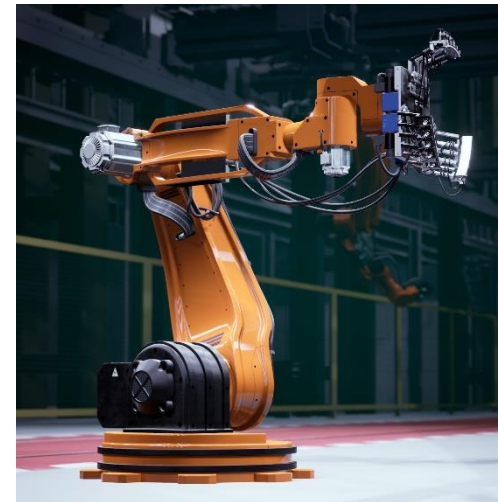
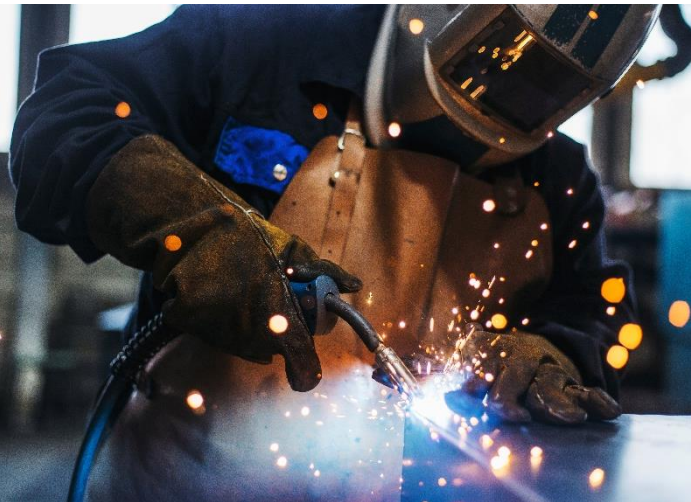


2018 Manufacturing Energy Consumption Survey



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Consumption Results

March 2021

U.S. Energy Information Administration
Office of Energy Statistics
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What is the *Manufacturing Energy Consumption Survey* (MECS)?

MECS is the only nationally representative source for estimates of energy-related characteristics, consumption, and expenditures for manufacturing establishments in the United States.

The U.S. Energy Information Administration (EIA) collects data for manufacturing establishments mainly through web questionnaires.

- EIA drew the 2018 MECS sample size of approximately 15,000 establishments from a national sample frame representing 97%–98% of the manufacturing payroll. We estimate the sample to represent at least that percentage of manufacturing energy consumption.
- This sample allows us to report separate estimates of energy use for 21 three-digit manufacturing subsectors and 50 industry groups and industries, as defined by the North American Industry Classification System (NAICS).

EIA has conducted the MECS periodically since 1985.

- The 2018 MECS is the 10th iteration.



Key takeaways from EIA's 2018 MECS results

- Natural gas and hydrocarbon gas liquids (HGLs)* continue to increase their shares of total consumption.
- Gross output continues to outpace manufacturing energy consumption, resulting in an overall decrease in energy intensity.
- From 1998 to 2018, manufacturing energy intensity decreased by 26%. During this same period, manufacturing gross output increased by 12%, implying continued energy efficiency gains.
- Nonfuel consumption (or the use of energy as a feedstock or raw input rather than for fuel) is dominant in the chemicals industry.
- Four industries—chemical, petroleum and coal products, paper, and primary metals—account for most of manufacturing energy consumption.
- Most subsectors cannot easily switch from natural gas to alternative fuels like coal, electricity, and renewables.

* Hydrocarbon gas liquids (HGLs) include ethane, ethylene, propane, propylene, normal butane, butylene, ethane-propane mixtures, propane-butane mixtures, and isobutane produced at refineries or natural gas processing plants, including plants that fractionate raw natural gas liquids (NGL). The MECS excludes natural gasoline from its definition because natural gasoline is not used as an energy source—fuel or feedstock—at manufacturing establishments.

Note: The 2018 MECS final data supersede the 2018 preliminary data previously published. For example, the MECS preliminary data showed an increase in energy intensity; however, the final data for the 2018 MECS show that manufacturing energy intensity slightly decreased.



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Manufacturing energy consumption

