BIOMASS WORLD TRADE

2/15/2025

INTRODUCTION

The USA exports more biomass than it imports, making it a net exporter of biomass energy. Biomass is exported in the form of Wood Pellets and Densified Biomass Fuels. It exported 9.54 million metric tons of wood pellets in 2023, valued at $1.75 billion. This was up from 9.01 million metric tons exported in 2022.

The USA is the world's largest exporter of biomass, followed by Brazil, Germany, Mainland China, and India. The USA Department of Energy (DOE) released a Report: Billion-Ton Report (BT23), which suggests that the USA could sustainably triple its biomass production to over 1 billion tons per year. It also identified feedstocks that could be used to produce biofuels for transportation and industrial processes.

The USA currently uses about 342 million tons of biomass, including corn grain for ethanol and wood/wood waste for heat and power to meet roughly five percent of its annual energy demand.

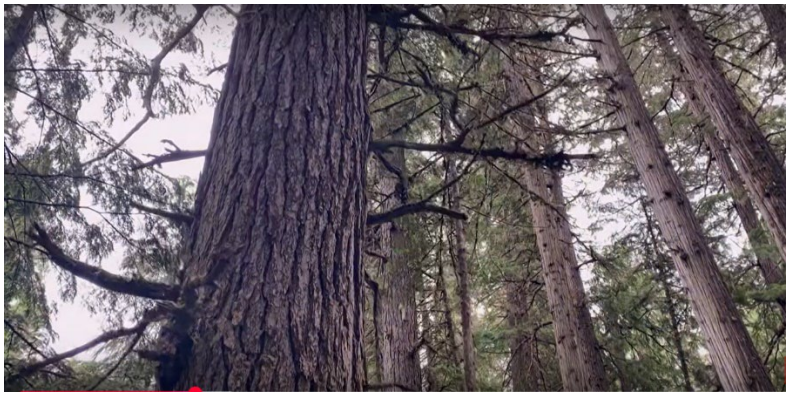

Figure 1. Two hundred years old trees.

Figure 2. Harvested trees piles.

As biomass is produced and used, carbon is released to the atmosphere. An equivalent amount of carbon is assumed to be reabsorbed by new growth, suggesting that modern bioenergy is a near zero-emission fuel. It is the largest source of what is classified as renewable energy globally, accounting for 55 percent of renewable energy and over 6 percent of global energy supply, exceeding the contributions from wind and solar energy generation combined.

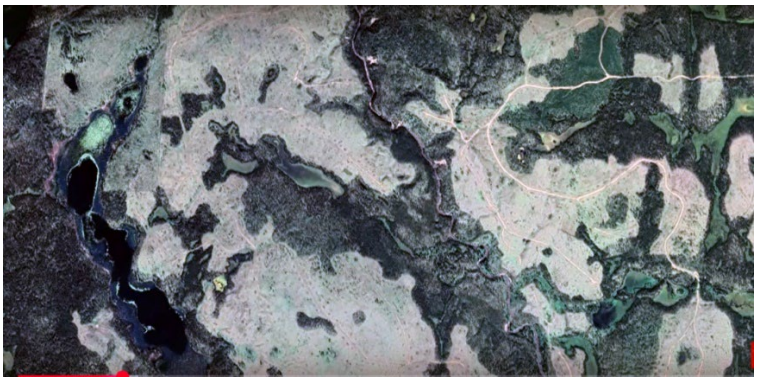

Figure 3. Effect of clear-cut tree harvesting in British Columbia, Canada.

Figure 4. Deforestation in British Columbia, Canada.

Figure 5. Harvested forest, Romania.

However, a time lag exists between harvesting and replacement of the bio-energy resources through regrowth that can range from months like corn to hundreds of years as mature trees. This loophole has been exploited in the Kyoto Treaty by multiple countries so that they can meet their treaty obligations. Wood pellets produced in the USA in fact come predominantly from whole mature grown trees, not from wood residues or unmerchantable wood as is being reported.

