ENVIRONMENTAL FOOTPRINT COMPARISON TOOL

A tool for understanding environmental decisions related to the pulp and paper industry

OVERVIEW OF EFFECTS OF DECREASED ENERGY CONSUMPTION

Introduction

Both pulp and paper and wood products manufacturing require significant energy in converting raw fiber into a finished product.

Pulp and paper making is energy intensive. There are two main reasons.

- First, a great deal of energy is required to separate solid wood into fibers. To this effect, recycled paper and paperboard mills are the indirect beneficiaries of the energy used by virgin mills to separate wood into fiber, which is why their energy requirements are usually lower.
- Second, the process of making paper and paperboard requires that fibers be transported and distributed into a thin sheet using water. The water that cannot be squeezed from this sheet must be evaporated, which requires a substantial amount of energy. All types of paper and paperboard mills need to apply this energy.

Smaller amounts of energy are required in many other places in pulping and paper making, but the energy requirements for pulping and for drying paper are the largest.

All mills require steam, which is generated by burning fossil fuels and biomass fuels, and most mills also purchase electricity. The amounts of electricity that are purchased are highly variable because many mills, and essentially all chemical pulp mills, generate large amounts of electricity. Mills usually generate electricity in combined heat and power (CHP) systems (also known as co-generation systems) which are far more efficient than the systems typically used by commercial electricity producers. In some cases, the amounts of electricity generated by a mill will exceed its needs and the mill will be able to sell electricity to the “grid.”

The pulp and paper industry obtains much of its energy from renewable sources, particularly biomass. Most of this is produced from the parts of the tree that are not needed for paper and paperboard production. In specific, the industry relies heavily on bark fuels and energy-rich “pulping liquors” which contain those parts of the wood that are not used for making paper (primarily the lignin that holds fibers together in the tree).

Energy usage in wood products plants varies substantially by product type. For plants that receive wood in the form of logs, the single highest energy requirement is for heat energy to dry the wood to product specifications. Wood products presses also require heat. Electrical energy requirements are much lower than heat energy requirements at wood products mills.

Heat energy may be applied directly or indirectly though steam or thermal oil. With a few exceptions, wood products presses are heated by steam or thermal oil. Most wood products rotary dryers are directly heated and most conveyor dryers are indirectly heated with steam.

Like the pulp and paper industry, the wood products industry obtains much of its energy from renewable biomass, primarily wood residuals. Wood residuals may be broadly defined as all wood materials not incorporated into the final product. Wood residuals are the primary fuel at most wood products plants with natural gas a distant second. Very few wood products plants burn coal or oil.

Industry Performance

Energy consumption in the North American pulp and paper industry has declined over the years, while the fraction of energy supplied by renewable fuels has increased. This is illustrated in Figures E1 and E2 for the U.S. pulp and paper industry[1] and Figures E3 and E4 for the Canadian pulp and paper industry. Between 1972 and 2010, there has been a 26% reduction in fenceline energy intensity in the U.S. pulp and paper industry. During this same time frame, the fraction of fenceline energy supplied by biomass and renewable energy like hydroelectric power has increased from 40% to 65%. It should be noted that there are various ways of expressing energy intensity such as fenceline energy intensity[2] used within this document, purchased energy intensity which is sensitive to marginal fuel choices and is the metric adopted by AF&PA in their energy sustainability goal[3], fuel energy intensity which considers the energy content of fuels used to generate steam and power at facilities, or useable energy intensity, which is based upon the energy content of steam and power used at facilities. When comparing energy intensity values from various sources, it is important to use the same energy intensity metric.

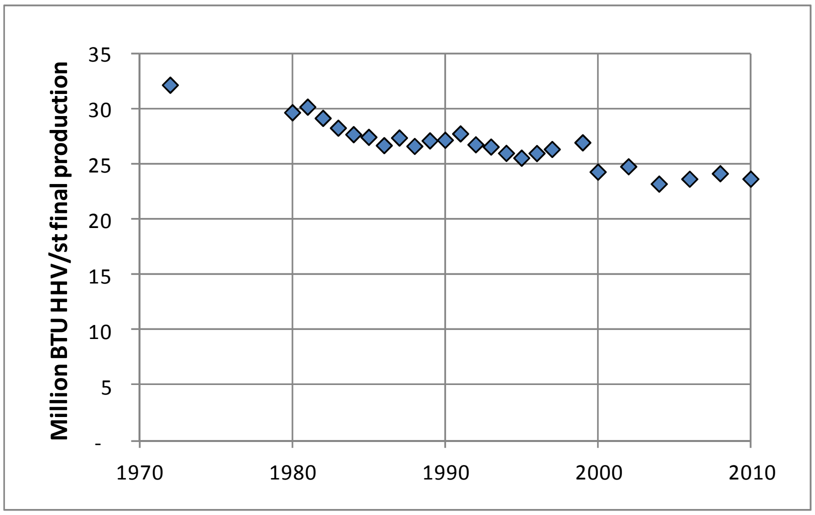

Figure E1. U.S. Pulp and Paper Industry Fenceline Energy Use Intensity since 1972 (Source: AF&PA 2012)