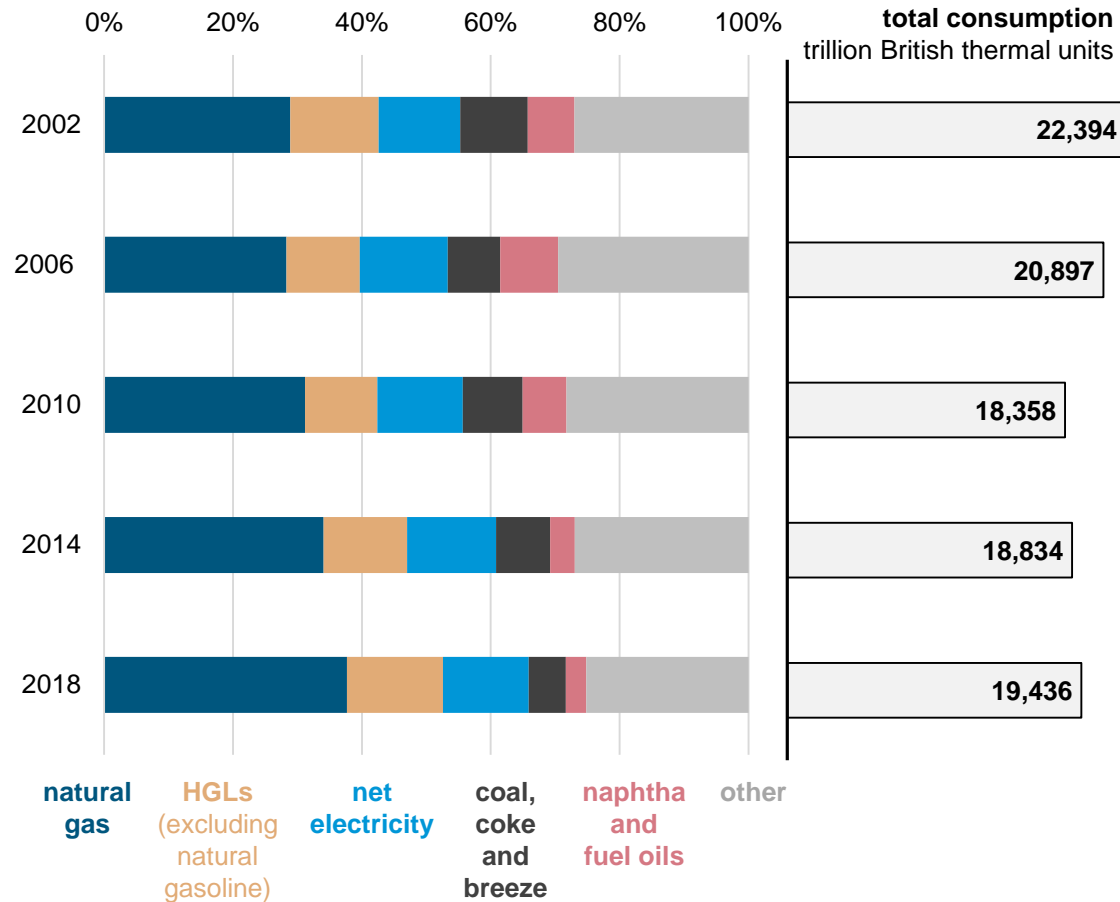
Manufacturing is the physical, mechanical, or chemical transformation of materials or substances into new products. Manufacturing operations are generally conducted in facilities described as plants, factories, or mills and characteristically use power-driven machines and materials-handling equipment. In addition, assembling the components of manufactured products is considered manufacturing, for example, blending materials, such as lubricating oils, plastics, resins, or liquors.

An establishment is an economic unit at a single location where manufacturing is performed. Manufacturing establishments are classified by the *North American Industrial Classification System (NAICS)*, which categorizes establishments according to the types of production processes they primarily use.

Manufacturers have two types of energy consumption—*fuel* and *nonfuel*. *Fuel* consumption is the use of any substance that can be burned to produce heat, power or to generate electricity. *Nonfuel* consumption is the use of energy as feedstock or raw material input.