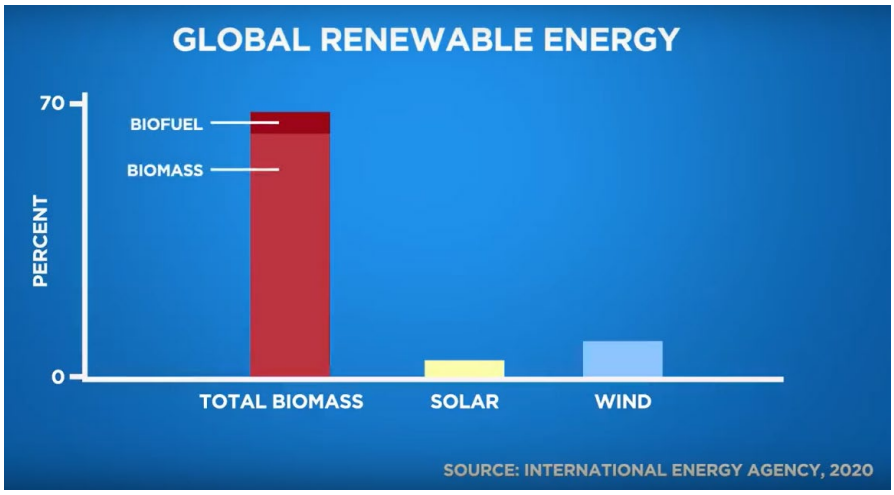

Figure 6. Biomass is the largest source of renewable energy globally, accounting for 55 percent of renewable energy and over 6 percent of global energy supply exceeding the contributions from wind and solar energy generation, combined. Source: IEA, International Energy Agency, 2020.

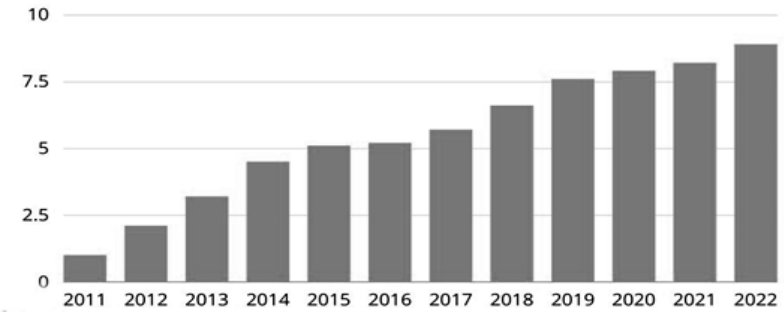

Figure 7. USA exports of wood pellets, million tons/year.

Figure 8. Loading wood pellets from barges onto cargo ships for export from the USA.

Figure 9. Loaded wood pellets on barge.

Figure 10. Loading cargo ship with wood pellets for export from barge.

BIOMASS EXPORTS FROM USA

Wood pellets from the USA's East Southern and Northwestern forests and woodlands are used globally in electricity production or home heating schemes identified as renewable. Wood pellets have been exported to 75 countries since 2012. Particularly, over 75 percent of USA wood pellets have been exported to the UK and Europe. Only four countries have received more than a million tons of wood pellets from the USA from 2012-2020:

United Kingdom: 37 million tons,
Belgium: 5.2 million tons,
Denmark: 2.1 million,
The Netherlands: 2.1 million tons.

The percentage of wood pellets going to each country is expected to continue to vary as bioenergy companies like Enviva secure long-term contracts with governments and their power plants.

