



WWF®

for a living planet®

Carbon dioxide (CO₂) and energy use in pulp and paper mills

Fossil carbon dioxide, CO₂, is a by product of burning fossil fuels like oil, coal and natural gas in order to generate energy. The pulp- and paper industry generates fossil CO₂ both directly by burning fossil fuels at the site to generate heat and/or power, and indirectly through their purchase of electric energy from the grid generated in power-plants run on fossil fuels. Whilst some companies transparently report their energy usage and CO₂ emissions at mill level, and their relative success in reducing energy use, many do not. Among companies that do report, it has become standard practice to report emissions of fossil fuel CO₂ separately (however, comparative studies of mill performances would be made easier if these figures were given in *per tonne* rather than as annual totals).

Unfortunately, emissions from electricity bought from the grid, which may be a very significant proportion of the totals, are often not included in the data. Thus, while all other emission thresholds in the Scorecard are based on actual performance data, the 'entry levels' for carbon dioxide emissions rely on reported averages (conservatively taken to refer to direct emissions only) 'scaled up' to address additional contributions from grid energy. These calculations rely on global relations between direct and indirect CO₂ emissions from the pulp-and paper sector (estimated to be 205 and 140 million tonnes, respectively, by NCASI)¹. As a result, the carbon dioxide scoring scale used in the initial version of the Scorecard is probably somewhat less robust than the other emission parameter scales and may need to be adjusted as more data become available.

The Paper Scorecard does not address CO₂ emissions from transportations of raw materials or finished products, simply because as yet there is almost no consistent and comparable data available. However, while unfortunate, excluding fossil CO₂ emissions from transportation does not invalidate the Scorecard approach, as these emissions are estimated by NCASI to be comparatively minor, only 9-14% of the emissions from combined direct and indirect burning of fossil fuels to generate energy.

Fossil fuel versus biomass CO₂ emissions

The environmental impact of CO₂ is that it acts as a greenhouse gas contributing to global warming. This effect is irrespective of whether the CO₂ is generated by combustion of fossil fuels like coal, oil and natural gas, or from burning of bio-fuels like wood. However, as sustainable production of renewable bio-fuels is assumed to rapidly capture the same amount of carbon dioxide released by burning into the production of new organic materials, burning of bio-fuels are not considered to add to the **net** level of carbon dioxide in the atmosphere.

Strictly speaking even use of bio-fuels does add to global warming, though, as all combustion processes, irrespective of the kind of fuel, also generate some other greenhouse gases like N₂O. While single molecules of these compounds are much more powerful greenhouse gases than molecules of carbon dioxide, the total amounts are normally so small that their combined effects are still minor compared to that of carbon dioxide. Thus, for the purposes of the Paper Scorecard, WWF has adopted the commonly used practise of considering burning of renewable fuels as climate neutral.

¹National Council for Air and Stream Improvement, Inc. (NCASI). 2007. *The greenhouse gas and carbon profile of the global forest products industry. Special report No. 07-02. Research triangle Park, N.C.*

How much energy is used in the pulp and paper industry?

The pulp and paper industry is extremely energy intensive; it is in fact the world's fifth largest industrial consumer of energy according to the Worldwatch institute². In the US it represents about 12% of total manufacturing energy use³. That said however, energy costs can represent up to 25% of the total costs, so mills make every effort to reduce consumption. According to CEPI⁴, "the paper industry has made important strides in reducing total energy use since 1973 and in increasing the fraction of energy provided from self-generated biomass sources. The paper industry is now the biggest user and producer of renewable energy sources". Nevertheless, many millions of tons of fossil fuel CO₂ contributing to climate change are released by paper mills every year.

Biomass based co-generation

Biomass (black liquor from the kraft pulping process and solid biomass residues) is a major energy source for the pulp industry. Biomass used in co-generation, or combined heat and power (CHP) systems are recognised as a key technology to save energy - thereby reducing emissions of fossil carbon dioxide. CHP is the simultaneous generation of usable heat and power (usually electricity) in a single process compared to using separate production of electricity in a power plant and conventional boilers. Because CHP systems make extensive use of the heat produced during the electricity generation process, overall efficiencies in excess of 70% at the point of use can be achieved (in contrast, the efficiency of conventional coal-fired and gas-fired power stations, which discard this heat, is typically around 38% and 48% respectively). According to the European Association for the Promotion of Cogeneration, the EU pulp and paper industry generates 90% of its on-site electricity production through CHP technology, thereby avoiding Greenhouse Gas Emissions of 8 million tonnes carbon dioxide equivalents per year⁵.

What are the fossil CO₂ emissions of individual mills?

This varies widely and depends on many factors such as size of mill (due to economies of scale) and how modern the mill is (it is generally true that retro fitted process improvements do not give the same economies), as well as on the fact that some pulps and papers by their specification are more energy intensive to produce than others (for example mechanical pulps are more energy demanding than chemical ones). Integrated mills (pulp and paper making on the same site) can benefit from the surplus energy produced from its waste - black liquor from pulping and use it to generate energy for the papermaking process. Another factor affecting fossil fuel CO₂ emissions is the source of bought electricity - which is often, but not always, from power stations dependent on fossil fuels.

WWF acknowledges that mills operate under very different conditions in different regions (as an example, the amount of fossil fuel used to generate grid electricity vary between countries), and that these differences create 'un-level playing fields'. However, WWF also recognises that some companies have made greater efforts, and achieved more improvements, than others. Thus, WWF encourages paper buyers to, in addition to compare scorings, ask how successfully mills have been in adopting more efficient technologies that reduce their energy demand (and associated emissions of fossil CO₂) as well as what steps has been taken to move away from fossil fuels to biomass. A WWF study of environmental reporting shows there is a wide range of success and commitment in achieving these two aims.

²Worldwatch Institute: *Paper cuts, recovering the paper landscape No 149* <http://www.worldwatch.org/taxonomy/term/40?page=2>

³Energy use US [.http://www.aceee.org/pubs/ie962.htm](http://www.aceee.org/pubs/ie962.htm)

⁴Confederation of European Paper Industries (CEPI), *Sustainability report 2005*

⁵Combined Heat and Power Association. <http://www.chpa.co.uk/>