Natural gas and HGLs continue to increase their shares of total consumption

Proportion of total consumption by energy source and year
percentage

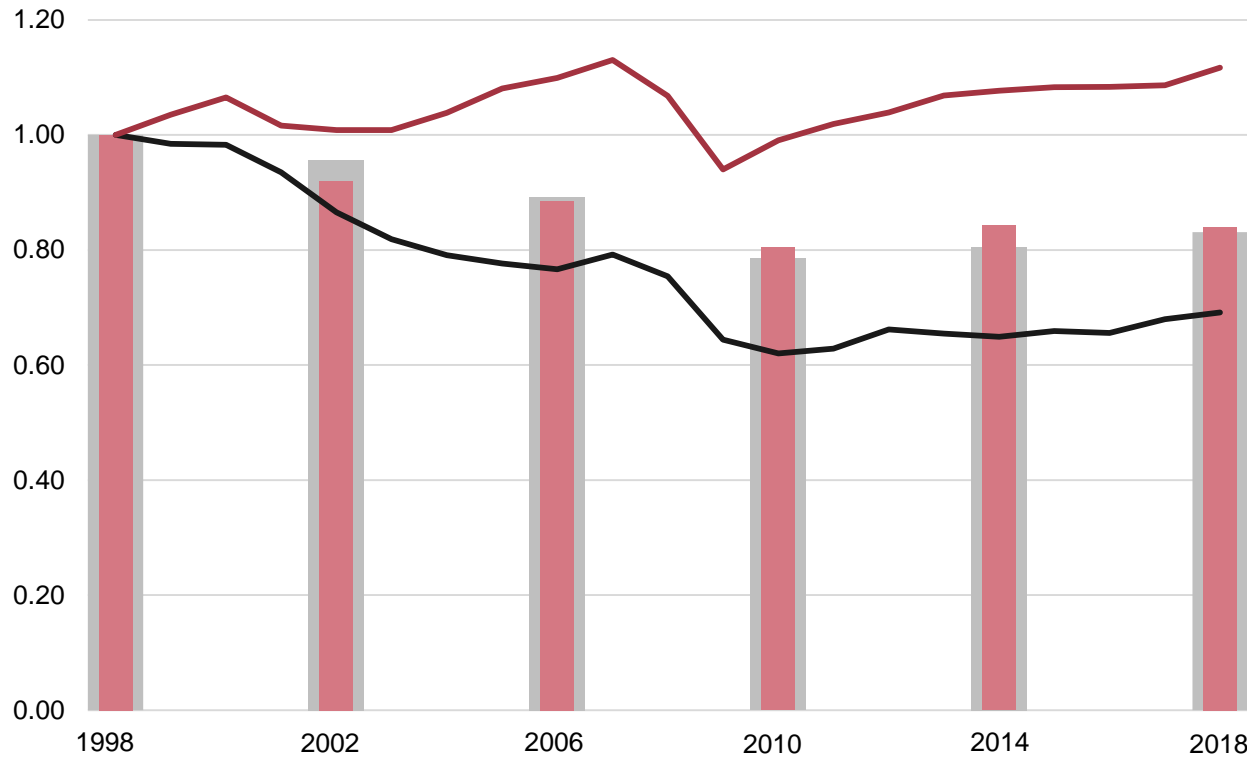


- MECS estimates that total manufacturing first-use energy consumption in 2018 totaled 19,436 trillion British thermal units (Btu). This amount represents a 3% increase from 2014.
- Natural gas and hydrocarbon gas liquids (HGL) continue to increase their shares of total consumption, rising from 43% of consumption in 2002 to 53% in 2018.
- Conversely, the use of coal, coal coke and breeze as well as naphtha and fuel oils has declined each survey cycle since 2002.

Gross output continues to outpace manufacturing energy consumption

Indexes of gross output, fuel only, fuel plus feedstock, and employees, 1998–2018

Index: 1998 = 1

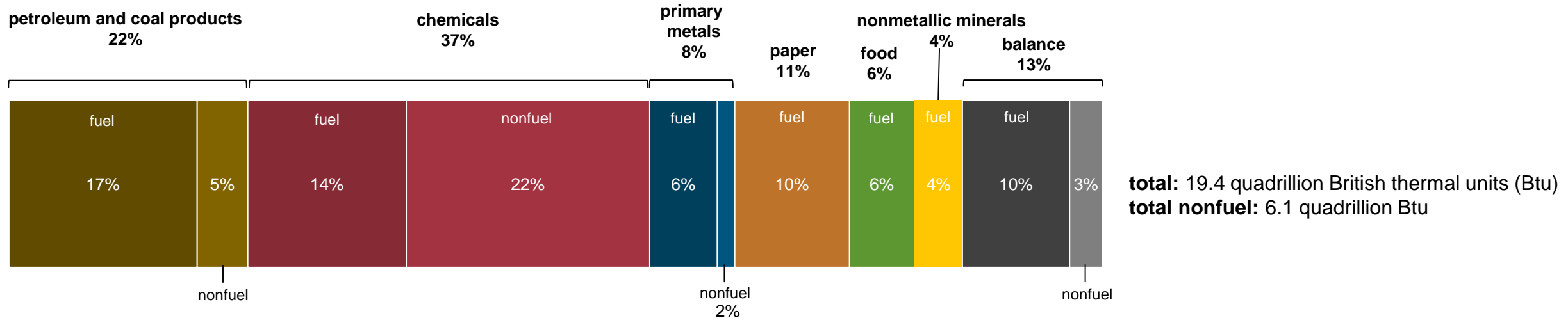


index of gross output
 index of fuel plus feedstock
 index of fuel
 index of employees

- Gross output has increased since 1998 levels, but fuel consumption and total manufacturing employment have decreased.
- Manufacturing gross output increased by 4% between 2014 and 2018 while energy consumption increased at 3%. The disparity in growth rates implies a slight decrease in energy intensity from 2014 to 2018.
- From 1998 to 2018, manufacturing energy intensity decreased by 26%. During this same period, manufacturing gross output increased by 12%, implying continued long-term energy efficiency gains in U.S. manufacturing.