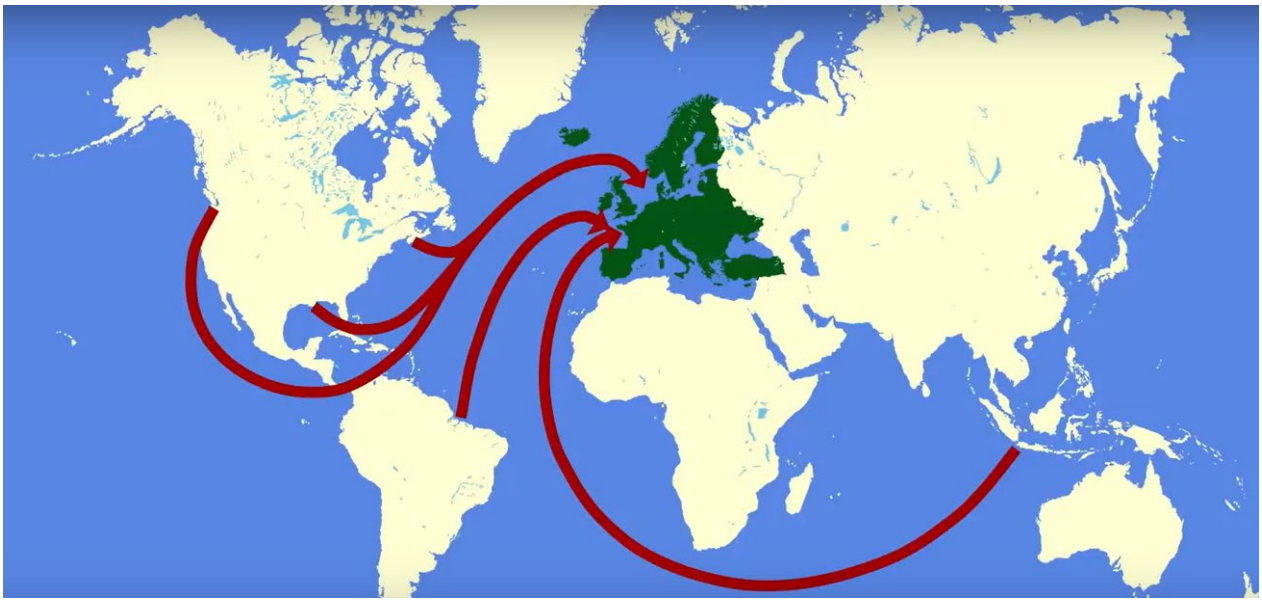

Figure 11. Biomass exports to the European Union, EU countries from North American, South American, and South Asian forests.

BIOMASS PRODUCTS, DENSIFIED BIOMASS FUEL

Biomass is formally defined as organic material that comes from crop residues, agricultural and food wastes, forest residuals, livestock, as well as biomass crops that are grown specifically as feedstocks to produce biobased products. After harvest or collection, biomass can be used to make sustainable fuel, fibers, electricity, construction materials, plastics, insulation, personal care items, and many other biobased products. Biobased products contributed $489 billion to the USA's economy in 2021, a more than five percent increase from $464 billion in 2020.

Figure 12. European wood stove models that burn imported as well as locally produced wood pellets.

Figure 13. Wood pellets stack.

Figure 14. Single wood pellet.

Figure 15. Wood pellets in dry storage.

Figure 16. Packaged wood pellets are used for consumers heating purposes.

Densified biomass fuel, a growing energy source in the USA, consists primarily of compressed wood pellets, briquettes, and logs. These fuels are easy and economical to store and transport. The manufacture of wood pellets utilizes wood residues from sustainably managed forests as well as high-quality wood waste from a variety of industrial activities such as construction and logging. Wood pellet combustion has a high efficiency level, averaging about 80 percent, despite high particulate emissions. Wood pellets are conveniently classified as a renewable energy source.

Densified biomass fuel is used for heating in wood pellet stoves or furnaces in residential settings and in large-scale boilers in commercial buildings. Industry uses utility-grade wood pellets in processes that require thermal energy, such as generating electricity.

BIOMASS PRODUCTION

As of August 2024, 77 operating manufacturers of densified biomass fuel had a total production capacity of 13.34 million tons per year and collectively had an equivalent of 2,432 full-time employees. The manufacturers purchased 1.73 million tons of raw biomass feedstock, produced 0.93 million tons of densified biomass fuel, and sold 0.89 million tons of densified biomass fuel. Domestic sales of densified biomass fuel in the USA were 0.15 million tons and averaged a price of $229.48 / ton. Exports in August 2024 were 0.73 million tons and averaged $187.41 / ton.

Figure 17. Wood pellet mill, Canada. Full sized trees are converted into wood pellets.

Figure 18. Wood pellet mill, Europe.

Figure 19. Wood pellets barge used for electrical power production in Europe.

Figure 20. Clear-cut forest.

Figure 21. Harvested trees in storage yard.

Figure 22. Commercial trees cutting.

Figure 23. Aged trees used for wood pellets.

Figure 24. Hauling harvested trees.

Figure 25. Harvested trees loading onto transportation trailer.

Figure 26. Systematic harvesting of forest.

Figure 27. Harvested trees in storage.

Wood pellets are supposedly made from compressed sawdust or other wood waste. In fact, it is mature trees that are used, and not merely waste from trees harvesting. When burned in power plants, they produce significant ash as particulate matter and emit more carbon dioxide than coal. Because wood pellets come from trees, wood pellets are sometimes touted as a "green energy" source.

