

## **Recycled Paper: How Does It Impact Carbon Emissions?**

### **Introduction**

We've all been told for a long time that we should use recycled paper, but do we know why? Does using recycled paper cause less CO<sub>2</sub> equivalent<sup>1</sup> greenhouse gases to be emitted, and do these benefits outweigh the cost premium that the recycled papers often command? And what about other factors such as process-chlorine free papers and FSC certification? This paper-free paper discusses the issues involved with making choices related to recycled papers.

### **An Online Tool to Help Choose Paper**

Environmental Defense Fund, a non-governmental organization that works with businesses to find solutions to environmental problems, has developed an online Paper Calculator to help individuals and companies make decisions about the environmental benefits of recycled paper. To see how it works, go to [www.papercalculator.org](http://www.papercalculator.org), and conduct a comparison between a ton of 0% recycled content paper and a ton of 100% recycled content. Click "Calculate," and an easy-to-understand table will appear which shows that making a ton of virgin paper emits 5,882lbs of carbon dioxide equivalent emissions, while making a ton of recycled paper emits 3,422lbs of carbon dioxide equivalent: a saving of 2,460lbs.

### **The Carbon Footprint of Paper: Digging into the Data**

The numbers that appear on the Paper Calculator are nice and clean, and it seems fairly obvious that consumers who want to reduce emissions of greenhouse gases should purchase recycled paper. To have a complete understanding of how these results were obtained, however, it is important to understand the methodology used to generate the numbers on the Paper Calculator. Two issues are particularly important.

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<sup>1</sup> A couple of brief definitions: Carbon Dioxide Equivalent and Greenhouse Gases. Carbon dioxide is a greenhouse gas, which means that it collects in the upper atmosphere and traps energy from the sun's rays, and holds that energy close to the Earth, causing what is known as the "greenhouse effect". Life would not be able to survive on Earth without the greenhouse gas effect, but when too much carbon dioxide is emitted the Earth starts to overheat: this is called "global warming." Some gases other than carbon dioxide also contribute to the greenhouse effect: methane, for example, is produced during anaerobic decomposition (such as when paper degrades in the absence of oxygen in a landfill), and can be even more powerful contributors to global warming than carbon dioxide. Methane, for example, is a greenhouse gas that is 21 times more powerful than carbon dioxide so scientists multiply the amount of methane emitted by 21 to produce a single, more easily understandable measure of "carbon dioxide equivalent" emissions.

Firstly, Environmental Defense carried out the research necessary to understand emissions associated with paper containing 0% recycled content (virgin) and 100% recycled content<sup>2</sup>, as in the example presented above. The calculator allows a consumer to enter other levels of recycled content (such as 30% or 50%) but the numbers for the carbon dioxide equivalent emissions are simply linearly interpolated from the 0% and 100% recycled content rates. Thus the carbon dioxide equivalent emissions for 50% recycled content will be precisely half of the 100% recycled content - which is a good approximation, but possibly not exactly correct in the real world. It would be extremely difficult and expensive to obtain data for every possible percentage of recycled paper content, so the interpolation method allows a useful comparison until better data becomes available. Users can thus expect the calculator to produce results showing that the higher the level of recycled content in a paper, the less carbon dioxide equivalent will be emitted.

Secondly, the Paper Calculator does not incorporate any of the changes in carbon content in forests that occur when old-growth forests are converted to plantations for tree harvest. These effects may include the storage of carbon from now dead tree roots, the decay of branches and leaves that are cut off the tree and not used for making paper (which produces carbon), and the loss of carbon-rich top-soil which had previously been held in place by tree roots, and which may now be emitted to the atmosphere. Different scientists have calculated wildly different figures for each of these factors, and including them in the Paper Calculator would produce results containing such a wide possibility for error as to render them useless. The Paper Calculator instead focuses on the emissions we do understand well to provide an imperfect but still useful result.

### **So Why Does Recycled Come Out So Much Better?**

It turns out that the manufacturing processes for making virgin and recycled paper essentially emit approximately the same amount of carbon dioxide. By using recycled paper, though, a consumer prevents waste paper from being put in landfills, which would degrade and produce the potent greenhouse gas called methane. These avoided methane emissions accrue as a "credit" to the recycled paper production process, which is why the Paper Calculator shows a large reduction in carbon dioxide equivalent emissions: the calculator multiplies the methane emissions by 21 to produce a figure for the amount of carbon dioxide would have to be emitted to have the same impact on global warming as putting the paper in the landfill.

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<sup>2</sup> Pre-consumer waste? Post-consumer waste? What's the difference? Pre-consumer waste is waste that was collected at a factory, and then recycled into new products. In this case, pre-consumer waste might include the excess paper that would normally be thrown away when sheets are trimmed to the correct size. Post-consumer waste means paper that a consumer used and then placed into a recycling bin. Any recycled content is better than none, but post-consumer waste is the preferred option.