Nonfuel consumption is dominant in the chemicals industry

Manufacturing energy fuel and nonfuel (feedstock) consumption by industry, 2018
percentage

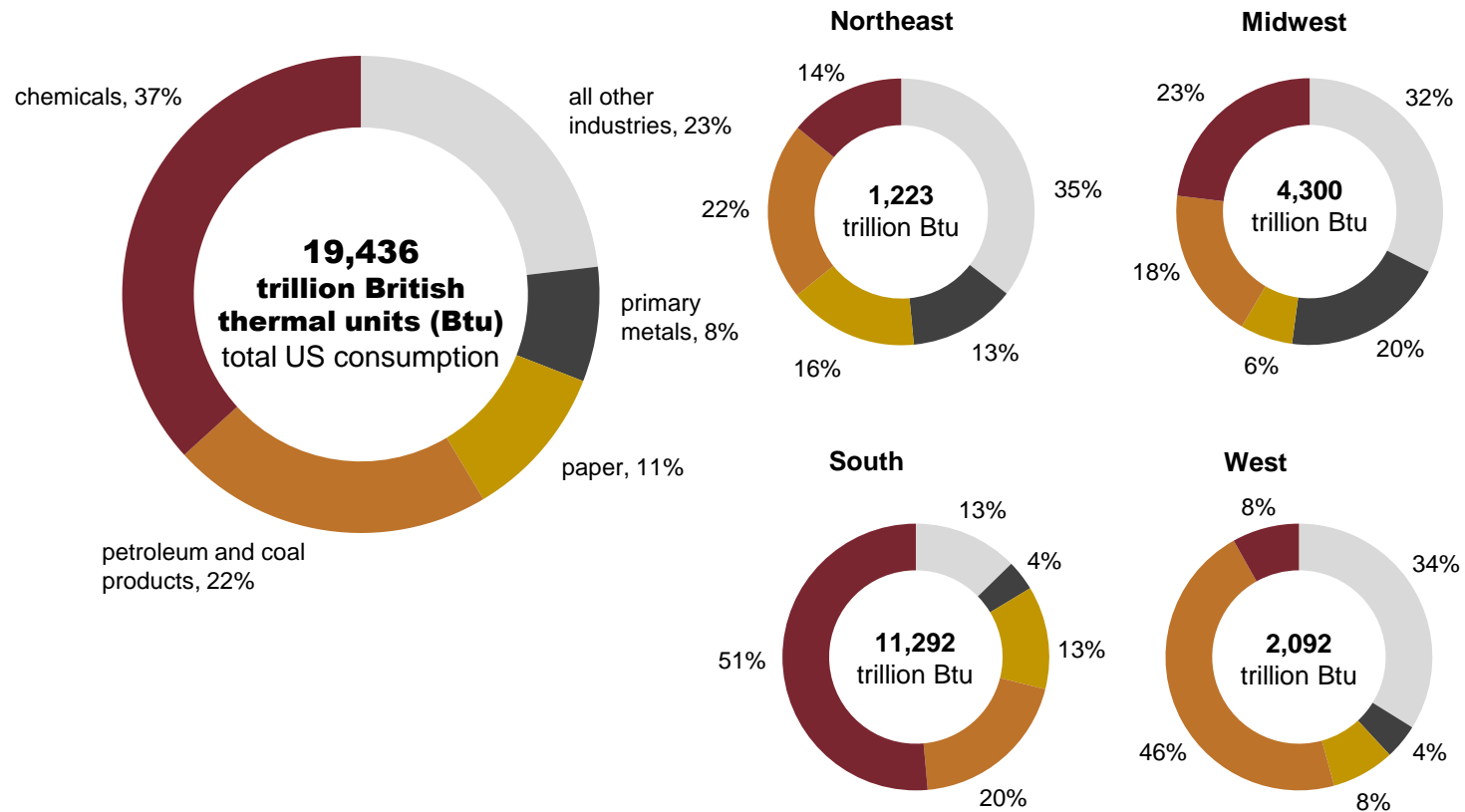


Note: To adjust for double counting, 1.6 quadrillion Btu are netted out of fuel consumption (MECS Table 1.2).

- Petroleum and coal products, chemicals, and primary metals account for more than 90% of feedstock use in manufacturing.
- Petroleum and coal products, chemicals, primary metals, paper, and food account for more than 84% of fuel used in manufacturing.

