products	17	40	Q	19	19	W	0	0	22
25	Furniture and Fixtures	NA	NA	NA	NA	NA	NA	NA	NA	NA
26	Paper and Allied Products	8	7	W	12	8	13	W	0	7
2621	<i>Paper Mills</i>	8	W	W	10	7	7	W	0	7
2631	<i>Paperboard Mills</i>	10	13	12	19	11	10	33	0	11
27	Printing and Publishing	17	18	0	Q	21	45	0	0	Q
28	Chemicals and Allied Products	9	11	W	26	12	22	20	W	21
2819	<i>Industrial Inorganic Chemicals, nec</i>	13	16	W	13	17	*	20	W	W
2821	<i>Plastics Materials and Resins</i>	7	9	26	19	7	*	0	0	*
2869	<i>Industrial Organic Chemicals, nec</i>	26	*	0	31	34	*	0	0	36
2873	<i>Nitrogenous Fertilizers</i>	17	14	0	24	18	*	0	0	*
29	Petroleum and Coal Products	5	7	W	19	8	W	0	0	5
2911	<i>Petroleum Refining</i>	5	7	W	16	9	W	0	0	W
30	Rubber and Misc. Plastics Products	14	20	46	Q	18	50	0	0	Q
31	Leather and Leather Products	36	37	0	Q	38	Q	0	0	Q
32	Stone, Clay and Glass Products	6	7	W	18	8	22	9	W	23
3241	<i>Cement, Hydraulic</i>	8	8	16	13	11	*	9	36	33
33	Primary Metal Industries	7	7	21	19	9	17	20	26	10
3312	<i>Blast Furnaces and Steel Mills</i>	15	18	22	13	13	*	20	20	18
3334	<i>Primary Aluminum</i>	8	8	0	9	9	11	13	0	12
34	Fabricated Metal Products	12	12	0	34	12	24	0	0	Q
35	Industrial Machinery and Equipment	29	18	0	35	42	34	0	0	42
36	Electronic and Other Electric Equipment	11	12	0	41	14	*	0	0	44
37	Transportation Equipment	9	9	25	48	8	27	31	0	15
38	Instruments and Related Products	13	14	*	40	17	*	0	0	27
39	Misc. Manufacturing Industries	21	21	0	Q	27	*	0	0	Q
	Total	3	4	7	8	4	9	8	14	5

* See Appendices A and D for descriptions of the Standard Industrial Classification system.

* Estimate less than 0.5 rounded to zero.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Q=Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

NA=Not available. Data are included in higher level totals.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey," and Office of Oil and Gas, Petroleum Supply Division, Form EIA-810, "Monthly Refinery Report" for 1988.

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Table 33. Relative Standard Errors for Table 2 of Detailed Statistics Section (Percent)

SIC Code ^a	Industry Groups and Industry	Total	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal	Coke and Breeze	Other
Total United States									
20	Food and Kindred Products	18	Q	Q	17	Q	34	W	Q
21	Tobacco Products	19	0	0	0	15	0	0	21
22	Textile Mill Products	*	0	*	*	*	0	0	*
23	Apparel and Other Textile Products	Q	0	0	0	0	0	0	Q
24	Lumber and Wood Products	45	0	Q	Q	34	0	0	49
25	Furniture and Fixtures	Q	0	0	0	0	0	0	Q
26	Paper and Allied Products	21	0	Q	15	*	0	0	25
2621	Paper Mills	13	0	W	17	0	0	0	W
2631	Paperboard Mills	28	0	34	Q	*	0	0	28
27	Printing and Publishing	45	0	0	48	0	0	0	Q
28	Chemicals and Allied Products	7	30	27	7	11	24	17	14
2819	Industrial Inorganic Chemicals, nec	12	0	W	W	*	W	W	14
2821	Plastics Materials and Resins	8	0	*	W	9	0	0	W
2869	Industrial Organic Chemicals, nec	13	0	32	13	16	0	Q	18
2873	Nitrogenous Fertilizers	9	0	0	9	W	0	0	W
29	Petroleum and Coal Products	34	0	Q	48	Q	42	0	34
2911	Petroleum Refining	1	0	0	0	0	0	0	1
30	Rubber and Misc. Plastics Products	19	W	*	*	W	48	0	*
31	Leather and Leather Products	Q	0	Q	0	0	0	0	Q
32	Stone, Clay and Glass Products	24	0	28	29	18	Q	Q	*
3241	Cement, Hydraulic	*	0	19	*	*	0	0	*
33	Primary Metal Industries	6	22	22	14	Q	8	11	8
3312	Blast Furnaces and Steel Mills	6	22	12	15	0	6	9	12
3334	Primary Aluminum	7	0	0	0	0	W	W	8
34	Fabricated Metal Products	21	0	Q	27	Q	47	47	44
35	Industrial Machinery and Equipment	20	0	Q	22	*	47	0	*
36	Electronic and Other Electric Equipment	24	0	34	47	33	48	26	27
37	Transportation Equipment	21	0	W	36	47	31	Q	30
38	Instruments and Related Products	33	0	*	*	Q	0	0	37
39	Misc. Manufacturing Industries	*	0	0	*	49	0	0	Q
	Total	3	25	18	7	11	6	9	1
Northeast Census Region									
20	Food and Kindred Products	Q	0	Q	Q	Q	0	0	0
21	Tobacco Products	NA	NA	NA	NA	NA	NA	NA	NA
22	Textile Mill Products	*	0	*	*	0	0	0	*
23	Apparel and Other Textile Products	0	0	0	0	0	0	0	0
24	Lumber and Wood Products	Q	0	0	0	0	0	0	Q
25	Furniture and Fixtures	0	0	0	0	0	0	0	0
26	Paper and Allied Products	37	0	Q	Q	Q	0	0	*
2621	Paper Mills	*	0	W	*	0	0	0	*
2631	Paperboard Mills	0	0	0	0	0	0	0	0
27	Printing and Publishing	Q	0	0	0	0	0	0	Q
28	Chemicals and Allied Products	19	0	Q	*	W	0	0	W
2819	Industrial Inorganic Chemicals, nec	*	0	0	0	0	0	0	*
2821	Plastics Materials and Resins	W	0	0	*	W	0	0	*
2869	Industrial Organic Chemicals, nec	33	0	29	0	39	0	0	*
2873	Nitrogenous Fertilizers	0	0	0	0	0	0	0	0
29	Petroleum and Coal Products	1	0	Q	0	Q	42	0	Q
2911	Petroleum Refining	1	0	0	0	0	0	0	1
30	Rubber and Misc. Plastics Products	*	0	*	Q	Q	0	0	*
31	Leather and Leather Products	Q	0	Q	0	0	0	0	Q
32	Stone, Clay and Glass Products	Q	0	Q	Q	*	0	0	*
3241	Cement, Hydraulic	*	0	0	0	0	0	0	*
33	Primary Metal Industries	13	0	Q	Q	*	13	28	28
3312	Blast Furnaces and Steel Mills	13	0	*	0	0	13	17	*
3334	Primary Aluminum	W	0	0	0	0	16	0	W
34	Fabricated Metal Products	*	0	Q	*	Q	0	0	Q
35	Industrial Machinery and Equipment	*	0	Q	*	Q	0	0	Q
36	Electronic and Other Electric Equipment	30	0	Q	Q	0	47	37	*
37	Transportation Equipment	*	0	*	Q	*	0	0	*
38	Instruments and Related Products	Q	0	0	Q	0	0	0	*
39	Misc. Manufacturing Industries	Q	0	0	Q	49	0	0	*
	Total	6	0	Q	26	W	13	24	W

See footnotes at end of table.

Table 33. Relative Standard Errors for Table 2 of Detailed Statistics Section (Continued)
(Percent)

SIC Code*	Industry Groups and Industry	Total	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal	Coke and Breeze	Other
Midwest Census Region									
20	Food and Kindred Products	24	0	Q	17	Q	Q	W	Q
21	Tobacco Products	NA	NA	NA	NA	NA	NA	NA	NA
22	Textile Mill Products	NA	NA	NA	NA	NA	NA	NA	NA
23	Apparel and Other Textile Products	Q	0	0	0	0	0	0	Q
24	Lumber and Wood Products	Q	0	Q	Q	0	0	0	0
25	Furniture and Fixtures	Q	0	0	0	0	0	0	Q
26	Paper and Allied Products	34	0	44	W	Q	0	0	W
2621	Paper Mills	16	0	W	*	0	0	0	W
2631	Paperboard Mills	42	0	Q	Q	Q	0	0	42
27	Printing and Publishing	Q	0	0	Q	0	0	0	Q
28	Chemicals and Allied Products	13	0	Q	18	W	Q	W	17
2819	Industrial Inorganic Chemicals, nec	W	0	0	*	0	0	0	W
2821	Plastics Materials and Resins	W	0	0	Q	W	0	0	*
2869	Industrial Organic Chemicals, nec	28	0	25	40	31	0	0	*
2873	Nitrogenous Fertilizers	17	0	0	17	0	0	0	0
29	Petroleum and Coal Products	1	W	Q	Q	0	0	0	Q
2911	Petroleum Refining	1	0	0	0	0	0	0	1
30	Rubber and Misc. Plastics Products	25	W	Q	*	Q	46	0	Q
31	Leather and Leather Products	0	0	0	0	0	0	0	0
32	Stone, Clay and Glass Products	*	0	Q	*	*	Q	Q	*
3241	Cement, Hydraulic	*	0	W	*	*	0	0	*
33	Primary Metal Industries	8	22	32	14	Q	8	17	16
3312	Blast Furnaces and Steel Mills	8	22	22	15	0	8	11	15
3334	Primary Aluminum	W	0	0	0	0	W	0	W
34	Fabricated Metal Products	29	0	30	29	Q	47	0	Q
35	Industrial Machinery and Equipment	24	0	Q	28	*	0	0	*
36	Electronic and Other Electric Equipment	Q	0	*	Q	*	0	0	*
37	Transportation Equipment	19	0	W	*	W	31	Q	40
38	Instruments and Related Products	NA	NA	NA	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	*	0	0	*	0	0	0	*
	Total	5	22	35	13	W	8	16	W
South Census Region									
20	Food and Kindred Products	28	0	W	32	Q	0	0	*
21	Tobacco Products	19	0	0	0	15	0	0	21
22	Textile Mill Products	*	0	0	*	*	0	0	*
23	Apparel and Other Textile Products	Q	0	0	0	0	0	0	Q
24	Lumber and Wood Products	*	0	Q	0	Q	0	0	*
25	Furniture and Fixtures	Q	0	0	0	0	0	0	Q
26	Paper and Allied Products	29	0	*	W	*	0	0	W
2621	Paper Mills	21	0	0	21	0	0	0	*
2631	Paperboard Mills	33	0	0	0	*	0	0	33
27	Printing and Publishing	*	0	0	Q	0	0	0	Q
28	Chemicals and Allied Products	8	30	W	8	13	17	W	14
2819	Industrial Inorganic Chemicals, nec	14	0	W	W	*	W	W	W
2821	Plastics Materials and Resins	9	0	*	W	W	0	0	W
2869	Industrial Organic Chemicals, nec	14	0	33	14	17	0	Q	19
2873	Nitrogenous Fertilizers	10	0	0	11	W	0	0	W
29	Petroleum and Coal Products	Q	0	Q	0	Q	0	0	Q
2911	Petroleum Refining	1	0	0	0	0	0	0	1
30	Rubber and Misc. Plastics Products	*	0	*	*	*	0	0	*
31	Leather and Leather Products	0	0	0	0	0	0	0	0
32	Stone, Clay and Glass Products	30	0	W	34	*	0	Q	*
3241	Cement, Hydraulic	*	0	W	0	Q	0	0	*
33	Primary Metal Industries	9	0	19	*	Q	W	W	W
3312	Blast Furnaces and Steel Mills	10	0	14	*	0	W	W	*
3334	Primary Aluminum	11	0	0	0	0	W	W	12
34	Fabricated Metal Products	39	0	*	Q	0	0	47	*
35	Industrial Machinery and Equipment	35	0	0	40	Q	47	0	Q
36	Electronic and Other Electric Equipment	31	0	Q	*	*	47	34	31
37	Transportation Equipment	*	0	31	Q	Q	0	0	*
38	Instruments and Related Products	NA	NA	NA	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	Q	0	0	Q	0	0	0	Q
	Total	4	30	22	8	13	W	12	W

See footnotes at end of table.

**Table 33. Relative Standard Errors for Table 2 of Detailed Statistics Section (Continued)
(Percent)**

SIC Code*	Industry Groups and Industry	Total	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal	Coke and Breeze	Other
West Census Region									
20	Food and Kindred Products	26	Q	Q	Q	Q	35	W	*
21	Tobacco Products	0	0	0	0	0	0	0	0
22	Textile Mill Products	0	0	0	0	0	0	0	0
23	Apparel and Other Textile Products	0	0	0	0	0	0	0	0
24	Lumber and Wood Products	49	0	38	Q	38	0	0	50
25	Furniture and Fixtures	NA	NA	NA	NA	NA	NA	NA	NA
26	Paper and Allied Products	*	0	24	*	*	0	0	*
2621	Paper Mills	0	0	0	0	0	0	0	0
2631	Paperboard Mills	*	0	24	0	*	0	0	*
27	Printing and Publishing	0	0	0	0	0	0	0	0
28	Chemicals and Allied Products	14	0	0	18	0	0	W	W
2819	Industrial Inorganic Chemicals, nec	W	0	0	*	0	0	W	*
2821	Plastics Materials and Resins	*	0	0	*	0	0	0	0
2869	Industrial Organic Chemicals, nec	40	0	0	0	0	0	0	40
2873	Nitrogenous Fertilizers	19	0	0	19	0	0	0	0
29	Petroleum and Coal Products	1	Q	Q	Q	0	0	0	W
2911	Petroleum Refining	1	0	0	0	0	0	0	1
30	Rubber and Misc. Plastics Products	Q	0	0	0	0	0	0	Q
31	Leather and Leather Products	Q	0	0	0	0	0	0	Q
32	Stone, Clay and Glass Products	*	0	39	*	*	0	0	Q
3241	Cement, Hydraulic	*	0	0	0	0	0	0	*
33	Primary Metal Industries	18	0	26	0	Q	W	W	W
3312	Blast Furnaces and Steel Mills	20	0	0	0	0	W	W	*
3334	Primary Aluminum	11	0	0	0	0	13	0	12
34	Fabricated Metal Products	Q	0	0	0	0	0	0	Q
35	Industrial Machinery and Equipment	Q	0	Q	Q	Q	0	0	Q
36	Electronic and Other Electric Equipment	Q	0	0	0	0	0	0	Q
37	Transportation Equipment	Q	0	Q	Q	Q	0	0	Q
38	Instruments and Related Products	*	0	0	*	0	0	0	Q
39	Misc. Manufacturing Industries	0	0	0	0	0	0	0	0
	Total	2	Q	39	17	33	W	21	W

* See Appendices A and D for descriptions of the Standard Industrial Classification system.

* Estimate less than 0.5 rounded to zero.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Q=Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

NA=Not available. Data are included in higher level totals.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey," and Office of Oil and Gas, Petroleum Supply Division, Form EIA-810, "Monthly Refinery Report" for 1988.

Table 34. Relative Standard Errors for Table 3 of Detailed Statistics Section (Percent)

SIC Code*	Industry Groups and Industry	Total	Net Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas
Total United States						
20	Food and Kindred Products	4	4	W	W	3
21	Tobacco Products	10	12	10	18	12
22	Textile Mill Products	4	4	6	18	5
23	Apparel and Other Textile Products	11	10	33	22	16
24	Lumber and Wood Products	10	13	29	22	12
25	Furniture and Fixtures	8	8	23	33	8
26	Paper and Allied Products	3	3	4	9	3
2621	Paper Mills	3	3	5	5	3
2631	Paperboard Mills	5	6	7	18	6
27	Printing and Publishing	7	7	28	20	8
28	Chemicals and Allied Products	4	4	8	10	6
2819	Industrial Inorganic Chemicals, nec	7	13	10	W	W
2821	Plastics Materials and Resins	7	5	W	17	W
2869	Industrial Organic Chemicals, nec	9	11	15	10	12
2873	Nitrogenous Fertilizers	8	7	0	11	9
29	Petroleum and Coal Products	4	4	6	18	5
2911	Petroleum Refining	4	4	6	11	5
30	Rubber and Misc. Plastics Products	4	5	W	15	5
31	Leather and Leather Products	14	22	31	31	12
32	Stone, Clay and Glass Products	4	3	16	25	4
3241	Cement, Hydraulic	5	5	Q	6	9
33	Primary Metal Industries	4	3	8	8	3
3312	Blast Furnaces and Steel Mills	5	4	8	6	4
3334	Primary Aluminum	6	6	23	8	6
34	Fabricated Metal Products	5	5	19	14	6
35	Industrial Machinery and Equipment	6	5	16	18	9
36	Electronic and Other Electric Equipment	4	5	13	16	5
37	Transportation Equipment	5	5	12	W	6
38	Instruments and Related Products	10	7	14	28	9
39	Misc. Manufacturing Industries	8	8	18	18	11
	Total	2	2	3	6	2
Northeast Census Region						
20	Food and Kindred Products	7	9	W	19	8
21	Tobacco Products	NA	NA	NA	NA	NA
22	Textile Mill Products	9	12	12	27	15
23	Apparel and Other Textile Products	28	30	39	29	43
24	Lumber and Wood Products	30	32	Q	Q	32
25	Furniture and Fixtures	20	17	39	37	22
26	Paper and Allied Products	4	5	5	W	W
2621	Paper Mills	5	W	6	W	8
2631	Paperboard Mills	11	11	19	35	15
27	Printing and Publishing	13	14	39	24	20
28	Chemicals and Allied Products	7	11	W	W	9
2819	Industrial Inorganic Chemicals, nec	12	12	15	43	12
2821	Plastics Materials and Resins	W	10	11	23	13
2869	Industrial Organic Chemicals, nec	14	21	25	13	16
2873	Nitrogenous Fertilizers	W	0	.	.
29	Petroleum and Coal Products	10	12	W	41	14
2911	Petroleum Refining	10	13	W	12	15
30	Rubber and Misc. Plastics Products	9	11	W	22	13
31	Leather and Leather Products	W	W	38	32	W
32	Stone, Clay and Glass Products	6	6	26	19	9
3241	Cement, Hydraulic	11	10	Q	12	.
33	Primary Metal Industries	7	6	14	19	6
3312	Blast Furnaces and Steel Mills	9	6	15	10	7
3334	Primary Aluminum	W	W	23	21	W
34	Fabricated Metal Products	15	9	20	19	24
35	Industrial Machinery and Equipment	10	12	17	24	13
36	Electronic and Other Electric Equipment	9	9	16	21	11
37	Transportation Equipment	14	17	18	16	16
38	Instruments and Related Products	19	13	15	33	14
39	Misc. Manufacturing Industries	W	W	19	21	W
	Total	3	3	4	9	4

See footnotes at end of table.

**Table 34. Relative Standard Errors for Table 3 of Detailed Statistics Section (Continued)
(Percent)**

SIC Code*	Industry Groups and Industry	LPG	Coal	Coke & Breeze	Other
Total United States					
20	Food and Kindred Products	W	11	W	22
21	Tobacco Products	15	14	0	•
22	Textile Mill Products	12	9	•	15
23	Apparel and Other Textile Products	37	44	0	39
24	Lumber and Wood Products	16	42	0	13
25	Furniture and Fixtures	19	26	0	19
26	Paper and Allied Products	8	4	0	4
2621	Paper Mills	7	4	0	4
2631	Paperboard Mills	8	7	0	5
27	Printing and Publishing	23	0	0	18
28	Chemicals and Allied Products	11	6	22	7
2819	Industrial Inorganic Chemicals, nec	15	W	W	9
2821	Plastics Materials and Resins	13	11	0	16
2869	Industrial Organic Chemicals, nec	14	15	0	10
2873	Nitrogenous Fertilizers	•	0	0	11
29	Petroleum and Coal Products	7	10	0	4
2911	Petroleum Refining	7	10	0	4
30	Rubber and Misc. Plastics Products	W	14	0	15
31	Leather and Leather Products	25	50	0	•
32	Stone, Clay and Glass Products	10	6	35	10
3241	Cement, Hydraulic	•	6	18	12
33	Primary Metal Industries	12	10	5	5
3312	Blast Furnaces and Steel Mills	14	12	6	5
3334	Primary Aluminum	8	0	0	13
34	Fabricated Metal Products	12	12	24	26
35	Industrial Machinery and Equipment	15	15	Q	18
36	Electronic and Other Electric Equipment	31	16	27	16
37	Transportation Equipment	13	9	W	12
38	Instruments and Related Products	Q	39	0	22
39	Misc. Manufacturing Industries	39	38	0	25
	Total	5	3	5	3
Northeast Census Region					
20	Food and Kindred Products	W	W	0	24
21	Tobacco Products	NA	NA	NA	NA
22	Textile Mill Products	30	34	0	33
23	Apparel and Other Textile Products	Q	0	0	•
24	Lumber and Wood Products	33	0	0	50
25	Furniture and Fixtures	Q	0	0	Q
26	Paper and Allied Products	9	W	0	W
2621	Paper Mills	9	W	0	6
2631	Paperboard Mills	27	24	0	•
27	Printing and Publishing	Q	0	0	33
28	Chemicals and Allied Products	W	14	0	W
2819	Industrial Inorganic Chemicals, nec	•	•	0	•
2821	Plastics Materials and Resins	W	W	0	17
2869	Industrial Organic Chemicals, nec	24	0	0	25
2873	Nitrogenous Fertilizers	0	0	0	•
29	Petroleum and Coal Products	17	W	0	W
2911	Petroleum Refining	17	12	0	W
30	Rubber and Misc. Plastics Products	W	W	0	30
31	Leather and Leather Products	•	Q	0	Q
32	Stone, Clay and Glass Products	16	10	17	19
3241	Cement, Hydraulic	•	10	18	21
33	Primary Metal Industries	25	24	13	10
3312	Blast Furnaces and Steel Mills	15	16	13	11
3334	Primary Aluminum	•	0	0	•
34	Fabricated Metal Products	21	30	43	Q
35	Industrial Machinery and Equipment	32	35	0	•
36	Electronic and Other Electric Equipment	27	33	29	37
37	Transportation Equipment	43	23	0	Q
38	Instruments and Related Products	29	39	0	32
39	Misc. Manufacturing Industries	27	47	0	•
	Total	W	9	13	W

See footnotes at end of table.

Table 34. Relative Standard Errors for Table 3 of Detailed Statistics Section (Continued)
(Percent)

SIC Code*	Industry Groups and Industry	Total	Net Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas
Midwest Census Region						
20	Food and Kindred Products	7	5	10	W	5
21	Tobacco Products	NA	NA	NA	NA	NA
22	Textile Mill Products	NA	NA	NA	NA	NA
23	Apparel and Other Textile Products	20	19	Q	40	23
24	Lumber and Wood Products	19	19	Q	W	21
25	Furniture and Fixtures	13	16	35	30	13
26	Paper and Allied Products	4	5	W	W	5
2621	Paper Mills	5	4	W	W	5
2631	Paperboard Mills	9	10	34	18	10
27	Printing and Publishing	10	10	Q	Q	12
28	Chemicals and Allied Products	6	11	W	W	7
2819	Industrial Inorganic Chemicals, nec	W	27	W	10	W
2821	Plastics Materials and Resins	W	10	15	12	10
2869	Industrial Organic Chemicals, nec	13	16	29	28	17
2873	Nitrogenous Fertilizers	17	15	0	16	18
29	Petroleum and Coal Products	7	7	W	40	8
2911	Petroleum Refining	7	8	W	15	8
30	Rubber and Misc. Plastics Products	7	7	W	28	9
31	Leather and Leather Products	27	Q	Q	Q	18
32	Stone, Clay and Glass Products	7	5	37	W	6
3241	Cement, Hydraulic	10	9	*	W	12
33	Primary Metal Industries	6	5	10	8	5
3312	Blast Furnaces and Steel Mills	7	5	10	8	6
3334	Primary Aluminum	W	W	0	14	W
34	Fabricated Metal Products	6	6	35	18	6
35	Industrial Machinery and Equipment	7	7	Q	19	8
36	Electronic and Other Electric Equipment	7	7	29	20	7
37	Transportation Equipment	7	7	14	W	9
38	Instruments and Related Products	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	13	14	Q	40	15
	Total	3	3	8	10	2
South Census Region						
20	Food and Kindred Products	6	7	15	W	6
21	Tobacco Products	11	12	10	18	12
22	Textile Mill Products	4	4	7	22	5
23	Apparel and Other Textile Products	12	11	Q	40	15
24	Lumber and Wood Products	13	11	W	W	21
25	Furniture and Fixtures	12	11	31	49	14
26	Paper and Allied Products	4	5	6	15	W
2621	Paper Mills	4	6	7	8	5
2631	Paperboard Mills	6	7	8	8	8
27	Printing and Publishing	12	13	43	24	16
28	Chemicals and Allied Products	5	5	8	13	7
2819	Industrial Inorganic Chemicals, nec	8	15	W	W	W
2821	Plastics Materials and Resins	9	7	W	24	W
2869	Industrial Organic Chemicals, nec	10	14	15	16	13
2873	Nitrogenous Fertilizers	11	10	0	13	11
29	Petroleum and Coal Products	5	6	W	W	6
2911	Petroleum Refining	5	6	W	12	6
30	Rubber and Misc. Plastics Products	6	7	11	22	8
31	Leather and Leather Products	W	W	Q	42	W
32	Stone, Clay and Glass Products	6	5	W	W	6
3241	Cement, Hydraulic	10	9	17	W	16
33	Primary Metal Industries	7	6	15	13	7
3312	Blast Furnaces and Steel Mills	9	6	15	10	8
3334	Primary Aluminum	9	9	0	12	9
34	Fabricated Metal Products	8	10	41	33	10
35	Industrial Machinery and Equipment	9	9	31	Q	10
36	Electronic and Other Electric Equipment	7	8	35	19	8
37	Transportation Equipment	6	8	20	19	6
38	Instruments and Related Products	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	W	W	46	42	W
	Total	2	2	4	14	4

See footnotes at end of table.

Table 34. Relative Standard Errors for Table 3 of Detailed Statistics Section (Continued)
(Percent)

SIC Code ^a	Industry Groups and Industry	LPG	Coal	Coke & Breeze	Other
Midwest Census Region					
20	Food and Kindred Products	Q	15	W	20
21	Tobacco Products	NA	NA	NA	NA
22	Textile Mill Products	NA	NA	NA	NA
23	Apparel and Other Textile Products	Q	Q	0	*
24	Lumber and Wood Products	W	Q	0	28
25	Furniture and Fixtures	34	48	0	33
26	Paper and Allied Products	14	8	0	W
2621	Paper Mills	5	8	0	7
2631	Paperboard Mills	12	10	0	16
27	Printing and Publishing	24	0	0	28
28	Chemicals and Allied Products	W	9	W	W
2819	Industrial Inorganic Chemicals, nec	*	18	W	*
2821	Plastics Materials and Resins	W	W	0	W
2869	Industrial Organic Chemicals, nec	24	17	0	25
2873	Nitrogenous Fertilizers	*	0	0	22
29	Petroleum and Coal Products	W	W	0	7
2911	Petroleum Refining	W	W	0	W
30	Rubber and Misc. Plastics Products	W	W	0	27
31	Leather and Leather Products	44	Q	0	Q
32	Stone, Clay and Glass Products	17	12	W	W
3241	Cement, Hydraulic	*	9	*	W
33	Primary Metal Industries	11	13	7	7
3312	Blast Furnaces and Steel Mills	20	14	7	7
3334	Primary Aluminum	*	0	0	22
34	Fabricated Metal Products	21	13	35	21
35	Industrial Machinery and Equipment	24	18	Q	29
36	Electronic and Other Electric Equipment	28	22	0	19
37	Transportation Equipment	W	10	W	15
38	Instruments and Related Products	NA	NA	NA	NA
39	Misc. Manufacturing Industries	*	38	0	*
	Total	W	5	7	W
South Census Region					
20	Food and Kindred Products	W	11	41	25
21	Tobacco Products	15	14	0	*
22	Textile Mill Products	11	9	*	17
23	Apparel and Other Textile Products	33	50	0	Q
24	Lumber and Wood Products	17	Q	0	16
25	Furniture and Fixtures	25	30	0	21
26	Paper and Allied Products	18	5	0	W
2621	Paper Mills	8	8	0	5
2631	Paperboard Mills	9	9	0	6
27	Printing and Publishing	29	0	0	25
28	Chemicals and Allied Products	W	8	W	W
2819	Industrial Inorganic Chemicals, nec	20	W	W	W
2821	Plastics Materials and Resins	17	W	0	W
2869	Industrial Organic Chemicals, nec	18	24	0	11
2873	Nitrogenous Fertilizers	*	0	0	13
29	Petroleum and Coal Products	14	W	0	5
2911	Petroleum Refining	12	W	0	5
30	Rubber and Misc. Plastics Products	13	24	0	22
31	Leather and Leather Products	Q	0	0	Q
32	Stone, Clay and Glass Products	16	10	Q	13
3241	Cement, Hydraulic	*	12	28	W
33	Primary Metal Industries	14	W	11	W
3312	Blast Furnaces and Steel Mills	11	W	12	W
3334	Primary Aluminum	*	0	0	*
34	Fabricated Metal Products	22	28	47	28
35	Industrial Machinery and Equipment	22	Q	47	32
36	Electronic and Other Electric Equipment	Q	25	Q	*
37	Transportation Equipment	14	19	*	22
38	Instruments and Related Products	NA	NA	NA	NA
39	Misc. Manufacturing Industries	Q	0	0	46
	Total	7	W	11	W

See footnotes at end of table.

Table 35. Relative Standard Errors for Table 4 of Detailed Statistics Section (Percent)

SIC Code*	Industry Groups and Industry	Total	Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal	Coke and Breeze	Other
Total United States										
20	Food and Kindred Products	4	4	W	W	3	W	11	W	15
21	Tobacco Products	11	8	10	18	12	15	14	0	*
22	Textile Mill Products	4	4	6	18	5	12	9	*	14
23	Apparel and Other Textile Products	11	10	33	22	16	37	44	0	40
24	Lumber and Wood Products	8	8	29	22	12	16	42	0	17
25	Furniture and Fixtures	8	8	23	33	8	19	26	0	37
26	Paper and Allied Products	2	3	4	9	3	8	4	0	4
2621	Paper Mills	3	3	5	5	3	7	4	0	4
2631	Paperboard Mills	4	5	7	18	6	8	7	0	6
27	Printing and Publishing	7	7	28	20	8	23	0	0	19
28	Chemicals and Allied Products	4	4	9	10	6	11	6	36	9
2819	Industrial Inorganic Chemicals, nec	7	13	10	W	W	15	W	W	13
2821	Plastics Materials and Resins	7	5	W	20	W	13	11	0	26
2869	Industrial Organic Chemicals, nec	9	7	16	10	12	15	15	0	13
2873	Nitrogenous Fertilizers	9	7	0	11	9	*	0	0	28
29	Petroleum and Coal Products	4	4	7	20	5	12	10	0	5
2911	Petroleum Refining	5	4	6	*	5	*	10	0	5
30	Rubber and Misc. Plastics Products	4	5	W	15	5	W	14	0	18
31	Leather and Leather Products	14	22	31	31	12	25	50	0	*
32	Stone, Clay and Glass Products	3	3	16	25	4	10	6	35	12
3241	Cement, Hydraulic	5	5	Q	6	9	*	6	18	15
33	Primary Metal Industries	3	3	8	8	3	12	10	6	9
3312	Blast Furnaces and Steel Mills	5	4	8	6	4	14	12	7	11
3334	Primary Aluminum	6	6	23	8	6	8	0	0	13
34	Fabricated Metal Products	5	5	19	14	6	12	12	24	28
35	Industrial Machinery and Equipment	6	5	16	18	9	15	15	Q	14
36	Electronic and Other Electric Equipment	4	5	13	16	5	31	16	27	17
37	Transportation Equipment	5	5	12	W	6	13	9	W	12
38	Instruments and Related Products	10	7	14	28	9	Q	39	0	21
39	Misc. Manufacturing Industries	8	8	18	18	11	39	38	0	31
	Total	2	2	3	6	2	6	3	6	4
Northeast Census Region										
20	Food and Kindred Products	7	9	W	19	8	W	W	0	24
21	Tobacco Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
22	Textile Mill Products	9	12	12	27	15	30	34	0	31
23	Apparel and Other Textile Products	28	30	39	29	43	Q	0	0	*
24	Lumber and Wood Products	33	24	Q	Q	32	33	0	0	Q
25	Furniture and Fixtures	17	17	39	37	22	Q	0	0	Q
26	Paper and Allied Products	4	5	5	W	W	9	W	0	W
2621	Paper Mills	4	W	6	W	8	9	W	0	8
2631	Paperboard Mills	11	11	19	35	15	27	24	0	*
27	Printing and Publishing	13	14	39	24	20	Q	0	0	34
28	Chemicals and Allied Products	7	11	W	W	9	W	14	0	W
2819	Industrial Inorganic Chemicals, nec	12	12	15	43	12	*	*	0	*
2821	Plastics Materials and Resins	W	10	11	33	13	W	W	0	24
2869	Industrial Organic Chemicals, nec	14	21	25	13	16	24	0	0	25
2873	Nitrogenous Fertilizers	*	28	0	*	*	0	0	0	*
29	Petroleum and Coal Products	10	11	W	42	14	Q	W	0	15
2911	Petroleum Refining	10	11	W	W	15	17	12	0	W
30	Rubber and Misc. Plastics Products	9	11	W	22	13	W	W	0	Q
31	Leather and Leather Products	W	W	38	32	W	*	Q	0	Q
32	Stone, Clay and Glass Products	7	6	28	19	9	16	10	17	26
3241	Cement, Hydraulic	11	10	Q	12	*	*	10	18	18
33	Primary Metal Industries	7	6	14	19	6	25	24	21	23
3312	Blast Furnaces and Steel Mills	9	6	15	10	7	15	16	22	18
3334	Primary Aluminum	W	W	23	21	W	*	0	0	*
34	Fabricated Metal Products	15	9	20	19	24	21	30	43	Q
35	Industrial Machinery and Equipment	10	12	17	24	13	32	35	0	*
36	Electronic and Other Electric Equipment	9	9	16	21	11	27	33	29	39
37	Transportation Equipment	14	16	18	16	16	43	23	0	49
38	Instruments and Related Products	19	13	15	33	14	29	39	0	*
39	Misc. Manufacturing Industries	W	W	19	21	W	27	47	0	*
	Total	3	3	4	9	4	W	9	20	W

See footnotes at end of table.

Table 35. Relative Standard Errors for Table 4 of Detailed Statistics Section (Continued)
(Percent)

SIC Code*	Industry Groups and Industry	Total	Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal	Coke and Breeze	Other
Midwest Census Region										
20	Food and Kindred Products	7	5	10	W	5	Q	15	W	21
21	Tobacco Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
22	Textile Mill Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
23	Apparel and Other Textile Products	20	19	Q	40	23	Q	Q	0	*
24	Lumber and Wood Products	18	19	Q	W	21	W	Q	0	42
25	Furniture and Fixtures	13	16	35	30	13	34	46	0	*
26	Paper and Allied Products	4	5	W	W	5	14	8	0	8
2621	Paper Mills	4	5	W	W	5	5	8	0	8
2631	Paperboard Mills	8	10	34	18	10	12	10	0	18
27	Printing and Publishing	10	10	Q	Q	12	24	0	0	30
28	Chemicals and Allied Products	6	11	W	W	7	W	9	W	13
2819	Industrial Inorganic Chemicals, nec	W	27	W	10	W	*	18	29	*
2821	Plastics Materials and Resins	W	10	15	12	10	W	W	0	W
2869	Industrial Organic Chemicals, nec	13	15	29	28	17	*	17	0	31
2873	Nitrogenous Fertilizers	17	15	0	16	18	*	0	0	Q
29	Petroleum and Coal Products	7	7	W	42	8	W	W	0	8
2911	Petroleum Refining	7	8	W	W	8	W	W	0	W
30	Rubber and Misc. Plastics Products	7	7	W	26	9	W	W	0	34
31	Leather and Leather Products	27	Q	Q	Q	18	44	Q	0	Q
32	Stone, Clay and Glass Products	6	5	37	W	6	17	12	W	W
3241	Cement, Hydraulic	9	9	*	W	12	*	9	*	W
33	Primary Metal Industries	5	5	10	8	5	11	13	7	11
3312	Blast Furnaces and Steel Mills	6	5	10	8	6	20	14	8	14
3334	Primary Aluminum	W	W	0	14	W	*	0	0	22
34	Fabricated Metal Products	6	6	35	18	6	21	13	35	22
35	Industrial Machinery and Equipment	7	7	Q	19	8	24	18	Q	15
36	Electronic and Other Electric Equipment	7	7	29	20	7	28	22	0	23
37	Transportation Equipment	7	7	14	W	9	W	10	W	13
38	Instruments and Related Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	13	14	Q	40	15	*	38	0	*
	Total	2	3	11	11	2	W	5	7	W
South Census Region										
20	Food and Kindred Products	5	7	15	W	6	W	11	41	31
21	Tobacco Products	11	8	10	18	12	15	14	0	*
22	Textile Mill Products	4	4	7	22	5	11	9	*	15
23	Apparel and Other Textile Products	12	11	Q	40	15	33	50	0	Q
24	Lumber and Wood Products	11	11	W	W	21	17	Q	0	18
25	Furniture and Fixtures	11	11	31	49	14	25	30	0	49
26	Paper and Allied Products	4	4	6	15	W	18	5	0	W
2621	Paper Mills	4	5	7	8	5	8	6	0	6
2631	Paperboard Mills	6	6	8	8	8	9	9	0	8
27	Printing and Publishing	12	13	43	24	16	29	0	0	25
28	Chemicals and Allied Products	5	4	8	13	7	W	8	W	11
2819	Industrial Inorganic Chemicals, nec	8	14	W	W	W	20	W	W	15
2821	Plastics Materials and Resins	9	6	W	24	W	17	W	0	W
2869	Industrial Organic Chemicals, nec	10	8	18	17	13	18	24	0	14
2873	Nitrogenous Fertilizers	11	10	0	13	11	*	0	0	29
29	Petroleum and Coal Products	6	5	W	W	6	Q	W	0	7
2911	Petroleum Refining	6	6	W	W	6	*	W	0	7
30	Rubber and Misc. Plastics Products	6	7	11	22	8	13	24	0	23
31	Leather and Leather Products	W	W	Q	42	W	Q	0	0	Q
32	Stone, Clay and Glass Products	6	5	W	W	6	16	10	Q	19
3241	Cement, Hydraulic	10	9	17	W	16	*	12	28	W
33	Primary Metal Industries	6	6	15	13	7	14	W	13	W
3312	Blast Furnaces and Steel Mills	9	6	15	10	8	11	W	15	W
3334	Primary Aluminum	9	9	0	12	9	*	0	0	*
34	Fabricated Metal Products	8	10	41	33	10	22	28	47	33
35	Industrial Machinery and Equipment	9	9	31	Q	10	22	Q	47	34
36	Electronic and Other Electric Equipment	7	8	35	19	8	Q	25	Q	*
37	Transportation Equipment	6	8	20	19	6	14	19	*	27
38	Instruments and Related Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	W	W	46	42	W	Q	0	0	Q
	Total	2	2	4	14	4	8	W	13	W

See footnotes at end of table.

Table 35. Relative Standard Errors for Table 4 of Detailed Statistics Section (Continued)
(Percent)

SIC Code*	Industry Groups and Industry	Total	Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal	Coke and Breeze	Other
West Census Region										
20	Food and Kindred Products	6	7	W	21	6	W	W	W	22
21	Tobacco Products	0	0	0	0	0	0	0	0	0
22	Textile Mill Products	25	49	0	23	21	Q	0	0	*
23	Apparel and Other Textile Products	33	37	0	0	38	Q	0	0	Q
24	Lumber and Wood Products	15	12	Q	19	19	W	0	0	26
25	Furniture and Fixtures	NA	NA	NA	NA	NA	NA	NA	NA	NA
26	Paper and Allied Products	5	6	W	12	6	14	W	0	W
2621	<i>Paper Mills</i>	6	W	W	10	7	7	W	0	9
2631	<i>Paperboard Mills</i>	9	10	12	19	11	10	33	0	11
27	Printing and Publishing	17	18	0	Q	21	45	0	0	Q
28	Chemicals and Allied Products	9	11	W	26	11	22	20	W	W
2819	<i>Industrial Inorganic Chemicals, nec</i>	W	16	W	13	17	*	20	W	*
2821	<i>Plastics Materials and Resins</i>	7	9	26	19	7	*	0	0	*
2869	<i>Industrial Organic Chemicals, nec</i>	31	25	0	31	34	*	0	0	*
2873	<i>Nitrogenous Fertilizers</i>	16	13	0	24	18	*	0	0	*
29	Petroleum and Coal Products	7	6	W	W	8	W	0	0	9
2911	<i>Petroleum Refining</i>	7	7	W	W	9	W	0	0	9
30	Rubber and Misc. Plastics Products	14	20	46	Q	18	50	0	0	Q
31	Leather and Leather Products	36	37	0	Q	38	Q	0	0	Q
32	Stone, Clay and Glass Products	6	7	W	19	8	22	9	W	W
3241	<i>Cement, Hydraulic</i>	8	8	16	13	11	*	9	36	33
33	Primary Metal Industries	6	7	21	19	9	17	W	30	W
3312	<i>Blast Furnaces and Steel Mills</i>	14	18	22	13	13	*	W	22	W
3334	<i>Primary Aluminum</i>	8	8	0	9	9	11	0	0	*
34	Fabricated Metal Products	12	12	0	34	12	24	0	0	Q
35	Industrial Machinery and Equipment	30	17	0	36	44	34	0	0	43
36	Electronic and Other Electric Equipment	11	12	0	41	14	*	0	0	Q
37	Transportation Equipment	9	9	W	W	8	W	31	0	16
38	Instruments and Related Products	13	14	*	40	17	*	0	0	28
39	Misc. Manufacturing Industries	21	21	0	Q	27	*	0	0	Q
	Total	3	3	8	9	4	9	W	16	W

* Estimate less than 0.5 rounded to zero.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Q=Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

NA=Not available. Data are included in higher level totals.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey."