However, there are multiple environmental issues associated with wood pellets use:

1. Producing wood pellets requires large amounts of energy: logging, transport, processing, drying and shipping. These processing steps add an estimated 10-20 percent more carbon emissions to the final carbon impact of these products.
2. Wood pellets are less efficient than other fuels in the electrical production sector. Wood pellets used for heating are moderately efficient, but wood pellets take more energy to combust than coal. They produce less energy for the same heating interval. For this reason and because of associated mechanical limitations, wood pellets are often burned mixed with coal.

DISCUSSION

Wood pellets do speed up and accelerate the process of releasing carbon into the atmosphere. This is true when comparing wood pellets to other wood products. For instance, the carbon stored in furniture or home construction may stay in the biosphere for decades or centuries. However, the carbon stored in wood pellets is released within a few years. The accelerated carbon input to the Earth's atmosphere by logging is significant.

Table 1. Carbon dioxide emissions in metric tonnes per TeraJoule TJ of Energy from different sources. Source: GIEC, IPPC.

Source	Emissions Metric tonnes of CO_2 / TeraJoule[TJ] t/TJ
Natural Gas	56
Fuel oil (Mazut)	74
Coal	98
Wood	112

Table 2. Fine particulates emissions from different sources. Grams per Giga Joules. Source: CITEPA.

Source	Emissions Grams / Gigajoules g/GJ
Natural Gas	0
Fuel oil (Mazut)	15
Coal	212
Wood	847

Clear-cutting forests and wooded areas to harvest wood for wood pellets additionally results in faunal and floral habitat loss and other environmental damage. A study found that more logging residues get removed during a bioenergy wood harvest. Those are branches, leaves, and smaller trunks. This leads to more significant impacts on the soil causing top soil loss and possible mud slides and leads to longer periods for forest recovery. As a result, the true environmental impact of wood pellet production is highly contested.

Communities with wood pellet mills complain about constant traffic, and the resulting thick dust that blankets everything around. Community members wash their cars multiple times a week. Wood pellet mills promise beneficial jobs opportunities to communities, but these jobs are often temporary or involve contracts with few benefits and securities.

Mills were twice as likely to be placed in under-resourced communities. The wood pellet mills in North and South Carolina were placed in the so-called “Environmental Justice” communities.

European countries are importing wood pellets to satisfy their carbon decrease commitments in the existing international climate treaties. The existing climate treaties presume that trees can be grown quickly within a time constant of tens of years, unlike fossil hydrocarbon fuels with hundreds of years.

Therefore, wood pellets are treated as “carbon neutral” in most countries’ carbon ledgers. However, substantial greenhouse gases are emitted when wood pellets are burned. Because wood pellets burn hotter than coal, one ton of wood pellets will produce more greenhouse gases than one ton of coal. Technically, other sources like wind and solar are far more efficient and possess a lower carbon signature than wood pellets.

Figure 28. Protest against subsidizing biomass harvesting.

The USA is a substantial producer of solid biomass for the reasons:
1. The USA's South is already "the wood basket of the world" providing between 10-20 percent of the world's paper, pulp, and other wood products.
2. The USA has already cleared 95 percent of its old-growth forests. In the forestry sector, any younger forests are fair game for harvest.
3. Subsidies offset the cost of building wood pellet mills, both from the USA's government and the purchasing countries.
4. The USA South has many forests, and over 90 percent of the forest resources are privately owned. Harvesting woody biomass, fuel wood, and wood chips is not subject to significant protective environmental regulations.

While many countries produce some wood pellets, the USA dominates the wood pellet export market. In 2020, the USA was responsible for 25 percent of total global wood pellet exports. The USA exported more biomass resources than the next two countries of Vietnam and Canada combined.

The number of mills built for wood pellet exports is expanding. Many foreign countries believe that wood energy is a viable way forward. As a result, there exists a high wood fiber demand from external sources.

As of 2022, there were 24 operating mills for wood pellet exports in the USA's South. An additional fifteen mills are either planned or under construction.

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APPENDIX

Figure A1. Wood Pellet Association of Canada.

Figure A2. Biomass Pellets Trade and Power Conference, Japan May 16, 2019.

Figure A3. Subsidized wood pellets for Drex electrical power plant, UK. Power Stations burning wood receive an equivalent of 2 million sterling pound per day as subsidy in the UK.