EFFECTS OF RECYCLED FIBER USE ON ENERGY USE

Energy Recovery from Discarded Forest Products

Used paper has a significant fuel value—10 to 17 MMBtu/ton (USEPA 2006) or one-half to three-quarters or more of the fuel value of coal. As a result, the effects of increased recycling on overall energy consumption depend on whether the recovered paper would otherwise have been burned for energy and whether this is considered an offset to energy used elsewhere in the value chain.

Several studies have examined the total energy requirements for systems involving paper recycling compared to systems where recovered paper is burned for energy. Finnveden and Ekvall (1998) analyzed seven European life cycle studies of paper packaging materials covering 26 scenarios and found that in all cases, the total life cycle energy for recycling was less than that for burning used virgin paper as a fuel. Denison (1996) examined three U.S. studies and found that from a total energy standpoint, burning virgin paper for energy was preferable to landfilling but burning for energy still had a higher total overall energy requirement (by 3 to 10 MMBtu/ton of recovered paper) than a system where the paper was recycled. The Paper Task Force (2002) came to similar conclusions, finding total energy benefits of 3 to 17 MMBtu/ton of recovered paper for recycling vs. burning virgin paper for energy.

If, however, one is interested in fossil fuel-related energy instead of total energy, the situation is far less straightforward. In the studies examined by Finnveden and Ekvall (1998), 18 scenarios found lower fossil fuel use for systems where used paper was burned for energy, while eight found lower fossil fuel use in systems where used paper was recycled. In comparing the studies, they found that the results depended primarily upon assumptions about what type of fuel was displaced by the paper-based fuel. Where paper-based fuel was assumed to displace fossil fuel, this was found to require less fossil fuel than a system involving paper recycling. Otherwise, the recycling system was found to have lower fossil fuel use. The Paper Task Force (2002) study assumed that paper-based fuel would displace fossil fuels. Except for the case of newsprint, the fossil fuel-related energy required for the system involving recycling had fossil fuel requirements that were 6 to 9 MMBtu/ton of recovered paper greater than the system wherein used paper was burned for energy. In the case of newsprint, recycling and burning for energy required approximately equal amounts of fossil fuel.

Generally speaking, burning used paper for energy has been found to reduce total (life cycle) energy requirements compared to landfilling, but total energy requirements have tended to be higher than in a system where used paper is recycled. On the other hand, life cycle fossil fuel use has frequently (although not always) been found to be lowest for systems where used paper is burned for energy as long as the paper-based fuel displaces fossil fuels. NCASI (2011) undertook a review of 17 studies that compared waste management options for paper and noted that environmental analyses of recovery for recycling over burning for energy have not produced findings that can be generalized, primarily due to this question's sensitivity to key issues such as

1. impact of land use and alternative usage of the forest area;
2. the type of energy (i.e., fuel type and whether it is used as power or heat) used during virgin and recovered fiber processing;
3. the type and amount of energy displaced when burning waste paper;
4. current capabilities of toxicity-related modeling for LCA impact indicators;
5. assumption regarding the degree of paper degradation in landfills and the approach used for modeling of biogenic carbon dioxide;
6. the selected allocation procedure for recycling, in cases where virgin and recycled paper are compared; and
7. recycled-to-virgin fiber substation ratio.

References

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