Indicator 5.24:

Avoided fossil fuel carbon emissions by using forest biomass for energy

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What is the indicator and why is it important?

Forest biomass (i.e., wood) is a renewable feedstock that may be used to produce electric power, heat, and/or liquid fuels. This material is abundant in many regions of the United States (fig. 24-1) and the diversity of energy options obtained from forest biomass has led to its utilization in each of the major energy sectors (fig 24-2). Wood is a product of photosynthesis whereby trees capture electromagnetic energy from the sun and convert it to chemical energy in the form of carbon (C). Some of that newly fixed C is returned to the atmosphere through metabolic processes during plant development. When trees are left to die, the remainder is slowly returned to the atmosphere through decomposition. When wood is consumed for energy, the C fixed through photosynthesis is quickly returned to the atmosphere through combustion. The atmospheric fate of C in forest biomass varies substantially by end use (e.g., energy feedstock, short- or long-lived wood product, natural decomposition), leading to debate on how to regulate emissions from the material when used for energy. Forest biomass may be used in place of coal, natural gas, and petroleum to avoid emissions from fossil fuel combustion for energy. This may reduce emissions from fossil fuel combustion and also create opportunities to improve, maintain, and restore the health and vigor of forest ecosystems in the United States.

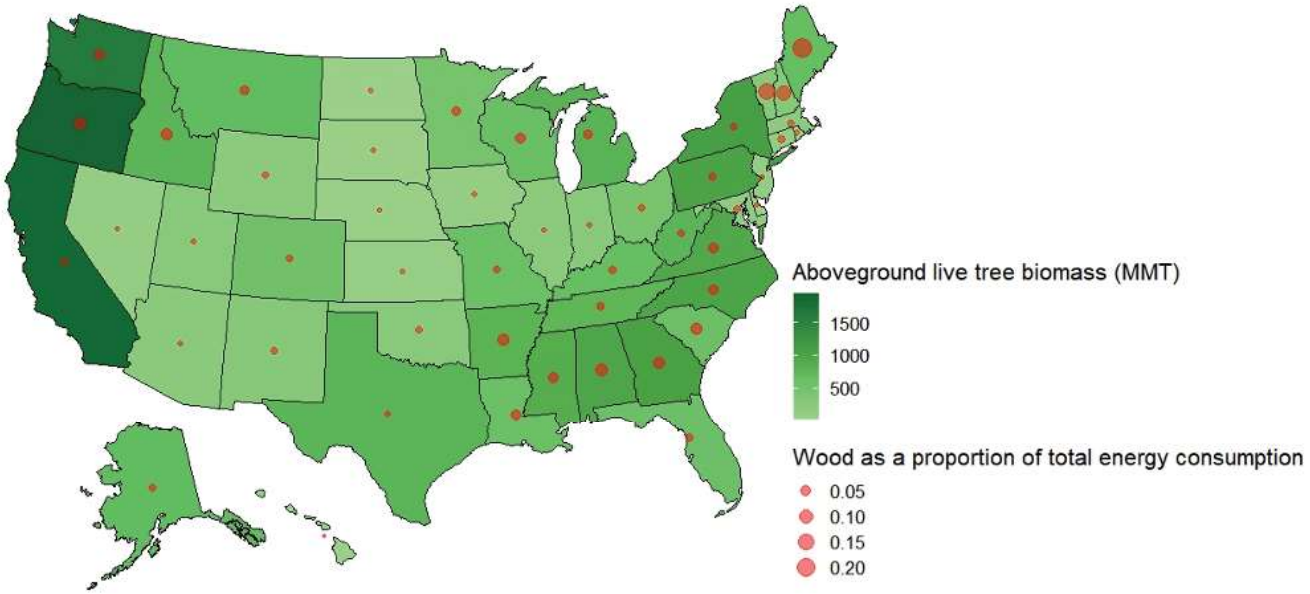

Figure 24-1—Estimated total aboveground live tree biomass (≥ 2.54 cm diameter at breast height) and wood energy as a percent of total energy consumption in the United States, 2018. Note that estimates for Alaska only represent the coastal southeast and southcentral forest land (USDA 2020, EIA 2020).