[1] Data represent American Forest & Paper Association (AF&PA) membership only.
[2] Fenceline energy is the energy content, on a high heating value basis, of all purchased and self-generated fuels and purchased electricity and steam, minus the energy content of any sold electricity and steam. Fenceline energy intensity is the fenceline energy divided by final production, which provides a measure of the amount of energy required to produce a fixed amount of paper, paperboard, or market pulp product.
[3] http://www.afandpa.org/sustainability/increase-energy-efficiency

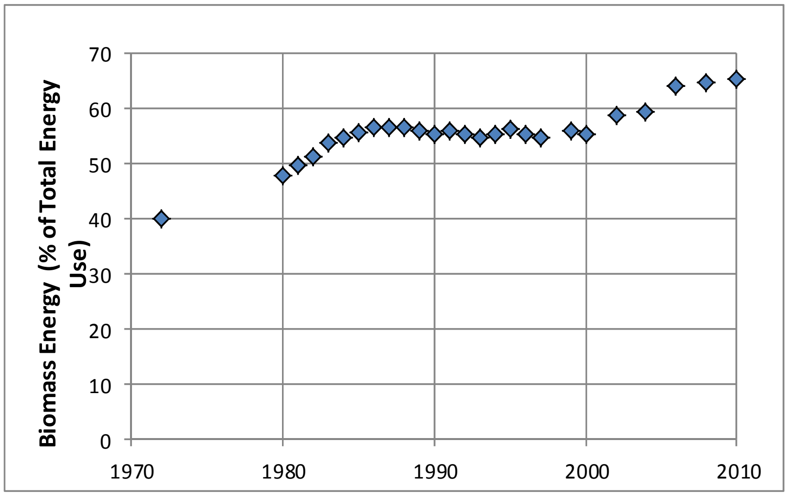

Figure E2. U.S. Pulp and Paper Industry Biomass and Renewable Energy as a Percent of Total Fenceline Energy Use (Source: AF&PA 2012)

Between 1990 and 2010 there has been a decrease of 27% in energy intensity in the Canadian pulp and paper industry, and the fraction of fenceline energy supplied by biomass has increased from 47% to 56%.

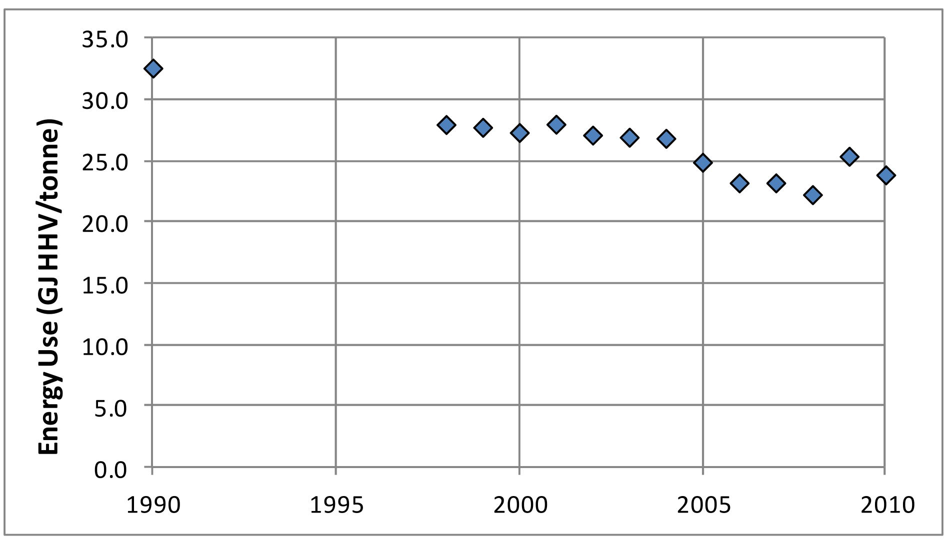

Figure E3. Canadian Pulp and Paper Industry Energy Use Intensity since 1990 (Source: CIEEDAC 2012)