Four industries account for most manufacturing energy consumption

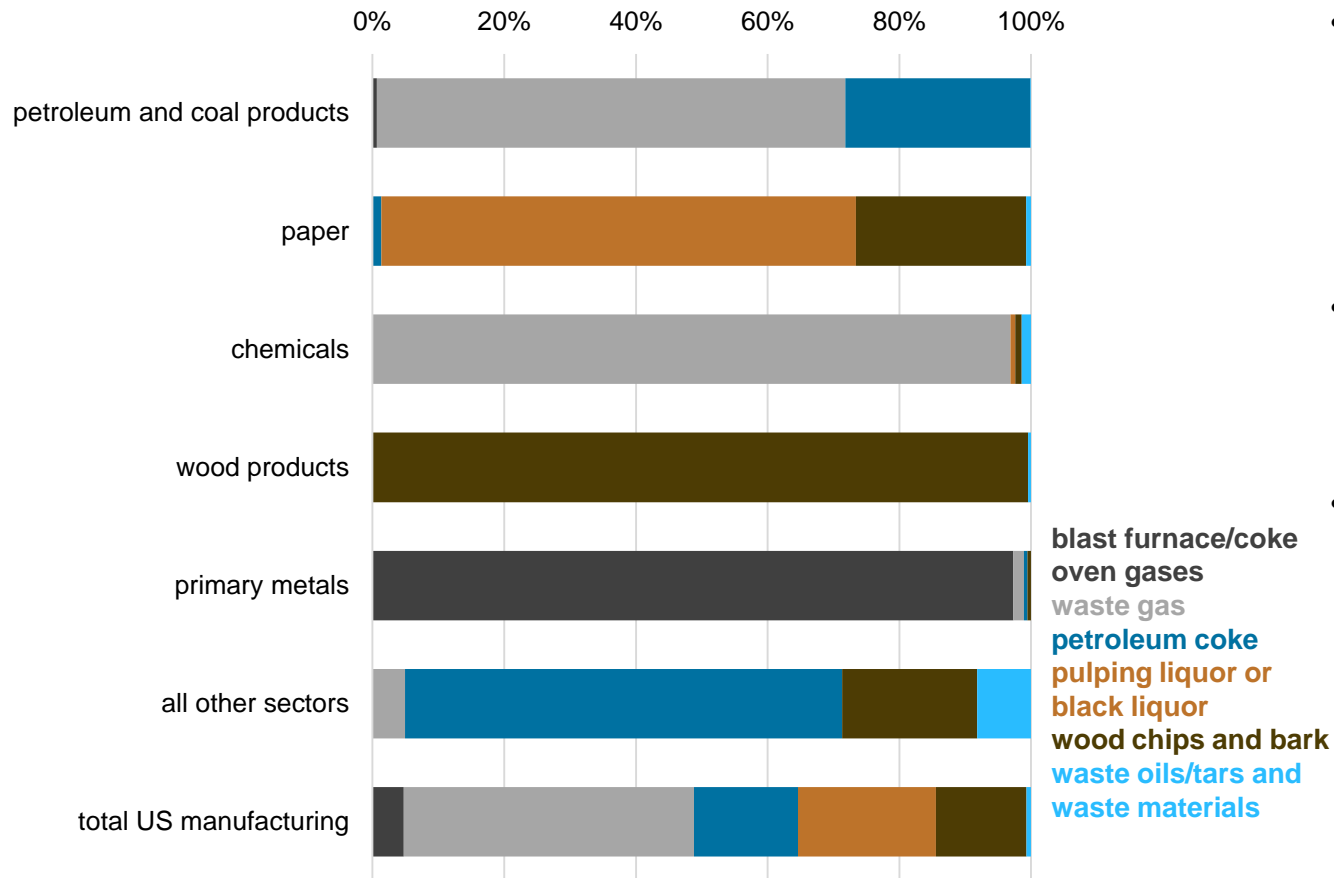
Proportion of total energy consumption by industry and region percentage



- The chemical, petroleum and coal products, paper, and primary metals industries accounted for 77% of manufacturing energy consumption in 2018.
- Manufacturing consumption was greatest in the South, and chemical manufacturing accounted for more than half (51%) of the South’s energy consumption.

Byproducts in fuel consumption vary by sector

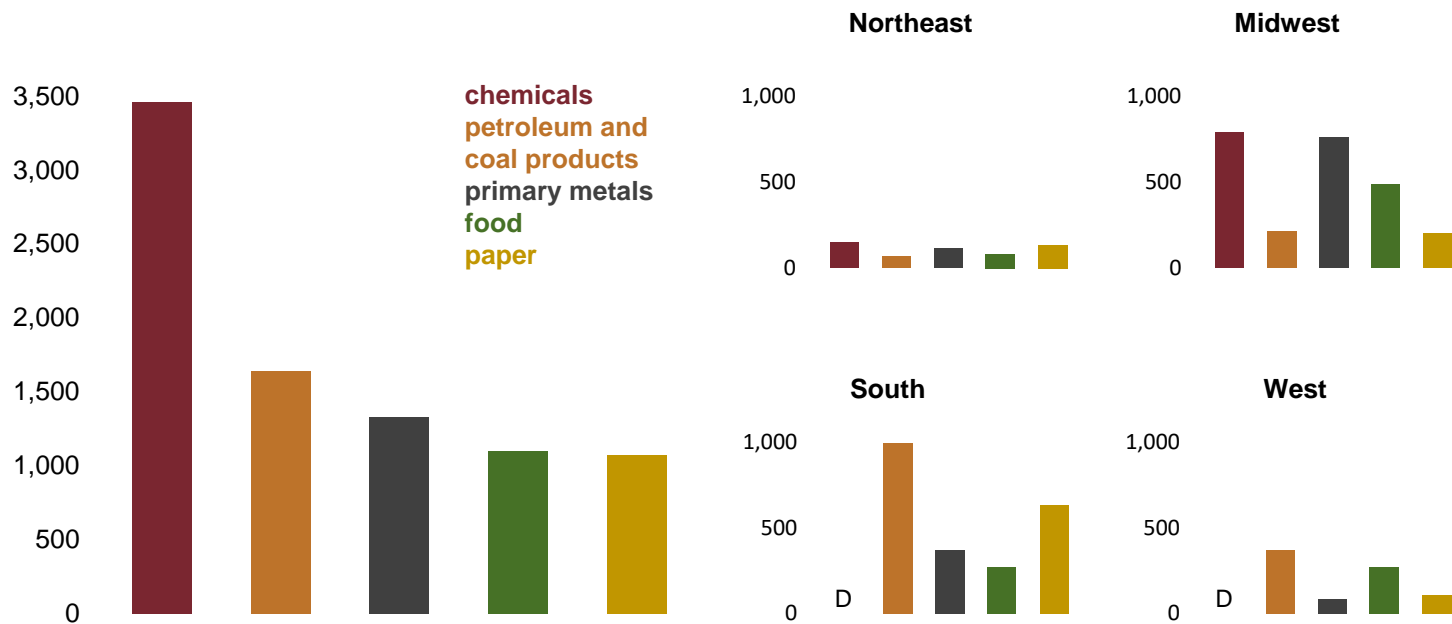
Selected byproducts used in fuel consumption by sector
percentage