What does the indicator show?

Energy-related activities are the primary sources of anthropogenic greenhouse gas emissions in the United States and fossil fuel combustion continues to comprise the majority of energy-related emissions, accounting for an estimated 5,249 Tg carbon dioxide (CO_2) equivalent (Eq.) in 2018 (transportation alone contributed the largest proportion, 28 percent). However, a market-driven shift toward less C intensive fuels by power producers, combined with increased fuel efficiency in the auto industry has led to a decrease in fossil fuel emissions over the last several years. There has been a steady increase in the consumption of renewable energy over that period (fig. 24-3), particularly from biofuels, wind, and solar, which has also contributed to reductions in fossil fuel emissions.

Forest biomass remains an important component of the renewable energy portfolio in the United States. Wood—in the form of fuelwood logs, mill waste, wood chips, pellets, spent pulping liquor, and other derivatives—is used in each of the four energy sectors in the United States (fig. 24-2). While wood consumption for energy has gone down since the mid-1980s, it still represents approximately 20 percent (nearly 2,300 trillion British thermal units [Btu] in 2018) of renewable energy consumption by source and is third only to hydroelectric power and wind in total renewable energy generation (fig. 24-3). The decline in wood energy may be due to investments in alternative renewable energy sources (fig. 24-3) and uncertainties associated with the regulation of biogenic emissions. Well over half of emissions from wood consumption for energy occurs in the industrial sector, where wood energy generation is mainly tied to the production of wood products, including pulp and paper.

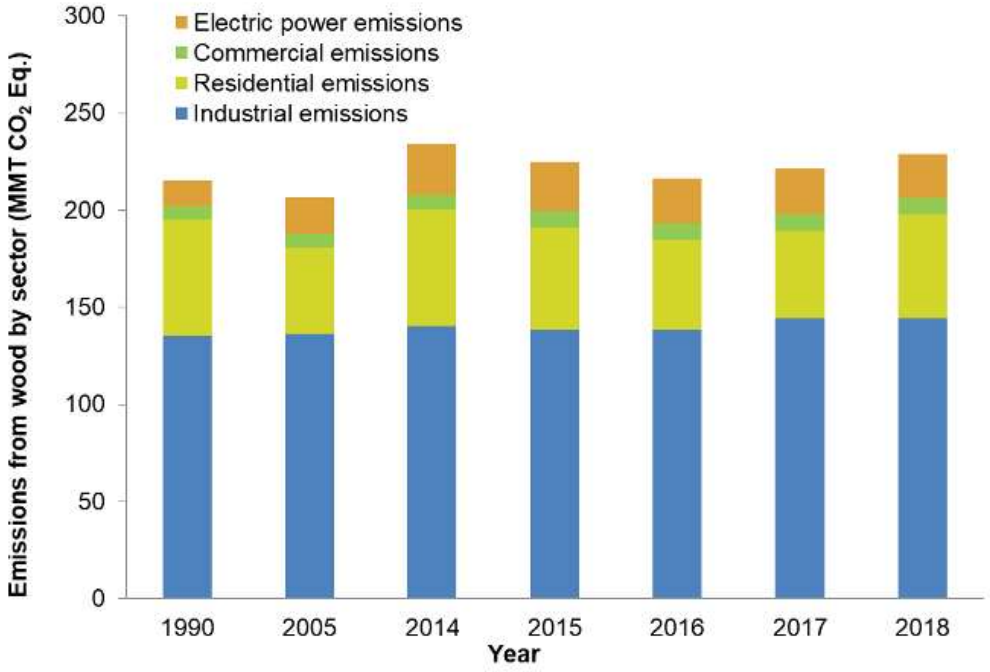

Figure 24-2—Estimated emissions from wood consumption for energy by sector in the United States, 1990–2018 (EPA 2018).

What has changed since 2015?