**Table 36. Relative Standard Errors for Table 5 of Detailed Statistics Section
(Percent)**

SIC Code*	Industry Groups and Industry	Residual Fuel Oil	Distillate Fuel Oil	LPG
20	Food and Kindred Products	6	8	10
21	Tobacco Products	12	16	10
22	Textile Mill Products	5	8	8
23	Apparel and Other Textile Products	24	47	30
24	Lumber and Wood Products	Q	20	16
25	Furniture and Fixtures	30	23	16
26	Paper and Allied Products	4	8	11
2621	Paper Mills	4	5	4
2631	Paperboard Mills	7	19	11
27	Printing and Publishing	25	17	16
28	Chemicals and Allied Products	6	8	19
2819	Industrial Inorganic Chemicals, nec	12	9	17
2821	Plastics Materials and Resins	14	40	15
2869	Industrial Organic Chemicals, nec	11	12	22
2873	Nitrogenous Fertilizers	20	16	21
29	Petroleum and Coal Products	63	Q	34
2911	Petroleum Refining	NA	NA	NA
30	Rubber and Misc. Plastics Products	8	10	12
31	Leather and Leather Products	Q	45	32
32	Stone, Clay and Glass Products	7	10	8
3241	Cement, Hydraulic	12	9	17
33	Primary Metal Industries	8	7	8
3312	Blast Furnaces and Steel Mills	8	6	6
3334	Primary Aluminum	W	10	9
34	Fabricated Metal Products	16	10	9
35	Industrial Machinery and Equipment	15	14	14
36	Electronic and Other Electric Equipment	15	10	23
37	Transportation Equipment	10	8	7
38	Instruments and Related Products	17	14	31
39	Misc. Manufacturing Industries	22	26	16
	Total	3	14	18

* See Appendices A and D for descriptions of the Standard Industrial Classification system.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Q=Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

NA=Not available. Data included in higher level totals.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey."

**Table 37. Relative Standard Errors for Table 6 of Detailed Statistics Section
(Percent)**

SIC Code ^a	Industry Groups and Industry	Consumption per Employee	Consumption per Dollar of Value Added	Consumption per Dollar of Value of Shipments	Major Byproducts as a Percent of Consumption	Fuel Oil as a Percent of Natural Gas
Total United States						
20	Food and Kindred Products	5	5	5	19	W
21	Tobacco Products	7	6	6	0	12
22	Textile Mill Products	4	4	4	35	7
23	Apparel and Other Textile Products	10	14	14	0	25
24	Lumber and Wood Products	15	15	13	0	23
25	Furniture and Fixtures	6	6	6	0	26
26	Paper and Allied Products	7	6	6	2	4
2621	Paper Mills	2	1	1	2	5
2631	Paperboard Mills	2	2	2	2	7
27	Printing and Publishing	7	7	6	0	18
28	Chemicals and Allied Products	8	8	6	8	9
2819	Industrial Inorganic Chemicals, nec	8	7	6	14	W
2821	Plastics Materials and Resins	8	5	5	13	W
2869	Industrial Organic Chemicals, nec	7	5	5	8	18
2873	Nitrogenous Fertilizers	6	5	5	15	11
29	Petroleum and Coal Products	6	3	2	2	7
2911	Petroleum Refining	2	3	2	2	7
30	Rubber and Misc. Plastics Products	4	4	4	24	W
31	Leather and Leather Products	14	14	12	0	30
32	Stone, Clay and Glass Products	6	6	6	0	19
3241	Cement, Hydraulic	2	2	2	0	21
33	Primary Metal Industries	5	5	5	3	6
3312	Blast Furnaces and Steel Mills	2	3	2	2	6
3334	Primary Aluminum	1	3	2	0	5
34	Fabricated Metal Products	5	6	7	0	13
35	Industrial Machinery and Equipment	6	7	7	0	16
36	Electronic and Other Electric Equipment	5	5	5	0	11
37	Transportation Equipment	4	4	3	0	W
38	Instruments and Related Products	10	9	9	0	15
39	Misc. Manufacturing Industries	9	8	8	0	15
	All Manufacturing	2	2	2	2	3
Northeast Census Region						
20	Food and Kindred Products	10	8	7	0	W
21	Tobacco Products	NA	NA	NA	NA	NA
22	Textile Mill Products	10	9	11	0	17
23	Apparel and Other Textile Products	21	20	26	0	48
24	Lumber and Wood Products	42	35	33	0	Q
25	Furniture and Fixtures	15	18	17	0	34
26	Paper and Allied Products	10	9	9	W	W
2621	Paper Mills	3	2	2	5	W
2631	Paperboard Mills	8	6	3	0	18
27	Printing and Publishing	13	13	14	0	28
28	Chemicals and Allied Products	15	21	17	25	W
2819	Industrial Inorganic Chemicals, nec	15	12	11	0	15
2821	Plastics Materials and Resins	W	W	W	W	12
2869	Industrial Organic Chemicals, nec	7	8	8	39	28
2873	Nitrogenous Fertilizers	13	35	13	0	5
29	Petroleum and Coal Products	16	10	5	W	W
2911	Petroleum Refining	4	8	1	W	W
30	Rubber and Misc. Plastics Products	8	8	7	26	W
31	Leather and Leather Products	W	W	W	0	W
32	Stone, Clay and Glass Products	8	9	8	0	18
3241	Cement, Hydraulic	8	7	5	0	32
33	Primary Metal Industries	14	12	11	6	10
3312	Blast Furnaces and Steel Mills	6	6	6	W	12
3334	Primary Aluminum	W	W	W	0	W
34	Fabricated Metal Products	14	11	12	0	27
35	Industrial Machinery and Equipment	8	17	12	0	18
36	Electronic and Other Electric Equipment	10	9	11	0	16
37	Transportation Equipment	10	11	8	0	8
38	Instruments and Related Products	19	18	18	0	19
39	Misc. Manufacturing Industries	W	W	W	0	W
	All Manufacturing	5	5	5	5	5

See footnotes at end of table.

Table 37. Relative Standard Errors for Table 6 of Detailed Statistics Section (Continued)
(Percent)

SIC Code ^a	Industry Groups and Industry	Consumption per Employee	Consumption per Dollar of Value Added	Consumption per Dollar of Value of Shipments	Major Byproducts as a Percent of Consumption	Fuel Oil as a Percent of Natural Gas
Midwest Census Region						
20	Food and Kindred Products	8	7	8	19	W
21	Tobacco Products	NA	NA	NA	NA	NA
22	Textile Mill Products	NA	NA	NA	NA	NA
23	Apparel and Other Textile Products	17	46	38	0	45
24	Lumber and Wood Products	25	21	20	0	W
25	Furniture and Fixtures	9	9	9	0	25
26	Paper and Allied Products	10	13	14	W	W
2621	Paper Mills	3	2	2	5	W
2631	Paperboard Mills	5	3	3	17	31
27	Printing and Publishing	11	11	10	0	37
28	Chemicals and Allied Products	17	15	13	W	W
2819	Industrial Inorganic Chemicals, nec	W	W	W	0	W
2821	Plastics Materials and Resins	W	W	W	W	16
2869	Industrial Organic Chemicals, nec	10	11	9	23	25
2873	Nitrogenous Fertilizers	14	7	7	17	13
29	Petroleum and Coal Products	16	7	4	2	W
2911	Petroleum Refining	2	3	2	2	W
30	Rubber and Misc. Plastics Products	6	5	5	0	W
31	Leather and Leather Products	18	24	19	0	49
32	Stone, Clay and Glass Products	10	9	9	0	W
3241	Cement, Hydraulic	4	3	3	0	W
33	Primary Metal Industries	7	6	5	3	7
3312	Blast Furnaces and Steel Mills	3	4	3	3	7
3334	Primary Aluminum	W	W	W	0	W
34	Fabricated Metal Products	6	6	6	0	24
35	Industrial Machinery and Equipment	5	6	6	0	19
36	Electronic and Other Electric Equipment	8	9	7	0	23
37	Transportation Equipment	6	5	4	0	W
38	Instruments and Related Products	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	11	11	11	0	39
	All Manufacturing	4	4	3	4	7
South Census Region						
20	Food and Kindred Products	8	7	6	0	W
21	Tobacco Products	7	6	6	0	12
22	Textile Mill Products	4	5	4	35	9
23	Apparel and Other Textile Products	12	15	14	0	37
24	Lumber and Wood Products	19	18	18	0	W
25	Furniture and Fixtures	8	8	10	0	41
26	Paper and Allied Products	9	7	7	2	W
2621	Paper Mills	2	2	2	2	7
2631	Paperboard Mills	3	2	2	2	10
27	Printing and Publishing	11	13	11	0	31
28	Chemicals and Allied Products	9	6	5	W	9
2819	Industrial Inorganic Chemicals, nec	10	8	6	W	W
2821	Plastics Materials and Resins	9	6	6	W	W
2869	Industrial Organic Chemicals, nec	6	6	5	8	18
2873	Nitrogenous Fertilizers	8	6	5	20	13
29	Petroleum and Coal Products	5	4	2	2	W
2911	Petroleum Refining	2	4	2	2	W
30	Rubber and Misc. Plastics Products	8	7	5	37	11
31	Leather and Leather Products	W	W	W	0	W
32	Stone, Clay and Glass Products	12	10	12	0	W
3241	Cement, Hydraulic	4	3	3	0	W
33	Primary Metal Industries	9	7	9	W	12
3312	Blast Furnaces and Steel Mills	4	3	4	3	9
3334	Primary Aluminum	2	4	2	0	7
34	Fabricated Metal Products	10	10	18	0	30
35	Industrial Machinery and Equipment	8	8	9	0	50
36	Electronic and Other Electric Equipment	8	8	9	0	17
37	Transportation Equipment	9	6	5	0	17
38	Instruments and Related Products	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	W	W	W	0	W
	All Manufacturing	4	3	3	2	6

See footnotes at end of table.

Table 37. Relative Standard Errors for Table 6 of Detailed Statistics Section (Continued)
(Percent)

SIC Code ^a	Industry Groups and Industry	Consumption per Employee	Consumption per Dollar of Value Added	Consumption per Dollar of Value of Shipments	Major Byproducts as a Percent of Consumption	Fuel Oil as a Percent of Natural Gas
West Census Region						
20	Food and Kindred Products	11	13	12	0	W
21	Tobacco Products	0	0	0	0	0
22	Textile Mill Products	23	12	24	0	25
23	Apparel and Other Textile Products	23	25	28	0	0
24	Lumber and Wood Products	32	30	25	0	24
25	Furniture and Fixtures	NA	NA	NA	NA	NA
26	Paper and Allied Products	30	15	13	W	W
2621	<i>Paper Mills</i>	3	3	2	4	W
2631	<i>Paperboard Mills</i>	4	3	3	4	12
27	Printing and Publishing	14	13	11	0	Q
28	Chemicals and Allied Products	23	15	17	W	W
2819	<i>Industrial Inorganic Chemicals, nec</i>	W	W	W	W	W
2821	<i>Plastics Materials and Resins</i>	7	7	5	0	15
2869	<i>Industrial Organic Chemicals, nec</i>	21	12	12	0	36
2873	<i>Nitrogenous Fertilizers</i>	12	19	14	32	29
29	Petroleum and Coal Products	6	6	5	W	W
2911	<i>Petroleum Refining</i>	4	6	5	W	W
30	Rubber and Misc. Plastics Products	15	18	19	0	41
31	Leather and Leather Products	41	36	33	0	47
32	Stone, Clay and Glass Products	11	16	15	0	W
3241	<i>Cement, Hydraulic</i>	2	4	4	0	11
33	Primary Metal Industries	13	22	20	W	15
3312	<i>Blast Furnaces and Steel Mills</i>	12	13	13	W	15
3334	<i>Primary Aluminum</i>	1	4	2	0	7
34	Fabricated Metal Products	17	22	12	0	35
35	Industrial Machinery and Equipment	29	32	32	0	Q
36	Electronic and Other Electric Equipment	9	8	7	0	42
37	Transportation Equipment	5	5	6	0	W
38	Instruments and Related Products	12	12	11	0	40
39	Misc. Manufacturing Industries	25	21	21	0	Q
	All Manufacturing	6	6	5	4	6

^a See Appendices A and D for descriptions of the Standard Industrial Classification system.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Q=Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

NA=Not available. Data are included in higher level totals.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey," and Bureau of the Census, Industry Division, data files for the "1988 Annual Survey of Manufactures" and the "1987 Census of Manufactures."

**Table 38. Relative Standard Errors for Table 7 of Detailed Statistics Section
(Percent)**

Economic Characteristics*	Total	Net Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal	Coke and Breeze	Other
Value of Shipments and Receipts (million dollars)									
Under 20	3	3	14	12	4	15	12	23	11
20-49	3	3	11	8	3	9	6	17	14
50-99	3	3	5	11	3	9	6	8	10
100-249	3	3	4	8	5	12	5	12	5
250-499	3	4	5	7	4	11	6	15	5
500 and Over	4	3	5	6	5	16	6	7	4
Not ascertained	0	0	0	0	0	0	0	0	0
Total	2	2	3	6	2	10	3	6	2
Employment Size									
Under 50	5	6	16	17	7	21	30	38	10
50-99	4	5	20	10	5	14	18	46	14
100-249	3	3	6	7	5	9	4	16	7
250-499	3	3	5	9	4	11	7	14	5
500-999	3	3	4	11	3	11	6	12	5
1,000 and Over	4	3	4	5	5	22	5	6	5
Not ascertained	0	0	0	0	0	0	0	0	0
Total	2	2	3	6	2	10	3	6	2

* Value of Shipments and Receipts and Employment Size were supplied by the Bureau of the Census.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey," Office of Oil and Gas, Petroleum Supply Division, Form EIA-810, "Monthly Refinery Report" for 1988, and Bureau of the Census, Industry Division, data files for the "1988 Annual Survey of Manufactures" and the "1987 Census of Manufactures."

**Table 39. Relative Standard Errors for Table 8 of Detailed Statistics Section
(Percent)**

Economic Characteristics*	Total	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal	Coke and Breeze	Other
Value of Shipments and Receipts (million dollars)								
Under 20	15	Q	33	15	47	23	42	24
20-49	7	24	36	10	25	13	16	16
50-99	9	W	19	12	22	13	13	28
100-249	9	Q	22	16	13	W	W	16
250-499	10	W	32	13	12	W	18	18
500 and Over	8	W	18	12	17	7	W	18
Not ascertained	1	0	0	0	0	0	0	1
Total	3	25	18	7	11	6	9	1
Employment Size								
Under 50	13	Q	41	16	33	19	Q	38
50-99	15	38	29	13	Q	38	Q	32
100-249	9	W	W	16	11	13	13	21
250-499	10	0	30	15	12	14	16	24
500-999	7	Q	30	10	11	12	14	21
1,000 and Over	8	W	W	17	24	7	11	17
Not ascertained	1	0	0	0	0	0	0	1
Total	3	25	18	7	11	6	9	1

* Value of Shipments and Receipts and Employment Size were supplied by the Bureau of the Census. See Appendix A.

W-Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Q-Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey," Office of Oil and Gas, Petroleum Supply Division, Form EIA-810, "Monthly Refinery Report" for 1988, and Bureau of the Census, Industry Division, data files for the "1988 Annual Survey of Manufactures" and the "1987 Census of Manufactures."

**Table 40. Relative Standard Errors for Table 9 of Detailed Statistics Section
(Percent)**

Economic Characteristics ^a	Total	Net Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal	Coke and Breeze	Other
Value of Shipments and Receipts (million dollars)									
Under 20	3	3	9	12	4	15	13	26	11
20-49	3	3	12	8	3	8	7	22	14
50-99	3	3	6	11	3	7	5	10	8
100-249	3	3	4	8	4	6	5	13	4
250-499	3	4	5	7	3	10	6	11	4
500 and Over	3	3	5	6	5	8	7	6	4
Total	2	2	3	6	2	5	3	5	3
Employment Size									
Under 50	5	6	16	18	7	23	38	42	11
50-99	4	5	23	10	4	11	18	Q	13
100-249	3	3	6	7	4	8	4	22	7
250-499	3	3	5	9	3	6	8	18	4
500-999	3	3	4	11	3	7	5	13	4
1,000 and Over	3	3	4	5	5	11	4	6	4
Total	2	2	3	6	2	5	3	5	3

^a Value of Shipments and Receipts and Employment Size were supplied by the Bureau of the Census. See Appendix A.

Q=Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey," and Bureau of the Census, Industry Division, data files for the "1988 Annual Survey of Manufactures" and the "1987 Census of Manufactures."

**Table 41. Relative Standard Errors for Table 10 of Detailed Statistics Section
(Percent)**

Economic Characteristics ^a	Total	Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal	Coke and Breeze	Other
Value of Shipments and Receipts (million dollars)									
Under 20	3	3	9	12	4	15	13	26	10
20-49	3	3	12	8	3	8	7	22	12
50-99	3	3	6	11	3	8	5	11	12
100-249	2	3	5	8	4	5	5	16	8
250-499	3	4	5	7	3	8	6	17	8
500 and Over	4	3	5	7	5	6	7	7	7
Total	2	2	3	6	2	6	3	6	4
Employment Size									
Under 50	5	6	17	18	7	29	38	42	14
50-99	4	5	24	10	4	11	18	Q	15
100-249	3	3	6	7	4	9	4	22	8
250-499	3	2	5	9	3	7	8	18	7
500-999	2	3	4	11	3	7	5	18	6
1,000 and Over	3	3	4	5	5	6	4	6	7
Total	2	2	3	6	2	6	3	6	4

^a Value of Shipments and Receipts and Employment Size were supplied by the Bureau of the Census. See Appendix A.

Q=Withheld because Relative Standard Error is greater than or equal to 50 percent. Data are included in higher level totals.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey," and Bureau of the Census, Industry Division, data files for the "1988 Annual Survey of Manufactures" and the "1987 Census of Manufactures."

**Table 42. Relative Standard Errors for Table 11, of Detailed Statistics Section
(Percent)**

Selected Characteristics	Residual Fuel Oil	Distillate Fuel Oil	LPG
Census Region			
Northeast	4	37	7
Midwest	5	5	13
South	5	6	21
West	6	9	11
Total	3	14	18
Value of Shipments and Receipts* (million dollars)			
Under 20	13	9	10
20-49	8	6	6
50-99	6	48	5
100-249	4	6	16
250-499	4	8	13
500 and Over	6	6	22
Total	3	14	18
Employment Size*			
Under 50	31	48	15
50-99	18	12	15
100-249	6	8	11
250-499	5	5	16
500-999	4	7	12
1,000 and Over	4	4	24
Total	3	14	18

* Value of Shipments and Receipts and Employment Size data were supplied by the Bureau of the Census. See Appendix A.
Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey" and Bureau of the Census, Industry Division, data files for the "1988 Annual Survey of Manufactures" and the "1987 Census of Manufactures."

Table 43. Relative Standard Errors for Table 12 of Detailed Statistics Section (Percent)

Economic Characteristics*	Consumption per Employee	Consumption per Dollar of Value Added	Consumption per Dollar of Value of Shipments	Major Byproducts as a Percent of Consumption	Fuel Oil as a Percent of Natural Gas
Value of Shipments and Receipts (million dollars)					
Under 20	4	4	4	15	10
20-49	5	5	4	18	8
50-99	4	5	5	7	8
100-249	4	5	4	4	5
250-499	5	6	5	3	5
500 and Over	5	5	4	2	6
All Manufacturing	2	2	2	2	3
Employment Size					
Under 50	6	6	6	14	17
50-99	7	7	6	19	14
100-249	6	5	5	5	6
250-499	5	5	4	4	5
500-999	5	5	5	3	5
1,000 and Over	4	4	4	2	6
All Manufacturing	2	2	2	2	3

* Value of Shipments and Receipts and Employment Size were supplied by the Bureau of the Census. See Appendix A.
 Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey," and Bureau of the Census, Industry Division, data files for the "1988 Annual Survey of Manufactures," and the "1987 Census of Manufactures."

Table 44. Relative Standard Errors for Table 13 of Detailed Statistics Section (Percent)

SIC Code ^a	Industry Groups and Industry	Total	Blast Furnance/ Coke Oven Gases	Waste Gas	Petroleum Coke	Pulping Liquor	Wood Chips, Bark	Other ^d
Total United States								
20	Food and Kindred Products	48	0	*	0	0	Q	*
21	Tobacco Products	*	0	0	0	0	0	*
22	Textile Mill Products	19	*	0	0	0	21	*
23	Apparel and Other Textile Products	Q	0	0	0	0	0	Q
24	Lumber and Wood Products	14	0	0	0	0	14	*
25	Furniture and Fixtures	20	0	0	0	0	21	*
26	Paper and Allied Products	4	0	0	13	4	4	28
2621	<i>Paper Mills</i>	4	0	0	20	4	4	16
2631	<i>Paperboard Mills</i>	6	0	0	18	6	6	*
27	Printing and Publishing	*	0	0	0	0	0	*
28	Chemicals and Allied Products	9	29	11	23	0	Q	19
2819	<i>Industrial Inorganic Chemicals, nec</i>	13	29	15	0	0	0	21
2821	<i>Plastics Materials and Resins</i>	29	0	15	0	0	Q	W
2869	<i>Industrial Organic Chemicals, nec</i>	12	0	13	0	0	W	W
2873	<i>Nitrogenous Fertilizers</i>	15	0	15	0	0	0	*
29	Petroleum and Coal Products	4	0	4	7	0	0	38
2911	<i>Petroleum Refining^f</i>	4	0	4	7	0	0	25
30	Rubber and Misc. Plastics Products	26	0	24	0	0	49	*
31	Leather and Leather Products	Q	0	0	0	0	Q	Q
32	Stone, Clay and Glass Products	12	0	0	11	0	Q	33
3241	<i>Cement, Hydraulic</i>	14	0	0	12	0	*	33
33	Primary Metal Industries	5	5	34	24	0	29	9
3312	<i>Blast Furnaces and Steel Mills</i>	6	5	0	*	0	0	8
3334	<i>Primary Aluminum</i>	*	0	0	0	0	*	*
34	Fabricated Metal Products	Q	0	0	0	0	Q	Q
35	Industrial Machinery and Equipment	*	0	0	0	0	0	*
36	Electronic and Other Electric Equipment	*	0	0	0	0	*	*
37	Transportation Equipment	12	0	0	0	0	Q	12
38	Instruments and Related Products	35	0	0	0	0	Q	38
39	Misc. Manufacturing Industries	*	0	0	0	0	*	Q
	Total	3	5	4	6	4	8	13

^a See Appendices A and D for descriptions of the Standard Industrial Classification system. See Appendix A.

^d "Other" includes waste oils/tars and waste materials.

* Estimates less than 0.5 rounded to zero.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Q=Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

Notes: *Totals may not equal sum of components because of independent rounding. *The estimates presented in this table are for the total consumption of energy for the production of heat and power, regardless of where the energy was produced. Specifically, the estimates include the quantities of energy that were originally produced offsite and purchased by or transferred to the establishment, plus those that were produced onsite from other energy or input materials not classified as energy, or were extracted from captive (onsite) mines or wells.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey."

**Table 45. Relative Standard Errors for Table 14 of Detailed Statistics Section
(Percent)**

SIC Code ^a	Industry Groups and Industry	Purchases	Transfers In	Total Onsite Generation	Sales and/or Transfers Offsite	Net Demand for Electricity
Total United States						
20	Food and Kindred Products	4	27	3	8	X
21	Tobacco Products	8	0	W	W	X
22	Textile Mill Products	4	42	6	16	X
23	Apparel and Other Textile Products	10	0	Q	Q	X
24	Lumber and Wood Products	8	Q	13	22	X
25	Furniture and Fixtures	8	0	5	42	X
26	Paper and Allied Products	3	15	1	2	X
2621	<i>Paper Mills</i>	3	15	1	2	X
2631	<i>Paperboard Mills</i>	5	0	1	3	X
27	Printing and Publishing	7	0	Q	Q	X
28	Chemicals and Allied Products	3	23	1	2	X
2819	<i>Industrial Inorganic Chemicals, nec</i>	W	W	1	W	X
2821	<i>Plastics Materials and Resins</i>	W	W	7	13	X
2869	<i>Industrial Organic Chemicals, nec</i>	7	22	1	3	X
2873	<i>Nitrogenous Fertilizers</i>	7	0	W	W	X
29	Petroleum and Coal Products	4	Q	2	2	X
2911	<i>Petroleum Refining</i>	W	W	2	2	X
30	Rubber and Misc. Plastics Products	5	Q	21	Q	X
31	Leather and Leather Products	22	0	6	Q	X
32	Stone, Clay and Glass Products	W	W	3	18	X
3241	<i>Cement, Hydraulic</i>	5	0	W	W	X
33	Primary Metal Industries	3	11	3	5	X
3312	<i>Blast Furnaces and Steel Mills</i>	4	11	1	6	X
3334	<i>Primary Aluminum</i>	W	W	.	W	X
34	Fabricated Metal Products	5	24	W	W	X
35	Industrial Machinery and Equipment	5	Q	10	28	X
36	Electronic and Other Electric Equipment	5	30	15	27	X
37	Transportation Equipment	W	W	4	11	X
38	Instruments and Related Products	7	Q	W	Q	X
39	Misc. Manufacturing Industries	8	0	Q	0	X
	Total	2	12	1	2	X
Northeast Census Region						
20	Food and Kindred Products	W	W	2	29	X
21	Tobacco Products	NA	NA	NA	NA	X
22	Textile Mill Products	12	0	W	W	X
23	Apparel and Other Textile Products	30	0	Q	0	X
24	Lumber and Wood Products	25	Q	W	Q	X
25	Furniture and Fixtures	17	0	W	Q	X
26	Paper and Allied Products	W	W	1	2	X
2621	<i>Paper Mills</i>	W	W	1	1	X
2631	<i>Paperboard Mills</i>	11	0	12	1	X
27	Printing and Publishing	14	0	W	W	X
28	Chemicals and Allied Products	W	W	14	20	X
2819	<i>Industrial Inorganic Chemicals, nec</i>	W	W	W	0	X
2821	<i>Plastics Materials and Resins</i>	10	0	W	W	X
2869	<i>Industrial Organic Chemicals, nec</i>	22	36	W	W	X
2873	<i>Nitrogenous Fertilizers</i>	28	0	0	0	X
29	Petroleum and Coal Products	W	0	W	W	X
2911	<i>Petroleum Refining</i>	11	0	W	W	X
30	Rubber and Misc. Plastics Products	11	0	W	Q	X
31	Leather and Leather Products	W	0	W	Q	X
32	Stone, Clay and Glass Products	W	W	11	Q	X
3241	<i>Cement, Hydraulic</i>	10	0	0	0	X
33	Primary Metal Industries	W	W	W	W	X
3312	<i>Blast Furnaces and Steel Mills</i>	W	W	1	W	X
3334	<i>Primary Aluminum</i>	W	0	0	W	X
34	Fabricated Metal Products	9	0	9	Q	X
35	Industrial Machinery and Equipment	12	Q	W	W	X
36	Electronic and Other Electric Equipment	9	Q	W	W	X
37	Transportation Equipment	16	0	W	W	X
38	Instruments and Related Products	14	Q	W	Q	X
39	Misc. Manufacturing Industries	W	0	Q	0	X
	Total	3	14	3	4	X

See footnotes at end of table.

Table 45. Relative Standard Errors for Table 14 of Detailed Statistics Section (Continued)
(Percent)

SIC Code ^a	Industry Groups and Industry	Purchases	Transfers In	Total Onsite Generation	Sales and/or Transfers Offsite	Net Demand for Electricity
Midwest Census Region						
20	Food and Kindred Products	5	20	2	5	X
21	Tobacco Products	NA	NA	NA	NA	X
22	Textile Mill Products	NA	NA	NA	NA	X
23	Apparel and Other Textile Products	19	0	Q	Q	X
24	Lumber and Wood Products	19	0	W	0	X
25	Furniture and Fixtures	16	0	16	48	X
26	Paper and Allied Products	W	W	1	9	X
2621	<i>Paper Mills</i>	W	W	1	W	X
2631	<i>Paperboard Mills</i>	10	0	5	5	X
27	Printing and Publishing	10	0	Q	Q	X
28	Chemicals and Allied Products	7	26	3	17	X
2819	<i>Industrial Inorganic Chemicals, nec</i>	W	W	W	0	X
2821	<i>Plastics Materials and Resins</i>	10	0	W	W	X
2869	<i>Industrial Organic Chemicals, nec</i>	17	40	2	1	X
2873	<i>Nitrogenous Fertilizers</i>	15	0	W	0	X
29	Petroleum and Coal Products	7	0	W	W	X
2911	<i>Petroleum Refining</i>	8	0	W	W	X
30	Rubber and Misc. Plastics Products	7	Q	44	0	X
31	Leather and Leather Products	Q	0	1	0	X
32	Stone, Clay and Glass Products	5	0	W	W	X
3241	<i>Cement, Hydraulic</i>	9	0	W	W	X
33	Primary Metal Industries	5	16	1	8	X
3312	<i>Blast Furnaces and Steel Mills</i>	W	W	1	10	X
3334	<i>Primary Aluminum</i>	W	W	*	W	X
34	Fabricated Metal Products	6	28	W	W	X
35	Industrial Machinery and Equipment	7	47	2	28	X
36	Electronic and Other Electric Equipment	7	37	W	Q	X
37	Transportation Equipment	W	W	W	14	X
38	Instruments and Related Products	NA	NA	NA	NA	X
39	Misc. Manufacturing Industries	14	0	*	0	X
	Total	2	16	1	5	X
South Census Region						
20	Food and Kindred Products	W	W	4	5	X
21	Tobacco Products	8	0	W	W	X
22	Textile Mill Products	4	42	W	W	X
23	Apparel and Other Textile Products	11	0	0	0	X
24	Lumber and Wood Products	11	Q	39	Q	X
25	Furniture and Fixtures	11	0	W	*	X
26	Paper and Allied Products	4	Q	1	1	X
2621	<i>Paper Mills</i>	W	W	1	1	X
2631	<i>Paperboard Mills</i>	6	0	1	1	X
27	Printing and Publishing	13	0	Q	0	X
28	Chemicals and Allied Products	W	W	1	2	X
2819	<i>Industrial Inorganic Chemicals, nec</i>	14	*	1	1	X
2821	<i>Plastics Materials and Resins</i>	W	W	9	15	X
2869	<i>Industrial Organic Chemicals, nec</i>	8	27	1	3	X
2873	<i>Nitrogenous Fertilizers</i>	10	0	W	W	X
29	Petroleum and Coal Products	5	Q	1	2	X
2911	<i>Petroleum Refining</i>	6	0	1	2	X
30	Rubber and Misc. Plastics Products	7	Q	W	W	X
31	Leather and Leather Products	W	0	W	0	X
32	Stone, Clay and Glass Products	5	45	23	Q	X
3241	<i>Cement, Hydraulic</i>	9	0	0	0	X
33	Primary Metal Industries	W	W	1	3	X
3312	<i>Blast Furnaces and Steel Mills</i>	W	W	W	3	X
3334	<i>Primary Aluminum</i>	W	W	0	W	X
34	Fabricated Metal Products	10	0	22	*	X
35	Industrial Machinery and Equipment	9	0	30	0	X
36	Electronic and Other Electric Equipment	8	0	W	W	X
37	Transportation Equipment	8	0	W	W	X
38	Instruments and Related Products	NA	NA	NA	NA	X
39	Misc. Manufacturing Industries	W	0	*	0	X
	Total	2	12	1	2	X

See footnotes at end of table.

Table 45. Relative Standard Errors for Table 14 of Detailed Statistics Section (Continued)
(Percent)

SIC Code ^a	Industry Groups and Industry	Purchases	Transfers In	Total Onsite Generation	Sales and/or Transfers Offsite	Net Demand for Electricity
West Census Region						
20	Food and Kindred Products	7	Q	7	12	X
21	Tobacco Products	0	0	0	0	X
22	Textile Mill Products	49	0	0	0	X
23	Apparel and Other Textile Products	37	0	*	0	X
24	Lumber and Wood Products	12	Q	14	24	X
25	Furniture and Fixtures	NA	NA	NA	NA	X
26	Paper and Allied Products	6	42	2	4	X
2621	<i>Paper Mills</i>	W	0	3	W	X
2631	<i>Paperboard Mills</i>	10	0	3	6	X
27	Printing and Publishing	18	0	W	Q	X
28	Chemicals and Allied Products	W	W	5	10	X
2819	<i>Industrial Inorganic Chemicals, nec</i>	W	W	W	W	X
2821	<i>Plastics Materials and Resins</i>	9	0	0	0	X
2869	<i>Industrial Organic Chemicals, nec</i>	25	0	W	W	X
2873	<i>Nitrogenous Fertilizers</i>	13	0	W	W	X
29	Petroleum and Coal Products	W	W	9	3	X
2911	<i>Petroleum Refining</i>	W	W	10	10	X
30	Rubber and Misc. Plastics Products	20	0	W	0	X
31	Leather and Leather Products	W	0	0	0	X
32	Stone, Clay and Glass Products	7	Q	W	W	X
3241	<i>Cement, Hydraulic</i>	8	0	W	W	X
33	Primary Metal Industries	7	Q	W	W	X
3312	<i>Blast Furnaces and Steel Mills</i>	W	W	W	W	X
3334	<i>Primary Aluminum</i>	8	0	0	0	X
34	Fabricated Metal Products	13	47	W	W	X
35	Industrial Machinery and Equipment	17	0	W	W	X
36	Electronic and Other Electric Equipment	12	0	W	W	X
37	Transportation Equipment	9	0	17	0	X
38	Instruments and Related Products	14	39	W	0	X
39	Misc. Manufacturing Industries	21	0	0	0	X
	Total	3	36	3	6	X

^a See Appendices A and D for descriptions of the Standard Industrial Classification system.

* Estimate less than 0.5 rounded to zero.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Q=Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

NA=Not available. Data are included in higher level totals.

X=Relative Standard Errors for Net Demand could not be calculated due to sampling methodology.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey."

**Table 46. Relative Standard Errors for Table 15 of Detailed Statistics
(Percent)**

Economic Characteristics*	Purchases	Transfers In	Onsite Generation	Sales/Transfers Offsite	Net Demand
Value of Shipments and Receipts (million dollars)					
Under 20	3	33	8	20	X
20-49	3	26	5	8	X
50-99	3	28	5	13	X
100-249	3	17	2	2	X
250-499	3	18	1	2	X
500 and Over	3	10	1	2	X
Total	2	12	1	2	X
Employment Size					
Under 50	6	41	9	3	X
50-99	5	20	6	4	X
100-249	3	34	5	7	X
250-499	3	18	1	4	X
500-999	3	15	1	3	X
1,000 and Over	2	14	1	2	X
Total	2	12	1	2	X

* Value of Shipments and Receipts and Employment Size were supplied by the Bureau of the Census.

X=Relative Standard Error could not be calculated due to sampling methodology.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey," and Bureau of the Census, Industry Division, data files for the "1988 Annual Survey of Manufactures" and the "1987 Census of Manufactures."

**Table 47. Relative Standard Errors for Table 16 of Detailed Statistics Section
(Percent)**

SIC Code ^a	Industry Groups and Industry	Total Purchased	Utility Supplier	Nonutility Supplier
20	Food and Kindred Products	4	4	28
21	Tobacco Products	8	8	0
22	Textile Mill Products	4	4	0
23	Apparel and Other Textile Products	10	10	0
24	Lumber and Wood Products	8	8	42
25	Furniture and Fixtures	8	W	W
26	Paper and Allied Products	3	3	17
2621	Paper Mills	3	W	W
2631	Paperboard Mills	5	5	33
27	Printing and Publishing	7	7	Q
28	Chemicals and Allied Products	3	4	15
2819	Industrial Inorganic Chemicals, nec	W	W	27
2821	Plastics Materials and Resins	W	5	W
2869	Industrial Organic Chemicals, nec	7	7	40
2873	Nitrogenous Fertilizers	7	W	W
29	Petroleum and Coal Products	4	W	W
2911	Petroleum Refining	W	4	W
30	Rubber and Misc. Plastics Products	5	5	0
31	Leather and Leather Products	22	22	Q
32	Stone, Clay and Glass Products	W	W	W
3241	Cement, Hydraulic	5	W	W
33	Primary Metal Industries	3	3	33
3312	Blast Furnaces and Steel Mills	4	W	W
3334	Primary Aluminum	W	W	0
34	Fabricated Metal Products	5	5	Q
35	Industrial Machinery and Equipment	5	5	0
36	Electronic and Other Electric Equipment	5	5	0
37	Transportation Equipment	W	W	22
38	Instruments and Related Products	7	7	0
39	Misc. Manufacturing Industries	8	8	0
	Total	2	2	12

^a See Appendices A and D for descriptions of the Standard Classification system.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Q=Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey."

**Table 48. Relative Standard Errors for Table 17 of Detailed Statistics Section
(Percent)**

Selected Characteristics	Total Purchased	Utility Supplier	Nonutility Supplier
Census Region			
Northeast	3	3	48
Midwest	2	2	24
South	2	2	35
West	3	3	13
Total	2	2	12
Value of Shipments and Receipts* (million dollars)			
Under 20	3	3	40
20-49	3	3	16
50-99	3	3	19
100-249	3	3	33
250-499	3	W	W
500 and Over	3	W	W
Total	2	2	12
Employment Size*			
Under 50	6	6	41
50-99	5	W	W
100-249	3	3	28
250-499	3	3	20
500-999	3	3	19
1,000 and Over	2	W	W
Total	2	2	12

* Value of Shipments and Receipts and Employment Size were supplied by the Bureau of the Census.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey," and Bureau of the Census, Industry Division, data files for the "1988 Annual Survey of Manufactures" and the "1987 Census of Manufactures."

Table 49. Relative Standard Errors for Table 18 of Detailed Statistics Section (Percent)

SIC Code*	Industry Groups and Industry	Steam		
		Total Purchased	Utility Supplier	Nonutility Supplier
20	Food and Kindred Products	18	18	24
21	Tobacco Products	W	W	0
22	Textile Mill Products	20	33	19
23	Apparel and Other Textile Products	48	Q	Q
24	Lumber and Wood Products	29	Q	32
25	Furniture and Fixtures	Q	Q	0
26	Paper and Allied Products	9	10	17
2621	Paper Mills	11	10	24
2631	Paperboard Mills	17	19	41
27	Printing and Publishing	34	38	Q
28	Chemicals and Allied Products	11	17	13
2819	Industrial Inorganic Chemicals, nec	19	21	22
2821	Plastics Materials and Resins	10	13	15
2869	Industrial Organic Chemicals, nec	17	25	23
2873	Nitrogenous Fertilizers	30	W	W
29	Petroleum and Coal Products	12	15	18
2911	Petroleum Refining	12	15	18
30	Rubber and Misc. Plastics Products	23	34	30
31	Leather and Leather Products	Q	0	Q
32	Stone, Clay and Glass Products	42	45	45
3241	Cement, Hydraulic	0	0	0
33	Primary Metal Industries	14	28	18
3312	Blast Furnaces and Steel Mills	W	W	W
3334	Primary Aluminum	0	0	0
34	Fabricated Metal Products	38	33	Q
35	Industrial Machinery and Equipment	35	39	Q
36	Electric and Other Electric Equipment	37	37	0
37	Transportation Equipment	18	18	24
38	Instruments and Related Products	Q	Q	0
39	Misc. Manufacturing Industries	42	Q	Q
	Total	8	8	8

* See Appendices A and D for descriptions of the Standard Industrial Classification system.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Q=Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey."

**Table 50. Relative Standard Errors for Table 19 of Detailed Statistics Section
(Percent)**

Selected Characteristics	Steam		
	Total Purchased	Utility Supplier	Nonutility Supplier
Census Region			
Northeast	13	17	22
Midwest	8	10	12
South	9	14	11
West	12	19	15
Total	6	8	8
Value of Shipments and Receipts* (million dollars)			
Under 20	21	30	30
20-49	12	15	19
50-99	11	13	18
100-249	7	9	10
250-499	14	15	16
500 and Over	10	13	12
Total	6	8	8
Employment Size*			
Under 50	44	Q	46
50-99	19	23	26
100-249	13	18	17
250-499	12	12	15
500-999	10	11	17
1,000 and Over	10	15	11
Total	6	8	8

* Value of Shipments and Receipts and Employment Size were supplied by the Bureau of the Census.

Q=Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey," and Bureau of the Census, Industry Division, data files for the "1988 Annual Survey of Manufactures" and the "1987 Census of Manufactures."

Table 51. Relative Standard Errors for Table 20 of Detailed Statistics Section (Percent)

SIC Code*	Industry Groups and Industry	Total Sold	Utility Purchaser	Nonutility Purchaser
20	Food and Kindred Products	8	11	4
21	Tobacco Products	W	W	W
22	Textile Mill Products	16	W	W
23	Apparel and Other Textile Products	Q	Q	0
24	Lumber and Wood Products	22	22	Q
25	Furniture and Fixtures	42	Q	48
26	Paper and Allied Products	2	2	2
2621	Paper Mills	2	2	1
2631	Paperboard Mills	3	3	1
27	Printing and Publishing	Q	Q	0
28	Chemicals and Allied Products	2	2	8
2819	Industrial Inorganic Chemicals, nec	W	6	W
2821	Plastics Materials and Resins	13	14	11
2869	Industrial Organic Chemicals, nec	3	2	11
2873	Nitrogenous Fertilizers	W	W	0
29	Petroleum and Coal Products	2	2	2
2911	Petroleum Refining	2	2	2
30	Rubber and Misc. Plastics Products	Q	Q	Q
31	Leather and Leather Products	Q	Q	0
32	Stone, Clay and Glass Products	18	5	43
3241	Cement, Hydraulic	W	W	0
33	Primary Metal Industries	5	2	8
3312	Blast Furnaces and Steel Mills	6	2	9
3334	Primary Aluminum	W	W	W
34	Fabricated Metal Products	W	Q	30
35	Industrial Machinery and Equipment	26	Q	26
36	Electronic and Electric Equipment	27	41	35
37	Transportation Equipment	11	20	13
38	Instruments and Related Products	Q	Q	0
39	Misc. Manufacturing Industries	0	0	0
	Total	2	2	4

* See Appendices A and D for descriptions of the Standard Industrial Classification system.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Q=Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey."

