



Environmental comparison of office paper produced with different fibre raw materials

Conducted on behalf of the *Initiative Pro Recyclingpapier* association

c/o Burson-Marsteller GmbH & Co. KG
Schützenstraße 5, 10117 Berlin,
Germany
Tel.: +49 30 240-79396; Fax: +49 30 240-79399
Email: info@papiernetz.de

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Institut für Energie- und Umweltforschung Heidelberg GmbH
Uli Gromke, Andreas Detzel
Wilckensstraße 3, 69120 Heidelberg, Germany
Tel.: +49 6221 476-70; Fax: +49 6221 476-719
Email: andreas.detzel@ifeu.de

Executive Summary

Germany is Europe's biggest producer and consumer of graphic paper. The country manufactures 1.5 million tonnes of uncoated printer and office paper each year, whereby recycled paper accounts for a good 20 per cent, or around 300,000 tonnes, of this output. ¹

The *Institut für Energie- und Umweltforschung* (Institute for Energy and Environmental Research – IFEU) in Heidelberg conducted a study on behalf of the *Initiative Pro Recyclingpapier* that analysed the processes for manufacturing paper using fresh fibre and recovered fibre. The most important finding from the study is that the environmental performance of recycled paper clearly outperforms fresh fibre-based paper with regard to all indicators examined in the analysis.

The German Environment Agency recommends using recycled paper

In August 2000, the German Environment Agency (UBA) published a background document with the title *Ökobilanzen für graphische Papiere* ("Life Cycle Assessments for Graphic Paper"). The document was based on a graphic-paper life-cycle assessment that had previously been conducted by a project group led by the IFEU.

In this document, the UBA highlighted one of the key findings of the assessment, namely that it is "significantly more environmentally friendly to manufacture graphic paper using waste and scrap paper than it is to use fresh fibres from wood raw materials".

The need for a new data basis

The aforementioned life-cycle assessment data is now over ten years old. The *Initiative Pro Recyclingpapier* therefore commissioned the IFEU to conduct a study that would update the data basis. The main objective of the study was to compare and assess the environmental impact of fresh fibre-based and recycled copy and printer paper. To this end, the study took into account key process steps for everything from obtaining raw materials (from forests or waste paper recycling facilities) to the manufacturing of the final paper product in Germany. Unlike the UBA's life-cycle assessment, the new study did not examine other types of graphic paper or the methods employed to dispose of used paper.

Model assumptions

The present study analyses the production of fresh fibre-based and recycled paper separately. The study ends with the finished copy paper product – i.e. more or less at the paper factory shipment facility. Upstream chemical and energy chains are also examined, as are the required transport operations along the process chain (see Figure 1).

In order to ensure a more accurate comparison, the study only looks at paper production in Germany. The secondary-fibre paper examined in the life-cycle assessment (shown as "Secondary D" in the charts in Figure 2) is manufactured from de-inked pulp (DIP), while the primary-fibre paper examined is made from bleached sulphate pulp (kraft pulp). The market pulp used in Germany mostly comes from countries such as Sweden and Finland, with lower volumes originating from overseas (e.g. Brazil). These regions are designated in the charts as "Primary North" and "Primary South".

¹ Verband Deutscher Papierfabriken e.V., "Papierkompass 2006", Bonn, 2006
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The scenarios chosen depict the average situation in each case. In other words, individual plants and factories may very well display results that are either higher or lower than the results presented in the study. The data used reflect the current state of affairs to the extent that this could be researched and determined on the basis of publicly accessible sources of information.

The comparative figure used for the analysis was 1,000 kg of manufactured office paper.

Indicators examined for the environmental assessment

Several indicators needed to be examined in order to be able to estimate the environmental impact of paper production. These indicators provide information on the negative impact of paper production on air, soil and water quality, and on (energy) resources.

Presentation of the results

The results of the study are presented as stacked bar charts that show different segments (sectors) of paper manufacturing. The individual sectors consist of both main processes and all relevant upstream chains, such as the provision of energy and auxiliary materials and the transport of raw materials and auxiliary materials (wood, waste paper, sodium hydroxide, etc.). A distinction is made between the provision of wood / waste paper, the production of pulp / de-inked pulp, pulp transport and paper production.

Overview of the results

- It takes a significantly greater amount of energy to produce pulp from wood than it does to reprocess waste paper.
- The production of recycled paper displays much better values than fresh fibre-based paper manufacturing in terms of the indicators of fossil resource requirement, greenhouse effect and acidification – and this despite the use of substantial amounts of production residue (spent lye, bark) in fresh-fibre production
- The higher sulphur content of the spent lye also leads to a significant increase of the overall acidification result when using it for energy generation to produce fresh fibres for primary-paper manufacturing.
- Primary fibres originating in southern regions need to be transported over long distances – and this negatively impacts the fossil resource requirement and greenhouse effect indicators in particular.
- The significantly higher process water requirement in the case of fresh fibre-based paper production is due to differences between the processes for manufacturing pulp and de-inked pulp: More water is needed to boil wood in order to extract fibres than is required for paper recycling processes.