- For total U.S. manufacturing, waste gas (for example, still gas, refinery gas, off gas, vent gas) accounted for the largest share of byproducts in fuel consumption (44%). Waste gas was the largest byproduct in the chemical (96%) and petroleum and coal (71%) sectors in 2018.
- Pulping liquor, or black liquor, accounted for 21% of manufacturing byproducts, and the paper sector consumed 854 trillion British thermal units (Btu) out of 857 trillion Btu.
- The primary metals sector consumed most (93%) of the blast furnace/coke oven gas byproducts.

Five sectors accounted for more than three-fourths of offsite-produced fuel consumption

Offsite-produced fuel consumption by region and top five consuming sectors
trillion British thermal units (Btu)



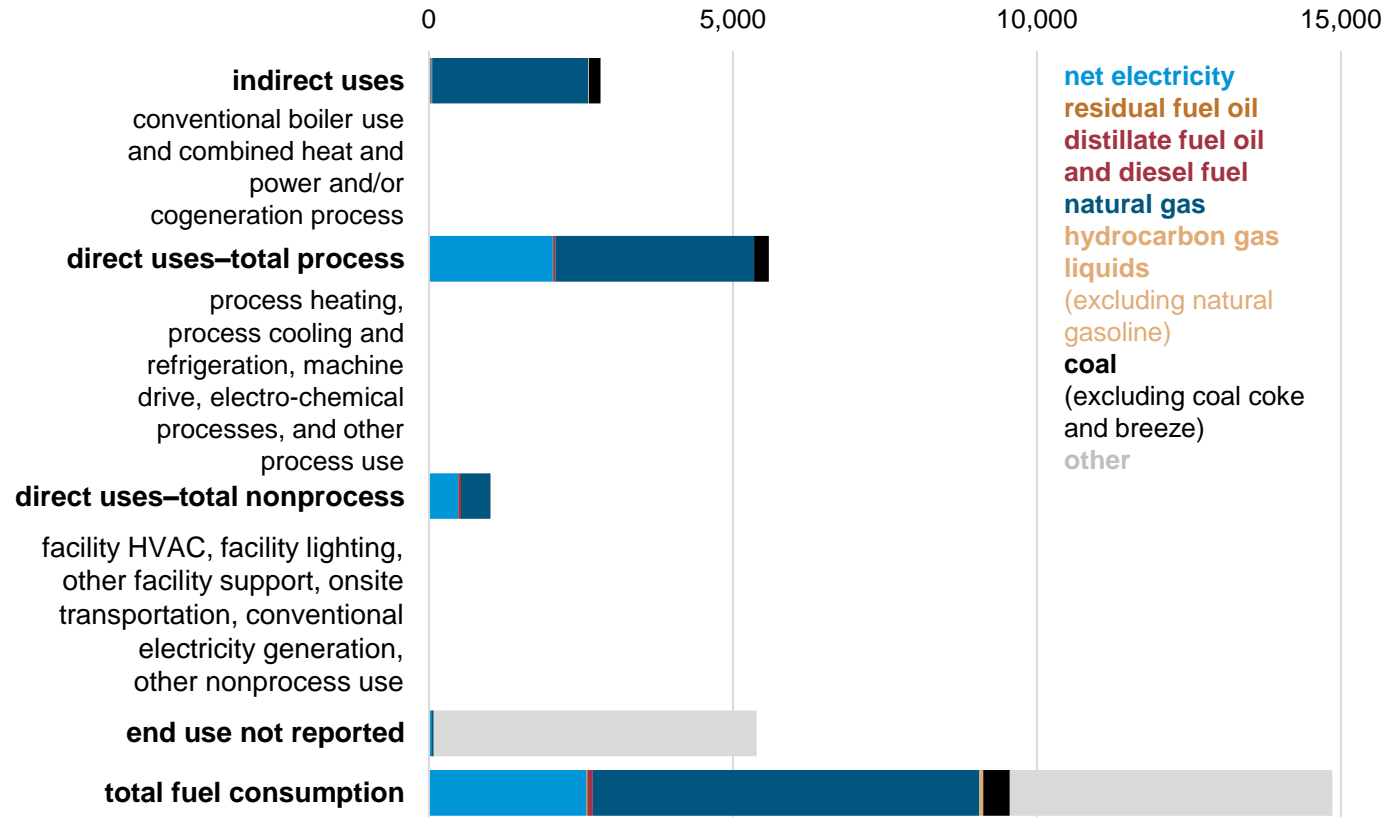
D = withheld to avoid disclosing data for individual establishments

- Chemicals, petroleum and coal products, primary metals, food, and paper were the largest consumers of offsite-produced fuel,* accounting for 8,596 trillion Btu of 11,142 trillion Btu total consumption.
- The Northeast region had the lowest offsite-produced fuel consumption of any U.S. region.