**Table 52. Relative Standard Errors for Table 21 of Detailed Statistics Section
(Percent)**

Selected Characteristics	Total Sold	Utility Purchaser	Nonutility Purchaser
Census Region			
Northeast	4	3	18
Midwest	5	10	8
South	2	1	4
West	6	6	11
Total	2	2	4
Value of Shipments and Receipts* (million dollars)			
Under 20	20	Q	Q
20-49	8	8	36
50-99	13	15	12
100-249	2	2	8
250-499	2	2	5
500 and Over	2	1	5
Total	2	2	4
Employment Size^a			
Under 50	3	W	W
50-99	4	W	W
100-249	7	7	18
250-499	4	3	12
500-999	3	4	5
1,000 and Over	2	1	4
Total	2	2	4

^a Value of Shipments and Receipts and Employment Size were supplied by the Bureau of the Census.
W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.
Q=Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.
Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey," and Bureau of the Census, Industry Division, data files for the "1988 Annual Survey of Manufactures" and the "1987 Census of Manufactures."

Table 53. Relative Standard Errors for Table 22 of Detailed Statistics Section (Percent)

SIC Code ^a	Industry Groups and Industry	Total	Cogeneration	Renewables	Other
20	Food and Kindred Products	3	3	W	W
21	Tobacco Products	W	W	0	0
22	Textile Mill Products	6	5	26	13
23	Apparel and Other Textile Products	Q	0	0	Q
24	Lumber and Wood Products	13	13	Q	6
25	Furniture and Fixtures	5	3	0	Q
26	Paper and Allied Products	1	1	1	2
2621	<i>Paper Mills</i>	1	1	1	1
2631	<i>Paperboard Mills</i>	1	1	W	W
27	Printing and Publishing	Q	W	0	W
28	Chemicals and Allied Products	1	1	0	1
2819	<i>Industrial Inorganic Chemicals, nec</i>	1	W	0	W
2821	<i>Plastics Materials and Resins</i>	7	7	0	1
2869	<i>Industrial Organic Chemicals, nec</i>	1	W	0	W
2873	<i>Nitrogenous Fertilizers</i>	W	3	0	W
29	Petroleum and Coal Products	2	2	0	1
2911	<i>Petroleum Refining</i>	2	2	0	1
30	Rubber and Misc. Plastics Products	21	24	Q	36
31	Leather and Leather Products	6	W	W	13
32	Stone, Clay and Glass Products	3	3	0	9
3241	<i>Cement, Hydraulic</i>	W	W	0	0
33	Primary Metal Industries	3	1	W	W
3312	<i>Blast Furnaces and Steel Mills</i>	1	2	0	1
3334	<i>Primary Aluminum</i>	*	0	0	*
34	Fabricated Metal Products	W	W	0	35
35	Industrial Machinery and Equipment	10	2	W	W
36	Electronic and Other Electric Equipment	15	W	0	W
37	Transportation Equipment	4	2	W	W
38	Instruments and Related Products	W	W	2	W
39	Misc. Manufacturing Industries	Q	0	Q	Q
	Total	1	1	2	3

^a See Appendices A and D for descriptions of the Standard Industrial Classification system.

* Estimate less than 0.5 rounded to zero.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Q=Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey."

**Table 54. Relative Standard Errors for Table 23 of Detailed Statistics Section
(Percent)**

Selected Characteristics	Total	Cogeneration	Renewables	Other
Census Region				
Northeast	3	2	3	13
Midwest	1	1	1	2
South	1	1	W	W
West	3	3	W	W
Total	1	1	2	3
Value of Shipments and Receipts* (million dollars)				
Under 20	8	11	W	W
20-49	5	5	7	18
50-99	5	5	1	4
100-249	2	1	1	10
250-499	1	1	1	3
500 and Over	1	1	W	W
Total	1	1	2	3
Employment Size*				
Under 50	9	2	45	21
50-99	6	5	33	18
100-249	5	5	13	12
250-499	1	1	1	3
500-999	1	1	1	6
1,000 and Over	1	1	1	1
Total	1	1	2	3

* Value of Shipments and Receipts and Employment Size were supplied by the Bureau of the Census.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey," and Bureau of the Census, Industry Division, data files for the "1988 Annual Survey of Manufactures" and the "1987 Census of Manufactures."

**Table 55. Relative Standard Errors for Table 24 of Detailed Statistics Section
(Percent)**

SIC Code*	Industry Groups and Industry	Total Generated Onsite	Interconnected With A Utility	Designated As A Qualifying Facility
20	Food and Kindred Products	3	3	2
21	Tobacco Products	W	W	W
22	Textile Mill Products	6	6	W
23	Apparel and Other Textile Products	Q	*	0
24	Lumber and Wood Products	13	13	22
25	Furniture and Fixtures	5	4	W
26	Paper and Allied Products	1	1	1
2621	<i>Paper Mills</i>	1	1	1
2631	<i>Paperboard Mills</i>	1	1	1
27	Printing and Publishing	Q	W	W
28	Chemicals and Allied Products	1	1	1
2819	<i>Industrial Inorganic Chemicals, nec</i>	1	1	W
2821	<i>Plastics Materials and Resins</i>	7	10	18
2869	<i>Industrial Organic Chemicals, nec</i>	1	1	1
2873	<i>Nitrogenous Fertilizers</i>	W	W	W
29	Petroleum and Coal Products	2	3	3
2911	<i>Petroleum Refining</i>	2	3	3
30	Rubber and Misc. Plastics Products	21	23	8
31	Leather and Leather Products	6	W	W
32	Stone, Clay and Glass Products	3	2	W
3241	<i>Cement, Hydraulic</i>	W	2	W
33	Primary Metal Industries	3	4	1
3312	<i>Blast Furnaces and Steel Mills</i>	1	2	1
3334	<i>Primary Aluminum</i>	*	0	0
34	Fabricated Metal Products	W	W	W
35	Industrial Machinery and Equipment	10	5	W
36	Electronic and Electric Equipment	15	W	W
37	Transportation Equipment	4	1	1
38	Instruments and Related Products	W	W	W
39	Misc. Manufacturing Industries	Q	Q	0
	Total	1	1	1

* See Appendices A and D for descriptions of the Standard Industrial Classification system.

* Estimate less than 0.5 rounded to zero.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Q=Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey."

**Table 56. Relative Standard Errors for Table 25 of Detailed Statistics Section
(Percent)**

Selected Characteristics	Total Generated Onsite	Interconnected With A Utility	Designated As A Qualifying Facility
Census Region			
Northeast	3	3	3
Midwest	1	1	1
South	1	1	1
West	3	4	4
Total	1	1	1
Value of Shipments and Receipts* (million dollars)			
Under 20	8	17	21
20-49	5	6	7
50-99	5	6	10
100-249	2	2	2
250-499	1	2	2
500 and Over	1	1	1
Total	1	1	1
Employment Size*			
Under 50	9	2	W
50-99	6	1	W
100-249	5	6	9
250-499	1	1	1
500-999	1	2	2
1,000 and Over	1	1	1
Total	1	1	1

* Value of Shipments and Receipts and Employment Size were supplied by the Bureau of the Census.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey," and Bureau of the Census, Industry Division, data files for the "1988 Annual Survey of Manufactures" and the "1987 Census of Manufactures."

Table 57. Relative Standard Errors for Table 26 of Detailed Statistics Section (Percent)

SIC Code ^a	Industry Groups and Industry	Total	Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal	Coke and Breeze	Other
Total United States										
20	Food and Kindred Products	4	4	W	W	3	W	11	W	27
21	Tobacco Products	11	8	10	18	12	12	14	0	19
22	Textile Mill Products	4	4	6	18	5	12	9	*	17
23	Apparel and Other Textile Products	11	10	33	22	16	37	43	0	Q
24	Lumber and Wood Products	10	8	W	22	12	15	W	0	21
25	Furniture and Fixtures	8	8	23	32	8	19	25	0	34
26	Paper and Allied Products	2	3	4	9	3	8	4	0	5
2621	Paper Mills	3	3	5	5	3	7	4	0	4
2631	Paperboard Mills	5	5	7	17	6	8	7	0	7
27	Printing and Publishing	7	7	28	20	8	23	0	0	19
28	Chemicals and Allied Products	5	3	9	10	5	11	6	18	11
2819	Industrial Inorganic Chemicals, nec	6	W	11	W	W	16	W	W	14
2821	Plastics Materials and Resins	7	W	W	20	W	11	10	0	20
2869	Industrial Organic Chemicals, nec	11	7	16	9	11	14	15	Q	16
2873	Nitrogenous Fertilizers	9	7	0	11	9	W	0	0	W
29	Petroleum and Coal Products	6	4	36	23	5	41	10	0	34
2911	Petroleum Refining	5	W	0	*	5	*	W	0	W
30	Rubber and Misc. Plastics Products	4	5	W	15	5	W	14	0	27
31	Leather and Leather Products	14	22	31	30	12	25	49	0	*
32	Stone, Clay and Glass Products	3	W	W	24	4	10	6	33	11
3241	Cement, Hydraulic	5	5	Q	6	9	*	6	18	15
33	Primary Metal Industries	4	3	7	8	4	14	6	7	7
3312	Blast Furnaces and Steel Mills	5	4	8	5	4	14	6	8	8
3334	Primary Aluminum	6	W	W	8	W	8	14	W	8
34	Fabricated Metal Products	5	5	19	14	7	12	12	22	35
35	Industrial Machinery and Equipment	6	5	16	18	9	15	15	Q	14
36	Electric and Electronic Equipment	5	5	13	16	5	31	16	24	22
37	Transportation Equipment	5	W	12	W	5	12	8	W	10
38	Instruments and Related Products	9	7	14	W	9	Q	W	0	21
39	Misc. Manufacturing Industries	8	8	17	18	11	37	38	0	42
	Total	2	2	3	6	2	11	3	6	5
Northeast Census Region										
20	Food and Kindred Products	7	W	W	19	8	W	W	0	36
21	Tobacco Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
22	Textile Mill Products	10	12	12	W	15	30	W	0	*
23	Apparel and Other Textile Products	28	30	39	29	43	Q	0	0	Q
24	Lumber and Wood Products	33	25	Q	Q	W	W	0	0	Q
25	Furniture and Fixtures	17	17	38	37	22	Q	0	0	Q
26	Paper and Allied Products	4	W	5	W	W	9	W	0	W
2621	Paper Mills	4	W	6	W	8	9	W	0	8
2631	Paperboard Mills	11	11	19	W	15	27	W	0	*
27	Printing and Publishing	14	14	W	24	20	Q	0	0	W
28	Chemicals and Allied Products	7	W	W	W	9	W	14	0	W
2819	Industrial Inorganic Chemicals, nec	12	W	15	W	12	*	*	0	*
2821	Plastics Materials and Resins	W	10	11	33	13	W	W	0	*
2869	Industrial Organic Chemicals, nec	W	22	W	13	W	W	0	0	*
2873	Nitrogenous Fertilizers	*	W	0	0	*	0	0	0	*
29	Petroleum and Coal Products	12	W	Q	44	W	Q	W	0	Q
2911	Petroleum Refining	12	11	0	0	16	0	12	0	0
30	Rubber and Misc. Plastics Products	9	11	W	22	13	W	W	0	50
31	Leather and Leather Products	W	W	38	32	W	*	Q	0	*
32	Stone, Clay and Glass Products	7	W	26	18	9	16	10	17	W
3241	Cement, Hydraulic	11	10	Q	12	*	*	11	W	18
33	Primary Metal Industries	9	W	14	W	6	25	13	W	21
3312	Blast Furnaces and Steel Mills	10	W	W	W	7	W	13	W	W
3334	Primary Aluminum	W	W	W	W	W	*	W	0	W
34	Fabricated Metal Products	15	9	20	19	24	21	W	W	*
35	Industrial Machinery and Equipment	10	12	17	24	13	W	W	0	*
36	Electric and Electronic Equipment	9	9	16	21	11	27	W	W	*
37	Transportation Equipment	14	16	18	W	16	40	W	0	*
38	Instruments and Related Products	18	14	15	W	14	29	W	0	*
39	Misc. Manufacturing Industries	W	W	19	21	W	24	W	0	Q
	Total	4	3	4	9	4	W	9	W	W

See footnotes at end of table.

Table 57. Relative Standard Errors for Table 26 of Detailed Statistics Section (Continued)
(Percent)

SIC Code*	Industry Groups and Industry	Total	Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal	Coke and Breeze	Other
Midwest Census Region										
20	Food and Kindred Products	7	5	10	W	5	Q	15	W	25
21	Tobacco Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
22	Textile Mill Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
23	Apparel and Other Textile Products	20	19	Q	40	23	Q	Q	0	Q
24	Lumber and Wood Products	18	19	Q	W	21	W	Q	0	35
25	Furniture and Fixtures	13	16	W	30	13	33	W	0	*
26	Paper and Allied Products	4	W	W	W	5	14	6	0	14
2621	Paper Mills	4	W	W	W	5	5	6	0	9
2631	Paperboard Mills	10	10	34	18	10	12	10	0	27
27	Printing and Publishing	10	10	Q	Q	12	24	0	0	34
28	Chemicals and Allied Products	7	7	W	W	8	W	9	W	18
2819	Industrial Inorganic Chemicals, nec	W	W	W	11	W	*	18	0	W
2821	Plastics Materials and Resins	W	10	18	W	10	W	W	0	W
2869	Industrial Organic Chemicals, nec	16	17	W	W	23	W	17	0	W
2873	Nitrogenous Fertilizers	W	15	0	16	W	*	0	0	Q
29	Petroleum and Coal Products	8	7	Q	39	8	Q	W	0	Q
2911	Petroleum Refining	W	8	0	0	W	0	W	0	0
30	Rubber and Misc. Plastics Products	7	7	W	W	9	W	W	0	39
31	Leather and Leather Products	28	Q	Q	Q	18	43	Q	0	*
32	Stone, Clay and Glass Products	6	5	37	W	6	16	12	W	W
3241	Cement, Hydraulic	9	9	*	W	12	*	9	*	W
33	Primary Metal Industries	6	5	10	8	5	23	8	8	13
3312	Blast Furnaces and Steel Mills	7	W	10	W	6	W	9	10	12
3334	Primary Aluminum	W	W	0	14	W	*	W	0	W
34	Fabricated Metal Products	6	6	W	18	6	20	13	W	29
35	Industrial Machinery and Equipment	7	7	Q	20	8	24	16	Q	15
36	Electric and Electronic Equipment	7	7	29	20	7	27	22	0	*
37	Transportation Equipment	6	W	14	W	8	W	9	W	10
38	Instruments and Related Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	13	14	Q	W	15	*	W	0	*
	Total	3	2	11	10	2	W	5	8	W
South Census Region										
20	Food and Kindred Products	5	W	15	W	6	W	12	W	43
21	Tobacco Products	11	8	10	18	12	12	14	0	19
22	Textile Mill Products	4	4	7	W	5	11	W	*	17
23	Apparel and Other Textile Products	12	11	Q	40	15	33	48	0	Q
24	Lumber and Wood Products	11	11	W	W	21	17	Q	0	20
25	Furniture and Fixtures	11	11	W	48	14	25	W	0	41
26	Paper and Allied Products	4	4	6	15	W	18	5	0	W
2621	Paper Mills	4	W	W	8	5	8	6	0	7
2631	Paperboard Mills	6	6	8	8	8	9	9	0	9
27	Printing and Publishing	12	13	W	W	16	W	0	0	W
28	Chemicals and Allied Products	6	W	W	12	6	W	8	W	12
2819	Industrial Inorganic Chemicals, nec	8	14	W	W	W	20	W	W	18
2821	Plastics Materials and Resins	9	W	W	23	W	12	W	0	W
2869	Industrial Organic Chemicals, nec	12	8	17	14	12	14	24	Q	18
2873	Nitrogenous Fertilizers	10	10	0	13	10	W	0	0	W
29	Petroleum and Coal Products	9	5	W	W	W	Q	W	0	45
2911	Petroleum Refining	6	6	0	*	7	*	W	0	W
30	Rubber and Misc. Plastics Products	6	7	11	22	8	13	25	0	Q
31	Leather and Leather Products	W	W	Q	W	W	Q	0	0	Q
32	Stone, Clay and Glass Products	6	5	W	W	6	18	10	Q	17
3241	Cement, Hydraulic	9	9	W	W	16	*	11	W	W
33	Primary Metal Industries	6	W	W	15	7	14	W	W	W
3312	Blast Furnaces and Steel Mills	9	W	W	9	8	12	W	W	W
3334	Primary Aluminum	9	W	0	W	9	*	W	W	W
34	Fabricated Metal Products	8	10	W	33	10	22	W	W	28
35	Industrial Machinery and Equipment	9	9	31	Q	10	23	Q	W	32
36	Electric and Electronic Equipment	9	8	36	19	8	Q	W	W	29
37	Transportation Equipment	6	8	W	19	6	14	W	*	24
38	Instruments and Related Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	W	W	W	W	W	Q	0	0	Q
	Total	3	2	5	13	4	W	W	12	W

See footnotes at end of table.

Table 57. Relative Standard Errors for Table 26 of Detailed Statistics Section (Continued)
(Percent)

SIC Code ^a	Industry Groups and Industry	Total	Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal	Coke and Breeze	Other
West Census Region										
20	Food and Kindred Products	8	7	W	21	8	W	W	W	24
21	Tobacco Products	0	0	0	0	0	0	0	0	0
22	Textile Mill Products	25	49	0	23	21	Q	0	0	*
23	Apparel and Other Textile Products	33	37	0	0	38	Q	0	0	Q
24	Lumber and Wood Products	18	12	Q	18	19	W	0	0	32
25	Furniture and Fixtures	NA	NA	NA	NA	NA	NA	NA	NA	NA
26	Paper and Allied Products	5	8	W	12	6	13	W	0	W
2621	Paper Mills	6	W	W	10	7	7	W	0	9
2631	Paperboard Mills	9	10	12	W	11	10	W	0	11
27	Printing and Publishing	17	18	0	Q	21	W	0	0	Q
28	Chemicals and Allied Products	9	W	W	27	12	22	W	W	W
2819	Industrial Inorganic Chemicals, nec	W	W	W	13	16	*	W	W	W
2821	Plastics Materials and Resins	7	9	W	W	7	*	0	0	*
2869	Industrial Organic Chemicals, nec	W	25	0	W	W	*	0	0	W
2873	Nitrogenous Fertilizers	W	13	0	*	W	*	0	0	*
29	Petroleum and Coal Products	8	W	Q	W	8	Q	0	0	31
2911	Petroleum Refining	W	W	0	0	W	0	0	0	W
30	Rubber and Misc. Plastics Products	14	20	W	Q	18	48	0	0	Q
31	Leather and Leather Products	W	W	0	Q	W	Q	0	0	Q
32	Stone, Clay and Glass Products	6	7	W	19	8	22	9	W	W
3241	Cement, Hydraulic	8	8	W	13	11	*	9	W	34
33	Primary Metal Industries	7	7	W	W	9	17	W	25	W
3312	Blast Furnaces and Steel Mills	15	W	W	13	13	*	W	W	W
3334	Primary Aluminum	8	8	0	9	9	11	13	0	11
34	Fabricated Metal Products	12	13	0	34	11	24	0	0	Q
35	Industrial Machinery and Equipment	29	17	0	W	42	W	0	0	43
36	Electronic and Other Electric Equipment	11	12	0	41	14	*	0	0	*
37	Transportation Equipment	9	9	W	W	8	W	W	0	*
38	Instruments and Related Products	13	14	*	44	W	*	0	0	*
39	Misc. Manufacturing Industries	21	21	0	Q	27	*	0	0	Q
	Total	3	3	9	9	4	12	W	W	W

^a See Appendices A and D for descriptions of the Standard Industrial Classification system.

* Estimate less than 0.5 rounded to zero.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Q=Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

NA=Not available. Data are included in higher level totals.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey."

**Table 58. Relative Standard Errors for Table 27 of Detailed Statistics Section
(Percent)**

Economic Characteristics*	Total	Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal	Coke & Breeze	Other
Value of Shipments and Receipts (million dollars)									
Under 20	3	3	15	12	4	15	13	23	11
20-49	3	3	11	8	3	10	6	17	18
50-99	4	3	6	11	3	9	6	8	14
100-249	3	3	5	8	5	13	5	12	7
250-499	3	3	5	7	4	14	6	15	8
500 and Over	5	3	5	7	5	17	6	8	16
Total	2	2	3	6	2	11	3	6	5
Employment Size									
Under 50	5	6	18	17	7	26	29	39	16
50-99	7	5	21	10	5	30	18	46	19
100-249	3	3	7	7	5	12	4	16	14
250-499	3	3	5	9	4	13	7	14	8
500-999	3	3	4	11	3	15	6	12	9
1,000 and Over	4	2	4	5	5	19	5	7	9
Total	2	2	3	6	2	11	3	6	5

* Value of Shipments and Receipts and Employment Size were supplied by the Bureau of the Census.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-848, "1988 Manufacturing Energy Consumption Survey," and the Bureau of the Census, Industry Division, data files for the "1988 Annual Survey of Manufactures" and the "1987 Census of Manufactures."

Table 59. Relative Standard Errors for Table 28 of Detailed Statistics Section (Percent)

SIC Code*	Industry Groups and Industry	Total	Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal	Coke and Breeze	Other
Total United States										
20	Food and Kindred Products	3	4	W	W	3	W	10	W	15
21	Tobacco Products	9	8	9	18	13	15	14	0	15
22	Textile Mill Products	4	4	6	18	5	10	8	*	13
23	Apparel and Other Textile Products	10	10	35	23	16	44	42	0	Q
24	Lumber and Wood Products	8	9	W	20	13	14	W	0	17
25	Furniture and Fixtures	8	8	23	29	9	17	27	0	49
26	Paper and Allied Products	2	3	4	8	3	7	4	0	5
2621	Paper Mills	3	3	5	5	3	6	4	0	5
2631	Paperboard Mills	4	4	6	14	5	7	7	0	8
27	Printing and Publishing	7	7	29	20	9	24	0	0	19
28	Chemicals and Allied Products	5	3	9	9	5	10	6	18	12
2819	Industrial Inorganic Chemicals, nec	6	W	11	W	W	14	W	W	15
2821	Plastics Materials and Resins	7	W	W	18	W	10	10	0	18
2869	Industrial Organic Chemicals, nec	10	6	16	9	10	13	16	Q	20
2873	Nitrogenous Fertilizers	8	7	0	10	9	W	0	0	W
29	Petroleum and Coal Products	4	4	39	24	5	40	13	0	39
2911	Petroleum Refining	4	W	0	*	5	*	W	0	W
30	Rubber and Misc. Plastics Products	5	5	W	14	6	W	15	0	28
31	Leather and Leather Products	18	22	31	26	12	21	50	0	*
32	Stone, Clay and Glass Products	4	W	W	29	4	10	6	28	10
3241	Cement, Hydraulic	5	5	Q	6	7	*	5	15	9
33	Primary Metal Industries	3	3	7	8	3	11	6	7	6
3312	Blast Furnaces and Steel Mills	4	4	8	5	4	11	6	8	6
3334	Primary Aluminum	6	W	W	8	W	7	11	W	7
34	Fabricated Metal Products	5	5	19	14	9	11	12	22	20
35	Industrial Machinery and Equipment	5	5	17	22	9	13	13	Q	15
36	Electronic and Other Electric Equipment	5	5	13	16	5	34	15	23	23
37	Transportation Equipment	5	W	13	W	6	13	7	W	9
38	Instruments and Related Products	8	8	14	W	9	45	W	0	16
39	Misc. Manufacturing Industries	8	9	18	20	11	37	37	0	40
	Total	2	2	3	7	2	9	3	6	7
Northeast Census Region										
20	Food and Kindred Products	8	W	W	20	9	W	W	0	34
21	Tobacco Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
22	Textile Mill Products	10	12	12	W	16	25	W	0	36
23	Apparel and Other Textile Products	27	28	41	29	42	Q	0	0	Q
24	Lumber and Wood Products	28	26	Q	Q	W	W	0	0	Q
25	Furniture and Fixtures	17	18	40	37	22	Q	0	0	44
26	Paper and Allied Products	4	W	5	W	W	8	W	0	W
2621	Paper Mills	4	W	6	W	8	8	W	0	9
2631	Paperboard Mills	10	11	18	W	15	24	W	0	*
27	Printing and Publishing	14	14	W	26	21	Q	0	0	W
28	Chemicals and Allied Products	8	W	W	W	10	W	14	0	W
2819	Industrial Inorganic Chemicals, nec	13	W	15	W	13	*	*	0	*
2821	Plastics Materials and Resins	W	12	10	30	16	W	W	0	21
2869	Industrial Organic Chemicals, nec	W	12	W	13	W	W	0	0	31
2873	Nitrogenous Fertilizers	27	W	0	0	27	0	0	0	*
29	Petroleum and Coal Products	12	W	Q	43	W	Q	W	0	Q
2911	Petroleum Refining	11	12	0	0	16	0	12	0	0
30	Rubber and Misc. Plastics Products	11	12	W	22	14	W	W	0	29
31	Leather and Leather Products	W	W	37	29	W	*	Q	0	*
32	Stone, Clay and Glass Products	7	W	24	18	9	13	10	18	W
3241	Cement, Hydraulic	11	10	Q	11	26	*	11	W	25
33	Primary Metal Industries	6	W	14	W	6	21	12	W	30
3312	Blast Furnaces and Steel Mills	8	W	W	W	7	W	12	W	W
3334	Primary Aluminum	W	W	W	W	W	*	W	0	W
34	Fabricated Metal Products	13	9	22	19	32	23	W	W	36
35	Industrial Machinery and Equipment	10	11	18	19	14	W	W	0	30
36	Electronic and Other Electric Equipment	9	10	16	21	11	23	W	W	30
37	Transportation Equipment	16	18	21	W	11	42	W	0	16
38	Instruments and Related Products	13	15	15	W	15	30	W	0	32
39	Misc. Manufacturing Industries	W	W	19	22	W	28	W	0	Q
	Total	3	3	4	8	5	W	9	W	W

See footnotes at end of table.

Table 59. Relative Standard Errors for Table 28 of Detailed Statistics Section (Continued)
(Percent)

SIC Code*	Industry Groups and Industry	Total	Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal	Coke and Breeze	Other
Midwest Census Region										
20	Food and Kindred Products	5	5	11	W	6	Q	14	W	25
21	Tobacco Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
22	Textile Mill Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
23	Apparel and Other Textile Products	18	18	Q	39	22	Q	Q	0	Q
24	Lumber and Wood Products	19	21	Q	W	22	W	Q	0	33
25	Furniture and Fixtures	12	13	W	35	13	27	W	0	39
26	Paper and Allied Products	4	W	W	W	5	13	5	0	17
2621	Paper Mills	4	W	W	W	5	5	5	0	10
2631	Paperboard Mills	9	9	33	*	10	*	11	0	33
27	Printing and Publishing	11	12	*	Q	13	30	0	0	34
28	Chemicals and Allied Products	6	7	W	W	7	W	9	W	14
2819	Industrial Inorganic Chemicals, nec	W	W	W	*	W	*	18	0	W
2821	Plastics Materials and Resins	W	10	16	W	10	W	W	0	W
2869	Industrial Organic Chemicals, nec	14	15	W	W	20	W	17	0	W
2873	Nitrogenous Fertilizers	W	14	0	*	W	*	0	0	*
29	Petroleum and Coal Products	8	7	Q	42	8	Q	W	0	50
2911	Petroleum Refining	W	7	0	0	W	0	W	0	0
30	Rubber and Misc. Plastics Products	7	8	W	W	10	W	W	0	43
31	Leather and Leather Products	43	Q	Q	Q	19	*	Q	0	*
32	Stone, Clay and Glass Products	5	5	36	W	7	20	13	W	W
3241	Cement, Hydraulic	8	9	*	W	11	*	9	*	W
33	Primary Metal Industries	5	5	10	10	5	17	9	8	12
3312	Blast Furnaces and Steel Mills	6	W	10	W	6	W	9	10	8
3334	Primary Aluminum	W	W	0	*	W	*	W	0	W
34	Fabricated Metal Products	6	7	W	19	7	18	13	W	18
35	Industrial Machinery and Equipment	7	7	Q	18	7	18	15	Q	15
36	Electronic and Other Electric Equipment	7	7	30	22	7	25	21	0	23
37	Transportation Equipment	7	W	15	W	10	W	8	W	11
38	Instruments and Related Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	13	14	Q	W	14	*	W	0	39
	Total	2	2	13	11	2	W	5	8	W
South Census Region										
20	Food and Kindred Products	6	W	15	W	6	W	11	W	25
21	Tobacco Products	9	8	9	18	13	15	14	0	15
22	Textile Mill Products	4	4	7	W	6	9	W	*	13
23	Apparel and Other Textile Products	11	11	Q	42	14	30	48	0	46
24	Lumber and Wood Products	12	13	W	W	28	17	Q	0	28
25	Furniture and Fixtures	11	11	W	46	14	23	W	0	Q
26	Paper and Allied Products	4	4	6	11	W	16	5	0	W
2621	Paper Mills	4	W	W	8	5	7	6	0	7
2631	Paperboard Mills	6	6	8	8	7	9	8	0	9
27	Printing and Publishing	13	13	W	W	17	W	0	0	W
28	Chemicals and Allied Products	6	W	W	10	6	W	7	W	13
2819	Industrial Inorganic Chemicals, nec	8	12	W	W	W	20	W	W	19
2821	Plastics Materials and Resins	8	W	W	24	W	11	W	0	W
2869	Industrial Organic Chemicals, nec	11	7	17	13	11	13	24	Q	21
2873	Nitrogenous Fertilizers	10	9	0	12	10	W	0	0	W
29	Petroleum and Coal Products	6	5	W	W	W	Q	W	0	Q
2911	Petroleum Refining	6	5	0	*	7	*	W	0	W
30	Rubber and Misc. Plastics Products	7	7	12	22	8	12	25	0	50
31	Leather and Leather Products	W	W	Q	W	W	*	0	0	Q
32	Stone, Clay and Glass Products	7	6	W	W	6	14	9	45	14
3241	Cement, Hydraulic	8	8	W	W	12	*	10	W	W
33	Primary Metal Industries	6	W	W	13	7	14	W	W	W
3312	Blast Furnaces and Steel Mills	8	W	W	9	8	11	W	W	W
3334	Primary Aluminum	9	W	0	W	9	*	W	W	W
34	Fabricated Metal Products	8	9	W	37	9	22	W	W	24
35	Industrial Machinery and Equipment	9	10	*	Q	10	27	Q	W	32
36	Electronic and Other Electric Equipment	8	8	35	18	8	Q	W	W	28
37	Transportation Equipment	8	9	W	20	7	18	W	*	21
38	Instruments and Related Products	NA	NA	NA	NA	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	W	W	W	W	W	Q	0	0	Q
	Total	3	2	5	16	3	W	W	12	W

See footnotes at end of table.

Table 59. Relative Standard Errors for Table 28 of Detailed Statistics Section (Continued)
(Percent)

SIC Code*	Industry Groups and Industry	Total	Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal	Coke and Breeze	Other
West Census Region										
20	Food and Kindred Products	6	8	W	22	7	W	W	W	29
21	Tobacco Products	0	0	0	0	0	0	0	0	0
22	Textile Mill Products	26	36	0	*	22	Q	0	0	*
23	Apparel and Other Textile Products	35	37	0	0	39	Q	0	0	Q
24	Lumber and Wood Products	13	14	44	21	19	W	0	0	24
25	Furniture and Fixtures	NA	NA	NA	NA	NA	NA	NA	NA	NA
26	Paper and Allied Products	5	6	W	8	6	17	W	0	W
2621	Paper Mills	6	W	W	8	7	7	W	0	9
2631	Paperboard Mills	9	9	11	W	11	10	W	0	13
27	Printing and Publishing	17	18	0	Q	20	W	0	0	Q
28	Chemicals and Allied Products	9	W	W	29	10	*	W	W	W
2819	Industrial Inorganic Chemicals, nec	W	W	W	13	14	*	W	W	W
2821	Plastics Materials and Resins	8	10	W	W	7	*	0	0	*
2869	Industrial Organic Chemicals, nec	W	22	0	W	W	*	0	0	W
2873	Nitrogenous Fertilizers	W	12	0	*	W	*	0	0	*
29	Petroleum and Coal Products	7	W	Q	W	8	Q	0	0	31
2911	Petroleum Refining	W	W	0	0	W	0	0	0	W
30	Rubber and Misc. Plastics Products	18	20	W	Q	18	34	0	0	Q
31	Leather and Leather Products	W	W	0	Q	W	Q	0	0	Q
32	Stone, Clay and Glass Products	6	6	W	21	8	25	9	W	W
3241	Cement, Hydraulic	8	8	W	13	11	*	9	W	15
33	Primary Metal Industries	7	7	W	W	9	18	W	28	W
3312	Blast Furnaces and Steel Mills	17	W	W	*	15	*	W	W	W
3334	Primary Aluminum	8	8	0	9	9	*	12	0	9
34	Fabricated Metal Products	12	14	0	33	11	27	0	0	Q
35	Industrial Machinery and Equipment	19	15	0	W	43	W	0	0	46
36	Electronic and Other Electric Equipment	12	13	0	41	12	*	0	0	30
37	Transportation Equipment	9	9	W	W	9	W	W	0	16
38	Instruments and Related Products	15	15	*	*	W	*	0	0	22
39	Misc. Manufacturing Industries	20	21	0	Q	25	*	0	0	Q
	Total	3	3	10	11	4	12	W	W	W

* See Appendices A and D for descriptions of the Standard Industrial Classification system.

* Estimate less than 0.5 rounded to zero.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

Q=Withheld because Relative Standard Error is greater than 50 percent. Data are included in higher level totals.

NA=Not available. Data are included in higher level totals.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey."

**Table 60. Relative Standard Errors for Table 29 of Detailed Statistics Section
(Percent)**

Economic Characteristics*	Total	Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal	Coke & Breeze	Other
Value of Shipments and Receipts (million dollars)									
Under 20	3	3	12	13	4	12	12	24	9
20-49	3	3	12	8	3	8	5	20	9
50-99	3	3	6	13	3	10	6	9	18
100-249	3	3	5	8	4	13	5	12	8
250-499	4	3	5	8	4	15	5	15	14
500 and Over	4	3	6	7	4	15	6	8	16
Total	2	2	3	7	2	9	3	8	7
Employment Size									
Under 50	5	5	20	19	8	20	29	42	12
50-99	4	5	22	11	4	20	17	42	24
100-249	3	3	7	8	4	14	4	19	11
250-499	3	3	5	9	3	12	6	19	9
500-999	3	2	4	14	3	17	6	12	16
1,000 and Over	4	2	4	5	4	18	5	8	11
Total	2	2	3	7	2	9	3	6	7

* Value of Shipments and Receipts and Employment Size were supplied by the Bureau of the Census.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey," and Bureau of the Census, Industry Division, data files for the "1988 Annual Survey of Manufactures" and the "1987 Census of Manufactures."

Table 61. Relative Standard Errors for Table 30, Parts 1 and 2 of Detailed Statistics Section (Percent)

SIC Code ^a	Industry Groups and Industry	Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal
Total United States							
20	Food and Kindred Products	1	W	W	1	W	2
21	Tobacco Products	2	2	2	4	5	1
22	Textile Mill Products	2	2	4	2	3	2
23	Apparel and Other Textile Products	3	4	4	3	14	2
24	Lumber and Wood Products	3	W	5	4	7	W
25	Furniture and Fixtures	4	3	7	3	7	3
26	Paper and Allied Products	1	1	4	1	3	1
2621	<i>Paper Mills</i>	1	1	2	1	2	1
2631	<i>Paperboard Mills</i>	2	2	5	1	4	1
27	Printing and Publishing	2	3	4	3	8	0
28	Chemicals and Allied Products	2	2	2	1	4	1
2819	<i>Industrial Inorganic Chemicals, nec</i>	W	2	W	W	4	W
2821	<i>Plastics Materials and Resins</i>	W	W	4	W	6	2
2869	<i>Industrial Organic Chemicals, nec</i>	2	2	3	2	5	1
2873	<i>Nitrogenous Fertilizers</i>	2	0	2	2	W	0
29	Petroleum and Coal Products	1	11	7	1	5	6
2911	<i>Petroleum Refining</i>	W	0	0	1	0	W
30	Rubber and Misc. Plastics Products	2	W	3	2	W	5
31	Leather and Leather Products	3	3	6	5	8	8
32	Stone, Clay and Glass Products	W	W	6	1	4	2
3241	<i>Cement, Hydraulic</i>	1	4	3	4	4	2
33	Primary Metal Industries	2	2	2	1	5	1
3312	<i>Blast Furnaces and Steel Mills</i>	1	2	1	1	5	1
3334	<i>Primary Aluminum</i>	W	W	1	W	3	7
34	Fabricated Metal Products	2	7	4	4	6	2
35	Industrial Machinery and Equipment	2	2	9	3	9	3
36	Electronic and Other Electric Equipment	2	2	3	2	7	3
37	Transportation Equipment	W	3	W	2	5	2
38	Instruments and Related Products	3	2	W	3	16	W
39	Misc. Manufacturing Industries	3	2	6	5	5	5
	Total	1	1	2	1	4	1
Northeast Census Region							
20	Food and Kindred Products	W	W	6	4	W	W
21	Tobacco Products	NA	NA	NA	NA	NA	NA
22	Textile Mill Products	3	2	W	5	7	W
23	Apparel and Other Textile Products	5	4	5	6	1	0
24	Lumber and Wood Products	6	5	12	W	W	0
25	Furniture and Fixtures	5	4	10	8	10	0
26	Paper and Allied Products	W	1	W	W	3	W
2621	<i>Paper Mills</i>	W	1	W	1	2	W
2631	<i>Paperboard Mills</i>	2	1	W	2	4	W
27	Printing and Publishing	4	W	5	5	19	0
28	Chemicals and Allied Products	W	W	W	4	W	3
2819	<i>Industrial Inorganic Chemicals, nec</i>	W	1	W	2	2	0
2821	<i>Plastics Materials and Resins</i>	4	1	5	6	W	W
2869	<i>Industrial Organic Chemicals, nec</i>	14	W	3	W	W	0
2873	<i>Nitrogenous Fertilizers</i>	W	0	0	2	0	0
29	Petroleum and Coal Products	W	12	4	W	18	W
2911	<i>Petroleum Refining</i>	3	0	0	1	0	2
30	Rubber and Misc. Plastics Products	3	W	3	4	W	W
31	Leather and Leather Products	W	3	6	W	7	8
32	Stone, Clay and Glass Products	W	4	4	3	6	2
3241	<i>Cement, Hydraulic</i>	1	2	3	5	5	2
33	Primary Metal Industries	W	3	W	2	7	2
3312	<i>Blast Furnaces and Steel Mills</i>	W	W	W	1	W	2
3334	<i>Primary Aluminum</i>	W	W	W	W	1	W
34	Fabricated Metal Products	3	9	5	10	10	W
35	Industrial Machinery and Equipment	6	3	10	4	W	W
36	Electronic and Other Electric Equipment	3	2	3	3	8	W
37	Transportation Equipment	4	4	W	8	4	W
38	Instruments and Related Products	4	2	W	5	17	W
39	Misc. Manufacturing Industries	W	2	6	W	10	W
	Total	2	1	2	2	W	2

See footnotes at end of table.

Table 61. Relative Standard Errors for Table 30, Parts 1 and 2 of Detailed Statistics Section (Continued)
(Percent)

SIC Code ^a	Industry Groups and Industry	Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal
Midwest Census Region							
20	Food and Kindred Products	2	3	W	2	4	2
21	Tobacco Products	NA	NA	NA	NA	NA	NA
22	Textile Mill Products	NA	NA	NA	NA	NA	NA
23	Apparel and Other Textile Products	4	0	5	6	13	0
24	Lumber and Wood Products	6	0	W	6	W	0
25	Furniture and Fixtures	9	W	10	3	11	W
26	Paper and Allied Products	W	W	W	2	5	2
2621	Paper Mills	W	W	W	1	2	2
2631	Paperboard Mills	2	2	6	2	17	3
27	Printing and Publishing	3	3	10	3	12	0
28	Chemicals and Allied Products	3	W	W	3	W	2
2819	Industrial Inorganic Chemicals, nec	W	W	4	W	6	3
2821	Plastics Materials and Resins	2	1	W	2	W	W
2869	Industrial Organic Chemicals, nec	3	W	W	5	W	2
2873	Nitrogenous Fertilizers	2	0	3	W	4	0
29	Petroleum and Coal Products	2	7	13	2	8	W
2911	Petroleum Refining	1	0	0	W	0	W
30	Rubber and Misc. Plastics Products	2	W	W	3	W	W
31	Leather and Leather Products	3	1	13	8	7	3
32	Stone, Clay and Glass Products	2	5	W	2	9	3
3241	Cement, Hydraulic	2	0	W	3	4	2
33	Primary Metal Industries	2	1	3	1	9	2
3312	Blast Furnaces and Steel Mills	W	1	W	1	W	1
3334	Primary Aluminum	W	0	1	W	2	W
34	Fabricated Metal Products	2	W	5	2	10	2
35	Industrial Machinery and Equipment	3	2	5	3	12	3
36	Electronic and Other Electric Equipment	2	7	6	2	21	4
37	Transportation Equipment	W	2	W	3	W	3
38	Instruments and Related Products	NA	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	5	0	W	7	11	W
	Total	1	3	4	1	W	2
South Census Region							
20	Food and Kindred Products	W	4	W	2	W	2
21	Tobacco Products	2	2	2	4	5	1
22	Textile Mill Products	3	2	W	2	3	W
23	Apparel and Other Textile Products	2	1	7	5	11	3
24	Lumber and Wood Products	4	W	W	7	8	0
25	Furniture and Fixtures	2	W	6	4	9	W
26	Paper and Allied Products	2	2	7	W	7	1
2621	Paper Mills	W	W	2	1	2	1
2631	Paperboard Mills	2	3	3	2	2	2
27	Printing and Publishing	4	W	W	7	W	0
28	Chemicals and Allied Products	W	W	3	1	W	2
2819	Industrial Inorganic Chemicals, nec	4	W	W	W	3	W
2821	Plastics Materials and Resins	W	W	2	W	2	W
2869	Industrial Organic Chemicals, nec	1	2	4	2	5	2
2873	Nitrogenous Fertilizers	2	0	2	2	W	0
29	Petroleum and Coal Products	1	W	W	W	8	W
2911	Petroleum Refining	W	0	0	1	0	W
30	Rubber and Misc. Plastics Products	2	5	5	3	5	2
31	Leather and Leather Products	W	0	W	W	12	0
32	Stone, Clay and Glass Products	2	W	W	2	4	2
3241	Cement, Hydraulic	2	W	W	5	9	3
33	Primary Metal Industries	W	W	3	2	5	W
3312	Blast Furnaces and Steel Mills	W	W	2	2	5	W
3334	Primary Aluminum	W	0	W	2	2	W
34	Fabricated Metal Products	6	W	7	4	10	W
35	Industrial Machinery and Equipment	3	6	11	3	11	4
36	Electronic and Other Electric Equipment	2	3	5	2	5	W
37	Transportation Equipment	2	W	4	2	10	W
38	Instruments and Related Products	NA	NA	NA	NA	NA	NA
39	Misc. Manufacturing Industries	W	W	W	W	7	0
	Total	1	2	4	1	W	W

See footnotes at end of table.