### **Other Issues: Process-Chlorine Free, FSC**

Of course, “recycled” isn’t the only choice that consumers must make related to paper: what about process-chlorine free options, or FSC certification? Chlorine is used in paper manufacturing to whiten and brighten the product. The manufacture of chlorine itself is incredibly energy-intensive<sup>3</sup>, so using less chlorine decreases carbon dioxide emissions by reducing the amount of electricity generated. Chlorine also has negative environmental impacts when it is released into rivers as effluent. Studies in Sweden<sup>4</sup> have shown that fish downstream of pulp mills accumulate chlorinated compounds in their bodies and show physical deformities and changes in fish population and community structure. Choosing process-chlorine free papers (often labeled “PCF free” by the paper manufacturers) thus reduces carbon dioxide emissions as well as other detrimental environmental impacts.

The Forest Stewardship Council (FSC) is a non-governmental organization that promotes the responsible management of the world’s forests. FSC-certified paper is produced from forests that are managed in a socially and environmentally responsible way. The Forest Stewardship Council does not claim that FSC certification can help to offset carbon emissions, although FSC certified timber does not include raw material from damaging forestry practices or forest conversion which lead to carbon emissions from deforestation, forest degradation (such as soil erosion) and forest fires. A timber-industry developed standard called the Sustainable Forestry Initiative also certifies paper, but FSC is generally seen to have more rigorous standards, which is the only standard to include:

- Prohibiting conversion of natural forests or other habitat around the world
- Prohibiting the use of highly hazardous pesticides around the world
- Prohibiting the cultivation of genetically modified trees (GMOs)
- Respecting the right of indigenous peoples around the world
- Auditing each certified operation at least annually – and if they are found not to comply, the certificate is withdrawn

Buying FSC-certified paper, then, may not result in a scientifically provable reduction in carbon emissions, but does produce other social and environmental benefits.

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<sup>3</sup> See, for example: Memorandum submitted by INEOS ChlorVinyls (ET02) to the British Parliament, available at: <http://www.publications.parliament.uk/pa/cm200809/cmselect/cmenvaud/memo/carbonmarkets/et0202.htm>

<sup>4</sup> See, for example: Hodson, P.V., M. Gagnon, J.J. Dodson, and C.M. Couillard. 1992a. Physiological responses of fish in "control" and BKME-polluted rivers Presented at the 13th Annual Meeting of the Society of Environmental Toxicology and Chemistry, Cincinnati, Ohio, Nov. 9-12, 1992.

## Keeping the Big Picture in Mind

It is only possible to buy paper with recycled content because other people have previously used paper and then disposed of it by recycling instead of putting it in the trash. Some experts argue that because there is not enough paper with recycled content available to satisfy consumer demand, that a single consumer who purchases paper with recycled content simply forces another consumer to use virgin paper instead<sup>5</sup>. For this reason, these experts argue that the “credit” for avoided landfill emissions should actually be “given” to the virgin paper: which would make virgin paper look more environmentally-friendly than recycled paper! No matter where the credit is applied, recycling paper results in an overall benefit to the environment, which will only occur if consumers continue to recycle virgin paper. To reduce greenhouse gas emissions to the greatest extent possible:

- Use less paper. Software programs are now available to help consumers print only the pages they need, rather than almost empty pages that often appear when websites are printed. Only print what you really need to have on paper.
- Use paper with a high level of recycled content; preferably 100% recycled, process-chlorine free.
- Choose FSC-certified paper once these other criteria are met.

## Conclusions

As is often the case with decisions related to environmental impacts it can be hard to evaluate the different options available, particularly when apparently competing certifications appear on different products. Climate Earth works with companies to help them understand their impacts on our global climate, and decisions such as what sort of paper to buy form an important part of a company’s efforts to reduce its environmental impact. Our approach to enterprise carbon accounting mirrors the style of this paper: we look at an issue holistically to understand the overall picture, incorporate the best data available, follow scientific methodology, and arrive at insights that executives can rely on to improve their business. As better data becomes available (and sometimes this means visiting suppliers to procure it), we iterate our findings. In this case, the preferred choice is quite clear: purchasing paper with a high level of post-consumer recycled fiber content is the environmentally preferable choice that results in the maximum reduction of carbon dioxide equivalent emissions. If the data changes, we’ll be the first to let you know.

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Info on impacts of chlorine on fish: [http://www.aet.org/science\\_of\\_ecf/eco\\_risk/sap97sec4.html#4](http://www.aet.org/science_of_ecf/eco_risk/sap97sec4.html#4)

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<sup>5</sup> See, for example: Ekvall, T. (2000). "A market-based approach to allocation at open-loop recycling." *Resources, Conservation and Recycling*(29): 91–109.