* Offsite-produced fuel is a measure of fuel consumption, which is equivalent to purchased fuel, and includes fuel produced offsite and consumed onsite. It excludes fuel produced and consumed onsite, energy used as raw material input, and electricity losses. An example of onsite-produced fuel is the production of black liquor in the pulping process to make paper, and the subsequent use of the produced black liquor as a fuel at pulp and paper mills.

Natural gas was the most used fuel for all end uses

End uses of fuel consumption
trillion British thermal units (Btu)

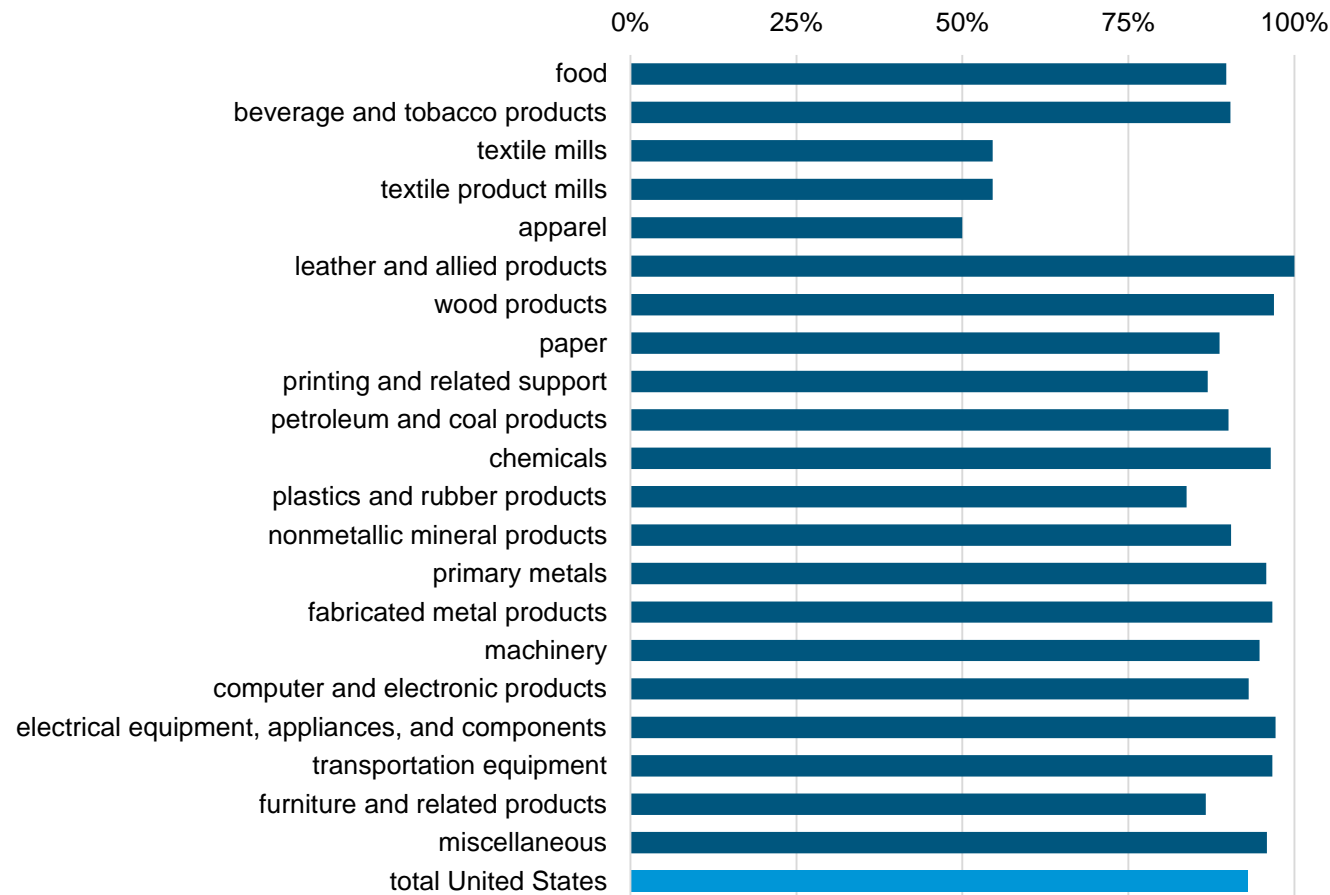


- Natural gas accounted for 43% of total fuel consumption (6,362 trillion Btu) in 2018, up from 39% in 2014.
- Natural gas use for indirect uses (boiler and combined heat and power) compared with other fossil fuels increased as a percentage over 20 years from 70% to 92%.
- Compared with indirect and total non-process uses, direct total process uses had the largest reportable consumption.