Table 61. Relative Standard Errors for Table 30, Parts 1 and 2 of Detailed Statistics Section (Continued)
(Percent)

SIC Code*	Industry Groups and Industry	Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal
West Census Region							
20	Food and Kindred Products	4	W	5	2	W	W
21	Tobacco Products	0	0	0	0	0	0
22	Textile Mill Products	18	0	3	5	9	0
23	Apparel and Other Textile Products	12	0	0	8	8	0
24	Lumber and Wood Products	6	17	6	6	W	0
25	Furniture and Fixtures	NA	NA	NA	NA	NA	NA
26	Paper and Allied Products	3	W	10	2	7	W
2621	Paper Mills	W	W	3	1	2	W
2631	Paperboard Mills	3	2	W	2	2	W
27	Printing and Publishing	5	0	2	6	W	0
28	Chemicals and Allied Products	W	W	7	5	9	W
2819	Industrial Inorganic Chemicals, nec	W	W	2	5	2	W
2821	Plastics Materials and Resins	3	W	W	2	3	0
2869	Industrial Organic Chemicals, nec	14	0	W	W	3	0
2873	Nitrogenous Fertilizers	6	0	0	W	2	0
29	Petroleum and Coal Products	W	8	W	4	2	0
2911	Petroleum Refining	W	0	0	W	0	0
30	Rubber and Misc. Plastics Products	5	W	10	8	19	0
31	Leather and Leather Products	W	0	0	W	12	0
32	Stone, Clay and Glass Products	3	W	5	2	12	3
3241	Cement, Hydraulic	3	W	8	2	3	2
33	Primary Metal Industries	3	W	W	4	5	W
3312	Blast Furnaces and Steel Mills	W	W	3	3	4	W
3334	Primary Aluminum	2	0	2	2	3	2
34	Fabricated Metal Products	6	0	4	3	8	0
35	Industrial Machinery and Equipment	6	0	W	15	W	0
36	Electronic and Other Electric Equipment	5	0	4	6	21	0
37	Transportation Equipment	3	W	W	3	W	W
38	Instruments and Related Products	4	0	5	W	16	0
39	Misc. Manufacturing Industries	9	0	0	7	3	0
	Total	2	3	3	2	5	W

* See Appendices A and D for description of the Standard Industrial Classification system.

W=Withheld to avoid disclosing data for individual establishments. Data are included in higher level totals.

NA=Not available. Data are included in higher level totals.

Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey."

**Table 62. Relative Standard Errors for Table 31 of Detailed Statistics Section
(Percent)**

Economic Characteristics*	Dollars per Physical Unit					
	Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal
Value of Shipments and Receipts (million dollars)						
Under 20	2	4	3	2	5	3
20-49	1	2	2	1	3	2
50-99	1	1	4	1	3	2
100-249	1	2	3	2	9	1
250-499	1	1	3	1	8	2
500 and Over	1	2	1	2	4	1
All Manufacturing	1	1	2	1	4	1
Employment Size						
Under 50	3	5	4	3	8	6
50-99	2	5	4	2	12	3
100-249	1	1	3	2	4	2
250-499	1	1	3	2	6	2
500-999	1	2	4	1	9	1
1,000 and Over	1	1	1	2	4	1
All Manufacturing	1	1	2	1	4	1

Economic Characteristics*	Dollars per Million Btu					
	Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG	Coal
Value of Shipments and Receipts (million dollars)						
Under 20	2	4	3	2	5	3
20-49	1	2	2	1	3	2
50-99	1	1	4	1	3	1
100-249	1	2	3	2	9	1
250-499	1	1	3	1	8	2
500 and Over	1	2	1	2	4	1
All Manufacturing	1	1	2	1	4	1
Employment Size						
Under 50	3	5	4	3	8	6
50-99	2	5	4	2	12	3
100-249	1	1	3	2	4	2
250-499	1	1	3	2	6	2
500-999	1	2	4	1	9	1
1,000 and Over	1	1	1	2	4	1
All Manufacturing	1	1	2	1	4	1

* Value of Shipments and Receipts and Employment Size data were supplied by the Bureau of the Census. See Appendix A.
Source: Energy Information Administration, Office of Energy Markets and End Use, Energy End Use Division, Form EIA-846, "1988 Manufacturing Energy Consumption Survey," and Bureau of the Census, Industry Division, data files for the "1988 Annual Survey of Manufactures" and the "1987 Census of Manufactures."

Appendix A

**Survey Design,
Implementation,
and Estimates**

Appendix A

Survey Design, Implementation, and Estimates

Introduction

The 1988 Manufacturing Energy Consumption Survey (MECS) has been designed by the Energy Information Administration (EIA) to provide information related to energy consumption in the manufacturing division. It is the second such survey to be completed. The first survey covered the year 1985. The MECS is an ongoing survey that is conducted every three years.

There were a few methodological and statistical refinements in the 1988 MECS. Most importantly, the 1988 data represent the entire manufacturing division. This coverage is more complete than that of the 1985 MECS, which did not represent the smallest manufacturing establishments. Also, the 1988 MECS collected both consumption-related and fuel-switching data on the same data collection form. These were two separate collections on the 1985 MECS. Fuel switching refers to the capability of manufacturers to substitute alternative fuels for those actually consumed in 1988. The consumption-related data are presented in this publication while the fuel-switching estimates will be presented in a separate report. Finally, the 1988 MECS sample was supplemented to account for new establishments (since the 1985 survey), and to enrich the sample of establishments that generate electricity onsite.

The basic unit of data collection for this survey was the manufacturing establishment. A nationally representative sample of these establishments supplied the information through mailed questionnaires. The Industry Division of the Bureau of the Census selected the MECS sample according to EIA design specifications; conducted the fieldwork; and handled data processing, again with EIA's input.

This appendix presents a summary of the design and implementation procedures for the survey, and describes the types of estimates included in this report. A methodological report published for the 1985 survey presented details relating to the background of the survey, forms design, sample design, and estimation procedures.¹⁵ This appendix also presents a brief overview of these topics and describes the changes made for the 1988 survey.

Description of the Manufacturing Division

The manufacturing division consists of all manufacturing establishments in the 50 States and the District of Columbia. The working definition of a manufacturing establishment is the definition stated in the Office of Management and Budget's Standard Industrial Classification (SIC) Manual:¹⁶

[Manufacturing establishments are] ... engaged in the mechanical or chemical transformation of materials or substances into new products. These establishments are usually described as plants, factories, or mills and characteristically use power driven machines and materials handling equipment. Establishments engaged in assembling component parts of manufactured products are also considered manufacturing if the new product is neither a structure nor other fixed improvement. Also included is the blending of materials such as lubricating oil, plastics, resins, or liquors.

The SIC Manual contains a hierarchical classification system that groups establishments according to their primary economic activities. This system divides the manufacturing division into 20 major industrial groups that are relatively homogeneous with respect to primary output. Each of these major industrial groups is

¹⁵Energy Information Administration, *Manufacturing Energy Consumption Survey: Methodological Report*, DOE/EIA-0514 (Washington, DC, 1988).

¹⁶Office of Management and Budget, *Standard Industrial Classification Manual, 1987* (Washington, DC, 1987), p. 67.

assigned a two-digit code. The two-digit codes for the manufacturing division range from SIC 20, Food and Kindred Products, through SIC 39, Miscellaneous Manufacturing Industries. Each major group is subdivided into three-digit groups, which are further divided into four-digit industries. For example, SIC 20 includes SIC 201, Meat Products, which, in turn, is subdivided into SIC 2011, Meat Packing Plants; SIC 2012, Sausages and Other Prepared Meat Products; SIC 2016, Poultry Dressing Plants; and SIC 2017, Poultry and Egg Processing.

The SIC category is the single most important classification variable in the MECS data system, both for selecting the MECS sample and analyzing the MECS data. The categories of primary interest for the MECS are the 20 major industrial groups (SIC 20 through 39) and the 10 most energy-consumptive four-digit industries within these industry groups. A description of these 20 major industrial groups and 10 industries appears in Appendix D.

The 1988 MECS uses the SIC classification scheme presented in the 1987 edition of SIC manual. The 1985 MECS was based on the 1972 SIC Manual. For the most part, the revisions were minor and had a negligible effect on the MECS estimates. However, there was one relatively significant revision in the way certain petrochemical plants were classified for the 1988 MECS, as opposed to the 1985 MECS. If the primary product of a petrochemical plant in 1985 was a liquified petroleum gas (LPG; e.g., ethane, propane), it was classified in SIC 2911, Petroleum Refining, regardless of how the LPG was produced. For the 1988 MECS, the establishment was classified in SIC 2911 only if the LPG was produced by a refinery process. If the LPG was produced by a chemical process, the establishment was classified in organic chemicals (SIC 2865 or 2869). Thus, when comparing the estimates for SIC's 2911, 2865, and 2869 between 1985 and 1988, the reader is cautioned to take the classification differences into account.

The Sampling Frame and Its Relationship to the Manufacturing Division

The 1988 MECS has expanded coverage over the 1985 MECS. The 1988 MECS estimates are for the *entire* manufacturing division. The 1985 estimates excluded the smallest establishments from coverage. Therefore, caution must be exercised by readers who wish to compare 1985 with 1988 estimates. EIA estimates that the smallest establishments represent 3 to 4 percent of overall 1988 energy consumption. The percentage varies by industry group. In certain SIC's with many small establishments, such as Apparel (SIC 23) and Leather (SIC 31), the percentage difference is much larger. In SIC's dominated by large establishments, such as Chemicals (SIC 28) and Pulp and Paper (SIC 26), the coverage difference is negligible.

As mentioned in the Introduction to this appendix, the Census Bureau serves as the collecting and compiling agent for the MECS. A major responsibility of the Industry Division of the Census Bureau is to conduct the Census of Manufactures (CM) and the Annual Survey of Manufactures (ASM). The CM is conducted for years ending in "2" or "7" (for example, 1982), and obtains economic data for the complete universe of approximately 350,000 manufacturing establishments in the United States. For the purposes of data collection, the CM universe is divided into two major subsets as follows.

1. **Small Single-Establishment Companies Not Sent a Report Form.** These companies are excused from filing a CM report. Generally, those with less than 5 employees are excused while all with more than 20 are mailed report forms. Those with 5 through 20 employees are excused or sent a report form based on the magnitude of their annual payroll and shipments data. Approximately 125,000 establishments are excused due to this criterion.
2. **Establishments Sent a Report Form.** The remaining manufacturing establishments in the universe are sent a report form.

The ASM is conducted during non-CM years to provide estimates of economic characteristics for the universe of manufacturing establishments. As with the CM, the ASM contains two components. The first component is the mail portion, a probability sample of manufacturing establishments selected from the list of establishments that are sent the CM report form (see above). Those establishments are weighted so that they

represent the mail portion of the CM universe. The second component of the ASM is the nonmail portion of the CM. These small establishments are not sent an ASM questionnaire, but their contribution to economic statistics is estimated based on selected information obtained annually from other Federal agencies.

The approach to building a sampling frame for the 1988 MECS was to update the 1985 MECS frame for changes in the population since that time. This was accomplished by the following means:

- The 1987 Census of Manufactures (CM) mail file list was separated into two groups according to whether an establishment was in operation before 1984.¹⁷
- The establishments in operation before 1984 were represented by 1985 MECS sample establishments that were still in operation in 1987. This was done by retaining 1985 MECS sample establishments that were matched to the 1987 CM list. This group of establishments, called the hold-over sample, retained the sampling weights based on their probabilities of selection for the 1985 MECS. (See "The Estimation Process" in this appendix.)
- A supplemental sample was drawn directly from those establishments on the 1987 CM list that came into existence after 1984. Together with the hold-over sample, this supplement updated the sample to represent the 1987 CM mail file.
- The MECS sample results were then further modified to represent the entire manufacturing population (including the nonmail file of the CM) by an adjustment to the sampling weights. This adjustment is explained later in this appendix in the section titled, "The Estimation Process."

Sample Design

In order to maximize EIA's ability to estimate changes in consumption from 1985 to 1988, the 1988 MECS sample consisted of two major components. The first, comprising approximately 10,600 establishments, is a "hold-over" component that included establishments in the 1985 MECS sample that were still in operation when the MECS was mailed on June 15, 1989. For the 1985 survey, the overall desired size of the MECS sample was set at 12,000 establishments based upon available resources and preliminary estimates of expected and desired sampling error. The desired sample size was allocated among 30 industry-based strata consisting of the 10 most energy-consuming four-digit SIC industries and the remaining portions of the 20 two-digit SIC industry groups. Due to random variability in the sample selection process, the actual sample contained 12,065 establishments.

For the 10 most energy-consuming industries, all the establishments in the 1984 ASM sample were included in the 1985 MECS sample with certainty. The remaining establishments were sampled from the 20 two-digit groups in a pattern designed to keep sampling errors within pre-established bounds for estimates of total consumption and consumption of four major types of energy: electricity, natural gas, residual oil, and coal. The procedure for subselecting ASM sample establishments into the MECS sample were such that their overall probabilities of selection for the MECS were proportional to an estimated energy measure of size. The overall probabilities for selection of the MECS sample establishments ranged from 0.002 to 1.000.

The selection of the MECS sample for 1985 was, therefore, a two-stage selection process, with the first stage being the selection of the ASM mail sample, and the second, being the subselection of the MECS sample from the ASM sample. Thus, a MECS sample establishment is selected conditionally upon it having been selected into the ASM mail sample, which means that its probability of selection from the ASM sample is a conditional probability. Therefore, the overall probability of selection into the MECS sample is represented by the product of this conditional probability and its ASM selection probability.

¹⁷The year 1984 was used as a cutoff because establishments that began operation during that year were omitted from the 1985 MECS sample.

The second component of the 1988 MECS consisted of two supplemental samples. The first, comprising about 1,500 establishments, represented that part of the 1987 CM mail file not covered by the hold-over sample.

The second comprised all establishments not otherwise selected for the 1988 MECS that reported onsite electricity generation of over 10,000 Kwh on the 1987 CM. The purpose of this supplement was to produce the best possible estimates of onsite electricity generation and associated measures. The generation supplemental sample added approximately 300 establishments to the total MECS sample.

Establishments beginning operation after 1984 were selected into the 1988 MECS using an energy measure of size that estimated 1987 purchased fuel consumption. The probabilities for selection into the MECS sample are proportional to an energy MOS computed similarly to the 1984 measure. The energy measure of size is the ratio of average 1985 total Btu per cost of fuels within an establishment's sampling stratum and region, multiplied by the establishment's 1987 CM value for cost of fuels. If the new establishment was (a) large enough to be mailed an ASM form in any year after 1984, and (b) was also classified in one of the 10 four-digit industries previously found to be the most energy-consumptive, it entered the MECS with certainty. Otherwise, its entry would be as a result of the same random selection process used for the original selection of the 1985 MECS sample.

Of the initial sample of 12,400 establishments, approximately 200 were determined to be out of business or out of scope based on updating procedures used by the Census Bureau. Thus, a final sample of 12,200 establishments were mailed a questionnaire. Of these, usable responses were received from 10,650 or 87 percent of those establishments. However, those respondents represented 96 percent of the total unweighted value of shipments and receipts of the final sample.

Fieldwork, Editing, and Quality Control

The 1988 MECS used customized questionnaires for specific industries, with similar energy consumption characteristics. The three questionnaires were:

- **Form EIA-846(A).**—This questionnaire was sent to the majority of the sample and collected the basic consumption, expenditure, and fuel-switching information.
- **Form EIA-846(B).**—This questionnaire was sent exclusively to establishments in the Petroleum Refining Industry (SIC 2911). The design of the questionnaire took advantage of the fact that other EIA surveys collect certain consumption and expenditure data from the refinery population. Thus, the EIA-846(B) did not require respondents to report on particular data items. The questionnaire also collects data on nonfuel use and shipments of energy sources from adjoining petrochemical plants.
- **Form EIA-846(C).**—This questionnaire was sent to establishments in the Steel Works, Blast Furnaces, and Rolling Mills Industry (SIC 3312), producers of Chemicals and Allied Products (SIC 28), and producers of Petroleum and Coal Products other than Petroleum Refining (SIC 29 excluding SIC 2911). It is identical to the EIA-846(A) except that it collects additional information on shipments of energy sources produced onsite.¹⁸

The questionnaires were mailed to the in-scope MECS sample establishments on June 15, 1989. Returned questionnaires were subjected to initial screening procedures for completeness, and incomplete forms or responses with obvious inconsistencies were set aside for review by industry specialists. Valid returned questionnaires were forwarded directly to check-in and then to data entry.

¹⁸Establishments in these industries routinely produce energy sources from the input of other energy sources, which are, in turn, sold or transferred to other establishments. The additional information collected on Form EIA-846(C) was to permit the necessary adjustments to avoid double counting. Response to these items was incomplete, however, and the adjustments were not made.

All forms that were incomplete or failed the initial screening procedures were carefully reviewed by the industry specialists from the Census Bureau and EIA. The Census Bureau specialists retrieved missing data and verified questionable items by telephone contact with the individual who completed the questionnaire. Once the forms were completed and verified, they were forwarded to check-in and to data entry.

The resulting MECS data file was then subjected to a series of computer edits. These edits included consistency checks against data items from other parts of the MECS and the 1988 ASM, as well as checks for outliers in the distribution of individual variables. Records with failed edits were reviewed and followed up by industry specialists.

Development of the Data File

The estimates in this report were developed from a data file consisting of both directly reported values and more complex items derived from a combination of directly reported values.

Reported values consist of responses to the 1988 MECS questionnaire (Appendix C). The exception are the estimates of energy consumption for nonfuel purposes and offsite-produced fuel consumption at petroleum refineries.¹⁹ For all remaining estimates, the responses to the questionnaire for each responding establishment were supplemented by the following economic data:

- Value of shipments and receipts
- Value added by manufacturing
- Total employment.

These economic data were not collected by the 1988 MECS, but were provided by the Census Bureau by linking the 1988 ASM economic data and MECS energy data at the establishment level.

The reported energy values were used to construct several derived values, which, in turn, were used to prepare the estimates appearing in selected tables in this report. (See "Survey Estimates" section in this appendix.) These derived values are defined as follows:

1. **Energy consumed onsite as a fuel and produced offsite.** This derived value represents onsite consumption of fuels that were originally produced offsite. That is, they arrived at the establishment as the result of a purchase, or were transferred to the establishment from outside sources. As such, this derived value is definitionally equivalent to "consumption of purchased" fuels as reported by the Census Bureau for the years 1974-1981. The Census Bureau defines "purchased" fuels to include those actually purchased plus those transferred in from other establishments.²⁰
2. **Energy consumed onsite for nonfuel purposes and produced offsite.** This derived value also represents energy that was originally produced offsite. This energy was used at the establishment site as raw material inputs and feedstocks.
3. **Energy consumed onsite as a fuel and produced onsite from nonenergy inputs.** This derived value covers materials such as wood chips, bark, and wood waste, and pulping liquor. These fuels are produced primarily in pulp and paper mills as a byproduct of wood used in the pulping process. Wood for pulping is not classified as energy in the MECS, and, therefore, would not have been included as an input. This derived value also covers waste materials, biomass, and hydrogen that was produced from the electrolysis

¹⁹The calculations for these quantities are discussed in the sections of this appendix titled, "Consumption for Nonfuel Purposes at Refineries" and "Offsite-Produced Fuel Use at Refineries."

²⁰U.S. Department of Commerce, Bureau of the Census, *Annual Survey (Census) of Manufactures*, "Fuels and Electric Energy Consumed," 1974-1982 (Washington, DC).

of brine. Energy sources such as petroleum and coal that were consumed as fuel and originated onsite from captive mines or wells (an unusual occurrence) are included here also.

4. **Energy consumed onsite for nonfuel purposes and produced onsite from nonenergy inputs.** Most onsite-produced energy that is used for nonfuel purposes is derived from other types of energy. The major exception is hydrogen that is produced from the electrolysis of brine. Hydrogen produced in this manner and used for nonfuel purposes is the major occurrence of this derived value. Energy sources such as petroleum and coal that were consumed as a nonfuel and originated onsite from captive mines or wells are included here also.
5. **Energy consumed onsite as a fuel and produced onsite from energy inputs.** This derived value covers a wide range of fuels consumed onsite that are produced onsite as direct products or byproducts of other types of energy.
6. **Energy consumed onsite for nonfuel purpose and produced onsite from energy inputs.** This derived value includes all petrochemical feedstocks and other raw material inputs that were produced onsite from existing energy or from other onsite-produced energy.

The first four of those derived values represent an addition to the energy consumed onsite, and are described in this publication as primary consumption (that is, either they were produced offsite or were produced onsite from nonenergy inputs). The fifth derived value described above does not represent an addition because it was produced onsite from energy that is already reported as input. Such energy, thus, represents duplicate counting of the input energy content. It is, however, a useful measure of onsite-produced fuel consumption and is nonduplicative with respect to an estimate of total fuel consumption. The sixth derived value is duplicative with respect to the consumption of energy for nonfuel purposes, and, therefore, was not used to prepare estimates. It was included only for computational purposes and completeness.

Assumptions Underlying Derived Values

Two basic assumptions are necessary to produce the derived values from the data reported on the MECS questionnaire. First, it is assumed that any energy produced onsite is disposed of as it is produced. That is, it is burned as a fuel and/or consumed as an input or feedstock; any excess is flared, dumped, transferred-out, sold, or is placed into inventory. For the purpose of computing the derived values, a quantity of an energy source produced onsite and placed into inventory *during the previous year* is not considered onsite production in the reporting year. A corollary of this assumption is that any energy source that was consumed onsite and originated offsite was acquired only if there was not sufficient onsite production to meet the establishment's needs of the energy source in the current year. Second, it is assumed that the priority use of onsite production is first as an input or feedstock and then as a fuel. While these assumptions are believed to reflect the energy use patterns at the vast majority of, but not all, establishments. The assumptions do provide a consistent method of determining an establishment's unduplicated total energy consumption and its reliance on outside providers to supply it.

The Estimation Process

Estimates in this report represent the entire population of manufacturers in the CM universe that were covered in the 1988 ASM. Full representation is accomplished by weighting the data from the establishment records in the consumption data file. Weighting is the process of multiplying the reported or derived values by a case-specific constant designed to inflate the data from each sample case to that portion of the population that it represents. The first, basic component in the MECS weights is the sampling weight. The sampling weight for a MECS sample case is the reciprocal of its overall probability of selection into the ASM and subsequent selection for the MECS.

The second component of the MECS weights is an adjustment for nonresponse. Adjustment factors to account for nonresponse were calculated by using the known energy measures of size of the respondents and the total sample. Because an establishment is selected into the MECS sample with a probability proportional to the establishment's energy measure of size, that measure can be viewed as an establishment's estimated contribution to energy consumption in 1987. A separate adjustment factor was computed for each of the 30 sampling strata²¹ and took the form:

$$a_s = \sum_j^{\text{Sample}} MOS_{s,j} + \sum_i^{\text{Resp.}} MOS_{s,i}, \quad (1)$$

where $MOS_{s,j}$ is the measure of size for MECS sample establishment j in stratum s , and $MOS_{s,i}$ is the measure of size for MECS respondent i in stratum s .

The last adjustment to the weights took advantage of the fact that a recent enumeration of the population, the 1987 CM, was performed prior to the compilation of the MECS data. It is difficult to maintain the accuracy and currency of a sample over a number of years even employing the established updating methods used by the Census Bureau. Time restrictions and the desire to have a longitudinal component in the MECS precluded drawing a completely new sample. Therefore, the MECS sample data were further adjusted by using known CM totals.

The adjustment that was used is analogous to the one that is routinely employed for ASM data. In the ASM case, cell totals have high correlations from year to year as a result of including many of the same establishments for each ASM within a CM cycle. By taking advantage of those correlations, cell totals can be made more reliable. The adjustment the Census Bureau chose maximizes those benefits.²² In that adjustment, CM data are substituted into the ASM sample establishments and a difference between that estimate and the actual Census total for any particular variable is computed. That difference is then added to the ASM data for the current year. The adjustment is shown in Equation (2):

$$Y'' = Y' - X' + X, \quad (2)$$

where Y'' is the adjusted ASM value, Y' is the ASM sample estimate for the current year, X' is the ASM sample estimate for the Census year, and X is the total Census for the Census year.

As all ASM quantities are also collected by the CM, the adjustment described can be done for the ASM variables individually. In order to have the MECS sample represent the 1988 MECS population as closely as possible, the MECS data should be adjusted in a way similar to the ASM. However, most data items collected by the MECS are not included on the CM. Data items included in the MECS are related to energy consumption and fuel switching, while ASM and CM data items are economic in nature. Therefore, a simple difference for corresponding items cannot be used to adjust MECS data as was done for the ASM data. Rather a measure that can be found on both the CM and the MECS must be used to ratio adjust all the MECS data items. The measure chosen was cost of fuels as it has shown a high correlation with energy consumption in the past.²³

Essentially each MECS nonresponse-adjusted weight was further adjusted by multiplying the weight by the ratio of cost of fuels measured by the 1987 CM to the 1987 cost of fuels estimate by the MECS sample establishments. This ratio was computed for each of the 30 MECS sampling strata (20 two-digit industry

²¹For the 1985 MECS there was a separate adjustment for employment size category as well as for sampling stratum. That added separation proved not to be worthwhile.

²²For a more detailed discussion, see U.S. Department of Commerce, Bureau of the Census, *The Annual Survey of Manufactures: A Report on Methodology*, Technical Paper No. 24, U.S. Government Printing Office (Washington, DC, February 1971).

²³Correlation coefficients between 1981 ASM establishment values of total purchased fuels and electric energy and the cost of fuels and electric energy ranged from .78 to .98 within two-digit SIC categories. (Unpublished document, U.S. Department of Commerce, Bureau of the Census.)

groups and 10 four-digit industries). For highly disaggregated estimates, the ratio adjustment is not as advantageous as for others. Indeed, as the same adjustment is used for all estimates within a stratum, it is possible that the adjustment could affect some estimates in an adverse way. This problem is discussed in greater detail in *Appendix B, Quality of the Data*. The ratio adjustment to the MECS weights takes the following form:

$$R_s = \frac{\sum_j^{CM} (CF_{s,j})}{\sum_i^{MECS} (W_{s,i} CF_{s,i})}, \quad (3)$$

where R_s is the adjustment to the MECS nonresponse adjusted weight in stratum s , $CF_{s,j}$ is the 1987 cost of fuels value for establishment j from the 1987 CM, $W_{s,i}$ is the nonresponse adjusted 1988 MECS weight for establishment i in stratum s , and $CF_{s,i}$ is the 1987 cost of fuels value for 1988 MECS sample establishment i in stratum s .

As was discussed in "The Sampling Frame and Its Relationship to the Manufacturing Division", the adjustment of the sampling weights according to Equation (3) extends the MECS sample coverage to the entire manufacturing division. This was not the case in for the 1985 when no CM-based ratio adjustment was performed.²⁴ The CM totals for cost of fuels includes the nonmail file imputed totals for cost of fuels as well as the mail file totals. Hence, by using the adjustment described in Equation (3), non-mail cases are also covered by the MECS.

Electricity Generation Estimates

In order to achieve greater reliability in electricity generation statistics, EIA decided to add a sample of known electricity-generating establishments. This supplemental sample included all establishments that reported at least 10,000 kWh of generation on the 1987 CM, that were not already in the MECS sample. As a result, all establishments with estimated electricity generation over the 10,000 kWh threshold were included in the MECS with certainty. All of those establishments, including those that were already in the MECS, were given conditional MECS sampling weights of 1 when electricity generation and sales statistics were computed. Recall that an establishment's MECS weight is a product of its ASM sampling weight and its conditional MECS weight. Therefore, only the ASM sampling weight was relevant for the computation of generation statistics for the 1987-identified electricity generating establishments. The establishments in the special electricity supplement were excluded from the computation of other estimates. If an establishment was already in the MECS sample, but was not among the establishments identified as having 10,000 kWh of electricity generation in 1987, its MECS weight was used for all estimation, including electricity generation and sales.

In the computation of "net electricity" (for example, see Table 1), normal weighting schemes were used and the supplemental electricity-generator sample was not included. Net electricity is the sum of electricity receipts and generation by renewable energy sources minus sales and transfers out. Although it is reasonable to estimate generation by renewable sources and sales and transfers out by using the supplemental sample, electricity receipts is more appropriately estimated by the normal methods. That is because virtually all establishments purchase or transfer in electricity regardless of whether they have onsite generation. Therefore, in order to estimate each component of net electricity using the same weighting scheme and to maintain compatibility with the 1985 MECS, the supplemental sample was not used for the estimation of net electricity.

²⁴The 1985 and 1988 MECS samples were both based on the 1982 CM file, augmented with updates to represent subsequent population changes as well as possible. Because the elapsed time between the 1985 MECS and the 1982 CM was shorter, there was less coverage degradation in the first cycle. As the 1987 CM and the 1988 MECS covered the same population, the adjustment described in equation (3) is a natural one. However, there were no corresponding Census data available to adjust the 1985 MECS.

Feedstocks and Offsite-Produced Fuel at Petroleum Refineries

The basic function of a petroleum refinery (SIC 2911) is to manufacture a wide variety of petroleum products from crude oil and other liquid hydrocarbon inputs. Those products can be grouped into three classes of use. The largest portion of refinery output is in the form of fuels that are ultimately consumed strictly for their energy content (e.g., motor gasoline, kerosene, and diesel oil). Many refinery products, however, are consumed, not for their energy content, but for their chemical properties. This class of energy products is generally known as petrochemical feedstocks. Finally, a third class of products consists of finished materials that are consumed for specific physical properties, rather than for their energy content or chemical properties. Those finished materials include asphalt, lubricants, waxes, and solvents, and are referred to as nonenergy products.²⁵

The MECS was specifically designed to collect information on the consumption of energy for heat, power, and electricity generation, and as petrochemical feedstocks and other raw material inputs. The consumption of energy was reported directly by the establishments in the MECS sample, and the estimates in this report reflect that consumption. For most industries, the end result of energy inputs is manufactured products that are not considered energy products. However, fuels and some petrochemical feedstocks produced from refinery inputs are treated as energy products by their subsequent users²⁶, and are reported not only in other manufacturing industries, but also in EIA surveys of consumption in other end-use sectors (residential households, residential vehicles, and commercial buildings). In that sense, refineries do not "use up" the majority of their inputs. They merely convert them from one form of energy (for example, crude oil) to another more usable form (for example, motor gasoline). Therefore, classifying refinery inputs that go into fuels and certain petrochemical feedstocks as refinery consumption would have resulted in massive double counting of total energy consumption, both within the manufacturing division, and across end-use sectors in the U.S. economy.

The third class of refinery products, nonenergy products, must be treated differently. The creation of those products by the refinery also requires energy inputs, primarily crude oil. The products are combustible and have a known heat content expressed in British thermal units (Btu). Asphalt, for example, contains 6.636 million Btu per 42-gallon barrel. However, the products are not recognized as energy by their subsequent consumers, and no provision was made for collecting data on their consumption from the MECS respondents. Therefore, the transformation of energy inputs to nonenergy products must be counted as refinery consumption, or it will never be accounted for anywhere in EIA's consumption surveys.

One characteristic of petroleum refineries is that, except for losses caused by spills, contamination, etc., the Btu content of the energy inputs exactly equals the Btu content of the outputs. Therefore, one only needs to know the quantities of those nonenergy products that were shipped by a refinery in order to know the quantity of energy inputs that was used to produce them. The EIA produces such information for all refinery products from the "Monthly Refinery Report," Form EIA-810. This form collects information on the monthly shipments from the universe of refineries in the United States. These data were the basis for estimating the input energy requirements for the nonenergy products.

The shipment quantities of the nonenergy products and certain classifications of petrochemical feedstocks, as reported on the "Monthly Refinery Report," were converted to Btu and summed to produce a monthly refinery total. Those totals were then summed across refineries and months to produce the total Btu value of refinery shipments of nonenergy products for 1988. That total was used to represent the total Btu value of the inputs used to produce the nonenergy products, and was inserted directly into the appropriate tables of this report to represent nonfuel consumption in refineries. (See "Survey Estimates" in this appendix.) Because the

²⁵Certain petroleum products can be classified according to the end-user of the product. For example, propane might be a fuel or a feedstock depending on the needs of the receiving establishment.

²⁶Whether a respondent reports a petrochemical feedstock as an energy source receipt often depends on the type of feedstock received. If the feedstock received is commonly used as a fuel, such as distillate fuel oil or ethane, then it is assumed that respondents will report it as an energy source receipt. If the refinery product received for petrochemical feedstock use is not normally considered a fuel, the assumption is made that respondents would not report it as an energy source receipt.

individual energy inputs corresponding to these shipments were not identified, the Btu value was entered in the "other" column.

The "Monthly Refinery Report" covers only the refinery part of an establishment while the MECS Forms EIA-846A through C cover energy use at the entire site, as defined by the Bureau of the Census. This difference affects MECS estimation only for cases in which a MECS report reflects energy use at both a refinery and a co-located petrochemical plant. For these cases, establishment nonfuel use is not completely estimated by shipments of refinery nonenergy products as measured by the EIA-810. There were no data items on the 1985 MECS survey to isolate refinery nonfuel use from that of the co-located petrochemical plant. This situation is corrected for the 1988 MECS. The format of the MECS refining report, Form EIA-846(B), (Appendix C), allows the inclusion of energy-related data from a petrochemical plant co-located with the refinery. Form EIA-846(B) collected nonfuel use at and shipments of energy sources from the co-located petrochemical plant (Columns 9 and 10 of Section II, Version A of EIA-846(B)). The total Btu of the consumption as a nonfuel minus the petrochemical plant shipments of energy sources is added across energy sources and establishments to the previously discussed refinery shipments of nonenergy sources. Note that for the petrochemical plant, estimation of nonfuel use is measured directly as the majority of that usage does not appear in products that will later be converted to fuel use by other manufacturing plants. The additional nonfuel use estimated for the adjoining petrochemical plants proved to be small relative to the refinery usage. That result was due mainly because the majority of petrochemical plants report separately on the MECS.

The EIA-810 data are also used to calculate the offsite-produced fuel use at the refinery establishment. (See "Derived Values" in this appendix.) Because Version A of Section II of Form EIA-846(B) collects only total fuel use of petroleum products (regardless of their origin), it was necessary to use the EIA-810 data to calculate the offsite-produced fuel ratio for those products. Estimation of the ratio utilized the same assumptions described in the section on "Assumptions Underlying Derived Values" except that EIA-810 data were used instead. This ratio is then applied to the MECS estimated value of total fuel.²⁷ Thus, this calculation takes the form:

$$O_{p,MECS} = \left(\frac{O_{p,EIA-810}}{F_{p,EIA-810}} \right) \cdot F_{p,MECS} \quad (4)$$

where $O_{p,MECS}$ is the MECS estimate of the contribution of fuel consumption of offsite-produced petroleum product p , $O_{p,EIA-810}$ is the EIA-810 estimate of the contribution to fuel consumption of offsite-produced petroleum product p , $F_{p,MECS}$ is the MECS estimate of total fuel use of petroleum product p , and $F_{p,EIA-810}$ is the EIA-810 estimate of the total fuel use of petroleum product p .

Estimates of the contribution to fuel consumption of offsite-produced nonpetroleum products are calculated directly from MECS data, using the same method employed in other SIC's.

Survey Estimates

Except for some estimates of energy consumption for nonfuel purposes at petroleum refineries, all energy consumption and energy-related statistics produced from MECS data are calculated by combining the data collected from the responding establishments with the adjusted sampling weights. These weights establish the relationship between the responding establishments and the manufacturing division as defined for the MECS. Two types of statistics are shown in this report: aggregates (for example, total natural gas consumption in the hydraulic cement industry), and ratios (for example, the amount of fuel consumed per dollar of value added in the manufacturing division). These statistics are based on the originally reported values, or the derived values reported earlier, and appear in Tables 1 through 31.

²⁷The MECS value for total fuel would also include the amount used at the adjoining petrochemical plant if one were present. Using a refinery-based ratio from the EIA-810 on this portion of the establishment is a source of error. However, refinery fuel use will usually dominate the petrochemical fuel use especially for petroleum products.

Tables 1 and 7 present estimates of the total primary consumption of energy for all purposes by the manufacturing division. This measure is intended to represent total demand for energy by manufactures. Except for petroleum refineries (see "Feedstocks and Offsite-Produce Fuel at Petroleum Refineries" in this appendix), the estimates in Tables 1 and 7 are based on the following derived values:

- X ■ Energy consumed onsite as a fuel and produced offsite
- ✓ ■ Energy consumed onsite for nonfuel purposes and produced offsite
- ✓ ■ Energy consumed onsite as a fuel and produced onsite from nonenergy inputs
- ✓ ■ Energy consumed onsite for nonfuel purposes and produced onsite from nonenergy inputs.

They also include estimates of net electricity and steam consumption; that is, purchases plus transfers in and generation from noncombustible renewable resources, minus quantities sold and transferred out. Primary consumption excludes quantities of energy that were produced from other energy inputs and, therefore, avoids double-counting.

The estimates shown in the petroleum refinery row of Table 1 are conceptually different from the estimates in the other rows of that table. For all industries except petroleum refineries, each cell represents the total primary consumption of energy for all purposes. In the petroleum refinery row, the cell entries for "net electricity" through "coke and breeze" represent only the quantities of given type of energy that was consumed as a fuel. The "other" cell of the petroleum refinery row includes other energy that was consumed as a fuel plus the quantity of energy (mostly crude oil) that was consumed for the production of nonenergy products, as estimated by the Btu value of the shipments. Note that although the estimates shown in the refinery row are computed differently, the total Btu does represent a nonduplicative measure of primary consumption.

Table 7 shows primary consumption for all purposes by economic characteristics of the establishment. For that table, the row entitled "not ascertainable" includes, in the "other" column, the total quantity of energy consumed for the production of nonenergy products by refineries. The quantities of energy consumed for the production of heat and power in refineries are included throughout the remainder of the table, depending on the value of shipments or employment size of the responding establishment.

Tables 2 and 8 present the total primary consumption of combustible energy for nonfuel purposes. These tables are based upon aggregates of the derived values of energy produced offsite plus those produced onsite from nonenergy inputs, and consumed onsite for nonfuel purposes. Tables 2 and 8 present the nonfuel primary consumption component of Tables 1 and 7. The entry in the "other" column of the petroleum refinery row of Table 2 represents the total inputs (mostly crude oil) for the production of nonenergy products. The other cells in the petroleum refinery row contain a zero entry because the table represents consumption for nonfuel purposes only, and the refinery inputs are available in aggregate form only.

Except for petroleum refineries (see "Feedstocks and Offsite-Produce Fuel at Petroleum Refineries" in this appendix), the estimates in Tables 2 and 8 are based on the following derived values:

- Energy consumed onsite for nonfuel purposes and produced offsite
- Energy consumed onsite for nonfuel purposes and produced onsite from nonenergy inputs.

Tables 3 and 9 present estimates of input energy for the production of heat, power, and electricity generation. For combustible energy, the estimates are based upon the originally reported MECS questionnaire responses to "Quantity consumed onsite in 1988 as a fuel" (see Appendix C). That reported value is exactly equal to the sum of the following derived values:

- Energy consumed onsite as a fuel and produced offsite
- Energy consumed onsite as a fuel and produced onsite from nonenergy inputs

- X₂ ■ Energy consumed onsite as a fuel and produced onsite from energy products.

Thus, the estimates of combustible energy in Tables 3 and 9 represent total consumption as a fuel, regardless of where the energy was produced.

It should be noted that the consumption estimates for combustible energy are not duplicative with respect to fuel use. There is obviously no duplication for quantities that were produced offsite as well as those produced onsite from nonenergy inputs. The situation is not as clear for quantities produced onsite from other energy inputs, however. Those quantities result from the consumption of an energy as a feedstock or raw material input. They do not result from the consumption of an energy as a fuel.

Examples of energy produced onsite from other energy inputs include,

- Coke oven gas produced as a byproduct of the destructive distillation of coal to produce coke
- Petroleum coke produced in refineries as a result of the high temperature treatment of petroleum fractions
- Still gas produced in refineries as a result of distillation, cracking, reforming, and other processes.

From those examples, it is clear that the input energy was not consumed as a fuel and would not have been included elsewhere in Tables 3 and 9.

The estimates of electricity and steam (note that steam is included in the "other" energy category) must conform to the same criteria as combustible energy. That is, they must represent inputs to produce heat and power, and to generate electricity that do not duplicate energy content represented elsewhere in Tables 3 and 9.

In the case of electricity, the quantities generated onsite by conventional generation or cogeneration must be excluded because the input fuels to produce the electricity (coal, for example) are already counted elsewhere in the table. Thus, the nonduplicative measure of electricity input for Tables 3 and 9 is the same net electricity estimate that appeared in Tables 1 and 7. The same rationale applies to steam. Onsite production is excluded because the input fuel would be counted elsewhere. Thus, the allocation of energy to the various sources shown in Tables 3 and 9 is consistent with a concept of "first use" of energy for heat, power, and electricity generation.

Tables 4 and 10 present the total consumption as a fuel of offsite-produced energy. As noted, these estimates are approximately definitionally equivalent to the Census Bureau's "purchased" fuels.

The estimates in Tables 4 and 10 are based on the following derived value:

- Energy consumed onsite as a fuel and produced offsite.

Tables 5 and 11 present total shell storage capacity of residual oil, distillate oil and LPG. Shell storage capacity includes all onsite capacity, including that which is dedicated or leased for storage of energy owned by other establishments.

Tables 6 and 12 present estimates of several energy-related operating ratios. These estimates are computed from energy data reported by the MECS responding establishments and economic data reported on the ASM for the same establishments. The consumption values used in the formation of these ratios are the total consumption values for heat and power appearing in Tables 3 and 9. It is not possible to exactly reconstruct the 1988 ASM estimates of economic variables by dividing MECS consumption by corresponding ratios of consumption per economic unit. Due to different purposes of the MECS and ASM, the size and weighting scheme of the MECS and ASM samples are different. Therefore, a MECS estimate for an economic variable would be expected to be slightly different due to sampling error, especially for the entries representing a relatively small number of establishments.