There has been a 90 percent increase in renewable energy consumption since 1990 and an 18 percent increase since 2015 driven, in large part, by expansion of biofuel, wind, and solar energy (fig. 24-3). Wood energy consumption has remained relatively stable over the time series, resulting in declines in the contribution of wood energy relative to total renewables. That said, wood energy continues to play a major role in forested regions of the United States and has consistently comprised approximately 2 percent of total energy consumption nationally (fig. 24-3). The use of forest biomass in the electric power sector has increased substantially over the last few years and wood continues to be widely used for cogeneration of energy in the industrial sector (fig. 24-2). In addition, homeowners are increasingly relying on wood as the primary heating source in their homes. These trends, combined with recent renewable energy initiatives and a focus on managing forests to mitigate climate change, may lead to future increases in the consumption of forest biomass for energy in the United States.

References

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U.S. Environmental Protection Agency (US EPA) 2020. Inventory of U.S. greenhouse gas emissions and sinks: 1990–2018. EPA 430-R-20-002.

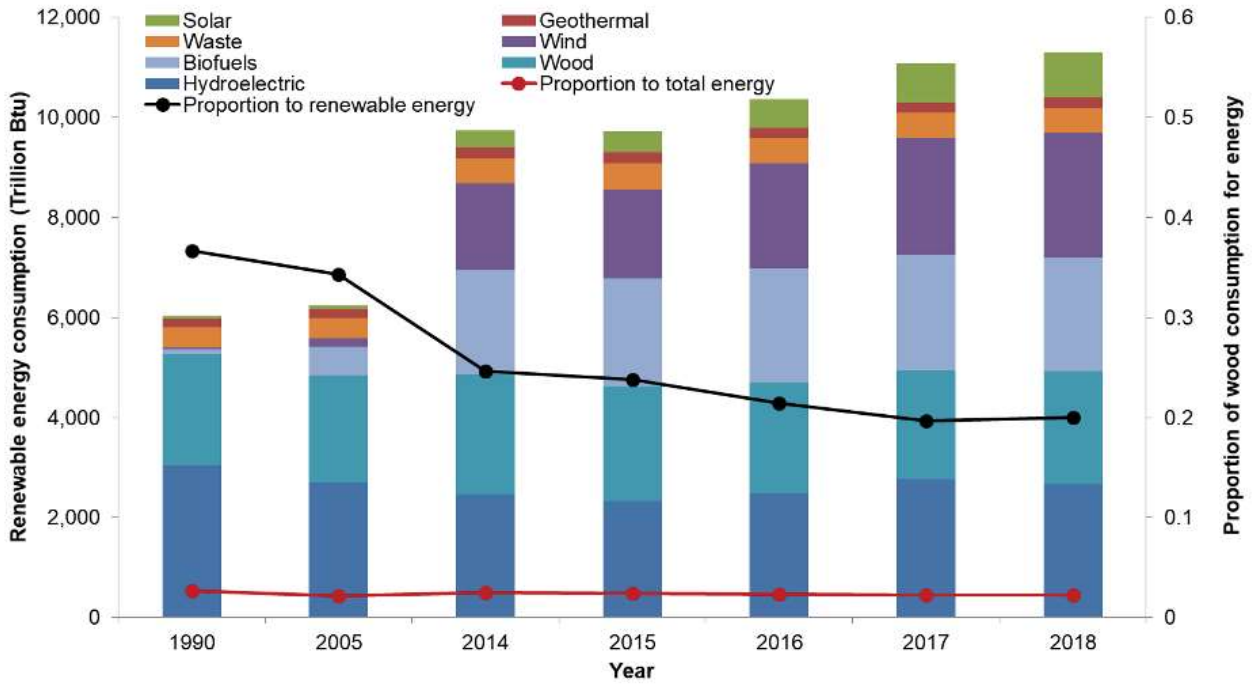

Figure 24-3—Renewable energy consumption by source (left axis) and proportion of the wood energy consumption (right axis) in the United States, 1990-2018 (Source: EIA 2020).