Energy at a Glance

Biomass

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Biomass can be a renewable form of fuel, but it burns less efficiently and produces more pollution and carbon dioxide than fossil fuels when used to generate electricity.

Introduction

Biomass is renewable organic material that can be burned for energy, most often wood and leftover waste from wood processing, crops and crop waste, garbage like paper and yard waste, as well as manure. Wood-based biomass, what the Energy Information Administration (EIA) defines as densified biomass fuel—consists of compressed and dried wood pellets and similar products.

Wood-based biomass fuel, including wood burned in residential fireplaces and wood burning stoves, is the largest single source of solid biomass energy in the United States, providing 2.1 percent of annual total energy consumption.[5] Energy from municipal solid waste products comprises 8.9 percent of total biomass energy in the United States. Although other countries burn more of their waste, the share of energy production is similarly low.[6,7]

Densified biomass fuel is often promoted as a "green" replacement for coal in power plants, especially in Europe.[8] The United Kingdom is the world's largest consumer of wood pellets, burning 21 percent of the global supply.[9] Of that portion, 75 percent is imported from the United States.[10]

The United States is a net exporter of wood pellets, according to the EIA. The pellets consist of a variety of feedstocks, including leftovers from sawmills and timber logging, as well as a substantial portion from virgin forests.[11]

Energy Content

Wood pellets have a much lower energy density, the amount of energy stored per unit of volume, than fossil fuels. Lower quality "house coal" has doubled the energy density of even high-quality wood pellets.[12] Compared to anthracite, wood pellets fall even further behind. (See figure below).

Manufacturing wood pellets uses energy and other resources, which produces carbon dioxide emissions. In fact, kiln-fired pellet drying processes can require an amount of energy that offsets more than half of the biomass' potential embedded energy.[13]

Quick Bullets

- It takes at least twice as much wood-based biomass fuel to produce the same amount of energy as coal.[1]
- Biomass power plants emit 50 to 85 percent more carbon dioxide (CO2) than modern coal plants, and more than three times as much carbon dioxide as natural gas-fueled power plants.[2]
- It can take 44 to 104 years to offset carbon dioxide emissions from burning biomass.[3,4]

Emissions

The U.S. Environmental Protection Agency (EPA) and the European Commission (EC) do not measure carbon dioxide emissions from wood-based biomass fueled power plants, citing the Intergovernmental Panel on Climate Change's (IPCC) claim it is a net-zero fuel source.[14] Growing new trees equivalent to the amount burned removes the amount of CO_2 emitted, supposedly making the use of biomass net-zero. However, the CO_2 uptake is dependent on the kind of trees or brush that occupy the land, and

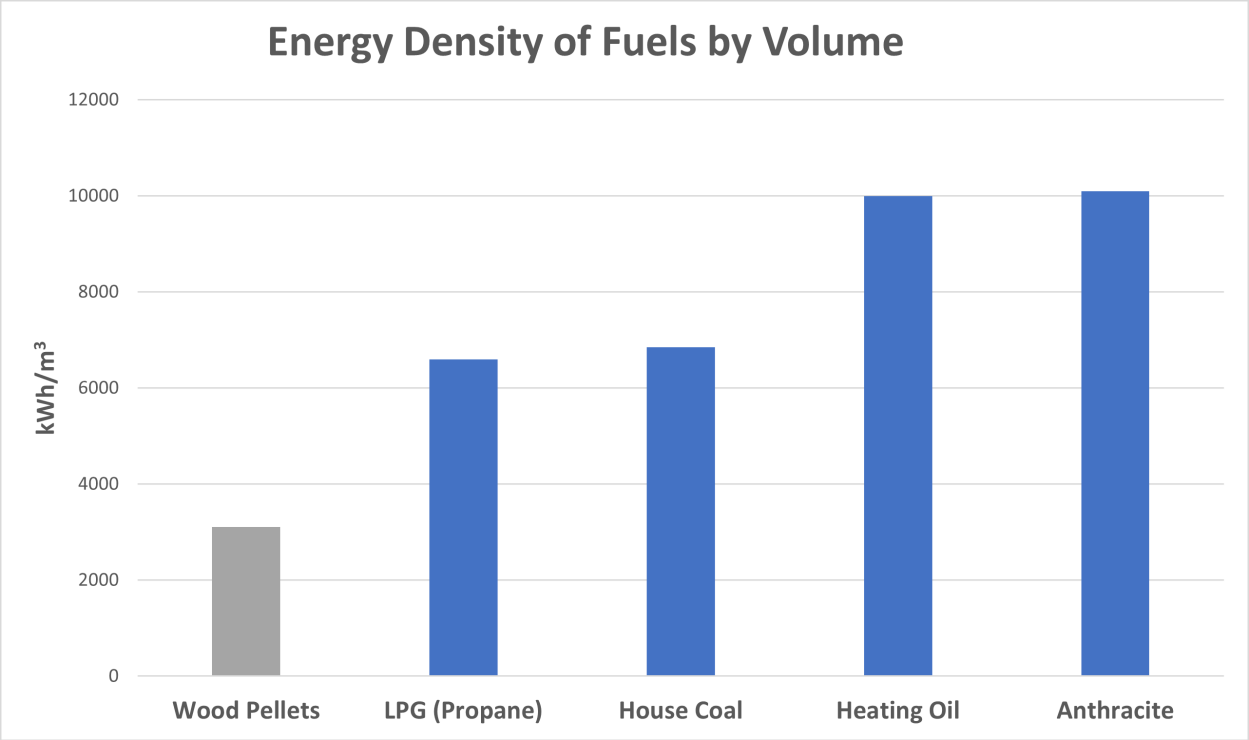

***Figure 1**: Energy density by volume of fuels, in kilowatt-hours per cubic meter.[13] Wood pellet data is for 10% moisture content pellets.*

how long they are left to grow.[15] Any carbon dioxide emitted from burned biomass takes decades to be removed, and even then, only if the replanted biomass is not harvested before it has removed an equivalent amount of CO_2.

With current technology and practices, replacing coal with wood bioenergy would likely increase short-term CO_2 emissions. Claims that wood-based bioenergy is carbon neutral are "not valid because it ignores the transient, but decades to centuries long, increase in CO_2 caused by biofuels."[16]

Research also suggests that densified biomass fuel production facilities, and the power plants that burn it, also emit high levels of regulated pollutants.[17]

Environmental Analysis

Trees grown specifically to be cut down and made into densified biomass are the third largest source of feedstocks for biomass fuel plants.[18,19] Biomass tree plantations often replace natural forests, displacing native hardwoods with faster growing trees such as Loblolly pines. Because these plantations are harvested on a relatively rapid rotation, they typically do not mature to their full carbon-storing potential. As a result, there is less carbon sequestered on these than in natural forests.[20]

Ecosystem disruption is amplified by this kind of tree farming. Repeatedly growing and then cutting down forests can have devastating impacts on plants and animals alike. Deforestation has risen 49 percent in Sweden, Finland, and across Baltic nations as demand for renewable fuel sources driven by EU mandates has risen.[21]

Conclusion

In the real-world, the evidence suggests biomass use requires more material inputs, creates more pollution, and produces more carbon dioxide than traditional fossil fuel energy sources.

Endnotes

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