Paper Products, Renewable Energy and Carbon Footprint

The Facts

Like most major manufacturing operations, papermaking is an energy-intensive endeavor. However, the North American paper and forest products industry produces and uses more renewable, carbon-neutral biomass energy than any other industrial sector, with most of it derived from leftovers of the production process.[1]

A look across the life cycle of paper shows that its carbon footprint can be divided into three basic elements: greenhouse gas emissions, carbon sequestration and avoided emissions. Each of these elements is influenced by important characteristics that make paper's carbon footprint smaller than might be expected: it's made from a renewable resource that stores carbon, it's manufactured using mostly renewable energy and it's recyclable.

Greenhouse gas emissions reduction

A carbon footprint is the amount of carbon dioxide (CO_2) and other greenhouse gases (GHG) that a person, organization, event or product causes to be released to the atmosphere, either directly or indirectly, during its life. For paper products, this life cycle includes everything from harvesting trees through the manufacturing process to use and disposal or recycling. The largest proportion of GHG emissions in the paper lifecycle occur when fossil fuels are burned during the manufacturing process.

The use of biomass energy has the potential to greatly reduce greenhouse gas emissions. Burning biomass releases about the same amount of carbon dioxide as burning fossil fuels. However, fossil fuels release carbon dioxide captured by photosynthesis millions of years ago — an essentially "new" greenhouse gas. Biomass, on the other hand, releases carbon dioxide that is largely balanced by the carbon dioxide captured in it as it grows.[2]

In the U.S. (2020), the pulp and paper industry was responsible for 0.6% of total CO_2e emissions, compared to 0.5% in 2019. The industry's emissions were slightly lower, but increased as a percentage of total emissions, which decreased 11% due to the reduction in transportation-related fossil fuel emissions resulting from the COVID-19 pandemic.[3,4]

In Canada (2018), the pulp and paper industry was responsible for 1.2% of total CO_2e emissions.[5,6]

Between 2005 and 2020, the U.S. pulp and paper sector reduced greenhouse gas emissions to 0.629 tons CO_2e per ton of product from 0.828 ton CO_2e per ton of product, a 24.1% decreased in GHG emissions.[7] Between 2007 and 2017, the Canadian paper and forest products industry reduced GHG emissions by from 22 million metric tons to 13.1 million metric tons or 40%.[8] These reductions are attributed to the predominant use of carbon-neutral biomass fuel, the switch from coal and oil to less carbon intensive fossil fuels such as natural gas, and equipment and process enhancements that improved energy efficiency.

Carbon sequestration

Carbon sequestration is the process by which atmospheric carbon dioxide is taken up by trees, grasses and other plants through photosynthesis and stored as carbon in biomass (trunks, branches, foliage, and roots) and soils. The sink of carbon sequestration in forests and wood products helps to offset sources of carbon dioxide to the atmosphere, such as deforestation, forest fires and fossil fuel emissions.[9]

Sustainable forestry practices [such as those implemented by the North American paper industry] can increase the ability of forests to sequester atmospheric carbon while enhancing other ecosystem services, such as improved soil and water quality. Planting new trees and improving forest health through thinning and prescribed burning are some of the ways to increase forest carbon in the long run. The perpetual cycle of harvesting and regenerating forests can also result in net carbon sequestration in wood products and new forest growth.[9]

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The long-term capacity of forest ecosystems to capture and store carbon depends in large part on their health, productivity, resilience, and adaptive capacity. Land management programs that restore forests to healthy and productive conditions will help ensure the long-term maintenance and transformation of forest carbon stocks. Ecosystems that are managed to adapt to changing conditions will capture carbon and store it more securely over the long term, while also furnishing wood-based materials.[10]

In the United States, sustainable forest management practices, the regeneration of forest area and timber harvesting resulted in net sequestration of carbon each year from 1990 through 2020.[11]

For the past century, Canada's managed forests have been a significant carbon sink, steadily adding carbon to that already stored. In recent decades, however, the situation has reversed in some years: Canadian forests have become carbon sources, releasing more carbon into the atmosphere than they are accumulating in any given year. Several factors have contributed to this shift. The annual total area burned by wildland fires has increased substantially. Unprecedented insect outbreaks have occurred. And annual harvest rates have shifted dramatically in response to economic demand, increasing in the 1990s and decreasing sharply with the global economic recession. The combination of these events and activities has resulted in Canada's managed forest acting as a net carbon source in years when large areas are burned.[12]

In the United States, forests and associated harvested wood products uptake the equivalent of more than 14% of economy-wide carbon dioxide (CO_2) emissions each year and store more than three decades of CO_2 emitted from fossil fuels.[13]

Avoided emissions

More than half of energy demand at North American pulp, paper and paper-based packaging mills (64% in the United States[14] and 62% in Canada[15]) is met using renewable, carbon-neutral fuels, primarily wood-based biomass.

Carbon neutrality is an inherent property of biomass reflecting the fact that the carbon residing inside it was only recently removed from the atmosphere, so returning it to the atmosphere has no net effect on atmospheric CO_2. This inherent property exists whether or not trees are regrown. The overall benefits of biomass fuels depend on how efficiently we use biomass to displace fossil fuels. The benefits are reduced if biomass is consumed faster than it is regrown since this shrinks future supplies of carbon-neutral fuel and can reduce the amounts of carbon sequestered.[16]

Sustainable forest management programs, which are strongly supported by the North American paper and forest products industry, not only ensure the growth of fiber supplies to meet future needs, but also ensure attention to environmental and biodiversity objectives for the long-term health of the ecosystems in which we operate.[16]

Recycling avoids the release of greenhouse gases when paper decomposes in landfills, and paper and paperboard is recycled more than any other material in the United States. By reducing the amount of paper and paperboard products going to landfills through recycling, greenhouse gases in the U.S. were lowered by 155 million metric tons of CO_2e in 2018. This is equivalent to taking over 33 million cars off the road for an entire year.[17]

Sources

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