Table 13 presents quantities of total inputs of byproduct and "other" energy sources used for heat, power, and electricity generation. These estimates are components of the estimates of combustible energy sources found in the last column of Tables 3 and 9. Net steam (see explanation for Tables 3 and 9) is not included in Table 13 but is included in the "Other" column in Tables 3 and 9.

Tables 14 and 15 present components of electricity demand. These quantities are calculated directly from responses to the MECS questionnaire. The quantities for purchases and other receipts are calculated using the normal MECS sample while the onsite generation and sales and/or transfers out quantity are calculated using the supplemental electricity generator sample and special weighting scheme. Note that the quantity "net demand for electricity" is not equivalent to "net electricity" shown in Tables 1, 3, 7, and 9. The latter quantity excludes onsite generation by combustible energy sources.

Tables 16 through 19 present quantities of electricity and steam purchases from utilities and nonutilities. These quantities are weighted totals of reported responses. A "utility" is defined as a company that produces and/or delivers electricity and/or natural gas, and is legally obligated to provide service to the public within its franchise area.

Tables 20 and 21 present quantities of electricity sold to utility and nonutility purchasers. These data are weighted totals of reported responses. The quantities of sales are estimated using the supplemental electricity generator sample.

Tables 22 and 23 present components of onsite electricity generation. These components are cogeneration, generation using renewable energy sources, and conventional generation using combustible energy sources. These data are weighted totals of reported responses. The quantities are estimated using the supplemental electricity generator sample.

Tables 24 and 25 show breakdowns of total onsite electricity generation by status of interconnection with a utility and/or designation as a "qualifying facility". An establishment is "interconnected" with a utility if it has the capability to deliver electricity to the grid as well as receive electricity from it. A qualifying facility must meet the requirements of an independent generator as defined in the Public Utilities Regulatory Policy Act (PURPA) of 1978 (see "Glossary").

Tables 26 through 31 present purchases, expenditures, and average prices for energy sources. The purchased quantities shown in Tables 26 and 27 are *not* values of consumption. These data are the amounts actually purchased in the open market regardless of their later disposition. Quantities received through transfers or from a central purchasing office are excluded. The prices shown in Tables 30 and 31 are the results of simple division of the expenditures presented in Tables 28 and 29 by the purchased quantities in Tables 26 and 27. Prices shown in Part 1 of Table 30 and the top panel of Table 31 are expressed in dollars per physical unit, while prices shown in Part 2 of Table 30 and the bottom panel of Table 31 are expressed in dollars per Btu. Both the expenditures and quantities purchased were values estimated directly from responses to the MECS questionnaires.

The Heat Content of Energy

Most of the estimates of individual energy in this report are presented in physical units (kilowatthours, barrels, and short tons). Row totals and combinations of types of energy are presented in Btu. Table 1 is presented in physical units and Btu in Parts 1 and 2, respectively.

A Btu is the quantity of heat required to raise the temperature of 1 pound of water by 1 degree Fahrenheit. Thus, converting physical units of a given type of energy to Btu is a means of expressing the heat content of that energy. All Btu quantities are in terms of higher heating value, with no regard for efficiency of use. Because no energy consumption process is 100 percent efficient (although some are considerably more energy efficient than others), Btu figures must be considered as the maximum available heat content. The following table presents the Btu conversion factors of major types of energy.

Table A1. Conversion of Physical Units to British Thermal Units

Type of Energy	British Thermal Units (thousands)
Electric Energy (1,000 kilowatthours)	3,412
Residual Fuel Oil (42 gallon barrel)	6,287
Distillate Fuel Oil (42 gallon barrel)	5,825
Natural Gas (1,000 cubic feet)	1,032
Liquefied Petroleum Gas (42 gallon barrel)	3,603
Coke and Breeze (short ton)	24,800
Coal Used as Fuel (short ton)	22,012
Coal Used for Coking (short ton)	26,800

Source: Energy Information Administration, *Monthly Energy Review*, (September 1990), pp. 124-127.

Appendix B
Quality of
the Data

Appendix B

Quality of the Data

Introduction

All data collection activities and the estimates produced from them are subject to a variety of errors. These errors may be broadly classified under two general types, sampling and nonsampling errors.

Sampling errors are defined as the variability in a survey estimator that arises because data are collected from a sample of units rather than the entire population. Each possible sample produces different estimates of population parameters, depending on the set of respondents that are selected. Nonsampling errors, on the other hand, occur in any data collection activity, whether a sample survey or a complete enumeration of the population. Nonsampling errors are attributable to all aspects of the total survey design other than the sampling process, and can include both random and systematic (biasing) errors. Commonly recognized sources of nonsampling error include undercoverage, random and systematic response errors, nonresponse, data processing errors, and tabulation errors. This appendix describes the effect of both sampling and nonsampling errors on data from the MECS. More details are presented in the methodological report for the MECS.²⁸

Sampling Error

The estimated values appearing in this report were developed from a sample of manufacturing establishments and, as a result, will differ from true population values that would be obtained from a complete enumeration. This is because the MECS sample is only one of a very large number of samples that could have been selected under the same sampling specifications. Each possible sample would yield its own estimates of the true population values, with the differences attributable to the particular set of establishments selected into each sample.

One measure of variability due to sampling is the average difference between the estimates that would be produced by all possible samples and the mean value of these estimates. This type of measure is commonly known as sampling error. Estimates of the magnitude of these sampling errors based on data from a single sample are provided by a statistic known as the standard error of an estimate. Standard errors for MECS estimates are computed from the reported data using the formula:

$$S_{\hat{Y}} = \sqrt{\sum_{i=1}^n y_i^2 (W_i)(W_i - 1)}, \quad (5)$$

where $\hat{Y} = \sum(y_i W_i)$ is the MECS survey estimator, y_i is the reported value of characteristic Y for the i^{th} MECS sample case, W_i is the final adjusted weight used to inflate the sample data to population estimates, and n is the number of MECS respondents. Justification for this formula is found in the MECS methodological report.

Estimates of standard errors have been computed from the MECS sample data for the estimated aggregate values and ratios appearing in this report. They are presented in the form of relative standard errors (RSE),

²⁸Energy Information Administration, *Manufacturing Energy Consumption Survey: Methodological Report, 1985*. Although this report describes data quality in the 1985 MECS, much of the discussion still holds for the 1988 MECS.

that is, the standard error divided by the estimated value to which it refers. The RSE's are given in Tables 32 through 62 in the section titled "Relative Standard Errors."

The estimates in this report can be used to produce proportion statistics based on the ratio of various estimates reported in the tables. Proportions are not given in the "Detailed Statistics Tables" but can be used to clarify the analysis. A proportion is the statistic of the form

$$\hat{P} = \frac{\hat{Y}}{\hat{X}}, \quad (6)$$

where \hat{Y} and \hat{X} are survey-based estimates of aggregate parameters Y and X , respectively, and characteristic X "encompasses" characteristic Y . That is, each population element (and, thus, each sample case) that contributes to Y also contributes to X , and the value of X for each element is greater than or equal to the value of Y .

The RSE's of aggregate statistics can be used to produce approximate errors for proportions. The straightforward additive error formula shown in Equation (1) gives rise to a similarly straightforward upper bound approximation to the error of an estimated proportion. The approximation can be expressed in terms of the RSEs of the aggregate statistics entering into the proportion as

$$RSE(\hat{P}) \leq \sqrt{[RSE(\hat{Y})]^2 \cdot (1 - 2\hat{P}) + [RSE(\hat{X})]^2}. \quad (7)$$

Justification for this formula is found in the MECS methodological report.

Nonsampling Errors and Bias

Nonsampling errors that affect MECS survey data can be divided into four major categories:

- Operational errors, including editing, coding, and tabulation errors.
- Errors of measurement, including a lack of precision by the respondent, failure of the respondent to understand instructions, etc..
- Errors of estimation, including the assumptions underlying the derived values.
- Errors of nonobservation, including nonresponse and noncoverage.

These errors are collectively referred to as nonsampling errors because they are not related to the sampling process, and, thus, would be equally likely to occur in a complete census or a sample survey.

It is felt that operational errors are not a major concern for the estimates included in this report. The quality control procedures that were employed for check-in, editing, coding and keying the returned questionnaires (Appendix A) are standard procedures that are in place at the Bureau of the Census and have withstood the test of time. Data tabulations were verified by comparing marginal totals in tables generated from files supplied to EIA with corresponding totals generated directly from microdata files held at the Census Bureau.

Errors of measurement are a concern in any data collection activity. The survey results for the MECS were subjected to extensive editing procedures which were specifically designed to detect errors of measurement. Responses that failed these tests for reasonableness and consistency were recalled by analysts familiar with manufacturing processes and energy use. Major errors, including omissions and misreporting by orders of magnitude, were corrected. No editing procedure is capable of identifying all measurement errors, however,

and some small errors will remain. To the extent that these errors are due to random, rather than systematic misjudgments, they are compensating in the aggregate totals presented in this report, and it is believed that there are few large systematic biases that result from them.

Errors of estimation could have resulted from the assumptions that underlie the derived values (Appendix A), and the estimates of the consumption of onsite- and offsite-produced fuels and raw material inputs could be biased as a result of such errors. For example, the assumption that energy produced onsite is consumed as an input or feedstock before any is consumed as a fuel could result in consistently underestimating the consumption of "over the fence" feedstocks and overestimating the consumption of "over the fence" fuels. These nonsampling errors, if present, are relevant only for tables in this report that are based on derived values. Estimates based upon reported values would not be subject to this potential source of bias.

Finally, several potential sources of nonsampling error and bias result from errors of nonobservation. As described in Appendix A, the 1988 MECS data were adjusted to cover the entire universe of manufacturers. Although this represents more complete coverage than the 1985 MECS, the additional coverage does not eliminate the need to make certain assumptions about the adjustments. For both the coverage and the nonresponse adjustments, the procedure was to ratio-adjust the weighted data from the MECS respondents to the estimated totals for the universe that was targeted by the MECS frame and sample design. Clearly, had these adjustments not been performed, the estimates produced from only the responding establishments would not have been representative of the target universe for the MECS. Such estimates would have been biased. Adjusting the sampling weights to reflect the target universe is an attempt to mitigate the potential effects of such a bias.

As described in Appendix A, separate adjustment factors were developed for each sampling stratum. Nonresponse adjustment factors were calculated for each of the 30 sampling strata using estimated 1988 fuel consumption for heat and power as estimated by the total measure of size for each stratum. Each stratum represents a relatively homogeneous subgrouping of establishments with respect to primary product output and level of fuel consumption.

Implicit in that procedure is the assumption that primary product output and level of fuel consumption are highly correlated with energy consumption patterns, so that the establishments within a stratum would also be homogeneous with respect to the quantities, types, and shares of energy consumed as fuels and for nonfuel purposes. Also, the weight adjustment method assumes that the relationship between survey variables of interest and the measure of size used for constructing the weight adjustment is the same for the population covered by MECS respondents within an adjustment stratum as it is for the rest of the population within that stratum.

To the extent that the nonresponding establishments within the adjustment cells share the energy consumption patterns of the responding establishments within the strata, the resulting adjustments to the MECS estimates will tend to be minimally biased. If, on the other hand, the energy consumption patterns of the responding and nonresponding establishments differ substantially, the resulting adjustments are potentially biased, and may not represent the originally targeted MECS universe.

The cost-of-fuels ratio adjustment was a correction for differential changes in the MECS sample and the population that it represents. The comparison of the 1988 MECS estimate to the 1988 ASM estimate for electricity receipts indicated that the adjustment benefitted that MECS estimate. The expectation is that at the stratum by United States level and the region total level, the adjustment will provide large benefits. Most benefitted at these levels are the estimates for each of the major fuel consumption categories, as each of these is expected to have a high correlation with cost of fuels.

The level of improvement at the region-by-stratum level is unclear. Within a stratum, the same cost of fuels ratio was used for each establishment. Thus, it is possible that for some estimates at the regional level the adjustment might have done more harm than good. EIA weighed this possibility against the expected benefits at the national level and decided to use the adjustment.

More detailed information on sources of nonsampling error in the MECS can be found in the methodological report.

Comparison with Other Data Sources

It is difficult to compare the results of the MECS with the results of other data collection efforts because of definitional and coverage differences. Table B1 presents the MECS estimates of total 1988 consumption of energy in manufacturing, along with consumption values produced from other EIA survey systems and published in other report series. The other survey data are presented as they are published, that is, in physical units or Btu, while the MECS data are shown on both scales for purposes of comparison.

MECS values are slightly to substantially lower than the other values, due primarily to differences in population coverage, as explained in the footnotes of Table B1. All of the non-MECS values cover the "industrial" division, which is commonly defined to consist of manufacturing, mining, construction, and agriculture (industries classified in SIC categories 01-39). However, there is some variability in the actual definitions, as explained in the footnotes.

The only non-MECS estimates that are based on a survey of consumers for the entire manufacturing division are the coal statistics. The quantity shown in Table B1 for coal consumption was collected by another EIA survey, the "Quarterly Coal Consumption Report—Manufacturing Plants," Form EIA-3, and published in the *Quarterly Coal Report*²⁹. The value is less than the MECS value for primary consumption. However, coal used at coke plants is excluded from the coal report quantity but included in the MECS quantity. Conversely, coal used at coal gasification projects are included in the coal report quantity but excluded from the MECS. Thus, it is important to realize specific coverage differences when comparing quantities that purport to measure the same characteristic.

The "Annual Refinery Report," Form EIA-820, is sent exclusively to petroleum refiners, and the resulting estimates appear in the *Petroleum Supply Annual*³⁰. A section of the survey collects refinery fuel use. The difference between the EIA-820 and MECS survey estimates for total fuel are most likely due to differences in coverage. The "Annual Refinery Report" covers the refinery portion of the establishment only. The MECS covers the entire establishment site, including an adjoining petrochemical plant that does not report separately on the Census of Manufactures or MECS. Again, underlying differences in coverage can help to explain differences in estimates that are ostensibly equivalent.

All other survey estimates shown are based on delivery data from the account records of energy suppliers. The sectoral designation of an account is sometimes based on the rate class to which a customer is assigned by the supplier rather than on the activities in which the customer is engaged. Therefore, it is likely that some industrial facilities are counted as nonindustrial energy use, and vice versa. The magnitude and direction of the effect of this sectoral crossover is difficult to determine.³¹

Even with the differences just mentioned, it is interesting to note that manufacturing (and, thus, the MECS estimates) accounts for a large proportion of total industrial energy use, except for petroleum products. The greatest disassociation between supply data and consumption occurs for petroleum products. A source of measurement error is that the major suppliers of petroleum products are within the economic sector for which consumption measurement is being performed. Another probable source of discrepancy is the allocation of distillate fuel oil and motor gasoline (not included in the displayed MECS estimate). Supply data are allocated on the basis of "off-highway" use, while MECS use is measured as "onsite." These definitions may not be equivalent.³² The fact that only residual oil, distillate oil, and LPG are included in the MECS estimate has

²⁹Energy Information Administration, *Quarterly Coal Report*, DOE/EIA-0121 (Washington, DC, various dates).

³⁰Energy Information Administration, *Petroleum Supply Annual*, DOE/EIA-0340 (Washington, DC, various dates).

³¹For further discussion of this topic, see *Energy Consumption by End-Use Sector: A Comparison of Measures by Consumption and Supply Surveys*, pp. 13-15.

³²For further discussion of the discrepancy in supply and consumption data in the industrial sector for petroleum products, see *Energy Consumption by End-Use Sector: A Comparison of Measures by Consumption and Supply Surveys*, pp. 34-36.

relatively little effect on the comparison, because other petroleum products are minor contributors to consumption in manufacturing (so minor that they are grouped in the "other" category for MECS publications). The majority of petroleum use in the industrial sector appears to take place in agriculture, mining, and construction.

After differences of coverage and sectoral definitions are taken into account, no obvious measurement differences remain that cannot be explained by the sampling variability inherent in the MECS. It is likely that some estimation biases will occur for scattered small population subgroups and certain specialized energy measures. In fact, some estimates in the data tables of this report have been suppressed because Census Bureau analysis that biases were likely. However, national-level estimates for comprehensive energy use measures appear to have no major problems.

Table B1. Estimates of the Consumption of Major Types of Energy in the Industrial Sector, 1988

Type of Energy	MECS Consumption ^a		Monthly Energy Review ^b	Electric Power Annual ^b	Natural Gas Annual ^c	Quarterly Coal Report ^d	Petroleum Supply Annual ^e
	Primary	Total Input					
Electricity							
Billion kWh	703	703	--	896	--	--	--
Trillion Btu	2,398	2,398	3,059	--	--	--	--
Natural Gas							
Billion Cubic Feet	5,695	5,141	--	--	7,479	--	--
Trillion Btu	5,860	5,290	7,697	--	--	--	--
Coal							
Thousand Short Tons	97,582	57,512	--	--	--	69,546	--
Trillion Btu	2,363	1,323	2,828	--	--	--	--
Total Petroleum Products^f							
Trillion Btu	1,812	881	8,463	--	--	--	--
Petroleum Refineries Only							
Trillion Btu	--	3,052	--	--	--	--	2,819

^aEstimates are from the Manufacturing Energy Consumption Survey (MECS) and cover the manufacturing industries (SIC 20-39).

^bEstimates cover the manufacturing industries, plus agriculture, mining, and construction (SIC 01-39). The estimate for natural gas consumption published in the *Monthly Energy Review* excludes consumption in the agricultural sector.

^cThe estimate covers the manufacturing industries plus the mining and construction industries (SIC 10-39). Lease and plant fuel at natural gas extraction sites, which would ordinarily be considered mining consumption, is shown separately in the *Natural Gas Annual* because of its subject matter interest, and is included here.

^dThe estimate covers the manufacturing industries (SIC 20-39), and includes the coal used at coal gasification projects (classified in the mining sector). It excludes the coal used in coke plants.

^eThe estimate covers fuel use at petroleum refineries (SIC 2911) only. The fuel used at petrochemical plants is excluded. The MECS estimate for SIC 2911 includes petrochemical fuel use if the petrochemical plant does not report separately on the Census or Annual Survey of Manufactures.

^fOil products included in the MECS estimates are residual fuel, distillate fuel oil, and LPG. All petroleum products are included in the estimate published in the *Monthly Energy Review*.

Appendix C

**Manufacturing
Energy
Consumption
Survey Forms**

Appendix C

1988 Manufacturing Energy Consumption Survey Form EIA-846A

OMB No. 1905-0169; Approval Expires 04/30/91

FORM **EIA-846A**
15 (1-89)

U. S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS
ACTING AS COLLECTING AND COMPILING AGENT FOR
UNITED STATES DEPARTMENT OF ENERGY
ENERGY INFORMATION ADMINISTRATION

Public reporting burden for this collection of information is estimated to average 8 hours per response, including the time of reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Energy Information Administration, Office of Statistical Standards, Et-73, Mail Station 1H 023 Forrestal, 1000 Independence Avenue, SW, Washington, DC 20485; and to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503.

In correspondence pertaining to this report, please refer to this Census File Number (CFN).



1988 MANUFACTURING ENERGY CONSUMPTION SURVEY

NOTICE - This survey is **mandatory** under the Federal Energy Administration Act of 1974, P.L. 93-275, and under Title 3, Subtitle B of the Omnibus Budget Reconciliation Act of 1986, P.L. 99-509. Failure to respond may result in criminal fines, civil penalties, and other sanctions as provided by law. The confidentiality of your response to this survey is protected by law (Title 13, U.S. Code). Your response may be seen only by sworn Census employees and may be used only for statistical purposes. The law also provides that copies retained in your files are **immune from legal process**.

Please correct errors in name, address, and ZIP Code. ENTER street and number if not shown.

PLEASE COMPLETE THIS
FORM AND RETURN TO

BUREAU OF THE CENSUS
1201 East Tenth Street
Jeffersonville, IN 47132

NOTE

Please read the enclosed instructions before filling out this form. Complete each item. If you have any questions, call (301) 763-7066.

DUE DATE: JULY 20, 1989

If you cannot file by the due date, a time extension request should be sent to the above address, please include your 11-digit Census File Number (CFN).

Section I - NONCOMBUSTIBLE ENERGY SOURCES

Item description (1)	Electricity (2)			Steam (3)			Industrial hot water (4)		
	109 Mil.	110 Thou.	111 kWh	117 Mil.	118 Thou.	119 Dol.	125 Mil.	126 Thou.	127 Dol.
1a. During 1988, what amount of each energy source was purchased by this establishment from utilities and delivered to this establishment site?	Kilowatthours			Million Btu			Million Btu		
1b. What was the total expenditure for the purchased energy sources reported on line 1a?	Dollars			Dollars			Dollars		
2a. During 1988, what amount of electricity and steam was purchased from nonutility suppliers by this establishment and delivered to this establishment site?	Kilowatthours			Million Btu					
2b. What was the total expenditure for the purchased electricity and steam reported on line 2a?	Dollars			Dollars					
3. During 1988, what amount of each energy source was transferred from outside establishments and delivered to this establishment site? Do not include the purchases reported in lines 1a or 2a.	Kilowatthours			Million Btu			Million Btu		
4. TOTAL electricity receipts. (Sum of lines 1a, 2a, and 3). NOTE - Copy this quantity to column 2, line 1 of Section III - FUEL SWITCHING.									
5. During 1988, how much electricity was generated on this establishment site by cogeneration?									
6. During 1988, how much of each energy source was generated onsite from solar power, wind power, hydropower, and geothermal sources?				Million Btu			Million Btu		
7. During 1988, how much electricity was generated onsite by processes other than those covered on lines 5 and 6?									
8. During 1988, how much electricity was sold or transferred to utilities?									
9. During 1988, how much of each energy source was sold or transferred to establishments other than utilities?				Million Btu			Million Btu		
	1 Name of energy supplier _____								
	Address - Number and street _____								
	City _____ State _____ ZIP Code _____ Phone number () _____								
<i>Questions 11 and 12 below should be answered if this establishment generated any electricity onsite in 1988. If no electricity was generated onsite (column 2 has zero entries for lines 5, 6, and 7), omit questions 11 and 12 and proceed directly to Section II - Combustible Energy Sources.</i>									
11. Was this establishment electrically interconnected with an electric utility (that is, able to deliver electricity to the grid as well as receive electricity) as of December 31, 1988?									<input type="checkbox"/> Yes <input type="checkbox"/> No
12. Was this establishment designated as a Qualifying Facility (QF) under Public Utility Regulatory Policies Act of 1978 (PURPA) as of December 31, 1988?									<input type="checkbox"/> Yes <input type="checkbox"/> No

1988 Manufacturing Energy Consumption Survey Form EIA-846A (Continued)

Section II — COMBUSTIBLE ENERGY SOURCES							
Energy sources (1)	Census Use Only (2)	Units used for reporting quantities (3)	Energy sources received in 1988				
			Quantity purchased by and delivered to this establishment (4)	Total expenditure, including delivery charges, of the quantity in col. (4) (5)			Total other receipts (transfers in and central purchases) (6)
				Mil	Thou	Dol	
A. SOLIDS							
1. Anthracite	406	Short tons					
2. Bituminous and subbituminous coal	414						
3. Breeze	448						
4. Coal coke	430						
5. Lignite	422						
6. Total coal and coke (Sum of anthracite, bituminous and subbituminous coal, breeze, coal coke and lignite)	455						
7. Biomass	901	Million Btu					
8. Petroleum coke	703	Barrels					
9. Roundwood (wood cut specifically for fuel use)	802	Million Btu					
10. Waste materials (wastepaper, packing materials, etc.)	729						
11. Wood chips, bark, and wood waste	810						
12. Other solids (Specify)	919						
	927						
B. GASES							
1. Natural gas	307	1,000 cu. ft.					
2. Acetylene	646	Million Btu					
3. Blast furnace gas	604						
4. Coke oven gas	612						
5. Hydrogen	638						
6. Waste and byproduct gases (e.g., refinery off gas, vent gas, plant gas, still gas)	620						
7. Other gases (Specify)	935						
	943						
C. LIQUIDS							
1. Distillate fuel oil (numbers 1, 2, and 4 fuel oils and diesel)	224	Barrels					
2. Kerosene	273						
3. LPG (ethane, ethylene, propane, propylene, butane, butylene)	240	Gallons					
4. Motor gasoline	232						
5. Pulping or black liquor	737	Million Btu					
6. Residual fuel oil (numbers 5, 6, navy special, and bunker c)	216	Barrels					
7. Waste oils and tars	711	Million Btu					
8. Other liquids (Specify)	950						
	968						

Enter the total design storage capacity located onsite as of December 31, 1988, for:

1a. Distillate fuel oil	224	Barrels
1b. Residual fuel oil	216	Barrels
1c. LPG	240	Gallons

FORM EIA-846A (5-1-88) Page 2

1988 Manufacturing Energy Consumption Survey Form EIA-846A (Continued)

Please enter this establishment's 11-digit Census File Number

Section II – COMBUSTIBLE ENERGY SOURCES – Continued

Energy sources produced onsite in 1988		Energy sources consumed onsite in 1988		Energy sources (11)	Census Use Only (12)
Quantity produced onsite (7)	Does the entry in col. (7) represent the product or byproduct of another energy source consumed onsite? (8)	Quantity consumed as a fuel (9)	Quantity consumed for all nonfuel purposes (10)		
				A. SOLIDS	
				1. Anthracite	408
				2. Bituminous and subbituminous coal	414
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			3. Breeze	448
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			4. Coal coke	430
				5. Lignite	422
		<i>Copy to line 1 of section 3</i>		6. Total coal and coke (Sum of anthracite, bituminous and subbituminous coal, breeze, coal coke and lignite)	455
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			7. Biomass	901
				8. Petroleum coke	703
				9. Roundwood (wood cut specifically for fuel use)	802
				10. Waste materials (wastepaper, packing materials, etc.)	729
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			11. Wood chips, bark, and wood waste	810
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			12. Other solids	919
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No				927
		<i>Copy to line 1 of section 3</i>			
				B. GASES	
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			1. Natural gas	307
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			2. Acetylene	648
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			3. Blast furnace gas	604
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			4. Coke oven gas	812
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			5. Hydrogen	638
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			6. Waste and byproduct gases (e.g., refinery off gas, vent gas, plant gas, still gas)	620
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			7. Other gases	935
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No				943
		<i>Copy to line 1 of section 3</i>			
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			C. LIQUIDS	
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			1. Distillate fuel oil (numbers 1, 2, and 4 fuel oils and diesel)	224
		<i>Copy to line 1 of section 3</i>		2. Kerosene	273
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			3. LPG (ethane, ethylene, propane, propylene, butane, butylene)	240
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			4. Motor gasoline	232
		<i>Copy to line 1 of section 3</i>		5. Pulping or black liquor	737
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			6. Residual fuel oil (numbers 5, 6, navy special, and bunker c)	218
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			7. Waste oils and tars	711
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			8. Other liquids	960
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No				968

1988 Manufacturing Energy Consumption Survey Form EIA-846A (Continued)

Section III -- FUEL SWITCHING

Item description (1)	Electricity (2)	Total coal and coke (3)
1. Quantity consumed — Copy the total electricity receipts from line 4 of section I, and the quantities of coal and coke, natural gas, distillate fuel oil, LPG, and residual fuel oil consumed onsite as a fuel from column (3) of section II.	Kilowatthours	Short tons
<i>Now answer lines 2 and 3 as appropriate for the columns with nonzero entries in line 1. Do not consider differences in energy prices when estimating amounts.</i>	Kilowatthours	Short tons
2. Quantity nonswitchable — Enter the amount of the quantity in line 1 that could NOT have been replaced within 30 days by another energy source in 1988.	Kilowatthours	Short tons
3. Quantity switchable — Subtract line 2 from line 1 and enter the results. This represents the total quantity of energy consumption that COULD HAVE BEEN replaced within 30 days by one or more alternative energy sources in 1988.	Kilowatthours	Short tons
<i>Now answer lines 4a through 10b as appropriate for the columns with nonzero entries in line 3. Complete one column before starting another.</i>	Kilowatthours	Short tons
4a. Of the amount shown in line 3, what is the maximum amount that could have been replaced by electricity?		
4b. What is the minimum lead time required to make the switch to electricity?		1 <input type="checkbox"/> Less than 1 day 2 <input type="checkbox"/> 1 day to 1 week 3 <input type="checkbox"/> More than 1 week but within 30 days
5a. Of the amount shown in line 3, what is the maximum amount that could have been replaced by coal and coke?	Kilowatthours	
5b. What is the minimum lead time required to make the switch to coal and coke?		1 <input type="checkbox"/> Less than 1 day 2 <input type="checkbox"/> 1 day to 1 week 3 <input type="checkbox"/> More than 1 week but within 30 days
6a. Of the amount shown in line 3, what is the maximum amount that could have been replaced by natural gas?	Kilowatthours	Short tons
6b. What is the minimum lead time required to make the switch to natural gas?		1 <input type="checkbox"/> Less than 1 day 2 <input type="checkbox"/> 1 day to 1 week 3 <input type="checkbox"/> More than 1 week but within 30 days
7a. Of the amount shown in line 3, what is the maximum amount that could have been replaced by distillate fuel oil?	Kilowatthours	Short tons
7b. What is the minimum lead time required to make the switch to distillate fuel oil?		1 <input type="checkbox"/> Less than 1 day 2 <input type="checkbox"/> 1 day to 1 week 3 <input type="checkbox"/> More than 1 week but within 30 days
8a. Of the amount shown in line 3, what is the maximum amount that could have been replaced by LPG?	Kilowatthours	Short tons
8b. What is the minimum lead time required to make the switch to LPG?		1 <input type="checkbox"/> Less than 1 day 2 <input type="checkbox"/> 1 day to 1 week 3 <input type="checkbox"/> More than 1 week but within 30 days
9a. Of the amount shown in line 3, what is the maximum amount that could have been replaced by residual fuel oil?	Kilowatthours	Short tons
9b. What is the minimum lead time required to make the switch to residual fuel oil?		1 <input type="checkbox"/> Less than 1 day 2 <input type="checkbox"/> 1 day to 1 week 3 <input type="checkbox"/> More than 1 week but within 30 days
10a. Of the amount shown in line 3, what is the maximum amount that could have been replaced by any other energy source? <i>Identify that energy source.</i>	Kilowatthours	Short tons
10b. What is the minimum lead time required to make the switch to that energy source?		1 <input type="checkbox"/> Less than 1 day 2 <input type="checkbox"/> 1 day to 1 week 3 <input type="checkbox"/> More than 1 week but within 30 days

1988 Manufacturing Energy Consumption Survey Form EIA-846A (Continued)

Section IV — REMARKS — Please use this space or attach a separate sheet for any explanations that may be essential in understanding your reported data. Be sure to include the name, address, and telephone number of power generating establishments of your company that transferred or delivered electricity or steam to your establishment in 1988 if you did not have enough room in section I.

Section V — CERTIFICATION — The data in this report have been prepared in accordance with the instructions.

Name of person to contact regarding this report — <i>Print or type</i>		Area code	Number	Extension		
		Telephone				
Address — <i>Number and street</i>		Period covered by this report	FROM:	Mo.	Day	Year
			TO:	Mo.	Day	Year
City	State	ZIP Code	Signature of authorized person		Date	

1988 Manufacturing Energy Consumption Survey Form EIA-846A (Continued)

EIA-846A-1
(5-12-89)

U.S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS

INSTRUCTIONS FOR FORM EIA-846A

1988 MANUFACTURING ENERGY CONSUMPTION SURVEY

A. Who is Responsible for Conducting the Manufacturing Energy Consumption Survey?

The Manufacturing Energy Consumption Survey (MECS) was designed, and is being sponsored, by the Energy Information Administration (EIA) of the U.S. Department of Energy. The survey is being administered and compiled by the U.S. Bureau of the Census.

B. What is The Purpose of This Survey?

The MECS will collect data on energy consumption and usage patterns for the manufacturing sector of the U.S. economy. In addition, it will measure the short-term (within 30 days) capability of your establishment to have used substitute fuels in place of those actually consumed in 1988. The information obtained from the MECS will be used to publish aggregate statistics on the consumption of energy for fuel and nonfuel uses, and on some energy-related issues such as energy prices, electricity generation onsite, and fuel-switching capabilities.

C. Who Should Report?

This survey is mandatory under the Federal Energy Administration Act of 1974, P.L. 93-275, and under Title 3, Subtitle B of the Omnibus Budget Reconciliation Act of 1986, Public Law 99-509.

This form is addressed to establishments operating primarily in the manufacturing sector, SIC 20 through 39, except for SIC 28, 29, and 3312, as defined by the 1987 Standard Industrial Classification Manual (SIC). Establishments operating in SIC 28, 29, or 3312, will complete similar MECS forms. Response by establishments included in the MECS sample selected for the survey and receiving the MECS survey form is required by law. Failure to respond may result in criminal fines, civil penalties, and other sanctions as provided by law.

D. How is My Privacy Protected?

By Section 9 of Title 13, U.S. Code, your report to the Census Bureau is confidential. It may be seen only by sworn Census Bureau employees and may be used only for statistical purposes. The law also provides that copies retained in your files are immune from legal process.

E. When is The Report Due?

The questionnaire should be returned by the due date specified on the form. Please use the enclosed return envelope. If the envelope has been misplaced, return the completed questionnaire to:

Bureau of the Census
1201 East Tenth Street
Jeffersonville, IN 47132

F. How is a Manufacturing Establishment Defined?

A manufacturing establishment is an economic unit at a single physical location where the mechanical or chemical transformation of materials or substances into new products is performed. These operations are generally conducted in facilities described as plants, factories, or mills and characteristically use power-driven machines and material-handling equipment. Manufacturing also includes such activities as the assembly of components of manufactured products and the blending of materials such as lubricating oil, plastics, resins, or liquors.

An establishment is not necessarily identical to a business concern or firm, either of which may consist of one or more establishments. An establishment may consist of one or more units that

are engaged in separate or distinct activities. These units may be separated physically as well as economically, with separate records or substantially accurate reports available for each. If this establishment has previously completed the Annual Survey of Manufactures (ASM), Form MA-1000, conducted by the U.S. Census Bureau, establishment boundaries should correspond to those used for the ASM. **Each unit should be treated as a separate establishment ONLY if that was the determination made for the ASM. Do not consolidate two ASM establishments into a single establishment for purposes of the MECS, or separate a single ASM establishment into two MECS establishments.** Match the 11-digit Census File Number (CFN) located on the MECS questionnaire mailing label with the CFN on the ASM mailing label. Responses to MECS questions should include the same activities as those considered when responding to the matching ASM. If this establishment has never completed an ASM, report for all activities that occur at this physical location.

Section 1 — NONCOMBUSTIBLE ENERGY SOURCES

Energy sources used in manufacturing can be divided into two groups: combustible (capable of being burned), and noncombustible (such as electricity, steam, and industrial hot water). The purpose of section 1 is to collect 1988 data for noncombustible energy sources, in particular, electricity and steam.

Column 2 collects data that will provide important information on the components of electricity production, and permit an estimate to be made of the total consumption of electricity at your establishment. Column 3 collects data on the additional contribution that steam makes to the total consumption of energy at your establishment through net transfers and steam generated onsite by renewable energy sources. Column 4 collects data on hot water purchased for use as an energy source and used at this establishment site.

Electricity is to be reported in thousands of kilowatt-hours. Steam and industrial hot water are to be reported in millions of Btu. If you keep your records for steam in pounds, use a factor of 1,200 Btu per pound of steam to convert your data into Btu.

SPECIFIC INSTRUCTIONS

Line 1a — Quantity Purchased From Utilities —

Enter the quantity of each noncombustible energy source that was purchased from a utility and delivered to this establishment site in 1988, regardless of when payment was made. For purposes of this question, utilities are companies that produce and/or deliver electricity and/or natural gas, and are legally obligated to provide service to the general public within their franchise area. Utilities do not include such generators of electricity as independent power producers, small power producers, or cogenerators not located at this establishment site. Include quantities purchased for ANY onsite use, for example, production of heat and power, electrolysis processes, or steam cleaning. **Exclude all:**

- quantities purchased from independent power producers, small power producers, or cogenerators not located at this establishment site.
- quantities delivered from other establishments in your company even if those quantities were repurchased from them by your establishment.
- quantities purchased and paid for by a central purchasing entity separate from this establishment.
- quantities for which payment was made in-kind.

CONTINUE ON PAGE 2

1988 Manufacturing Energy Consumption Survey Form EIA-846A (Continued)

Page 2

Line 1b — Expenditures For Purchases From Utilities — Enter the total expenditures for the purchased quantities reported on line 1a. Include all expenditures regardless of when payment was actually made.

Line 2a — Quantity Purchased From Nonutilities — Enter the quantity of electricity and steam that was purchased from offsite nonutility power producers and delivered to this establishment site in 1988, regardless of when payment was made. Include quantities purchased for **ANY** onsite use.
Exclude all:

- quantities delivered from other establishments in your company even if those quantities were repurchased from them by your establishment.
- quantities purchased and paid for by a central purchasing entity separate from this establishment.
- quantities for which payment was made in-kind.

Line 2b — Expenditures For Purchases From Nonutilities — Enter the total expenditures for the purchased quantities reported on line 2a. Include all expenditures regardless of when payment was actually made.

Line 3 — Other Receipts — Enter all additional quantities delivered to your establishment site in 1988 but not reported on lines 1a or 2a.
Include:

- quantities purchased and paid for by a central purchasing entity separate from this establishment.
- quantities transferred from another establishment of your company for which payment was not made.
- quantities delivered from another establishment of your company even if those quantities were repurchased from them by your establishment.
- quantities for which payment was made in-kind.

Line 4 — Total Electricity Receipts — Enter the sum of lines 1a, 2a and 3 for electricity only. *Copy this total electricity receipt figure to column 2, line 1 of Section III — Fuel Switching.*

Line 5 — Quantity Cogenerated — Enter the total quantity of electricity cogenerated from all energy sources, including renewable sources. For purposes of this survey, electrical cogeneration is defined as the production of electric energy and another form of useful energy (such as heat or steam) through the sequential use of energy.

Line 6 — Quantity Generated from Renewables — Enter the total quantity of each noncombustible energy source generated onsite directly from solar power, wind power, hydropower, or geothermal sources. Any electricity produced as a part of a cogeneration process (that is, electricity generated from geothermal steam which is then itself used) should be excluded. Such quantities should be included on line 5.

Line 7 — Other Generation — Enter the total quantity of electricity generated onsite by all other means not included on lines 5 and 6 above. For example, electricity generated by diesel generators should be reported here.

Line 8 — Sales or Transfers to Utilities — Enter the total quantity of electricity sold or transferred by your establishment in 1988 to utilities. For purposes of this question, utilities are companies that produce and/or deliver electricity and/or natural gas, and are legally obligated to provide service to the general public within their franchise area. Utilities do not include such generators of electricity as independent power producers, small power producers, or cogenerators not located at this establishment site. Include quantities exchanged for the same or any other energy source(s).

Line 9 — Sales or Transfers to Nonutilities — Enter the total quantity of each noncombustible energy source sold or transferred in 1988 to establishments other than utilities. Include quantities exchanged for the same or any other energy source(s).

Line 10 — Nonutility Suppliers — If any electricity reported in column 2, line 3 was obtained by transfer from another establishment of your company, enter the name, address and telephone number of the supplying establishment. If you received transfers from more than one of this type of establishment, use the "Remarks" section to identify remaining suppliers.

Questions 11 and 12 should be completed if there was any electricity generated at this establishment site in 1988 (column 2 has a nonzero entry on lines 5, 6, or 7). If your establishment had no onsite generation in 1988, omit questions 11 and 12 and proceed with Section II — Combustible Energy Sources.

Question 11 — Indicate by checking the appropriate box whether or not this establishment was electrically interconnected with an electric utility (that is, able to deliver electricity to the grid as well as receive electricity) as of December 31, 1988.

Question 12 — Indicate by checking the appropriate box whether or not this establishment was designated as a Qualifying Facility (QF) under the Public Utility Regulatory Policies Act of 1978 (PURPA) as of December 31, 1988.

Section II — COMBUSTIBLE ENERGY SOURCES

Column 1 — Energy Sources to be Reported — Twenty-three energy sources have been preprinted in column 1, separated into the general categories of solids, gases, and liquids. Prior to completing columns 4 through 10, determine from the criteria below which of the preprinted energy sources should be included for reporting and which excluded.

First, EXCLUDE all energy sources that were not consumed for any purpose at this establishment site during 1988. All excluded energy sources should be lined out, and no entries should be made in columns 4 through 10. Next, if your establishment consumed any energy sources for any purpose during 1988 that are not included in the preprinted list, add those energy sources under the "Other" heading for solids, gases, or liquids.

All unlined energy sources, including any additions to the preprinted list, should be further evaluated for inclusion or exclusion by the specific criterion in the following paragraph.

1988 Manufacturing Energy Consumption Survey Form EIA-846A (Continued)

Page 3

If your only means of supply of an energy source during 1988 was as a byproduct of energy source inputs to any of your manufacturing processes, it should be included ONLY if it was at least partially consumed onsite as a fuel during 1988 (that is for heat, power, or electricity generation). If none of that onsite-produced energy source was consumed onsite as a fuel, it should be excluded.

Complete columns 4 through 10 for all energy sources that were not excluded by the above procedures. Entries should be made in accordance with the specific instructions for these columns.

Column 3 — Reporting Units — Use the indicated units for reporting all quantities. For those establishments that keep records in Btu, note that volume measures should be reported as actual physical quantities, rather than adjusted to represent a standard energy content. One barrel contains 42 gallons. The approximate liquid equivalent conversion factor of LPG is 3.603 million Btu per barrel. Petroleum coke should also be reported in barrels. A barrel will hold approximately 400 pounds of petroleum coke, or the equivalent of 6.024 million Btu. A short ton of petroleum coke contains approximately 30.12 million Btu. Natural gas should be reported in thousands of cubic feet. One thousand cubic feet of natural gas is equal to about 10.3 therms, or 1.03 million Btu.

Column 4 — Quantity Purchased — Enter the quantity of each energy source that was purchased and delivered to this establishment in 1988, regardless of when payment was made. Include quantities of those energy sources that were purchased for ANY onsite use, for example, the production of heat or power, electrolysis processes, steam cleaning, or as a petrochemical feedstock or a raw material input to any manufacturing operation.
Exclude all:

- quantities delivered from another establishment in your company even if those quantities were repurchased from them by your establishment.
- quantities purchased and paid for by a central purchasing entity separate from this establishment.
- quantities for which payment was made in-kind.