Note: Some of the data could not be represented in this chart so that individual data would not be disclosed or the estimate was less than 0.5. HVAC = heating, ventilation, and air conditioning.

Most sectors cannot easily switch from natural gas to another fuel

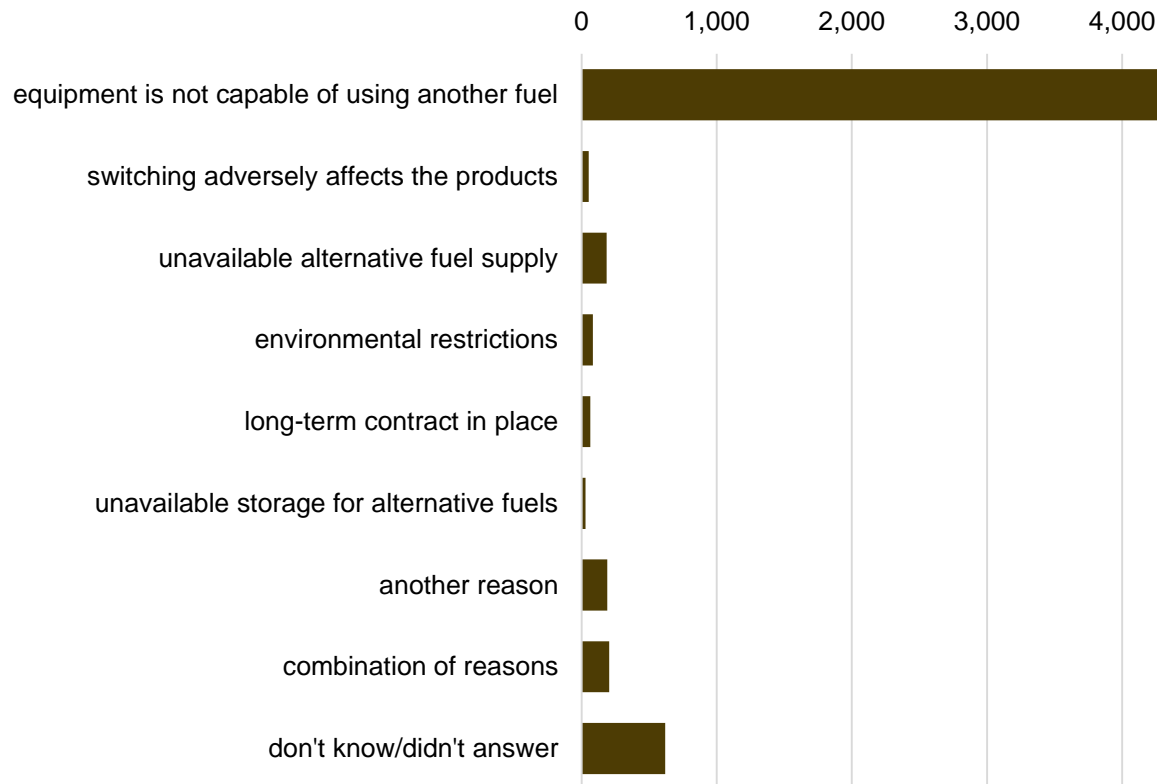
Non-switchable natural gas percent used by sector
percentage



- Overall, the percentage of natural gas that could not be switched in the manufacturing sector was 93% in 2018.
- Apparel (50%), textile mills (55%), and textile product mills (55%) had the smallest percentages of natural gas that could not be switched to another fuel.
- Conversely, switching from natural gas to other fuels (such as coal, fuel oils, electricity, or HGLs) has limited potential, and the electricity sector is most likely to switch.

Due to equipment limitations, most natural gas fuel cannot be switched with other fuels

Natural gas fuel switching limitations by reason
billion cubic feet



- The most common reason manufacturers could not switch from natural gas was that their equipment was not capable of using another fuel.
- A combination of reasons (204 billion cubic feet) and an unavailable alternative fuel supply (185 billion cubic feet) were also common responses.
- About 10% of the non-switchable amount was unknown.

References and additional information

References

All graphs are sourced from Form EIA-846A/B, *Manufacturing Energy Consumption Survey*.

Gross output estimates are sourced from the Bureau of Economic Analysis, [Gross Output by Industry](#) data series.

Manufacturing employee estimates are sourced from the U.S. Census Bureau, based on one-year estimates from the [Annual Survey of Manufacturers](#).

Please direct questions about the MECS to Tom Lorenz, Survey Manager, thomas.lorenz@eia.gov



Projected schedule of MECS releases

Consumption tables | February 23, 2021

Fuel-switching and economic tables | April 2021

Count and price tables | June 2021



For more information

U.S. Energy Information Administration homepage | www.eia.gov

Manufacturing Energy Consumption Survey | www.eia.gov/consumption/manufacturing

Consumption and Efficiency | <https://www.eia.gov/consumption>

Today in Energy | www.eia.gov/todayinenergy