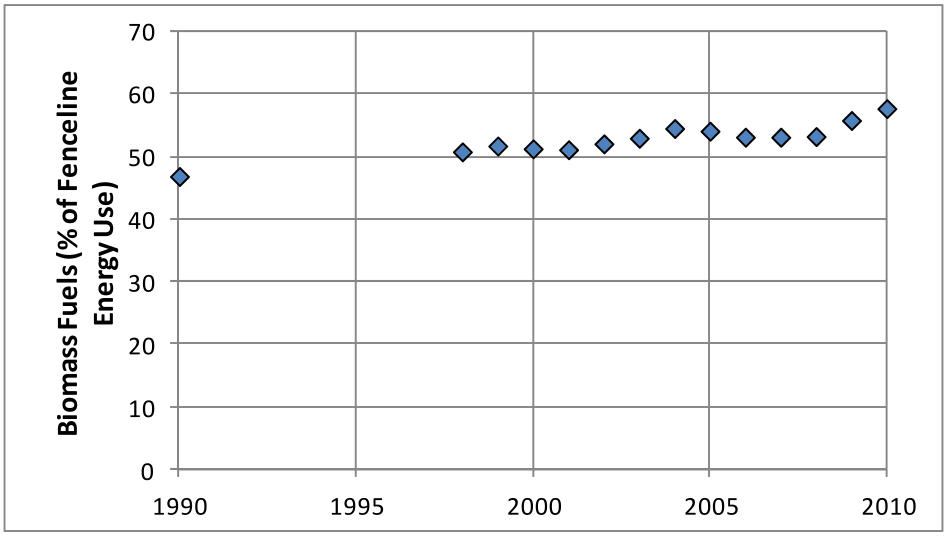

Figure E4. Canadian Pulp and Paper Industry Biomass Energy as a Percent of Total Fenceline Energy Use (Source: CIEEDAC 2012)

The energy intensity trend for the U.S. wood products sector from 2000 to 2010 is given in Figure E5. Underlying data in Figure E5 may be considered to have higher uncertainty than the U.S. pulp and paper energy data because the wood products sector energy data do not undergo equivalent quality assurance and quality control procedures. There has been an increase in energy intensity between 2000 and 2010 for the wood products sector. Contributing factors that may have adversely affected wood products results include a dramatic reduction in production represented by the data and a shift in production mix to more energy intense structural panel products from lumber products.

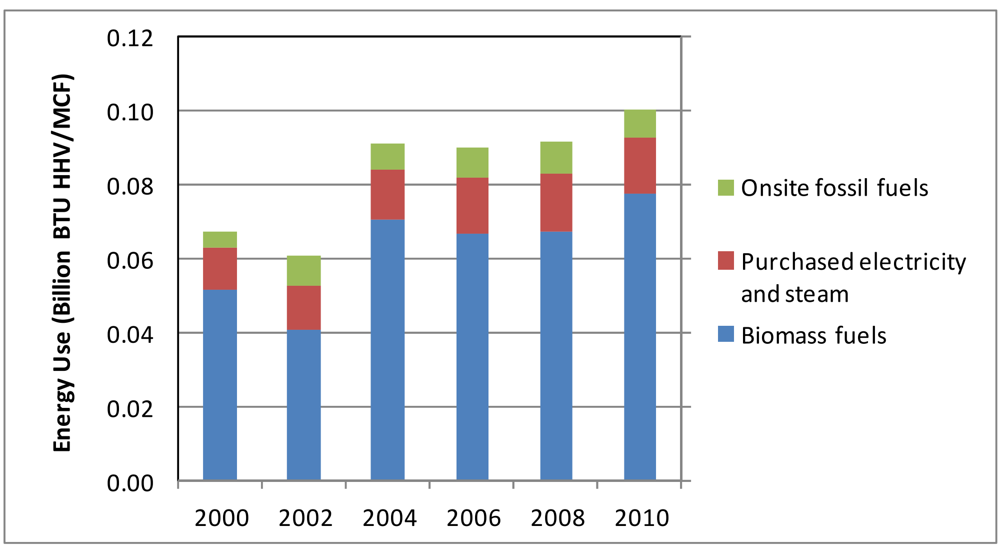

Figure E5. U.S. Wood Products Industry Energy Use Intensity since 2000 (Source: AF&PA 2012)

Opportunities for Improvement and Challenges to Further Energy Use Reduction

One way to determine whether there are opportunities to further reduce energy use is to compare a facility's energy consumption to that of other facilities manufacturing the same products. If the energy consumption is greater than that of other facilities, there may be ways to reduce the facility's energy consumption and thereby reduce greenhouse gas (GHG) emissions. That said, comparison of a facility's energy consumption to reference values is limited due to the wide variation in mill configuration, which can make it very difficult to compare energy use of two similar facilities. For example, these comparisons do not specifically identify where opportunities for improvement may be found, and mill-specific circumstances may result in irrelevant comparisons (for example, some facilities may consume fuels in quantities higher than expected, but as a result are able to generate excess electrical power and steam for export to other users). Complex mills that produce a variety of product grades utilizing a combination of manufacturing processes may have complex internal energy flows that can be difficult to compare to those of other facilities. Therefore, these comparisons should be used with caution and an awareness of the potential limitations in their utility.

References

American Forest & Paper Association (AF&PA). 2012. *AF&PA environmental, health & safety verification program fuel and energy data*. Washington, DC: American Forest & Paper Association.

Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). 2012. Energy use and related data: Canadian paper manufacturing industries 1990 to 2010. Canadian Industrial Energy End-Use Data and Analysis Centre. http://www2.cieedac.sfu.ca/media/publications/Pulp_Paper_Analysis_2011__2010__Final.pdf