Column 5 — Expenditures — Enter the total expenditures for each of the purchased quantities reported in column 4. Include all expenditures regardless of when payment was made.

Column 6 — Other Receipts — For each included energy source, enter all additional quantities delivered to your establishment site in 1988 but not reported in column 4.
Include:

- quantities purchased and paid for by a central purchasing entity separate from this establishment.
- quantities transferred from another establishment of your company for which payment was not made.
- quantities delivered from another establishment of your company even if these quantities were repurchased from them by your establishment.
- quantities for which payment was made in-kind.

Column 7 — Onsite Production — Enter the total quantity of any energy source that was produced onsite in 1988 as a product, a byproduct, a waste material, or an output from a captive (onsite) mine or well, and was at least partially consumed onsite. Enter the TOTAL quantity produced onsite, regardless of whether some or all of it was consumed as a fuel or feedstock, transferred offsite, sold, or otherwise disposed of. Examples of byproducts include coke, hydrogen, still gas, coke oven gas, wood chips and black liquor. Examples of waste products include wood scraps, packing materials, waste paper and cardboard, and waste oils.

Column 8 — Source of Onsite Production — For each energy source that has an entry in column 7, check the "Yes" box if the amount listed in column 7 resulted from consumption of any other energy source listed in Section II — Combustible Energy Sources. Check the "No" box if the energy source came from captive wells or mines, or is a product or byproduct/waste product from materials not listed in section II as a combustible energy source. Examples include:

- hydrogen produced as a byproduct of natural gas in an ammonia plant would have the "Yes" box checked.
- hydrogen produced through the electrolysis of brine in a chlorine plant would have the "No" box checked.
- coke oven gas produced during the coal coking process would have the "Yes" box checked.
- wood chips produced as a byproduct of wood purchased for use as a raw material rather than a fuel would have the "No" box checked.
- pulping (black) liquor, used in the chemical pulping of wood, that is burned in a recovery furnace or otherwise combusted, would have the "No" box checked.

Column 9 — Onsite Fuel Consumption — Enter the quantity consumed onsite as a fuel for the production of heat, steam, power, or the generation of electricity. Also include fuel consumed by vehicles dedicated primarily for use onsite. Copy the entries, if any, in column 9 for natural gas, distillate fuel oil, residual fuel oil, LPG, and total coal products to line 1 of Section III — Fuel Switching.

Column 10 — Onsite Nonfuel Consumption — Enter the quantity of each energy source that was consumed onsite for all purposes other than fuel use. Include all quantities consumed as feedstocks (for example, butane processed in producing rubber compounds), raw materials (for example, coal used to produce coke), additives, or ingredients for products manufactured by this establishment. Exclude all offsite dispositions such as sales and transfers to other establishments.

Question 1 — Enter the total design storage capacity located onsite as of December 31, 1988, for residual fuel oil, distillate fuel oil, and LPG. Report the shell capacity (that is, the design capacity of the storage tanks) in the units of measure specified.
Include:

- Onsite capacity of all storage facilities regardless of the intended disposition of the energy source (include both product storage tanks and tanks dedicated for onsite use).
- Onsite capacity dedicated or leased for storage of energy sources owned by other establishments.

1988 Manufacturing Energy Consumption Survey Form EIA-846A (Continued)

Page 4

Section III – FUEL SWITCHING

This portion of the survey is intended to measure the short-term capability of your establishment to have used substitute energy sources in place of those actually consumed in 1988. Capability to use substitute energy sources means that this establishment's combustors (for example, boilers, furnaces, ovens, blast furnaces) had the machinery or equipment either in place or available for installation in 1988 so that substitutions could actually have been introduced within 30 days without extensive modifications.

NOTE — Fuel-switching capability as measured by this survey does not depend on the relative prices of energy sources; it depends only on the characteristics of your equipment and certain legal constraints. Fuel-switching capability sets limits on the extent to which you could switch to a substitute energy source if you wanted to or needed to. It has nothing to do with whether you would want to switch if you could. Therefore, relative prices of energy sources are not related to fuel-switching CAPABILITY and should be ignored when completing this section.

We recognize that records of fuel-switching capability are not regularly maintained. Accordingly, reasonable approximations of fuel-switching capability are acceptable. These approximations should be based on the judgment of a person knowledgeable about the fuel-switching capability and operations of your establishment. They are not expected to be formal engineering estimates based on a day-by-day analysis of the operating levels of individual combustors and interactions between them. Respond as realistically as possible, given your actual operations in 1988.

Base your estimates on the availability of substitute energy sources and the physical condition of your equipment during 1988. Include switching capability that could have resulted from the use of redundant and/or standby combustors, and from combustors that were already equipped to fire alternative fuels. Lines 1 through 3 of this portion of the form measure your establishment's overall capability to have switched from specific energy sources in 1988. Lines 4a through 10b describe your capability to replace a given energy source by specific alternative energy sources.

SPECIFIC INSTRUCTIONS

Line 1 — Quantity Consumed — Enter the total electricity receipts figure from column 2, line 4 of Section I, and the fuel consumption figures from Section II for total coal and coke, natural gas, distillate fuel oil, LPG, and residual fuel oil. The quantities to be copied are noted in the appropriate boxes of sections I and II.

Line 2 — Quantity Nonswitchable — Enter the amount of the quantity reported on Line 1 that could NOT have been replaced within 30 days by any other energy source in 1988, even given a severe curtailment. **NOTE** — Include only that portion of total electricity receipts (purchases plus transfers in) that could NOT have been replaced by either onsite-generated electricity or energy source(s) which accomplish the same purposes as the offsite-produced electricity (e.g. supplying heat or power). Portions of individual fuels may be non-switchable due to limitations such as:

- the characteristics of your physical plant (for example, single-fired combustors or the absence of redundant and/or standby combustors), or the requirements of your manufacturing process.
- binding take or pay contracts with energy suppliers that were in place.
- environmental regulations which limit the amounts of potential replacement fuels that could be burned.

DO NOT consider current relative prices of fuels as a limitation to switching capability.

Line 3 — Quantity Switchable — Subtract line 2 from line 1 and enter the results. These values represent the quantity of each energy source consumed that COULD HAVE BEEN replaced within 30 days by at least one other energy source in 1988. **NOTE** — If all entries on line 3 are zero, complete the Remarks and Certification sections of the survey and return it to the Census Bureau. For each entry on line 3 that is nonzero, complete the remainder of that column. Complete one column before starting another.

Lines 4 through 10, Part a — Replacement Quantities — Report the maximum amount of the quantity shown on Line 3 that could have been replaced within 30 days by each of the energy sources on lines 4 through 10, under the constraints listed in the instructions for line 2. Report all amounts in the units of the energy source that is being replaced. DO NOT convert this amount to units of the replacement energy sources. **NOTE** — Be sure to take into account not only the fuels that could be directly substituted for offsite-produced electricity, but also the fuels needed to generate electricity onsite that could have been used in place of electricity receipts.

NOTE — The sum of lines 4a through 10a for each column must be at least as large as the entry on line 3 of that column, and may be larger if more than one alternative fuel could have been used.

Lines 4 through 10, Part b — Lead Time — Mark the minimum lead time required to switch to each replacement energy source identified.

Section IV — REMARKS

Please provide any explanations that may be helpful to us in understanding your reported data. Attach a separate sheet if necessary. Be sure to include the name, address, and telephone number of nonutility power generating establishments of your company that supplied electricity to your establishment if you did not have enough room in section I to identify them.

Section V — CERTIFICATION

Period Covered By This Report — Enter the month, day, and year of the beginning and the end of the period covered by your report. If a calendar year report: "From January 1 to December 31, 1988,"; if a fiscal year, specify which (such as "From December 1, 1987 to November 30, 1988"). If a part-year report is submitted because the establishment was not in operation or under your company's control for the entire year, specify the actual period covered: for example "January 2, 1988 to August 15, 1988," or "June 1, 1988 to December 31, 1988."

1988 Manufacturing Energy Consumption Survey Form EIA-846B

OMB No. 1905-0169; Approval Expires 04/30/91

FORM EIA-846B
5-1-89

U.S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS
ACTING AS COLLECTING AND COMPILING AGENT FOR
UNITED STATES DEPARTMENT OF ENERGY
ENERGY INFORMATION ADMINISTRATION

Public reporting burden for this collection of information is estimated to average 8 hours per response, including the time of reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Energy Information Administration, Office of Statistical Standards, E-73, Mail Station: 114-023 Forrestal, 1000 Independence Avenue, SW, Washington, DC 20485; and to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503.

In correspondence pertaining to this report, please refer to this Census File Number (CFN).



Petroleum Refineries

1988 MANUFACTURING ENERGY CONSUMPTION SURVEY

NOTICE - This survey is mandatory under the Federal Energy Administration Act of 1974, P.L. 93-275, and under Title 3, Subtitle B of the Omnibus Budget Reconciliation Act of 1986, P.L. 99-508. Failure to respond may result in criminal fines, civil penalties, and other sanctions as provided by law. The confidentiality of your response to this survey is protected by law (title 13, U.S. Code). Your response may be seen only by sworn Census employees and may be used only for statistical purposes. The law also provides that copies retained in your files are immune from legal process.

Please correct errors in name, address, and ZIP Code. ENTER street and number if not shown.

PLEASE COMPLETE THIS FORM AND RETURN TO
BUREAU OF THE CENSUS
1201 East Tenth Street
Jeffersonville, IN 47132

NOTE

Please read the enclosed instructions before filling out this form. Complete each item. If you have any questions, call (301) 763-7068.

DUE DATE: JULY 20, 1989

If you cannot file by the due date, a time extension request should be sent to the above address, please include your 11-digit Census File Number (CFN).

Section I - NONCOMBUSTIBLE ENERGY SOURCES

Item description (1)	Electricity (2)			Steam (3)			Industrial hot water (4)																																
	109 Mil.	Thou.	kWh	117 Mil.	Thou.	DoI.	125 Mil.	Thou.	DoI.																														
1a. During 1988, what amount of each energy source was purchased by this establishment from utilities and delivered to this establishment site?	Kilowatthours			Million Btu			Million Btu																																
1b. What was the total expenditure for the purchased energy sources reported on line 1a?	Dollars			Dollars			Dollars																																
2a. During 1988, what amount of electricity and steam was purchased from nonutility suppliers by this establishment and delivered to this establishment site?	Kilowatthours			Million Btu																																			
2b. What was the total expenditure for the purchased electricity and steam reported on line 2a?	Dollars			Dollars																																			
3. During 1988, what amount of each energy source was transferred from outside establishments and delivered to this establishment site? Do not include the purchases reported in lines 1a or 2a.	Kilowatthours			Million Btu			Million Btu																																
4. TOTAL electricity receipts. (Sum of lines 1a, 2a, and 3). NOTE - Copy this quantity to column 2, line 1 of Section III - FUEL SWITCHING.																																							
5. During 1988, how much electricity was generated on this establishment site by cogeneration?																																							
6. During 1988, how much of each energy source was generated onsite from solar power, wind power, hydropower, and geothermal sources?				Million Btu			Million Btu																																
7. During 1988, how much electricity was generated onsite by processes other than those covered on lines 5 and 6?																																							
8. During 1988, how much electricity was sold or transferred to utilities?																																							
9. During 1988, how much of each energy source was sold or transferred to establishments other than utilities?				Million Btu			Million Btu																																
10. If line 3, column 2 has a nonzero entry, and any of your electricity suppliers was another establishment of your company, identify that establishment at right. If you received electricity transfers from more than one establishment of your company, provide their identifying information in the "Remarks" section.	<table style="width: 100%; border: none;"> <tr> <td style="width: 40%; border: none;">1. Name of energy supplier</td> <td colspan="9" style="border: none;">_____</td> </tr> <tr> <td style="border: none;">Address - Number and street</td> <td colspan="9" style="border: none;">_____</td> </tr> <tr> <td style="border: none;">City</td> <td style="border: none;">State</td> <td style="border: none;">ZIP Code</td> <td style="border: none;">Phone number</td> <td colspan="6" style="border: none;">() _____</td> </tr> </table>									1. Name of energy supplier	_____									Address - Number and street	_____									City	State	ZIP Code	Phone number	() _____					
1. Name of energy supplier	_____																																						
Address - Number and street	_____																																						
City	State	ZIP Code	Phone number	() _____																																			
<p><i>Questions 11 and 12 below should be answered if this establishment generated any electricity onsite in 1988. If no electricity was generated onsite (column 2 has zero entries for lines 5, 6, and 7), omit questions 11 and 12 and proceed directly to Section II - Combustible Energy Sources.</i></p>																																							
11. Was this establishment electrically interconnected with an electric utility (that is, able to deliver electricity to the grid as well as receive electricity) as of December 31, 1988?										1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No																													
12. Was this establishment designated as a Qualifying Facility (QF) under Public Utility Regulatory Policies Act of 1978 (PURPA) as of December 31, 1988?										1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No																													

1988 Manufacturing Energy Consumption Survey Form EIA-846B (Continued)

Section II – COMBUSTIBLE ENERGY SOURCES

For purposes of this portion of the survey, a refinery is an installation that manufactures finished petroleum products from crude oil, unfinished oils, natural gas liquids, other hydrocarbons, and alcohol. Products include motor gasoline, unfinished oils, aviation gasoline, special naphthas, kerosene, distillate fuel oil, residual fuel oil, lubricating oils, asphalt and road oil, waxes, petroleum coke, still gas and petrochemical feedstocks. Nonrefinery or petrochemical operations produce substances by the chemical treatment of raw materials derived from petroleum or natural gas. Among the final products are plastics (including synthetic rubbers), synthetic fibers, chemicals, drugs, and detergents.

Check the box next to the correct description of the establishment identified on the address label. Then supply data for Section II according to the instructions for that description.

CLASSIFICATION	INSTRUCTIONS
182 <input type="checkbox"/> Establishment consists of REFINERY operations ONLY. (There may be nonrefinery (petrochemical) operations collocated, but those operations are identified as a separate establishment for purposes of the Annual Survey of Manufactures, Census Form MA-1000.)	Complete Version A of Section II but do NOT make any entries in columns 9 and 10. Ignore Version B of Section II on pages 4 and 5.
2 <input type="checkbox"/> Establishment consists of both REFINERY AND NONREFINERY operations.	Complete Version A of Section II INCLUDING columns 9 and 10. Ignore Version B of Section II on pages 4 and 5.
3 <input type="checkbox"/> Establishment consists of NONREFINERY operations ONLY. (There may be collocated refinery operations but those operations are identified as a separate establishment for purposes of the Annual Survey of Manufactures, Census Form MA-1000.)	Complete Version B of Section II on pages 4 and 5. Ignore Version A.

VERSION A

Energy sources (1)	Census Use Only (2)	Units used for reporting quantities (3)	Enter amounts for entire establishment				
			Quantity purchased by and delivered to this establishment (4)	Total expenditure, including delivery charges, for the quantity in col. (4) (5)			Total other receipts (transfers in and central purchases) (6)
				Mil.	Thou.	Dol.	
A. PETROLEUM BASED							
1. Crude oil/lease condensate	208	Barrels					
2. Residual fuel oil (numbers 5, 6, navy special, and bunker c)	216						
3. Distillate fuel oil (numbers 1, 2, and 4 fuel oils and diesel)	224						
4. LPG (ethane, ethylene, propane, propylene, butane, butylene)	240	Gallons					
5. Motor gasoline	232						
6. Waste and byproduct gases (e.g., refinery off gas, vent gas, plant gas, still gas)	620	Million Btu					
7. Petroleum coke	703	Barrels					
8. Waste oils and tars	711	Million Btu					
9. Other (Specify)	950						
	968						
B. NONPETROLEUM BASED							
1. Anthracite	406	Short tons					
2. Bituminous and subbituminous coal	414						
3. Breeze	448						
4. Coal coke	430						
5. Lignite	422						
6. Total coal and coke (Sum of anthracite, bituminous and subbituminous coal, breeze, coal coke and lignite)	455						
7. Natural gas	307	1,000 cu. ft.					
8. Hydrogen	638	Million Btu					
9. Waste materials (wastepaper, packing materials, etc.)	729						
10. Other (Specify)	976						
	984						

1988 Manufacturing Energy Consumption Survey Form EIA-846B (Continued)

Please enter this establishment's 11-digit Census File Number

Section II – COMBUSTIBLE ENERGY SOURCES – Continued

VERSION A – Continued

Enter amounts for entire establishment		Enter amount for nonrefinery operations only		Energy sources (11)	Census Use Only 201 (12)
Quantity of each energy source produced onsite (7)	Quantity consumed onsite as a fuel (8)	Quantity consumed onsite for all nonfuel purposes (9)	Shipments offsite to other establishments (10)		
				A. PETROLEUM BASED	
				1. Crude oil/lease condensate	208
<i>Copy to line 1 of section 3</i>				2. Residual fuel oil (numbers 5, 6, navy special, and bunker c)	216
<i>Copy to line 1 of section 3</i>				3. Distillate fuel oil (numbers 1, 2, and 4 fuel oils and diesel)	224
<i>Copy to line 1 of section 3</i>				4. LPG (ethane, ethylene, propane, propylene, butane, butylene)	240
				5. Motor gasoline	232
				6. Waste and byproduct gases (e.g., refinery off gas, vent gas, plant gas, still gas)	620
				7. Petroleum coke	703
				8. Waste oils and tars	711
				9. Other	950
					968
				B. NONPETROLEUM BASED	
				1. Anthracite	406
				2. Bituminous and subbituminous coal	414
				3. Breeze	448
				4. Coal coke	430
				5. Lignite	422
<i>Copy to line 1 of section 3</i>				6. Total coal and coke (Sum of anthracite, bituminous and subbituminous coal, breeze, coal coke and lignite)	455
				7. Natural gas	307
				8. Hydrogen	638
				9. Waste materials (wastepaper, packing materials, etc.)	729
				10. Other	976
					984

1988 Manufacturing Energy Consumption Survey Form EIA-846B (Continued)

Section II - COMBUSTIBLE ENERGY SOURCES - VERSION B

Energy sources (1)	Census Use Only (2)	Units used for reporting quantities (3)	Energy sources received in 1988				
			Quantity purchased by and delivered to this establishment (4)	Total expenditure, including delivery charges, of the quantity in col. (4) (5)			Total other receipts (transfers in and central purchases) (6)
				Mil.	Thou.	Dol.	
A. SOLIDS							
1. Anthracite	406	Short tons					
2. Bituminous and subbituminous coal	414						
3. Breeze	448						
4. Coal coke	430						
5. Lignite	422						
6. Total coal and coke (Sum of anthracite, bituminous and subbituminous coal, breeze, coal coke and lignite)	455						
7. Biomass	901	Million Btu					
8. Petroleum coke	703	Barrels					
9. Roundwood (wood cut specifically for fuel use)	802	Million Btu					
10. Waste materials (wastepaper, packing materials, etc.)	729						
11. Wood chips, bark, and wood waste	810						
12. Other solids (Specify)	919						
	927						
B. GASES							
1. Natural gas	307	1,000 cu. ft.					
2. Acetylene	646	Million Btu					
3. Blast furnace gas	604						
4. Coke oven gas	612						
5. Hydrogen	638						
6. Waste and byproduct gases (e.g., refinery off gas, vent gas, plant gas, still gas)	620						
7. Other gases (Specify)	935						
	943						
C. LIQUIDS							
1. Distillate fuel oil (numbers 1, 2, and 4 fuel oils and diesel)	224	Barrels					
2. Kerosene	273	Gallons					
3. LPG (ethane, ethylene, propane, propylene, butane, butylene)	240						
4. Motor gasoline	232	Million Btu					
5. Pulping or black liquor	737	Barrels					
6. Residual fuel oil (numbers 5, 6, navy special, and bunker c)	216						
7. Waste oils and tars	711	Million Btu					
8. Other liquids (Specify)	950						
	968						

For the purposes of questions 1, 2a, and 2b below, energy sources include: acetylene, breeze, butane/butylene, coal coke, distillate fuel oil, ethane/ethylene, isobutane, petroleum coke, propane/propylene, and residual fuel oil.

1. Total Btu content of energy source products shipped during 1988 Million Btu
*If the answer to question 1 is zero, omit questions 2a and 2b and proceed directly to question 3 on page 5.
 If question 1 has a nonzero response, include in the answers to questions 2a and 2b only those energy source products that were reported in question 1.*
- 2a. Total Btu value of all energy source inventories as of December 31, 1987 Million Btu
- 2b. Total Btu value of all energy source inventories as of December 31, 1988 Million Btu

1988 Manufacturing Energy Consumption Survey Form EIA-846B (Continued)

Please enter this establishment's 11-digit Census File Number

Section II – COMBUSTIBLE ENERGY SOURCES – VERSION B – Continued

Energy sources produced onsite in 1988		Energy sources consumed onsite in 1988		Energy sources (11)	Census Use Only (12)
Quantity produced onsite (7)	Does the entry in col. (7) represent the product or byproduct of another energy source consumed onsite? (8)	Quantity consumed as a fuel (9)	Quantity consumed for all nonfuel purposes (10)		
A. SOLIDS					
				1. Anthracite	406
				2. Bituminous and subbituminous coal	414
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			3. Breeze	448
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			4. Coal coke	430
				5. Lignite	422
		Copy to line 1 of section 3 <u>z</u>		6. Total coal and coke (Sum of anthracite, bituminous and subbituminous coal, breeze, coal coke and lignite)	455
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			7. Biomass	901
				8. Petroleum coke	703
				9. Roundwood (wood cut specifically for fuel use)	802
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			10. Waste materials (wastepaper, packing materials, etc.)	729
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			11. Wood chips, bark, and wood waste	810
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			12. Other solids	919
					927
		Copy to line 1 of section 3 <u>z</u>		B. GASES	
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			1. Natural gas	307
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			2. Acetylene	646
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			3. Blast furnace gas	604
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			4. Coke oven gas	612
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			5. Hydrogen	638
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			6. Waste and byproduct gases (e.g., refinery off gas, vent gas, plant gas, still gas)	620
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			7. Other gases	935
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No				943
		Copy to line 1 of section 3 <u>z</u>		C. LIQUIDS	
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			1. Distillate fuel oil (numbers 1, 2, and 4 fuel oils and diesel)	224
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			2. Kerosene	273
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No	Copy to line 1 of section 3 <u>z</u>		3. LPG (ethane, ethylene, propane, propylene, butane, butylene)	240
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			4. Motor gasoline	232
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			5. Pulping or black liquor	737
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No	Copy to line 1 of section 3 <u>z</u>		6. Residual fuel oil (numbers 5, 6, navy special, and bunker c)	216
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			7. Waste oils and tars	711
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No			8. Other liquids	950
	1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> No				968
3. Enter the total design storage capacity located onsite as of December 31, 1988 for:					
3a. Distillate fuel oil					224 _____ Barrels
3b. Residual fuel oil					216 _____ Barrels
3c. LPG					240 _____ Gallons

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1988 Manufacturing Energy Consumption Survey Form EIA-846B (Continued)

Section III — FUEL SWITCHING

Item description (1)	Electricity (2) Kilowatthours	Total coal and coke (3) Short tons
1. Quantity consumed — Copy the total electricity receipts from line 4 of section I, and the quantities of coal and coke, natural gas, distillate fuel oil, LPG, and residual fuel oil consumed onsite as a fuel from column (8) of section II, version A or column (9) of section II, version B. <i>Now answer lines 2 and 3 as appropriate for the columns with nonzero entries in line 1. Do not consider differences in energy prices when estimating amounts.</i>	109	455
2. Quantity nonswitchable — Enter the amount of the quantity in line 1 that could NOT have been replaced within 30 days by another energy source in 1988.	Kilowatthours	Short tons
3. Quantity switchable — Subtract line 2 from line 1 and enter the results. This represents the total quantity of energy consumption that COULD HAVE BEEN replaced within 30 days by one or more alternative energy sources in 1988. <i>Now answer lines 4a through 10b as appropriate for the columns with nonzero entries in line 3. Complete one column before starting another.</i>	Kilowatthours	Short tons
4a. Of the amount shown in line 3, what is the maximum amount that could have been replaced by electricity?		
4b. What is the minimum lead time required to make the switch to electricity?		1 <input type="checkbox"/> Less than 1 day 2 <input type="checkbox"/> 1 day to 1 week 3 <input type="checkbox"/> More than 1 week but within 30 days
5a. Of the amount shown in line 3, what is the maximum amount that could have been replaced by coal and coke?	Kilowatthours	
5b. What is the minimum lead time required to make the switch to coal and coke?		1 <input type="checkbox"/> Less than 1 day 2 <input type="checkbox"/> 1 day to 1 week 3 <input type="checkbox"/> More than 1 week but within 30 days
6a. Of the amount shown in line 3, what is the maximum amount that could have been replaced by natural gas?	Kilowatthours	Short tons
6b. What is the minimum lead time required to make the switch to natural gas?		1 <input type="checkbox"/> Less than 1 day 2 <input type="checkbox"/> 1 day to 1 week 3 <input type="checkbox"/> More than 1 week but within 30 days
7a. Of the amount shown in line 3, what is the maximum amount that could have been replaced by distillate fuel oil?	Kilowatthours	Short tons
7b. What is the minimum lead time required to make the switch to distillate fuel oil?		1 <input type="checkbox"/> Less than 1 day 2 <input type="checkbox"/> 1 day to 1 week 3 <input type="checkbox"/> More than 1 week but within 30 days
8a. Of the amount shown in line 3, what is the maximum amount that could have been replaced by LPG?	Kilowatthours	Short tons
8b. What is the minimum lead time required to make the switch to LPG?		1 <input type="checkbox"/> Less than 1 day 2 <input type="checkbox"/> 1 day to 1 week 3 <input type="checkbox"/> More than 1 week but within 30 days
9a. Of the amount shown in line 3, what is the maximum amount that could have been replaced by residual fuel oil?	Kilowatthours	Short tons
9b. What is the minimum lead time required to make the switch to residual fuel oil?		1 <input type="checkbox"/> Less than 1 day 2 <input type="checkbox"/> 1 day to 1 week 3 <input type="checkbox"/> More than 1 week but within 30 days
10a. Of the amount shown in line 3, what is the maximum amount that could have been replaced by any other energy source? <i>Identify that energy source.</i>	Kilowatthours	Short tons
10b. What is the minimum lead time required to make the switch to that energy source?		1 <input type="checkbox"/> Less than 1 day 2 <input type="checkbox"/> 1 day to 1 week 3 <input type="checkbox"/> More than 1 week but within 30 days

1988 Manufacturing Energy Consumption Survey Form EIA-846B (Continued)

Section IV -- REMARKS — Please use this space or attach a separate sheet for any explanations that may be essential in understanding your reported data. Be sure to include the name, address, and telephone number of power generating establishments of your company that transferred or delivered electricity or steam to your establishment in 1988 if you did not have enough room in section I.

Section V -- CERTIFICATION — The data in this report have been prepared in accordance with the instructions.

Name of person to contact regarding this report — Print or type					Area code	Number	Extension
Address — Number and street					Telephone		
City					State		ZIP Code
Signature of authorized person					Date		
FROM: Mo. Day Year					TO: Mo. Day Year		
Period covered by this report							

1988 Manufacturing Energy Consumption Survey Form EIA-846B (Continued)

EIA-846B-1
5-12-88

U.S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS

INSTRUCTIONS FOR FORM EIA-846B

Petroleum Refineries

1988 MANUFACTURING ENERGY CONSUMPTION SURVEY

A. Who is Responsible for Conducting the Manufacturing Energy Consumption Survey?

The Manufacturing Energy Consumption Survey (MECS) was designed, and is being sponsored, by the Energy Information Administration (EIA) of the U.S. Department of Energy. The survey is being administered and compiled by the U.S. Bureau of the Census.

B. What is The Purpose of This Survey?

The MECS will collect data on energy consumption and usage patterns for the manufacturing sector of the U.S. economy. In addition, it will measure the short-term (within 30 days) capability of your establishment to have used substitute fuels in place of those actually consumed in 1988. The information obtained from the MECS will be used to publish aggregate statistics on the consumption of energy for fuel and nonfuel uses, and on some energy-related issues such as energy prices, electricity generation onsite, and fuel-switching capabilities.

C. Who Should Report?

This survey is mandatory under the Federal Energy Administration Act of 1974, P.L. 93-275, and under Title 3, Subtitle B of the Omnibus Budget Reconciliation Act of 1986, Public Law 99-509.

This form is addressed to establishments operating petroleum refineries SIC 2911, as defined by the 1987 Standard Industrial Classification Manual (SIC). Establishments operating in the manufacturing sector, SIC 20 through 28, the remainder of SIC 29, and SIC 30 through 39 will complete similar MECS forms. Response by establishments included in the MECS sample selected for the survey and receiving the MECS survey form is required by law. Failure to respond may result in criminal fines, civil penalties, and other sanctions as provided by law.

D. How Is My Privacy Protected?

By Section 9 of Title 13, U.S. Code, your report to the Census Bureau is confidential. It may be seen only by sworn Census Bureau employees and may be used only for statistical purposes. The law also provides that copies retained in your files are immune from legal process.

E. When Is The Report Due?

The questionnaire should be returned by the due date specified on the form. Please use the enclosed return envelope. If the envelope has been misplaced, return the completed questionnaire to:

Bureau of the Census
1201 East Tenth Street
Jeffersonville, IN 47132

F. How Is a Manufacturing Establishment Defined?

A manufacturing establishment is an economic unit at a single physical location where the mechanical or chemical transformation of materials or substances into new products is performed. These operations are generally conducted in facilities described as plants, factories, or mills and characteristically use power-driven machines and material-handling equipment. Manufacturing also includes such activities as the assembly of components of manufactured products and the blending of materials such as lubricating oil, plastics, resins, or liquors.

An establishment is not necessarily identical to a business concern or firm, either of which may consist of one or more establishments. An establishment may consist of one or more units that

are engaged in separate or distinct activities. These units may be separated physically as well as economically, with separate records or substantially accurate reports available for each. If this establishment has previously completed the Annual Survey of Manufactures (ASM), Form MA-1000, conducted by the U.S. Census Bureau, establishment boundaries should correspond to those used for the ASM. **Each unit should be treated as a separate establishment ONLY if that was the determination made for the ASM. Do not consolidate two ASM establishments into a single establishment for purposes of the MECS, or separate a single ASM establishment into two MECS establishments.** Match the 11-digit Census File Number (CFN) located on the MECS questionnaire mailing label with the CFN on the ASM mailing label. Responses to MECS questions should include the same activities as those considered when responding to the matching ASM. If this establishment has never completed an ASM, report for all activities that occur at this physical location.

Section 1 - NONCOMBUSTIBLE ENERGY SOURCES

Energy sources used in manufacturing can be divided into two groups: combustible (capable of being burned), and noncombustible (such as electricity, steam, and industrial hot water). The purpose of section 1 is to collect 1988 data for noncombustible energy sources, in particular, electricity and steam.

Column 2 collects data that will provide important information on the components of electricity production, and permit an estimate to be made of the total consumption of electricity at your establishment. Column 3 collects data on the additional contribution that steam makes to the total consumption of energy at your establishment through net transfers and steam generated onsite by renewable energy sources. Column 4 collects data on hot water purchased for use as an energy source and used at this establishment site.

Electricity is to be reported in thousands of kilowatt-hours. Steam and industrial hot water are to be reported in millions of Btu. If you keep your records for steam in pounds, use a factor of 1,200 Btu per pound of steam to convert your data into Btu.

SPECIFIC INSTRUCTIONS

Line 1a - Quantity Purchased From Utilities - Enter the quantity of each noncombustible energy source that was purchased from a utility and delivered to this establishment site in 1988, regardless of when payment was made. For purposes of this question, utilities are companies that produce and/or deliver electricity and/or natural gas, and are legally obligated to provide service to the general public within their franchise area. Utilities do not include such generators of electricity as independent power producers, small power producers, or cogenerators not located at this establishment site. Include quantities purchased for **ANY** onsite use, for example, production of heat and power, electrolysis processes, or steam cleaning. **Exclude all:**

- quantities purchased from independent power producers, small power producers, or cogenerators not located at this establishment site.
- quantities delivered from other establishments in your company even if those quantities were repurchased from them by your establishment.
- quantities purchased and paid for by a central purchasing entity separate from this establishment.
- quantities for which payment was made in-kind.

CONTINUE ON PAGE 2

1988 Manufacturing Energy Consumption Survey Form EIA-846B (Continued)

Page 2

Line 1b — Expenditures For Purchases From Utilities — Enter the total expenditures for the purchased quantities reported on line 1a. Include all expenditures regardless of when payment was actually made.

Line 2a — Quantity Purchased From Nonutilities — Enter the quantity of electricity and steam that was purchased from offsite nonutility power producers and delivered to this establishment site in 1988, regardless of when payment was made. Include quantities purchased for **ANY** onsite use.
Exclude all:

- quantities delivered from other establishments in your company even if those quantities were repurchased from them by your establishment.
- quantities purchased and paid for by a central purchasing entity separate from this establishment.
- quantities for which payment was made in-kind.

Line 2b — Expenditures For Purchases From Nonutilities — Enter the total expenditures for the purchased quantities reported on line 2a. Include all expenditures regardless of when payment was actually made.

Line 3 — Other Receipts — Enter all additional quantities delivered to your establishment site in 1988 but not reported on lines 1a or 2a.
Include:

- quantities purchased and paid for by a central purchasing entity separate from this establishment.
- quantities transferred from another establishment of your company for which payment was not made.
- quantities delivered from another establishment of your company even if those quantities were repurchased from them by your establishment.
- quantities for which payment was made in-kind.

Line 4 — Total Electricity Receipts — Enter the sum of lines 1a, 2a and 3 for electricity only. Copy this total electricity receipt figure to column 2, line 1 of Section III — Fuel Switching.

Line 5 — Quantity Cogenerated — Enter the total quantity of electricity cogenerated from all energy sources, including renewable sources. For purposes of this survey, electrical cogeneration is defined as the production of electric energy and another form of useful energy (such as heat or steam) through the sequential use of energy.

Line 6 — Quantity Generated from Renewables — Enter the total quantity of each noncombustible energy source generated onsite directly from solar power, wind power, hydropower, or geothermal sources. Any electricity produced as a part of a cogeneration process (that is, electricity generated from geothermal steam which is then itself used) should be excluded. Such quantities should be included on line 5.

Line 7 — Other Generation — Enter the total quantity of electricity generated onsite by all other means not included on lines 5 and 6 above. For example, electricity generated by diesel generators should be reported here.

Line 8 — Sales or Transfers to Utilities — Enter the total quantity of electricity sold or transferred by your establishment in 1988 to utilities. For purposes of this survey, utilities are companies that produce and/or deliver electricity and/or natural gas, and are legally obligated to provide service to the general public within their franchise area. Utilities do not include such generators of electricity as independent power producers, small power producers, or cogenerators not located at this establishment site. Include quantities exchanged for the same or any other energy source(s).

Line 9 — Sales or Transfers to Nonutilities — Enter the total quantity of each noncombustible energy source sold or transferred in 1988 to establishments other than utilities. Include quantities exchanged for the same or any other energy source(s).

Line 10 — Nonutility Suppliers — If any electricity reported in column 2, line 3 was obtained by transfer from another establishment of your company, enter the name, address and telephone number of the supplying establishment. If you received transfers from more than one of this type of establishment, use the 'Remarks' section to identify remaining suppliers.

Questions 11 and 12 should be completed if there was any electricity generated at this establishment site in 1988 (column 2 has a nonzero entry on lines 5, 6, or 7). If your establishment had no onsite generation in 1988, omit questions 11 and 12 and proceed with Section II — Combustible Energy Sources.

Question 11 — Indicate by checking the appropriate box whether or not this establishment was electrically interconnected with an electric utility (that is, able to deliver electricity to the grid as well as receive electricity) as of December 31, 1988.

Question 12 — Indicate by checking the appropriate box whether or not this establishment was designated as a Qualifying Facility (QF) under the Public Utility Regulatory Policies Act of 1978 (PURPA) as of December 31, 1988.

Section II — COMBUSTIBLE ENERGY SOURCES

There are two versions of Section II — Combustible Energy Sources. In order to determine which version you should complete, first determine whether your establishment consists only of a refinery, only of a petrochemical operation, or some combination of the two. For purposes of this survey, a refinery is an installation that manufactures finished petroleum products from crude oil, unfinished oils, natural gas liquids, other hydrocarbons, and alcohol. Processes used by a refinery include fractional distillation, cracking (both catalytic and hydrocracking), coking, reforming, alkylation, isomerization, polymerization, hydrotreating and sweetening. Products include, but are not limited to, unfinished oils, motor gasoline, aviation gasoline, special naphthas, kerosene, distillate fuel oil, residual fuel oil, lubricating oils, asphalt and road oil, waxes, petroleum coke, still gas and petrochemical feedstocks. A petrochemical operation produces substances by the chemical treatment of raw materials derived from petroleum or natural gas. Among the final products are plastics (including synthetic rubbers), synthetic fibers, chemicals, drugs, and detergents.

1988 Manufacturing Energy Consumption Survey Form EIA-846B (Continued)

Page 3

Second, determine what establishment boundaries were used when completing the 1988 Annual Survey of Manufactures. Check the box next to the correct description of the manufacturing site that contains the establishment identified on the address label. Opposite each box is the schedule of Section II that should be completed.

- If the establishment site contains refinery operations **only**, complete version A of Section II **omitting** columns 9 and 10. (If the site contains both refinery and adjacent petrochemical operations that are identified as **separate establishments** for purposes of the ASM, version A of Section II should be completed, **omitting** columns 9 and 10.)
- If the establishment site contains both refinery and petrochemical operations that are identified as a **single** establishment for purposes of the ASM, complete ALL unshaded areas of version A.
- If the establishment site contains petrochemical operations **only**, complete version B of Section II. (If the site contains both petrochemical and refinery operations that are identified as **separate establishments** for purposes of the ASM, complete version B of Section II.)

VERSION A — SECTION II — COMBUSTIBLE ENERGY SOURCES

Column 1 — Energy Sources to be Reported — Sixteen energy sources have been preprinted in column 1, separated into the general categories of petroleum and nonpetroleum based. Determine from the criteria below which of the preprinted energy sources should be included for reporting and which excluded.

First, EXCLUDE all energy sources that were not consumed for any purpose at this establishment site during 1988. All excluded energy sources should be lined out, and no entries should be made in any column. Next, if your establishment consumed any energy sources for any purpose during 1988 that are not included in the preprinted list, add those energy sources under the "Other" heading for petroleum based or nonpetroleum based energy sources. NOTE — In making additional entries, the preprinted entry "Waste and byproduct gases" includes all waste gas streams (for example, refinery gas, fuel gas, vent gas, offgas, still gas, and other waste gases) produced onsite except hydrogen.

All unlined energy sources, including any additions to the preprinted list, should be further evaluated for inclusion or exclusion by the specific criterion listed below.

If your only means of supply of an energy source during 1988 was as a byproduct of energy source inputs to any of your manufacturing processes, it should be included ONLY if it was at least partially consumed onsite as a fuel during 1988 (that is for heat, power, or electricity generation). If none of that onsite-produced energy source was consumed onsite as a fuel, it should be excluded.

Complete the appropriate columns for all energy sources that were not excluded by the above procedures. Entries should be made in accordance with the specific instructions for these columns.

Column 3 — Reporting Units — Use the indicated units for reporting all quantities. For those establishments that keep records in Btu, note that volume measures should be reported as actual physical quantities, rather than adjusted to represent a standard energy content. One barrel contains 42 gallons. The approximate liquid equivalent conversion factor of LPG is 3.603 million Btu per barrel. Petroleum coke should also be reported in barrels. A barrel will hold approximately 400 pounds of petroleum coke, or the equivalent of 6.024 million Btu. A short ton of petroleum coke contains approximately 30.12 million Btu. Natural gas should be reported in thousands of cubic feet. One thousand cubic feet of natural gas is equal to about 10.3 therms, or 1.03 million Btu.

Column 4 — Quantity Purchased — Complete for nonpetroleum based energy sources only. Enter the quantity of each energy source that was purchased and delivered to this establishment in 1988, regardless of when payment was made. Include quantities of those energy sources that were purchased for **ANY** onsite use, for example, the production of heat or power, electrolysis processes, steam cleaning, or as a petrochemical feedstock or a raw material input to any manufacturing operation. **Exclude** all:

- quantities delivered from another establishment in your company even if those quantities were repurchased from them by your establishment.
- quantities purchased and paid for by a central purchasing entity separate from this establishment.
- quantities for which payment was made in-kind.

Column 5 — Expenditures — Complete for nonpetroleum based energy sources only. Enter the total expenditures for each of the purchased quantities reported in column 4. Include all expenditures regardless of when payment was made.

Column 6 — Other Receipts — Complete for nonpetroleum based energy sources only. For each included energy source, enter all additional quantities delivered to your establishment site in 1988 but not reported in column 4. **Include:**

- quantities purchased and paid for by a central purchasing entity separate from this establishment.
- quantities transferred from another establishment of your company for which payment was not made.
- quantities delivered from another establishment of your company even if these quantities were repurchased from them by your establishment.
- quantities for which payment was made in-kind.

Exclude any quantities transferred between a petroleum refinery and a chemical plant if the two were treated as a single establishment by the ASM.

Column 7 — Onsite Production — Complete for nonpetroleum based energy sources only. Enter the total quantity of any energy source that was produced onsite in 1988 as a product, a byproduct, a waste material, or an output from a captive (onsite) mine or well, and was at least partially consumed onsite. Enter the TOTAL quantity produced onsite, regardless of whether some or all of it was consumed as a fuel or feedstock, transferred offsite, sold, or otherwise disposed of. Examples of byproducts include petroleum coke, hydrogen, and still gas. Examples of waste products include wood scraps, packing materials, waste paper and cardboard, and waste oils.

1988 Manufacturing Energy Consumption Survey Form EIA-846B (Continued)

Page 4

Column 8 — Onsite Fuel Consumption — Complete for ALL energy sources. Enter the quantity consumed onsite as a fuel for the production of heat, steam, power, or the generation of electricity. Also include fuel consumed by vehicles dedicated primarily for use onsite. Copy the entries, if any, in Column 8 for natural gas, distillate fuel oil, residual fuel oil, LPG, and total coal products to line 1 of section III — Fuel Switching.

Column 9 — Onsite Nonfuel Consumption — Complete ONLY if your establishment contains both refinery and non-refinery operations that are identified as a **single establishment** for purposes of the ASM. Note that this column requests data for the **NON-REFINERY** operations only. Enter the quantity of each energy source that was consumed onsite for all purposes other than fuel use. Include all quantities consumed as feedstocks (for example, butane processed in producing rubber compounds), raw materials (for example, coal used to produce coke), additives, or ingredients for products manufactured by this establishment. Exclude all offsite dispositions such as sales and transfers to other establishments.

Column 10 — Shipments Offsite to Other Establishments — Complete ONLY if your establishment contains both refinery and non-refinery operations that are identified as a **single establishment** for purposes of the ASM. Note that this column requests data for the **NON-REFINERY** operations only. Enter the quantity of each energy source that was shipped offsite to any other establishment.

VERSION B — SECTION II — COMBUSTIBLE ENERGY SOURCES

Column 1 — Energy Sources to be Reported — Twenty-three energy sources have been preprinted in column 1, separated into the general categories of solids, gases, and liquids. Determine from the criteria below which of the preprinted energy sources should be included for reporting and which excluded.

First, EXCLUDE all energy sources that were not consumed for any purpose at this establishment site during 1988. All excluded energy sources should be lined out, and no entries should be made in any column. Next, if your establishment consumed any energy sources for any purpose during 1988 that are not included in the preprinted list, add those energy sources under the "Other" heading for solids, gases, and liquids. NOTE — In making additional entries, the preprinted entry "Waste and byproduct gases" includes all waste gas streams (for example, refinery gas, fuel gas, vent gas, offgas, still gas, and other waste gases) produced onsite except hydrogen.

All unlined energy sources, including any additions to the preprinted list, should be further evaluated for inclusion or exclusion by the specific criterion listed below.

If your only means of supply of an energy source during 1988 was as a byproduct of energy source inputs to any of your manufacturing processes, it should be included ONLY if it was at least partially consumed onsite as a fuel during 1988 (that is for heat, power, or electricity generation). If none of that onsite-produced energy source was consumed onsite as a fuel, it should be excluded.

Complete the appropriate columns for all energy sources that were not excluded by the above procedures. Entries should be made in accordance with the specific instructions for these columns.

Column 3 — Reporting Units — Use the indicated units for reporting all quantities. For those establishments that keep records in Btu, note that volume measures should be reported as actual physical quantities, rather than adjusted to represent a standard energy content. One barrel contains 42 gallons. The approximate liquid equivalent conversion factor of LPG is 3.603 million Btu per barrel. Petroleum coke should also be reported in barrels. A barrel will hold approximately 400 pounds of petroleum coke, or the equivalent of 6.024 million Btu. A short ton of petroleum coke contains approximately 30.12 million Btu. Natural gas should be reported in thousands of cubic feet. One thousand cubic feet of natural gas is equal to about 10.3 therms, or 1.03 million Btu.

Column 4 — Quantity Purchased — Enter the quantity of each energy source that was purchased and delivered to this establishment in 1988, regardless of when payment was made. Include quantities of those energy sources that were purchased for **ANY** onsite use, for example, the production of heat or power, electrolysis processes, steam cleaning, or as a petrochemical feedstock or a raw material input to any manufacturing operation. **Exclude** all:

- quantities delivered from another establishment in your company even if those quantities were repurchased from them by your establishment.
- quantities purchased and paid for by a central purchasing entity separate from this establishment.
- quantities for which payment was made in-kind.

Column 5 — Expenditures — Enter the total expenditures for each of the purchased quantities reported in column 4. Include all expenditures regardless of when payment was made.

Column 6 — Other Receipts — For each included energy source, enter all additional quantities delivered to your establishment site in 1988 but not reported in column 4. **Include:**

- quantities purchased and paid for by a central purchasing entity separate from this establishment.
- quantities transferred from another establishment of your company for which payment was not made.
- quantities delivered from another establishment of your company even if these quantities were repurchased from them by your establishment.
- quantities for which payment was made in-kind.

Exclude any quantities transferred between a petroleum refinery and a chemical plant if the two were treated as a **single establishment** by the ASM.

Column 7 — Onsite Production — Enter the total quantity of any energy source that was produced onsite in 1988 as a product, a byproduct, a waste material, or an output from a captive (onsite) mine or well, and was at least partially consumed onsite. Enter the TOTAL quantity produced onsite, regardless of whether some or all of it was consumed as a fuel or feedstock, transferred offsite, sold, or otherwise disposed of. Examples of byproducts include petroleum coke, hydrogen, and still gas. Examples of waste products include wood scraps, packing materials, waste paper and cardboard, and waste oils.

1988 Manufacturing Energy Consumption Survey Form EIA-846B (Continued)

Page 5

Column 8 — Source of Onsite Production — For each energy source that has an entry in column 7, check the "Yes" box if the amount listed in column 7 resulted from consumption of any other energy source listed in Section II — Combustible Energy Sources. Check the "No" box if the energy source came from captive wells or mines, or is a product or byproduct/waste product from materials not listed in Section II as a combustible energy source. Examples include:

- hydrogen produced as a byproduct of natural gas in an ammonia plant would have the "Yes" box checked.
- hydrogen produced through the electrolysis of brine in a chlorine plant would have the "No" box checked.
- coke oven gas produced during the coal coking process would have the "Yes" box checked.
- wood chips produced as a byproduct of wood purchased for use as a raw material rather than a fuel would have the "No" box checked.
- pulping (black) liquor, used in the chemical pulping of wood, that is burned in a recovery furnace or otherwise combusted, would have the "No" box checked.

Column 9 — Onsite Fuel Consumption — Enter the quantity consumed onsite as a fuel for the production of heat, steam, power, or the generation of electricity. Also include fuel consumed by vehicles dedicated primarily for use onsite. Copy the entries, if any, in column 9 for natural gas, distillate fuel oil, residual fuel oil, LPG, and total coal products to line 1 of Section III — Fuel Switching.

Column 10 — Onsite Nonfuel Consumption — Enter the quantity of each energy source that was consumed onsite for all purposes other than fuel use. Include all quantities consumed as feedstocks (for example, butane processed in producing rubber compounds), raw materials (for example, coal used to produce coke), additives, or ingredients for products manufactured by this establishment. **Exclude** all offsite dispositions such as sales and transfers to other establishments.

Supplemental Questions —

For the purposes of Questions 1, 2a, and 2b, energy sources and their **approximate** Btu conversion factors include:

Acetylene	21,500	Btu/lb
Breeze	19.8	million Btu/short ton
Butane	21,308	Btu/lb
Butylene	20,787	Btu/lb
Coal Coke	24.8	million Btu/short ton
Distillate fuel oil	5.825	million Btu/barrel
Ethane	22,320	Btu/lb
Ethylene	21,644	Btu/lb
Isobutane	21,257	Btu/lb
Petroleum coke	6.024	million Btu/barrel
Propane	21,661	Btu/lb
Propylene	21,041	Btu/lb
Residual fuel oil	6.287	million Btu/barrel

NOTE — If your establishment uses more precise conversion values for your operations, use them in place of the approximations given above.

Question 1 — Enter the total Btu content of all energy source products shipped offsite during 1988.

If the answer to question 1 is zero, omit question 2, parts a and b, and proceed directly to question 3. If question 1 has a non-zero response, include in the response to question 2 only those energy source products that were reported in question 1.

Question 2a — Enter the total Btu value of all energy source inventories as of December 31, 1987.

Question 2b — Enter the total Btu value of all energy source inventories as of December 31, 1988.

Question 3 — Enter the total design storage capacity located onsite as of December 31, 1988, for residual fuel oil, distillate fuel oil, and LPG. Report the shell capacity (that is, the design capacity of the storage tanks) in the units of measure specified. **Include:**

- onsite capacity of all storage facilities regardless of the intended disposition of the energy source (include both product storage tanks and tanks dedicated for onsite use).
- onsite capacity dedicated or leased for storage of energy sources owned by other establishments.

Section III — FUEL SWITCHING

This portion of the survey is intended to measure the short-term capability of your establishment to have used substitute energy sources in place of those actually consumed in 1988. Capability to use substitute energy sources means that this establishment's combustors (for example, boilers, furnaces, ovens, blast furnaces) had the machinery or equipment either in place or available for installation in 1988 so that substitutions could actually have been introduced within 30 days without extensive modifications.

NOTE — Fuel-switching capability as measured by this survey does not depend on the relative prices of energy sources, it depends only on the characteristics of your equipment and certain legal constraints. Fuel-switching capability sets limits on the extent to which you could switch to a substitute energy source if you wanted to or needed to. It has nothing to do with whether you would want to switch if you could. Therefore, relative prices of energy sources are not related to fuel-switching CAPABILITY and should be ignored when completing this section.

We recognize that records of fuel-switching capability are not regularly maintained. Accordingly, reasonable approximations of fuel-switching capability are acceptable. These approximations should be based on the judgment of a person knowledgeable about the fuel-switching capability and operations of your establishment. They are not expected to be formal engineering estimates based on a day-by-day analysis of the operating levels of individual combustors and interactions between them. Respond as realistically as possible, given your actual operations in 1988.

Base your estimates on the availability of substitute energy sources and the physical condition of your equipment during 1988. Include switching capability that could have resulted from the use of redundant and/or standby combustors, and from combustors that were already equipped to fire alternative fuels. Lines 1 through 3 of this portion of the form measure your establishment's overall capability to have switched from specific energy sources in 1988. Lines 4a through 10b describe your capability to replace a given energy source by specific alternative energy sources.

1988 Manufacturing Energy Consumption Survey Form EIA-846B (Continued)

Page 6

Specific Instructions

Line 1 — Quantity Consumed — Enter the total electricity receipts figure from line 4 of Section I, and the fuel consumption figures from Section II for total coal and coke, natural gas, distillate fuel oil, LPG, and residual fuel oil. The quantities to be copied are noted in the appropriate boxes of Sections I and II.

Line 2 — Quantity Nonswitchable — Enter the amount of the quantity reported on Line 1 that could NOT have been replaced within 30 days by any other energy source in 1988, even given a severe curtailment. NOTE — Include only that portion of total electricity receipts (purchases plus transfers in) that could NOT have been replaced by either onsite-generated electricity or energy source(s) which accomplish the same purposes as the offsite-produced electricity (e.g., supplying heat or power). Portions of individual fuels may be non-switchable due to limitations such as:

- the characteristics of your physical plant (for example, single-fired combustors or the absence of redundant and/or standby combustors), or the requirements of your manufacturing process.
- binding take or pay contracts with energy suppliers that were in place.
- environmental regulations which limit the amounts of potential replacement fuels that could be burned.

DO NOT consider current relative prices of fuels as a limitation to switching capability.

Line 3 — Quantity Switchable — Subtract line 2 from line 1 and enter the results. These values represent the quantity of each energy source consumed that COULD HAVE BEEN replaced within 30 days by at least one other energy source in 1988. NOTE — If all entries on line 3 are zero, complete the Comments and Certification sections of the survey and return it to the Census Bureau. For each entry on line 3 that is non-zero, complete the remainder of that column. Complete one column before starting another.

Lines 4 through 10, Part a — Replacement Quantities — Report the maximum amount of the quantity shown on line 3 that could have been replaced within 30 days by each of the energy sources on lines 4 through 10, under the constraints listed in the instructions for line 2. Report all amounts in the units of the energy source that is being replaced. DO NOT convert this amount to units of the replacement energy sources. NOTE — Be sure to take into account not only the fuels that could be directly substituted for offsite-produced electricity, but also the fuels needed to generate electricity onsite that could have been used in place of electricity receipts.

NOTE — The sum of lines 4a through 10a for each column must be at least as large as the entry on line 3 of that column, and may be larger if more than one alternative fuel could have been used.

Lines 4 through 10, Part b — Lead Time — Mark the minimum lead time required to switch to each replacement energy source identified.

Section IV — REMARKS

Please provide any explanations that may be helpful to us in understanding your reported data. Attach a separate sheet if necessary. Be sure to include the name, address, and telephone number of nonutility power generating establishments of your company that supplied electricity to your establishment if you did not have enough room in section I to identify them.

Section V — CERTIFICATION

Period Covered By This Report — Enter the month, day, and year of the beginning and the end of the period covered by your report. If a calendar year report: "From January 1 to December 31, 1988,"; if a fiscal year, specify which (such as "From December 1, 1987 to November 30, 1988"). If a part-year report is submitted because the establishment was not in operation or under your company's control for the entire year, specify the actual period covered: for example "January 2, 1988 to August 15, 1988," or "June 1, 1988 to December 31, 1988."

1988 Manufacturing Energy Consumption Survey Form EIA-846C

OMB No. 1905-0169; Approval Expires 04/30/91

FORM **EIA-846C**
(5-1-89)

Public reporting burden for this collection of information is estimated to average 8 hours per response, including the time of reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Energy Information Administration, Office of Statistical Standards, E1-73, Mail Station: 1H-023 Forrestal, 1000 Independence Avenue, SW, Washington, DC 20485; and to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503.

U.S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS
ACTING AS COLLECTING AND COMPLYING AGENT FOR
UNITED STATES DEPARTMENT OF ENERGY
ENERGY INFORMATION ADMINISTRATION



**Chemicals and Allied Products;
Steel Works, Blast Furnaces,
and Rolling Mills; Products of
Petroleum and Coal**

**1988
MANUFACTURING ENERGY
CONSUMPTION SURVEY**

In correspondence pertaining to this report, please refer to this Census File Number (CFN).

NOTICE — This survey is mandatory under the Federal Energy Administration Act of 1974, P.L. 93-275, and under Title 3, Subtitle B of the Omnibus Budget Reconciliation Act of 1986, P.L. 99-509. Failure to respond may result in criminal fines, civil penalties, and other sanctions as provided by law. The confidentiality of your response to this survey is processed by law (title 13, U.S. Code). Your response may be seen only by sworn Census employees and may be used only for statistical purposes. The law also provides that copies retained in your files are immune from legal process.

Please correct errors in name, address, and ZIP Code. ENTER street and number if not shown.

PLEASE COMPLETE THIS FORM AND RETURN TO

BUREAU OF THE CENSUS
1201 East Tenth Street
Jeffersonville, IN 47132

NOTE

Please read the enclosed instructions before filling out this form. Complete each item. If you have any questions, call (301) 763-7066.

DUE DATE:

If you cannot file by the due date, a time extension request should be sent to the above address, please include your 11-digit Census File Number (CFN).

Section I — NONCOMBUSTIBLE ENERGY SOURCES

Item description (1)	Electricity (2)			Steam (3)			Industrial hot water (4)		
	Kilowatthours			Million Btu			Million Btu		
1a. During 1988, what amount of each energy source was purchased by this establishment from utilities and delivered to this establishment site?	Mil.	Thou.	kWh						
1b. What was the total expenditure for the purchased energy sources reported on line 1a?	Mil.	Thou.	Dol.	Mil.	Thou.	Dol.	Mil.	Thou.	Dol.
2a. During 1988, what amount of electricity and steam was purchased from nonutility suppliers by this establishment and delivered to this establishment site?	Mil.	Thou.	kWh						
2b. What was the total expenditure for the purchased electricity and steam reported on line 2a?	Mil.	Thou.	Dol.	Mil.	Thou.	Dol.			
3. During 1988, what amount of each energy source was transferred from outside establishments and delivered to this establishment site? Do not include the purchases reported in lines 1a or 2a.	Mil.	Thou.	kWh						
4. TOTAL electricity receipts. (Sum of lines 1a, 2a, and 3). NOTE — Copy this quantity to column 2, line 1 of Section III — FUEL SWITCHING.									
5. During 1988, how much electricity was generated on this establishment site by cogeneration?									
6. During 1988, how much of each energy source was generated onsite from solar power, wind power, hydropower, and geothermal sources?									
7. During 1988, how much electricity was generated onsite by processes other than those covered on lines 5 and 6?									
8. During 1988, how much electricity was sold or transferred to utilities?									
9. During 1988, how much of each energy source was sold or transferred to establishments other than utilities?									
10. If line 3, column 2 has a nonzero entry, and any of your electricity suppliers was another establishment of your company, identify that establishment at right. If you received electricity transfers from more than one establishment of your company, provide their identifying information in the "Remarks" section.	1. Name of energy supplier _____								
	Address — Number and street _____								
	City _____			State _____		ZIP Code _____		Phone number _____	
	Questions 11 and 12 below should be answered if this establishment generated any electricity onsite in 1988. If no electricity was generated onsite (column 2 has zero entries for lines 5, 6, and 7), omit questions 11 and 12 and proceed directly to Section II — Combustible Energy Sources.								
11. Was this establishment electrically interconnected with an electric utility (that is, able to deliver electricity to the grid as well as receive electricity) as of December 31, 1988?							1 <input type="checkbox"/> Yes		2 <input type="checkbox"/> No
12. Was this establishment designated as a Qualifying Facility (QF) under Public Utility Regulatory Policies Act of 1978 (PURPA) as of December 31, 1988?							1 <input type="checkbox"/> Yes		2 <input type="checkbox"/> No

1988 Manufacturing Energy Consumption Survey Form EIA-846C (Continued)

Section II - COMBUSTIBLE ENERGY SOURCES							
Energy sources (1)	Census Use Only (2)	Units used for reporting quantities (3)	Energy sources received in 1988				
			Quantity purchased by and delivered to this establishment (4)	Total expenditure, including delivery charges, of the quantity in col. (4) (5)			Total other receipts (transfers in and central purchases) (6)
				Mil.	Thou.	Dol.	
A. SOLIDS							
1. Anthracite	406	Short tons					
2. Bituminous and subbituminous coal	414						
3. Breeze	448						
4. Coal coke	430						
5. Lignite	422						
6. Total coal and coke (Sum of anthracite, bituminous and subbituminous coal, breeze, coal coke and lignite)	455						
7. Biomass	901	Million Btu					
B. GASES							
8. Petroleum coke	703	Barrels					
9. Roundwood (wood cut specifically for fuel use)	802	Million Btu					
10. Waste materials (wastepaper, packing materials, etc.)	729						
11. Wood chips, bark, and wood waste	810						
12. Other solids (Specify)	919						
	927						
B. GASES							
1. Natural gas	307	1,000 cu. ft.					
2. Acetylene	646	Million Btu					
3. Blast furnace gas	604						
4. Coke oven gas	612						
5. Hydrogen	638						
6. Waste and byproduct gases (e.g., refinery off gas, vent gas, plant gas, still gas)	620						
7. Other gases (Specify)	935						
	943						
C. LIQUIDS							
1. Distillate fuel oil (numbers 1, 2, and 4 fuel oils and diesel)	224	Barrels					
2. Kerosene	273						
3. LPG (ethane, ethylene, propane, propylene, butane, butylene)	240	Gallons					
4. Motor gasoline	232						
5. Pulping or black liquor	737	Million Btu					
6. Residual fuel oil (numbers 5, 6, navy special, and bunker c)	216	Barrels					
7. Waste oils and tars	711	Million Btu					
8. Other liquids (Specify)	950						
	968						

For the purposes of questions 1, 2a, and 2b below, energy sources include: acetylene, breeze, butane/butylene, coal coke, distillate fuel oil, ethane/ethylene, isobutane, petroleum coke, propane/propylene, and residual fuel oil.

1. Total Btu content of energy source products shipped during 1988. 182 Million Btu
If the answer to question 1 is zero, omit questions 2a and 2b and proceed directly to question 3 on page 3.
If question 1 has a nonzero response, include in the answers to questions 2a and 2b only those energy source products that were reported in question 1.

2a. Total Btu value of all energy source inventories as of December 31, 1987. Million Btu

2b. Total Btu value of all energy source inventories as of December 31, 1988. Million Btu

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1988 Manufacturing Energy Consumption Survey Form EIA-846C (Continued)

Section III — FUEL SWITCHING

Item description (1)	Electricity (2)	Total coal and coke (3)
	Kilowatthours	Short tons
1. Quantity consumed — Copy the total electricity receipts from line 4 of section I, and the quantities of coal and coke, natural gas, distillate fuel oil, LPG, and residual fuel oil consumed onsite as a fuel from column (9) of section II. <i>Now answer lines 2 and 3 as appropriate for the columns with nonzero entries in line 1. Do not consider differences in energy prices when estimating amounts.</i>	Kilowatthours	Short tons
2. Quantity nonswitchable — Enter the amount of the quantity in line 1 that could NOT have been replaced within 30 days by another energy source in 1988.	Kilowatthours	Short tons
3. Quantity switchable — Subtract line 2 from line 1 and enter the results. This represents the total quantity of energy consumption that COULD HAVE BEEN replaced within 30 days by one or more alternative energy sources in 1988. <i>Now answer lines 4a through 10b as appropriate for the columns with nonzero entries in line 3. Complete one column before starting another.</i>	Kilowatthours	Short tons
4a. Of the amount shown in line 3, what is the maximum amount that could have been replaced by electricity?	Kilowatthours	Short tons
4b. What is the minimum lead time required to make the switch to electricity?		1 <input type="checkbox"/> Less than 1 day 2 <input type="checkbox"/> 1 day to 1 week 3 <input type="checkbox"/> More than 1 week but within 30 days
5a. Of the amount shown in line 3, what is the maximum amount that could have been replaced by coal and coke?	Kilowatthours	Short tons
5b. What is the minimum lead time required to make the switch to coal and coke?	1 <input type="checkbox"/> Less than 1 day 2 <input type="checkbox"/> 1 day to 1 week 3 <input type="checkbox"/> More than 1 week but within 30 days	Short tons
6a. Of the amount shown in line 3, what is the maximum amount that could have been replaced by natural gas?	Kilowatthours	Short tons
6b. What is the minimum lead time required to make the switch to natural gas?	1 <input type="checkbox"/> Less than 1 day 2 <input type="checkbox"/> 1 day to 1 week 3 <input type="checkbox"/> More than 1 week but within 30 days	1 <input type="checkbox"/> Less than 1 day 2 <input type="checkbox"/> 1 day to 1 week 3 <input type="checkbox"/> More than 1 week but within 30 days
7a. Of the amount shown in line 3, what is the maximum amount that could have been replaced by distillate fuel oil?	Kilowatthours	Short tons
7b. What is the minimum lead time required to make the switch to distillate fuel oil?	1 <input type="checkbox"/> Less than 1 day 2 <input type="checkbox"/> 1 day to 1 week 3 <input type="checkbox"/> More than 1 week but within 30 days	1 <input type="checkbox"/> Less than 1 day 2 <input type="checkbox"/> 1 day to 1 week 3 <input type="checkbox"/> More than 1 week but within 30 days
8a. Of the amount shown in line 3, what is the maximum amount that could have been replaced by LPG?	Kilowatthours	Short tons
8b. What is the minimum lead time required to make the switch to LPG?	1 <input type="checkbox"/> Less than 1 day 2 <input type="checkbox"/> 1 day to 1 week 3 <input type="checkbox"/> More than 1 week but within 30 days	1 <input type="checkbox"/> Less than 1 day 2 <input type="checkbox"/> 1 day to 1 week 3 <input type="checkbox"/> More than 1 week but within 30 days
9a. Of the amount shown in line 3, what is the maximum amount that could have been replaced by residual fuel oil?	Kilowatthours	Short tons
9b. What is the minimum lead time required to make the switch to residual fuel oil?	1 <input type="checkbox"/> Less than 1 day 2 <input type="checkbox"/> 1 day to 1 week 3 <input type="checkbox"/> More than 1 week but within 30 days	1 <input type="checkbox"/> Less than 1 day 2 <input type="checkbox"/> 1 day to 1 week 3 <input type="checkbox"/> More than 1 week but within 30 days
10a. Of the amount shown in line 3, what is the maximum amount that could have been replaced by any other energy source? <i>Identify that energy source.</i>	Kilowatthours	Short tons
10b. What is the minimum lead time required to make the switch to that energy source?	1 <input type="checkbox"/> Less than 1 day 2 <input type="checkbox"/> 1 day to 1 week 3 <input type="checkbox"/> More than 1 week but within 30 days	1 <input type="checkbox"/> Less than 1 day 2 <input type="checkbox"/> 1 day to 1 week 3 <input type="checkbox"/> More than 1 week but within 30 days

1988 Manufacturing Energy Consumption Survey Form EIA-846C (Continued)

Section IV — REMARKS — Please use this space or attach a separate sheet for any explanations that may be essential in understanding your reported data. Be sure to include the name, address, and telephone number of power generating establishments of your company that transferred or delivered electricity or steam to your establishment in 1988 if you did not have enough room in section I.

Section V — CERTIFICATION — The data in this report have been prepared in accordance with the instructions.

Name of person to contact regarding this report — <i>Print or type</i>		Area code	Number	Extension
Address — <i>Number and street</i>		Telephone		
City	State	ZIP Code	Signature of authorized person	
Period covered by this report		FROM:	Mo.	Day
		TO:	Mo.	Day
			Year	Year

1988 Manufacturing Energy Consumption Survey Form EIA-846C (Continued)

EIA-846C-I
15-12-88

U.S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS

INSTRUCTIONS FOR FORM EIA-846C

Chemicals and Allied Products; Steel Works, Blast Furnaces, and Rolling Mills; Products of Petroleum and Coal

1988 MANUFACTURING ENERGY CONSUMPTION SURVEY

A. Who is Responsible for Conducting the Manufacturing Energy Consumption Survey?

The Manufacturing Energy Consumption Survey (MECS) was designed, and is being sponsored, by the Energy Information Administration (EIA) of the U.S. Department of Energy. The survey is being administered and compiled by the U.S. Bureau of the Census.

B. What is The Purpose of This Survey?

The MECS will collect data on energy consumption and usage patterns for the manufacturing sector of the U.S. economy. In addition, it will measure the short-term (within 30 days) capability of your establishment to have used substitute fuels in place of those actually consumed in 1988. The information obtained from the MECS will be used to publish aggregate statistics on the consumption of energy for fuel and nonfuel uses, and on some energy-related issues such as energy prices, electricity generation onsite, and fuel-switching capabilities.

C. Who Should Report?

This survey is mandatory under the Federal Energy Administration Act of 1974, P.L. 93-275, and under Title 3, Subtitle B of the Omnibus Budget Reconciliation Act of 1986, Public Law 99-509.

This form is addressed to establishments operating in SIC 28, 29 (except 2911), and 3312, as defined by the 1987 Standard Industrial Classification Manual (SIC). Establishments operating in the manufacturing sector, SIC 20 through 27, and 30 through 39 will complete similar MECS forms. Response by establishments included in the MECS sample selected for the survey and receiving the MECS survey form is required by law. Failure to respond may result in criminal fines, civil penalties, and other sanctions as provided by law.

D. How Is My Privacy Protected?

By Section 9 of Title 13, U.S. Code, your report to the Census Bureau is confidential. It may be seen only by sworn Census Bureau employees and may be used only for statistical purposes. The law also provides that copies retained in your files are immune from legal process.

E. When Is The Report Due?

The questionnaire should be returned by the due date specified on the form. Please use the enclosed return envelope. If the envelope has been misplaced, return the completed questionnaire to:

Bureau of the Census
1201 East Tenth Street
Jeffersonville, IN 47132

F. How Is a Manufacturing Establishment Defined?

A manufacturing establishment is an economic unit at a single physical location where the mechanical or chemical transformation of materials or substances into new products is performed. These operations are generally conducted in facilities described as plants, factories, or mills and characteristically use power-driven machines and material-handling equipment. Manufacturing also includes such activities as the assembly of components of manufactured products and the blending of materials such as lubricating oil, plastics, resins, or liquors.

An establishment is not necessarily identical to a business concern or firm, either of which may consist of one or more establishments. An establishment may consist of one or more units that

are engaged in separate or distinct activities. These units may be separated physically as well as economically, with separate records or substantially accurate reports available for each. If this establishment has previously completed the Annual Survey of Manufactures (ASM), Form MA-1000, conducted by the U.S. Census Bureau, establishment boundaries should correspond to those used for the ASM. **Each unit should be treated as a separate establishment ONLY if that was the determination made for the ASM. Do not consolidate two ASM establishments into a single establishment for purposes of the MECS, or separate a single ASM establishment into two MECS establishments.** Match the 11-digit Census File Number (CFN) located on the MECS questionnaire mailing label with the CFN on the ASM mailing label. Responses to MECS questions should include the same activities as those considered when responding to the matching ASM. If this establishment has never completed an ASM, report for all activities that occur at this physical location.

Section 1 – NONCOMBUSTIBLE ENERGY SOURCES

Energy sources used in manufacturing can be divided into two groups: combustible (capable of being burned), and noncombustible (such as electricity, steam, and industrial hot water). The purpose of section 1 is to collect 1988 data for noncombustible energy sources, in particular, electricity and steam.

Column 2 collects data that will provide important information on the components of electricity production, and permit an estimate to be made of the total consumption of electricity at your establishment. Column 3 collects data on the additional contribution that steam makes to the total consumption of energy at your establishment through net transfers and steam generated onsite by renewable energy sources. Column 4 collects data on hot water purchased for use as an energy source and used at this establishment site.

Electricity is to be reported in thousands of kilowatt-hours. Steam and industrial hot water are to be reported in millions of Btu. If you keep your records for steam in pounds, use a factor of 1,200 Btu per pound of steam to convert your data into Btu.

SPECIFIC INSTRUCTIONS

Line 1a – Quantity Purchased From Utilities –

Enter the quantity of each noncombustible energy source that was purchased from a utility and delivered to this establishment site in 1988, regardless of when payment was made. For purposes of this question, utilities are companies that produce and/or deliver electricity and/or natural gas, and are legally obligated to provide service to the general public within their franchise area. Utilities do not include such generators of electricity as independent power producers, small power producers, or cogenerators not located at this establishment site. Include quantities purchased for **ANY** onsite use, for example, production of heat and power, electrolysis processes, or steam cleaning.

Exclude all:

- quantities purchased from independent power producers, small power producers, or cogenerators not located at this establishment site.
- quantities delivered from other establishments in your company even if those quantities were repurchased from them by your establishment.
- quantities purchased and paid for by a central purchasing entity separate from this establishment.
- quantities for which payment was made in-kind.

CONTINUE ON PAGE 2

1988 Manufacturing Energy Consumption Survey Form EIA-846C (Continued)

Page 2

Line 1b — Expenditures For Purchases From Utilities — Enter the total expenditures for the purchased quantities reported on line 1a. Include all expenditures regardless of when payment was actually made.

Line 2a — Quantity Purchased From Nonutilities — Enter the quantity of electricity and steam that was purchased from offsite nonutility power producers and delivered to this establishment site in 1988, regardless of when payment was made. Include quantities purchased for **ANY** onsite use.

Exclude all:

- quantities delivered from other establishments in your company even if those quantities were repurchased from them by your establishment.
- quantities purchased and paid for by a central purchasing entity separate from this establishment.
- quantities for which payment was made in-kind.

Line 2b — Expenditures For Purchases From Nonutilities — Enter the total expenditures for the purchased quantities reported on line 2a. Include all expenditures regardless of when payment was actually made.

Line 3 — Other Receipts — Enter all additional quantities delivered to your establishment site in 1988 but not reported on lines 1a or 2a.

Include:

- quantities purchased and paid for by a central purchasing entity separate from this establishment.
- quantities transferred from another establishment of your company for which payment was not made.
- quantities delivered from another establishment of your company even if those quantities were repurchased from them by your establishment.
- quantities for which payment was made in-kind.

Line 4 — Total Electricity Receipts — Enter the sum of lines 1a, 2a, and 3 for electricity only. *Copy this total electricity receipt figure to column 2, line 1 of Section III — Fuel Switching.*

Line 5 — Quantity Cogenerated — Enter the total quantity of electricity cogenerated from all energy sources, including renewable sources. For purposes of this survey, electrical cogeneration is defined as the production of electric energy and another form of useful energy (such as heat or steam) through the sequential use of energy.

Line 6 — Quantity Generated from Renewables — Enter the total quantity of each noncombustible energy source generated onsite directly from solar power, wind power, hydropower, or geothermal sources. Any electricity produced as a part of a cogeneration process (that is, electricity generated from geothermal steam which is then itself used) should be excluded. Such quantities should be included on line 5.

Line 7 — Other Generation — Enter the total quantity of electricity generated onsite by all other means not included on lines 5 and 6 above. For example, electricity generated by diesel generators should be reported here.

Line 8 — Sales or Transfers to Utilities — Enter the total quantity of electricity sold or transferred by your establishment in 1988 to utilities. For purposes of this survey, utilities are companies that produce and/or deliver electricity and/or natural gas, and are legally obligated to provide service to the general public within their franchise area. Utilities do not include such generators of electricity as independent power producers, small power producers, or cogenerators not located at this establishment site. Include quantities exchanged for the same or any other energy source(s).

Line 9 — Sales or Transfers to Nonutilities — Enter the total quantity of each noncombustible energy source sold or transferred in 1988 to establishments other than utilities. Include quantities exchanged for the same or any other energy source(s).

Line 10 — Nonutility Suppliers — If any electricity reported in column 2, line 3 was obtained by transfer from another establishment of your company, enter the name, address and telephone number of the supplying establishment. If you received transfers from more than one of this type of establishment, use the "Remarks" section to identify remaining suppliers.

Questions 11 and 12 should be completed if there was any electricity generated at this establishment site in 1988 (column 2 has a nonzero entry on lines 5, 6, or 7). If your establishment had no onsite generation in 1988, omit questions 11 and 12 and proceed with Section II — Combustible Energy Sources.

Question 11 — Indicate by checking the appropriate box whether or not this establishment was electrically interconnected with an electric utility (that is, able to deliver electricity to the grid as well as receive electricity) as of December 31, 1988.

Question 12 — Indicate by checking the appropriate box whether or not this establishment was designated as a Qualifying Facility (QF) under the Public Utility Regulatory Policies Act of 1978 (PURPA) as of December 31, 1988.

Section II — COMBUSTIBLE ENERGY SOURCES

Column 1 — Energy Sources to be Reported — Twenty-three energy sources have been preprinted in column 1, separated into the general categories of solids, gases, and liquids. Prior to completing columns 4 through 10, determine from the criteria below which of the preprinted energy sources should be included for reporting and which excluded.

First, EXCLUDE all energy sources that were not consumed for any purpose at this establishment site during 1988. All excluded energy sources should be lined out, and no entries should be made in columns 4 through 10. Next, if your establishment consumed any energy sources for any purpose during 1988 that are not included in the preprinted list, add those energy sources under the "Other" heading for solids, gases, or liquids.

All unlined energy sources, including any additions to the preprinted list, should be further evaluated for inclusion or exclusion by the specific criterion listed below.

If your only means of supply of an energy source during 1988 was as a byproduct of energy source inputs to any of your manufacturing processes, it should be included ONLY if it was at least partially consumed onsite as a fuel during 1988 (that is for heat, power, or electricity generation). If none of that onsite-produced energy source was consumed onsite as a fuel, it should be excluded.

Complete columns 4 through 10 for all energy sources that were not excluded by the above procedures. Entries should be made in accordance with the specific instructions for these columns.

1988 Manufacturing Energy Consumption Survey Form EIA-846C (Continued)

Page 3

Column 3 — Reporting Units — Use the indicated units for reporting all quantities. For those establishments that keep records in Btu, note that volume measures should be reported as actual physical quantities, rather than adjusted to represent a standard energy content. One barrel contains 42 gallons. The approximate liquid equivalent conversion factor of LPG is 3,603 million Btu per barrel. Petroleum coke should also be reported in barrels. A barrel will hold approximately 400 pounds of petroleum coke, or the equivalent of 6.024 million Btu. A short ton of petroleum coke contains approximately 30.12 million Btu. Natural gas should be reported in thousands of cubic feet. One thousand cubic feet of natural gas is equal to about 10.3 therms, or 1.03 million Btu.

Column 4 — Quantity Purchased — Enter the quantity of each energy source that was purchased and delivered to this establishment in 1988, regardless of when payment was made. Include quantities of those energy sources that were purchased for **ANY** onsite use, for example, the production of heat or power, electrolysis processes, steam cleaning, or as a petrochemical feedstock or a raw material input to any manufacturing operation. **Exclude** all:

- quantities delivered from another establishment in your company even if those quantities were repurchased from them by your establishment.
- quantities purchased and paid for by a central purchasing entity separate from this establishment.
- quantities for which payment was made in-kind.

Column 5 — Expenditures — Enter the total expenditures for each of the purchased quantities reported in column 4. Include all expenditures regardless of when payment was made.

Column 6 — Other Receipts — For each included energy source, enter all additional quantities delivered to your establishment site in 1988 but not reported in column 4. **Include:**

- quantities purchased and paid for by a central purchasing entity separate from this establishment.
- quantities transferred from another establishment of your company for which payment was not made.
- quantities delivered from another establishment of your company even if these quantities were repurchased from them by your establishment.
- quantities for which payment was made in-kind.

Column 7 — Onsite Production — Enter the total quantity of any energy source that was produced onsite in 1988 as a product, a byproduct, a waste material, or an output from a captive (onsite) mine or well, and was at least partially consumed onsite. Enter the **TOTAL** quantity produced onsite, regardless of whether some or all of it was consumed as a fuel or feedstock, transferred offsite, sold, or otherwise disposed of. Examples of byproducts include coke, hydrogen, still gas, coke oven gas, wood chips and black liquor. Examples of waste products include wood scraps, packing materials, waste paper and cardboard, and waste oils.

Column 8 — Source of Onsite Production — For each energy source that has an entry in column 7, check the "Yes" box if the amount listed in column 7 resulted from consumption of any other energy source listed in Section II — Combustible Energy Sources. Check the "No" box if the energy source came from captive wells or mines, or is a product or byproduct/waste product from materials not listed in section II as a combustible energy source. Examples include:

- hydrogen produced as a byproduct of natural gas in an ammonia plant would have the "Yes" box checked.
- hydrogen produced through the electrolysis of brine in a chlorine plant would have the "No" box checked.
- coke oven gas produced during the coal coking process would have the "Yes" box checked.
- wood chips produced as a byproduct of wood purchased for use as a raw material rather than a fuel would have the "No" box checked.
- pulping (black) liquor, used in the chemical pulping of wood, that is burned in a recovery furnace or otherwise combusted, would have the "No" box checked.

Column 9 — Onsite Fuel Consumption — Enter the quantity consumed onsite as a fuel for the production of heat, steam, power, or the generation of electricity. Also include fuel consumed by vehicles dedicated primarily for use onsite. Copy the entries, if any, in column 9 for natural gas, distillate fuel oil, residual fuel oil, LPG, and total coal products to line 1 of Section III — Fuel Switching.

Column 10 — Onsite Nonfuel Consumption — Enter the quantity of each energy source that was consumed onsite for all purposes other than fuel use. Include all quantities consumed as feedstocks (for example, butane processed in producing rubber compounds), raw materials (for example, coal used to produce coke), additives, or ingredients for products manufactured by this establishment. Exclude all offsite dispositions such as sales and transfers to other establishments.

Supplemental Questions —

For the purposes of Questions 1, 2a, and 2b, energy sources and their **approximate** Btu conversion factors include:

Acetylene	21,500 Btu/lb
Breeze	19.8 million Btu/short ton
Butane	21,308 Btu/lb
Butylene	20,787 Btu/lb
Coal Coke	24.8 million Btu/short ton
Distillate fuel oil	5,825 million Btu/barrel
Ethane	22,320 Btu/lb
Ethylene	21,644 Btu/lb
Isobutane	21,257 Btu/lb
Petroleum coke	6.024 million Btu/barrel
Propane	21,661 Btu/lb
Propylene	21,041 Btu/lb
Residual fuel oil	6.287 million Btu/barrel

NOTE — If your establishment uses more precise conversion values for your operations, use them in place of the approximations given above.

1988 Manufacturing Energy Consumption Survey Form EIA-846C (Continued)

Page 4

Question 1 — Enter the total Btu content of all energy source products shipped offsite during 1988.

If the answer to question 1 is zero, omit question 2, parts a and b, and proceed directly to question 3. If question 1 has a non-zero response, include in the response to question 2 only those energy source products that were reported in question 1.

Question 2a — Enter the total Btu value of all energy source inventories as of December 31, 1987.

Question 2b — Enter the total Btu value of all energy source inventories as of December 31, 1988.

Question 3 — Enter the total design storage capacity located onsite as of December 31, 1988, for residual fuel oil, distillate fuel oil, and LPG. Report the shell capacity (that is, the design capacity of the storage tanks) in the units of measure specified.

Include:

- onsite capacity of all storage facilities regardless of the intended disposition of the energy source (include both product storage tanks and tanks dedicated for onsite use).
- onsite capacity dedicated or leased for storage of energy sources owned by other establishments.

Section III — FUEL SWITCHING

This portion of the survey is intended to measure the short-term capability of your establishment to have used substitute energy sources in place of those actually consumed in 1988. Capability to use substitute energy sources means that this establishment's combustors (for example, boilers, furnaces, ovens, blast furnaces) had the machinery or equipment either in place or available for installation in 1988 so that substitutions could actually have been introduced within 30 days without extensive modifications.

NOTE — Fuel-switching capability as measured by this survey does not depend on the relative prices of energy sources; it depends only on the characteristics of your equipment and certain legal constraints. Fuel-switching capability sets limits on the extent to which you could switch to a substitute energy source if you wanted to or needed to. It has nothing to do with whether you would want to switch if you could. Therefore, relative prices of energy sources are not related to fuel-switching CAPABILITY and should be ignored when completing this section.

We recognize that records of fuel-switching capability are not regularly maintained. Accordingly, reasonable approximations of fuel-switching capability are acceptable. These approximations should be based on the judgment of a person knowledgeable about the fuel-switching capability and operations of your establishment. They are not expected to be formal engineering estimates based on a day-by-day analysis of the operating levels of individual combustors and interactions between them. Respond as realistically as possible, given your actual operations in 1988.

Base your estimates on the availability of substitute energy sources and the physical condition of your equipment during 1988. Include switching capability that could have resulted from the use of redundant and/or standby combustors, and from combustors that were already equipped to fire alternative fuels. Lines 1 through 3 of this portion of the form measure your establishment's overall capability to have switched from specific energy sources in 1988. Lines 4a through 10b describe your capability to replace a given energy source by specific alternative energy sources.

SPECIFIC INSTRUCTIONS

Line 1 — Quantity Consumed — Enter the total electricity receipts figure from column 2, line 4 of Section I, and the fuel consumption figures from Section II for total coal and coke, natural gas, distillate fuel oil, LPG, and residual fuel oil. The quantities to be copied are noted in the appropriate boxes of sections I and II.

Line 2 — Quantity Nonswitchable — Enter the amount of the quantity reported on Line 1 that could NOT have been replaced within 30 days by any other energy source in 1988, even given a severe curtailment. **NOTE** — Include only that portion of total electricity receipts (purchases plus transfers in) that could NOT have been replaced by either onsite-generated electricity or energy source(s) which accomplish the same purposes as the offsite-produced electricity (e.g. supplying heat or power). Portions of individual fuels may be non-switchable due to limitations such as:

- the characteristics of your physical plant (for example, single-fired combustors or the absence of redundant and/or standby combustors), or the requirements of your manufacturing process.
- binding take or pay contracts with energy suppliers that were in place.
- environmental regulations which limit the amounts of potential replacement fuels that could be burned.

DO NOT consider current relative prices of fuels as a limitation to switching capability.

Line 3 — Quantity Switchable — Subtract line 2 from line 1 and enter the results. These values represent the quantity of each energy source consumed that COULD HAVE BEEN replaced within 30 days by at least one other energy source in 1988. **NOTE** — If all entries on line 3 are zero, complete the Remarks and Certification sections of the survey and return it to the Census Bureau. For each entry on line 3 that is nonzero, complete the remainder of that column. Complete one column before starting another.

Lines 4 through 10, Part a — Replacement Quantities — Report the maximum amount of the quantity shown on Line 3 that could have been replaced within 30 days by each of the energy sources on lines 4 through 10, under the constraints listed in the instructions for line 2. Report all amounts in the units of the energy source that is being replaced. DO NOT convert this amount to units of the replacement energy sources. **NOTE** — Be sure to take into account not only the fuels that could be directly substituted for offsite-produced electricity, but also the fuels needed to generate electricity onsite that could have been used in place of electricity receipts.

NOTE — The sum of lines 4a through 10a for each column must be at least as large as the entry on line 3 of that column, and may be larger if more than one alternative fuel could have been used.

Lines 4 through 10, Part b — Lead Time — Mark the minimum lead time required to switch to each replacement energy source identified.

Section IV — REMARKS

Please provide any explanations that may be helpful to us in understanding your reported data. Attach a separate sheet if necessary. Be sure to include the name, address, and telephone number of nonutility power generating establishments of your company that supplied electricity to your establishment if you did not have enough room in section I to identify them.

Section V — CERTIFICATION

Period Covered By This Report — Enter the month, day, and year of the beginning and the end of the period covered by your report. If a calendar year report: "From January 1 to December 31, 1988,"; if a fiscal year, specify which (such as "From December 1, 1987 to November 30, 1988"). If a part-year report is submitted because the establishment was not in operation or under your company's control for the entire year, specify the actual period covered: for example "January 2, 1988 to August 15, 1988," or "June 1, 1988 to December 31, 1988."

Appendix D

**Descriptions of
Industry Groups
and Selected
Industries**

Appendix D

Descriptions of Major Industrial Groups and Selected Industries

This appendix contains descriptions of industrial groups and selected industries taken from the *Standard Industrial Classification Manual, 1987* (SIC).³³ This appendix includes descriptions of the 30 groups that comprise the strata of the Manufacturing Energy Consumption Survey. These are the 20 major industrial groups (2-digit SIC) and the 10 major energy-consuming industries (4-digit SIC). The Standard Industrial Classification system is described in Appendix A.

SIC 20—Food and Kindred Products: This major group includes establishments manufacturing foods and beverages for human consumption and certain related products such as manufactured ice, chewing gum, vegetable and animal fats and oils, and prepared feeds for animals and fowls.

SIC 21—Tobacco Products: This major group includes establishments engaged in manufacturing cigarettes, cigars, smoking and chewing tobacco, snuff, and reconstituted tobacco and in stemming and redrying tobacco.

SIC 22—Textile Mill Products: This major group includes establishments engaged in performing any of the following operations: (1) preparation of fiber and subsequent manufacturing of yarn, thread, braids, twine, and cordage; (2) manufacturing broadwoven fabrics, narrow woven fabrics, knit fabrics, and carpets and rugs from yarn; (3) dyeing and finishing fiber, yarn, fabrics, and knit apparel; (4) coating, waterproofing, or otherwise treating fabrics; (5) the integrated manufacture of knit apparel and other finished articles from yarn; and (6) the manufacture of felt goods, lace goods, nonwoven fabrics, and miscellaneous textiles.

SIC 23—Apparel and Other Textile Products: This major group, known as the cutting-up and needle trades, includes establishments producing clothing and fabricating products by cutting and sewing purchased woven or knit textile fabrics and related materials, such as leather, rubberized fabrics, plastics, and furs.

SIC 24—Lumber and Wood Products: This major group includes establishments engaged in cutting timber and pulpwood; merchant sawmills, lath mills, shingle mills, cooperage stock mills, planing mills, and plywood and veneer mills engaged in producing lumber and wood basic materials; and establishments engaged in manufacturing finished articles made entirely or mainly of wood or related materials.

SIC 25—Furniture and Fixtures: This major group includes establishments engaged in manufacturing household, office, public building, and restaurant furniture; and office and store fixtures.

SIC 26—Paper and Allied Products: This major group includes establishments primarily engaged in the manufacture of pulps from wood and other cellulose fibers, and from rags; the manufacture of paper and paper board; and the manufacture of paper and paperboard into converted products, such as paper coated off the paper machine, paper bags, paper boxes, and envelopes.

SIC 2621—Paper Mills: Establishments primarily engaged in manufacturing paper from wood pulp and other fiber pulp, and which may also manufacture converted paper products.

SIC 2631—Paperboard Mills: Establishments primarily engaged in manufacturing paperboard, including paperboard coated on the paperboard machine, from wood pulp and other fiber pulp.

³³Executive Office of the President, Office of Management and Budget, *Standard Industrial Classification Manual, 1987*, pp. 67-263.

SIC 27—Printing and Publishing: This major group includes establishments engaged in printing by one or more common processes, such as letterpress, lithography (including offset), gravure, or screen; and those establishments which perform services for the printing trade, such as bookbinding and platemaking.

SIC 28—Chemicals and Allied Products: This major group includes establishments producing basic chemicals, and establishments manufacturing products by predominantly chemical processes. Establishments classified in this major group manufacture three general classes of products: (1) basic chemicals, such as acids, alkalies, salts, and organic chemicals; (2) chemical products to be used in further manufacture, such as synthetic fibers, plastics materials, dry colors, and pigments; and (3) finished chemical products to be used for ultimate consumption, such as drugs, cosmetics, and soaps; or to be used as materials or supplies in other industries, such as paints, fertilizers, and explosives.

SIC 2819—Industrial Inorganic Chemicals, Not Elsewhere Classified: Establishments primarily engaged in manufacturing industrial inorganic chemicals, excluding alkalies and chlorine, industrial gases, and inorganic pigments.

SIC 2821—Plastics Materials and Resins: Establishments primarily engaged in manufacturing synthetic resins, plastics materials, and nonvulcanizable elastomers.

SIC 2869—Industrial Organic Chemicals, Not Elsewhere Classified: Establishments primarily engaged in manufacturing industrial organic chemicals, excluding gum and wood chemicals, and cyclic organic crudes and intermediates, and organic dyes and pigments.

SIC 2873—Nitrogenous Fertilizers: Establishments primarily engaged in manufacturing nitrogenous fertilizer materials or mixed fertilizers from nitrogenous materials produced in the same establishment.

SIC 29—Petroleum Refining and Related Industries: This major group includes establishments primarily engaged in petroleum refining, manufacturing paving and roofing materials, and compounding lubricating oils and greases from purchased materials.

SIC 2911—Petroleum Refining: Establishments primarily engaged in producing gasoline, kerosene, distillate fuel oils, residual fuel oils, and lubricants, through fractionation or straight distillation of crude oil, redistillation of unfinished petroleum derivatives, cracking or other processes.

SIC 30—Rubber and Miscellaneous Plastics Products: This major group includes establishments manufacturing products, not elsewhere classified, from plastics, resins, and from natural, synthetic, or reclaimed rubber, gutta percha, balata, or gutta siak.

SIC 31—Leather and Leather Products: This major group includes establishments engaged in tanning, currying, and finishing hides and skins, leather converters, and establishments manufacturing finished leather and artificial leather products and some similar products made of other materials.

SIC 32—Stone, Clay, Glass, and Concrete Products: This major group includes establishments manufacturing flat glass and other glass products, cement, structural clay products, pottery, concrete and gypsum products, cut stone, abrasive and asbestos products, and other products from materials taken principally from the earth in the form of stone, clay, and sand.

SIC 3241—Cement, Hydraulic: Establishments primarily engaged in manufacturing hydraulic cement, including portland, natural, masonry, and pozzolana cements.

SIC 33—Primary Metal Industries: This major group includes establishments engaged in smelting and refining ferrous and nonferrous metals from ore, pig, or scrap; in rolling, drawing, and alloying metals; in manufacturing castings and other basic metal products; and in manufacturing nails, spikes, and insulated wire and cable.

SIC 3312—Steel Works, Blast Furnaces (Including Coke Ovens), and Rolling Mills: Establishments primarily engaged in manufacturing hot metal, pig iron, and silvery pig iron from iron ore and iron and steel scrap; converting pig iron, scrap iron, and scrap steel into steel; and in hot-rolling iron and steel into basic shapes, such as plates, sheets, strips, rods, bars, and tubing.

SIC 3334—Primary Production of Aluminum: Establishments primarily engaged in producing aluminum from alumina and in refining aluminum by any process.

SIC 34—Fabricated Metal Products: This major group includes establishments engaged in fabricating ferrous and nonferrous metal products such as metal cans, tinware, handtools, cutlery, general hardware, nonelectric heating apparatus, fabricated structural metal products, metal forgings, metal stampings, ordnance (except vehicles and guided missiles), and a variety of metal and wire products, not elsewhere classified.

SIC 35—Industrial Machinery and Equipment: This major group includes establishments engaged in manufacturing industrial and commercial machinery and equipment and computers.

SIC 36—Electronic and Other Electric Equipment: This major group includes establishments engaged in manufacturing machinery, apparatus, and supplies for the generation, storage, transmission, transformation, and utilization of electrical energy.

SIC 37—Transportation Equipment: This major group includes establishments engaged in manufacturing equipment for transportation of passengers and cargo by land, air, and water.

SIC 38—Instruments and Related Products: This major group includes establishments engaged in manufacturing instruments (including professional and scientific) for measuring, testing, analyzing, and controlling, and their associated sensors and accessories; optical instruments and lenses; surveying and drafting instruments; hydrological, hydrographic, meteorological, and geophysical equipment; search, detection, navigation, and guidance systems and equipment; surgical, medical, and dental instruments, equipment and supplies; ophthalmic goods; photographic equipment and supplies; and watches and clocks.

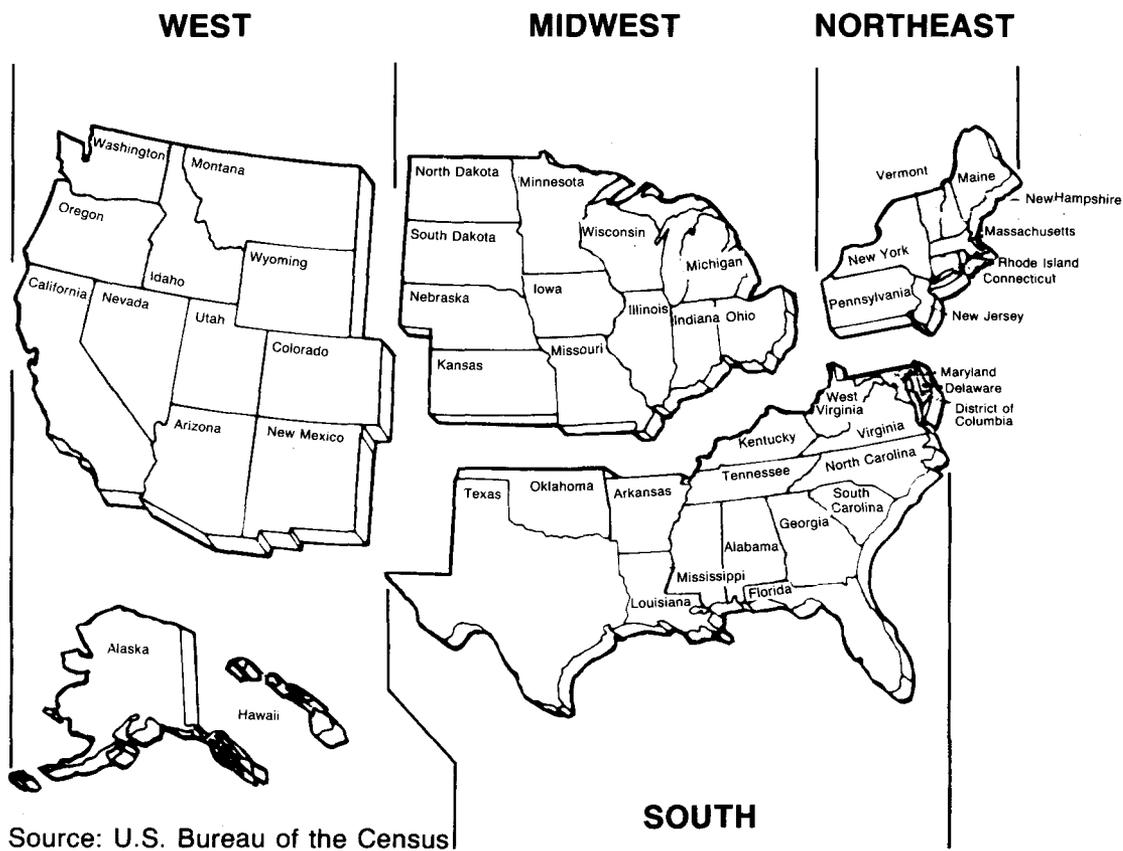
SIC 39—Miscellaneous Manufacturing Industries: This major group includes establishments primarily engaged in manufacturing products not classified in any other major group.

Appendix E

**Map of U.S.
Census Regions**

Appendix E

Map of U.S. Census Regions



Appendix F

**Related EIA
Publications on
Energy
Consumption**

Appendix F

Related EIA Publications on Energy Consumption

These publications are available from the National Energy Information Center or the Superintendent of Documents. See the inside cover of this report on how to obtain copies of these publications. Please note that the prices quoted are subject to change.

In addition to the reports listed below, public use data tapes for the residential, residential transportation and commercial sectors are available from the National Technical Information Service (NTIS). To obtain information on how to order tapes, you may call NTIS at 703/487-4807, FAX number 703/321-8547.

Industrial Sector

Manufacturing Energy Consumption Survey: Energy Efficiency in Manufacturing, 1985; January 1990, DOE/EIA-0516(85), GPO Stock No. 061-00300650-7, \$4.25.

Manufacturing Energy Consumption Survey: Fuel Switching Capability, 1985; December 1988, DOE/EIA-0515(85), GPO Stock No. 061-003-00601-9, \$3.50.

Manufacturing Energy Consumption Survey: Methodological Report, 1985; November 1988, DOE/EIA-0514(85), GPO Stock No. 061-00300595-1, \$6.00.

Manufacturing Energy Consumption Survey: Consumption of Energy, 1985; November 1988, DOE/EIA-0512(85), GPO Stock No. 061-003-00594-2, \$6.00.

"Manufacturing Sector Energy Consumption 1985 Provisional Estimates," Monthly Energy Review, January 1987, DOE/EIA-0035(87/01), pp. vii-x.

Report on the 1980 Manufacturing Industries' Energy Consumption Study and Survey of Large Combustors; February 1983, DOE/EIA-0358, GPO Stock No. 061-003-00293-5, \$5.00.

Industrial Energy Consumption, "Survey of Large Combustors: Report on Alternate Fuel-Burning Capabilities of Large Boilers in 1979"; February 1982, DOE/EIA-0304, GPO Stock No. 061-003-0233-1, \$2.50.

Methodological Report of the 1980 Manufacturing Industries Survey of Large Combustors (EIA-463); March 1982, DOE/EIA-0306 (no GPO Stock No.).

Commercial Sector

Note: The name of the Nonresidential Buildings Energy Consumption Survey was changed to the Commercial Buildings Energy Consumption Survey, beginning with the 1989 survey. The survey name was also dropped from the report title.

Characteristics of Buildings

Nonresidential Buildings Energy Consumption Survey: Characteristics of Commercial Buildings, 1986; September 1988, DOE/EIA-0246(86), GPO Stock No. 061-003-00580-2, \$16.00.

Nonresidential Buildings Energy Consumption Survey: Characteristics of Commercial Buildings, 1983; July 1985, DOE/EIA-0246(83), GPO Stock No. 061-003-00439-3, \$7.50.

Nonresidential Buildings Energy Consumption Survey: Characteristics of Commercial Buildings, 1983; A Supplemental Reference, DOE/EIA-M008, \$22.95. Available from the NTIS, Order No. DE-85015581.

Nonresidential Buildings Energy Consumption Survey: Fuel Characteristics and Conservation Practices; June 1981, DOE/EIA-0278, GPO Stock No. 061-00300200-5, \$9.00.

Nonresidential Buildings Energy Consumption Survey: Building Characteristics; March 1981, DOE/EIA-0246, GPO Stock No. 061-003-00171-8, \$6.50.

Consumption and Expenditures

Nonresidential Buildings Energy Consumption Survey: Commercial Buildings Consumption and Expenditures 1986; May 1989, DOE/EIA-0318(86), GPO Stock No. 061-003-00613-2, \$19.00.

Nonresidential Buildings Energy Consumption Survey: Commercial Buildings, Consumption and Expenditures 1983; September 1986, DOE/EIA-0318(83), GPO Stock No. 061-003-00496-2, \$13.00.

Nonresidential Buildings Energy Consumption Survey: 1979 Consumption and Expenditures, Part 1: Natural Gas and Electricity; March 1983, DOE/EIA-0318/1, GPO Stock No. 061-003-00298-6, \$9.50.

Nonresidential Buildings Energy Consumption Survey: 1979 Consumption and Expenditures, Part 2: Steam, Coal, Fuel Oil, LPG, and Total Fuels; December 1983, DOE/EIA-0318(79)/2, GPO Stock No. 061003-00366-4, \$6.00.

Residential Transportation Sector

Note: The survey name was dropped from the beginning of the report title starting with the 1988 data report, and the report title changed to "*Household Vehicles Energy Consumption 1988*."

Household Vehicles Energy Consumption 1988; February 1990, DOE/EIA-0464(88), GPO Stock No. 061-003-00652-3, \$11.00.

Residential Transportation Energy Consumption Survey: Consumption Patterns of Household Vehicles 1985; April 1987, DOE/EIA-0464(85), GPO Stock No. 061-003-00521-7, \$8.50.

Residential Transportation Energy Consumption Survey: Consumption Patterns of Household Vehicles, 1983; January 1985, DOE/EIA-0464(83), GPO Stock No. 061-003-00420-2, \$4.50.

Residential Energy Consumption Survey: Consumption Patterns of Household Vehicles, Supplement: January 1981 to September 1981; February 1983,

DOE/EIA-0328, GPO Stock No. 061-003-00297-8, \$4.75.

Residential Energy Consumption Survey: Consumption Patterns of Household Vehicles, June 1979 to December 1980; April 1982, DOE/EIA-0319 (no GPO Stock No.).

Residential Sector

Housing Characteristics

Note: The survey name was dropped from the beginning of the report title starting with the 1987 data reports.

Housing Characteristics 1987; May 1989, DOE/EIA-0314(87), GPO Stock No. 061-003-00619-1, \$13.00.

Residential Energy Consumption Survey: Housing Characteristics 1984; October 1986, DOE/EIA-0314(84), GPO Stock No. 061-003-00499-7, \$12.00.

Residential Energy Consumption Survey: Housing Characteristics, 1982; August 1984, DOE/EIA-0314(82), GPO Stock No. 061-003-00393-1, \$7.00.

Residential Energy Consumption Survey Housing Characteristics, 1981; August 1983, DOE/EIA-0314(81), GPO Stock No. 061-003-00330-3, \$6.50.

Residential Energy Consumption Survey: Housing Characteristics, 1980; June 1982, DOE/EIA-0314, GPO Stock No. 061-003-00256-1, \$11.00.

Residential Energy Consumption Survey: Characteristics of the Housing Stock and Households, 1978; February 1980, DOE/EIA-0207/2, GPO Stock No. 061-003-00093-2, \$4.25.

Residential Energy Consumption Survey: Conservation; February 1980, DOE/EIA-0207/3, GPO Stock No. 061003-00087-8, \$6.00.

Preliminary Conservation Tables from the National Interim Energy Consumption Survey; August 1979, DOE/EIA-0193/P (no GPO Stock No.).

Characteristics of the Housing Stock and Households: Preliminary Findings from the National Interim Energy Consumption Survey; October 1979, DOE/EIA-0199/P (no GPO Stock No. available).

Consumption and Expenditures

Note: The survey name was dropped from the beginning of the report title starting with the 1987 data reports. The titles were changed to *Household Energy Consumption and Expenditures 1987, Part 1 and Part 2*.

Household Energy Consumption and Expenditures 1987, Part 1: National Data; October 1989, DOE/EIA-0321/1(87), GPO Stock No. 061-003-00635-3, \$15.00. Note: Energy end-use data are included in this report.

Household Energy Consumption and Expenditures 1987, Part 2: Regional Data; DOE/EIA-0321/2(87) (no GPO Stock No available), \$16.00.

Residential Energy Consumption Survey: Consumption and Expenditures, April 1984 Through March 1985, Part 1: National Data; March 1987, DOE/EIA-0321/1(84), GPO Stock No. 061-003-00519-5, \$9.50.

Residential Energy Consumption Survey: Consumption and Expenditures, April 1984 Through March 1985, Part 2: Regional Data; May 1987, DOE/EIA-0321/2(84), GPO Stock No. 061-003-00528-4, \$17.00. Note: Energy end-use data are included in this report.

Residential Energy Consumption Survey: Consumption and Expenditures, April 1982 Through March 1983, Part 1: National Data; November 1984, DOE/EIA-0321/1(82), GPO Stock No. 061-003-00411-3, \$7.00.

Residential Energy Consumption Survey: Consumption and Expenditures, April 1982 Through March 1983, Part 2: Regional Data; December 1984, DOE/EIA-0321/2(82), GPO Stock No. 061-003-00414-8, \$9.50.

Residential Energy Consumption Survey: Consumption and Expenditures, April 1981 Through March 1982, Part 1: National Data; September 1983, DOE/EIA-0321/1(81), GPO Stock No. 061-003-00340-1, \$6.00.

Residential Energy Consumption Survey: Consumption and Expenditures, April 1981 Through March 1982, Part 2: Regional Data; October 1983, DOE/EIA-0321/2(81), GPO Stock No. 061-003-00357-5, \$8.00.

Residential Energy Consumption Survey: Consumption and Expenditures, April 1980 Through March 1981, Part 1: National Data; September 1982, DOE/EIA-0321/1(80), GPO Stock No. 061-003-00278-1, \$7.50.

Residential Energy Consumption Survey: Consumption and Expenditures, April 1980 Through March 1981, Part 2: Regional Data; June 1983, DOE/EIA-0321/2(80), GPO Stock No. 061-003-00319-2, \$7.00.

Residential Energy Consumption Survey: 1979-1980 Consumption and Expenditures, Part 1: National Data (Including Conservation); April 1981, DOE/EIA-0262/1, GPO Stock No. 061-00300191-2, \$6.50.

Residential Energy Consumption Survey: 1979-1980 Consumption and Expenditures, Part II: Regional Data; May 1981, DOE/EIA-0262/2, GPO Stock No. 061-003-00189-1, \$8.50.

Residential Energy Consumption Survey: Consumption and Expenditures, April 1978 Through March 1979; July 1980, DOE/EIA-0207/5, GPO Stock No. 061-003-00131-9, \$7.50.

Single-Family Households: Fuel Oil Inventories and Expenditures: National Interim Energy Consumption Survey; December 1979, DOE/EIA-0207/1, GPO Stock No. 061-003-00075-4, \$3.50.

Other Publications on the Residential Sector

"*End-Use Consumption of Residential Energy*" (Article), pp. vii-xiv, *Monthly Energy Review*, July 1987, DOE/EIA-0035(87/07).

Residential Energy Consumption Survey: Trends in Consumption and Expenditures 1978-1984 June 1987, DOE/EIA-0482, GPO Stock No. 061-003-00535-7, \$12.00.

Residential Conservation Measures; July 1986, SR/EEUD/86/01 (no GPO Stock No.).

An Economic Evaluation of Energy Conservation and Renewable Energy Tax Credits; October 1985, Service Report (no GPO Stock No.).

Residential Energy Consumption and Expenditures by End Use for 1978, 1980, and 1981; December 1984, DOE/EIA-0458, GPO Stock No. 061-003-00415-6, \$4.50.

Weatherization Program Evaluation, SR-EEUD-84-1; August 1984 (available from the Office of the Assistant Secretary for Conservation and Renewable Energy, Department of Energy).

Residential Energy Consumption Survey: Regression Analysis of Energy Consumption by End Use; October 1983, DOE/EIA-0431, GPO Stock No. 061-00300347-8, \$5.00.

National Interim Energy Consumption Survey: Exploring the Variability In Energy Consumption; July 1981, DOE/EIA-0272, GPO Stock No. 061-003-00205-6, \$5.00.

National Interim Energy Consumption Survey: Exploring the Variability in Energy Consumption--A Supplement; October 1981, DOE/EIA-0272/S, GPO Stock No. 061-003-00217-0, \$4.50.

Energy Use by U.S. Households; November 1980, DOE/EIA-0248 (brochure, no GPO Stock No.).

Cross-Sector

Energy Consumption by End-Use Sector: A Comparison of Measures by Consumption and Supply Surveys; April 6, 1990, DOE/EIA-0533 (no GPO Stock No. available), \$2.50.

Natural Gas: Use and Expenditures; April 1983, DOE/EIA-0382, GPO Stock No. 061-003-00307-9, \$5.50.

Public Use Tapes

Note: All tapes are available through the NTIS.

Residential and Residential Transportation Sectors

Residential Energy Consumption Survey: 1987 and Residential Transportation Energy Consumption Survey, 1988, Order No. PB90-501461, \$220.

Residential Energy Consumption Survey: 1984 and Residential Transportation Energy Consumption Survey, 1985; Order No. PB87-186540, \$220.

Residential Energy Consumption Survey: 1982 and Residential Transportation Energy Consumption Survey, 1983; Order No. PB85-221760, \$220.

Residential Energy Consumption Survey: Consumption and Expenditures, 1980-1981; Monthly Billing Data; Order No. PB84-166230, \$220.

Residential Energy Consumption Survey: Housing Characteristics, 1981; Consumption and Expenditures, 1981-1982; Monthly Billing Data; Order No. PB84-120476, \$220.

Residential Energy Consumption Survey: Housing Characteristics, Annualized Consumption and Expenditures, 1980-1981; Order No. PB83-199554, \$220.

Residential Energy Consumption Survey: Household Transportation Panel Monthly Gas Purchases and Vehicle and Household Characteristics, 6/79-9/81; Order No. PB84-162452, \$220.

Residential Energy Consumption Survey: Household Screener Survey, 1979-1980; Order No. PB82-114877, \$220.

Residential Energy Consumption Survey: Household Monthly Energy Consumption and Expenditures, 1978-1979; Order No. PB82-114901, \$220.

National Interim Energy Consumption Survey (Residential), 1978; Order No. PB81-108714, \$220.

Commercial Sector

Nonresidential Buildings Energy Consumption Survey: 1986 Data; Order No. PB90-500034, \$220.

Nonresidential Buildings Energy Consumption Survey: 1979 and 1983 Data; Order No. PB88-245162, \$220.

Public Use Diskettes

Note: All diskettes are available through the NTIS.

Residential Energy Consumption Survey 1987 Data, ASCII format: Order No. PB-91-505115, \$130, and dBASE format: Order No. PB-91-505107, \$130.

Nonresidential Buildings Energy Consumption Survey 1986 Data, ASCII format: Order No. PB91-506808, \$130.

Residential Transportation Energy Consumption Survey 1988 Data (Ordering information not available, order from NTIS by title.)

Planned Publications

Manufacturing Energy Consumption Survey: Fuel Switching Capability 1988; planned for September 1991.

Manufacturing Energy Consumption Survey: Changes in Energy Efficiency Through 1988; planned for January 1992.

Manufacturing Energy Consumption Survey: Changes in Energy Consumption 1985 - 1988; planned for early 1992.

Commercial Buildings Consumption and Expenditures 1989; planned for early 1992.

Housing Characteristics 1990; planned for March 1992.

Household Energy Consumption and Expenditures 1990, Part 1: National Data; planned for September 1992.

Household Energy Consumption and Expenditures 1990, Part 2: Regional Data; planned for December 1992.

Household Vehicles Energy Consumption 1991; planned for December 1992.

Note: the Energy Information Administration also publishes the *State Energy Data Report Consumption Estimates* annually, DOE/EIA-0214.

Glossary

Anthracite: A hard, black, lustrous coal containing a high percentage of fixed carbon and a low percentage of volatile matter. It is often referred to as hard coal.

Barrel: A volumetric unit of measure equivalent to 42 U.S. gallons.

Biomass: Organic (animal waste), nonfossil plant material constituting an exploitable energy source.

Bituminous Coal: A soft coal (the most common solid fossil fuel), which is high in carbonaceous matter, with a volatility greater than anthracite.

Blast Furnace: A shaft furnace in which solid fuel is burned with an air blast to smelt ore in a continuous operation.

Blast Furnace Gas: The waste combustible gas generated in a blast furnace when iron ore is being reduced with coke to metallic iron. It is commonly used as a fuel within the steel works.

Breeze: The residue from the fine screenings of crushed coke.

British Thermal Unit (Btu): The amount of energy required to raise the temperature of one pound of water one degree Fahrenheit.

Butane (C₄H₁₀): A normally gaseous, paraffinic hydrocarbon extracted from natural gas or refinery gas streams. It includes isobutane (a branch-chain configuration) and isobutane (a straight-chain configuration). It is used primarily for blending into high-octane gasoline, for residential and commercial heating, and for industrial uses, especially the manufacture of chemicals and rubber.

Butylene (C₄H₈): A normally gaseous, olefinic hydrocarbon recovered from the refinery processes, and converted to alkylate, a high-octane gasoline blending component.

Byproduct: A secondary or additional product resulting from the feedstock use of energy or the processing of nonenergy materials. For example, the more common byproducts of coke ovens are

coal gas, tar, and a mixture of benzene, toluene, and xylenes (BTX).

Census Region: A geographic area defined by the Bureau of the Census, consisting of various States selected according to population size and physical location. The States are grouped into four regions:

1. Northeast: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.
2. South: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia.
3. Midwest: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.
4. West: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

Coal Coke: The strong, porous residue, consisting of carbon and mineral ash, which is formed when the volatile constituents of bituminous coal are driven off by heat in the absence of or with a limited supply of air. Coal coke is used primarily in blast furnaces.

Cogeneration: The production of electrical energy and another form of useful energy (such as heat or steam) through the sequential use of energy.

Coke Oven Gas: The mixture of permanent gases produced by the carbonization of coal in a coke oven at temperatures in excess of 1,000 degrees Celsius.

Consumption: The use of energy as a source of heat or power, or as an input to the manufacturing process.

Conversion Factor: A number which translates units of one system into corresponding values of

another system. Conversion factors are used to translate physical units of measure for various energy sources into their Btu equivalents.

Crude Oil: A mixture of hydrocarbons that exists in a liquid state in natural underground reservoirs and remains liquid at atmospheric pressure after passing through surface separating facilities. Crude oil is reported as liquid equivalents at the surface (excluding basic sediment and water), measured in terms of stock tank barrels of 42 U.S. gallons at atmospheric pressure, and corrected to 60 degrees Fahrenheit.

Distillate Fuel Oil: A general classification for light fuel oils distilled during the refining process. The classification includes products known as Nos. 1, 2, and 4 fuel oils; and Nos. 1, 2, and 4 diesel fuels. Distillate fuel oil is used primarily for space heating, on-and-off highway engine fuel, and electric power generation.

Energy: The capacity for doing work as measured in the capability of doing work (potential energy) or the conversion of this capability to motion (kinetic energy).

Energy Source: A substance such as natural gas, coal, or electricity that supplies heat or power.

Establishment: As defined by the *1987 Standard Industrial Classification Manual*, "...an economic unit, generally at a single physical location, where business is conducted or where services or industrial operations are performed." (See **Manufacturing Establishment**.)

Ethane (C₂H₆): A colorless, odorless, gaseous hydrocarbon extracted from natural gas or refinery gas streams. Ethane is used primarily as a petrochemical feedstock for the production of chemicals and plastic materials.

Ethylene (C₂H₄): A colorless, flammable, gaseous olefinic hydrocarbon recovered from natural gas and petroleum. Ethylene is used primarily as a petrochemical feedstock for numerous chemical applications and the production of consumer goods.

Expenditures: Funds spent for energy purchased and paid for, or delivered to a manufacturer during a calendar year. For the purposes of the MECS, the expenditure dollar includes State and local taxes and delivery charges.

Fossil Fuel: Any naturally occurring organic fuel, such as coal crude oil, and natural gas.

Fuel: Any substance that can be burned to produce heat.

Fuel Use (of Energy): Use of energy in the production of heat, steam, power, or the generation of electricity.

Generation: The process of producing steam or electrical energy by transforming other forms of energy.

Geothermal Energy: Hot water or steam, extracted from reservoirs in the earth's crust, which is generally supplied to steam turbines that drive generators to produce electricity.

Hydroelectric Power: Electricity generated by a turbine driven by falling water.

Hydrogen (H₂): A colorless, odorless, highly flammable gaseous element; the lightest of all gases and the most abundant element in the universe.

Industrial Sector: A subdivision of U.S. economic activity defined by the Energy Information Administration to include manufacturing, construction, mining, agriculture, fishing, and forestry establishments.

Kilowatthour (kWh): A unit of work or energy, measured as 1,000 watts (1 kilowatt) of power expended for 1 hour. Once generated, one kWh is equivalent to 3,412 Btu.

Liquefied Petroleum Gases (LPG): Ethane, ethylene, propane, propylene, normal butane, butylene, ethane-propanemixtures, propane-butanemixtures, and isobutane produced at refineries or natural gas processing plants, including plants that fractionate raw natural gas plant liquids.

Lease Condensate: A natural gas liquid recovered from gas well gas (associated and nonassociated) in lease separators or field facilities. Lease condensate consists primarily of pentanes and heavier hydrocarbons. Volumes are reported in terms of barrels of 42 U.S. gallons, at atmospheric pressure, and corrected to 60 degrees Fahrenheit.

Lease Separator: A facility located at the surface for the purposes of (1) separating casinghead gas from produced crude oil and water at the tempera-

ture and pressure conditions of the separator; and (2) separating gas from that portion of associated gas and nonassociated gas which liquefies at temperature and pressure conditions of the separator.

Lignite: A brownish-black coal of low rank with a high percentage of inherent moisture and volatile matter content. It is also referred to as brown coal.

Manufacturing Division: One of 10 fields of economic activity defined by the *Standard Industrial Classification Manual*. The manufacturing division includes all establishments engaged in the mechanical or chemical transformation of materials or substances into new products. Other divisions of the U.S. economy are agriculture, forestry, fishing, hunting, and trapping; mining; construction; transportation, communications, electric, gas, and sanitary services; wholesale trade; retail trade; finance, insurance, and real estate; personal, business, professional, repair, recreation, and other services; and public administration. The establishments in the manufacturing division constitute the universe for the MECS.

Manufacturing Establishment: An economic unit at a single physical location where mechanical or chemical transformation of materials or substances into new products are performed. These operations are generally conducted in facilities described as plants, factories, or mills, and characteristically use power-driven machines and materials-handling equipment. In addition, the assembly of components of manufactured products is considered manufacturing, as in the blending of materials such as lubricating oils, plastics, resins, or liquors. (See **Establishment**.)

Motor Gasoline: A complex mixture of relatively volatile hydrocarbons, with or without small quantities of additives, obtained by blending appropriate refinery streams to form a fuel suitable for use in spark-ignition engines. Motor gasoline includes both leaded and unleaded grades of finished motor gasoline, blending components, and gasohol.

Natural Gas: A mixture of hydrocarbon compounds and small quantities of various nonhydrocarbons existing in the gaseous phase or in solution with oil in natural underground reservoirs at reservoir conditions. Natural gas may be subclassified as:

1. **Associated Gas:** Free natural gas, commonly known as gas-cap gas, which overlies and is in contact with crude oil in the reservoir.
2. **Dissolved Gas:** Natural gas which is in solution with crude oil in the reservoir at reservoir conditions.
3. **Nonassociated Gas:** Free natural gas not in contact with crude oil in the reservoir.

All natural gas volumes are reported in cubic feet at a pressure base of 14.73 psia, at 60 degrees Fahrenheit.

Nonfuel Use (of Energy): Use of energy as a feedstock or raw material input.

Petroleum Coke: A solid residue, high in carbon content and low in hydrogen, which is the final product of thermal decomposition in the condensation process in cracking crude oil. Petroleum coke can yield almost pure carbon or artificial graphite suitable for the production of carbon or graphite electrodes, structural graphite, motor brushes, dry cells, and similar products.

Petrochemical Feedstock: Chemical feedstocks derived from petroleum, and used principally for the manufacture of chemicals, synthetic rubber, and a variety of plastics.

Plant: Commonly used as a synonym for an establishment. However, the term can also be used to refer to a particular process within an establishment.

Propane (C₃H₈): A colorless, gaseous hydrocarbon extracted from natural gas or refinery gas streams. It is used primarily for residential and commercial heating and cooling, and also as a fuel for transportation. Industrial applications include use as a petrochemical feedstock.

Propylene (C₃H₆): A gaseous hydrocarbon recovered from refinery processes. Propylene is used primarily as a petrochemical feedstock.

Pulping Liquor (Black Liquor): The alkaline spent liquor removed from the digesters in the process of chemically pulping wood. After evaporation, the liquor is burned as a fuel in a recovery furnace that permits the recovery of certain basic chemicals.

Quadrillion Btu: Equivalent to 10¹⁵ Btu.

Refinery: A plant, device, or process which heats crude oil so that it separates into chemical components, which are then distilled off as more usable substances.

Relative Standard Error (RSE): A percentage measure of the precision of a survey statistic. The RSE is defined as the standard error of a survey estimate divided by the survey estimate and multiplied by 100. The standard error is the square root of the variance.

Residual Fuel Oil: The general classification for the heavier oils that remain after the distillate fuel oils and lighter hydrocarbons are distilled away in refinery operations. The classification includes No. 5 (light and heavy), No. 6 (including heavy-grade, so called Bunker C oil), and Navy Special fuel oil.

Roundwood: Wood cut specifically for use as a fuel.

Short Ton: A unit of weight equal to 2,000 pounds.

Solar Energy: The radiant energy of the sun, which can be converted into other forms of energy, such as heat or electricity.

Standard Industrial Classification (SIC): A classification scheme developed by the Office of Management and Budget, which categorizes establishments into groups with similar economic activities.

Still Gas (Refinery Gas): Any form or mixture of gas produced in refineries by distillation, cracking, reforming, and other processes, the principal constituents of which are methane, hydrogen, ethane, ethylene, propane, propylene, butanes, butylene, etc. Still gas is used as a petrochemical feedstock and as a fuel in refineries.

Storage Capacity: For the purposes of the MECS, storage capacity includes any volumetric capacity (including tank tops and tank bottoms) that is on the establishment site even it is dedicated or leased for the storage of an energy source by other establishments.

Subbituminous Coal: A dull, black coal of intermediate rank between lignite and bituminous coal. Subbituminous coal, like bituminous coal, is used as a fuel.

Turbine: A machine for generating rotary mechanical power from an energy stream (such as water, steam, or hot gas). Turbines convert kinetic energy to mechanical energy through the principles of impulse and reaction, or a mixture of the two.

Waste Materials: Otherwise discarded combustible materials which, when burned, produce energy for such purposes as space heating and electric power generation. The size of the waste may be reduced by shredders, grinders, or hammermills. Noncombustible materials, if any, may be removed. The waste may be dried and then burned, either alone or in combination with fossil fuels.

Waste Oils and Tar: Petroleum-based materials that are worthless for any purpose other than fuel use.

Wind Energy: Energy present in wind motion that can be converted to mechanical energy for driving pumps, mills, and electric power generators. Wind pushes against sails, vanes, or blades radiating from a central rotating shaft.

Wood Waste: Wood byproducts used as a fuel. Included are limb wood, wood chips, bark, sawdust, forest residues, charcoal, and pulp waste.

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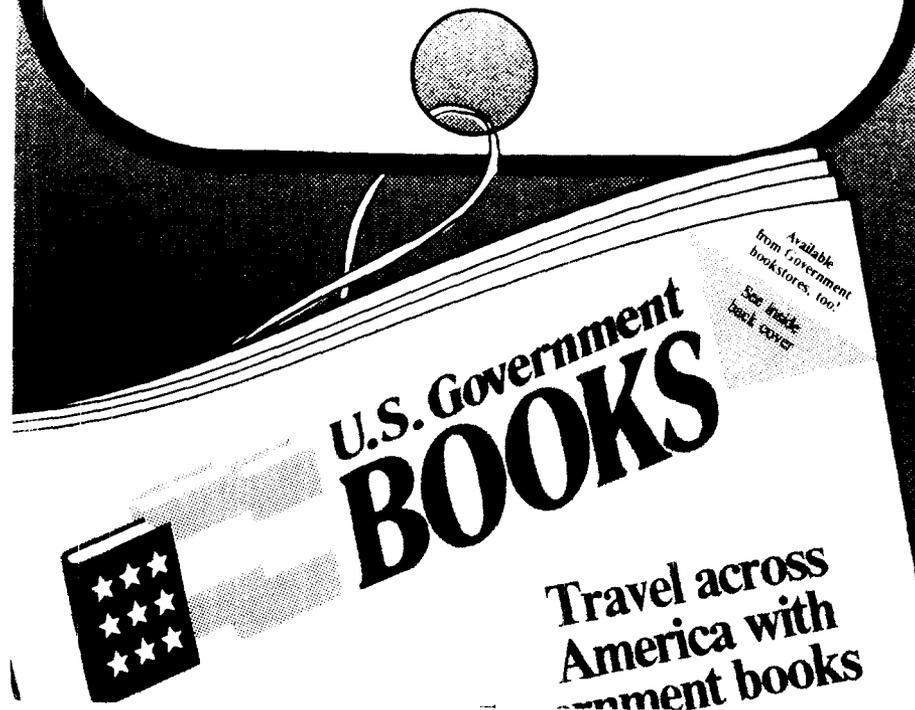
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