Tables 1 and 2 use different examples to show the emission reductions that can be achieved through paper recycling. For example, the production of just one package of recycled paper (500 sheets) in lieu of manufacturing fresh fibre-based paper from pulp obtained from southern regions reduces the consumption of fossil resources by the same amount as would be needed to keep a 100W bulb lit for 44 hours using fossil resources in the German electricity mix.

Manufacturing one tonne of recycled paper rather than fresh fibre-based paper made from northern pulp reduces CO₂ emissions by an amount equivalent to the emissions produced by an average car when it travels approximately 1,000 km.

If all the copy paper used in Germany (800,000 tonnes per year) were to be made from waste paper, the process water requirement for copy paper production would be about 25.4 million m³ lower (about the size of a small reservoir) than if the same amount of paper were made using fresh fibres.

Conclusion and recommendation

The environmental impact of paper production using recycled paper is lower with regard to all of the indicators examined. The IFEU therefore believes that everyone should continue to follow the German Environment Agency's recommendation in favour of using recycled paper or paper with the highest possible waste paper content.

This is particularly important in cases in which the production of fresh fibre-based paper requires raw materials to be transported over long distances: Therefore, for ecological reasons, no pulp from overseas should be used to produce primary paper, and the waste paper used to manufacture recycled paper should be obtained from regional sources.

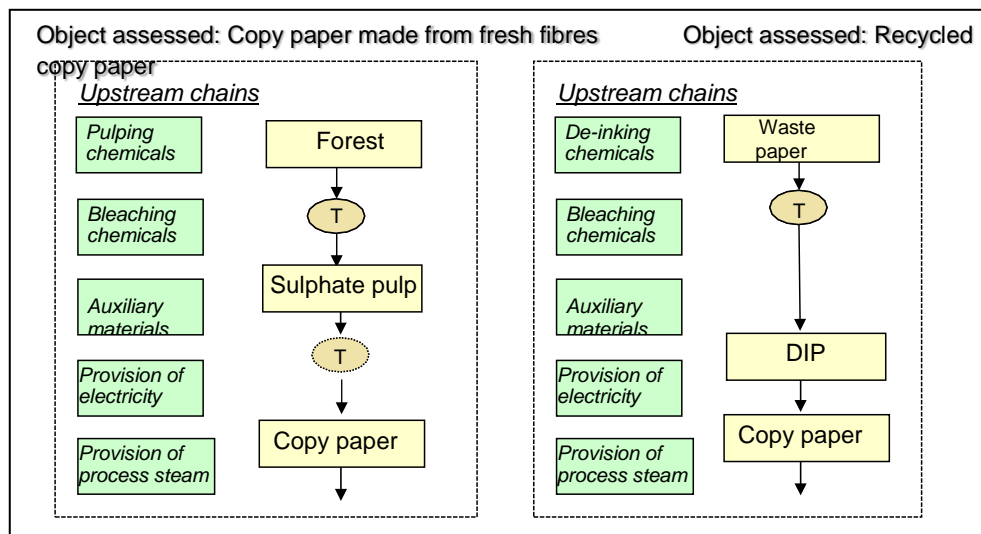


Figure 1: System boundaries of the processes taken into account in the current environmental assessment. T stands for Transport

Comparison between fresh fibre-based paper (made from northern pulp) and recycled paper	Resources [crude oil equivalent in kg]	Greenhouse effect [CO ₂ equivalent in kg]	Process water [kg]
In relation to one package of copy paper (500 sheets)			
	0.08	0.5	80
In relation to 1 tonne of paper (400 packages of 500 sheets each)			
	33	183	31,800
In relation to 800,000 tonnes of office paper (average annual consumption in Germany)			
	26,500,000	146,000,000	25,400,000,000

Table 1: Emission reductions achieved through the production of recycled paper as opposed to production of fresh fibre-based paper made from pulp from northern regions

Comparison between fresh fibre-based paper (made from southern pulp) and recycled paper	Resources [crude oil equivalent in kg]	Greenhouse effect [CO ₂ equivalent in kg]	Process water [kg]
In relation to one package of copy paper (500 sheets)			
	0.21	0.9	80
In relation to 1 tonne of paper (400 packages of 500 sheets each)			
	82	347	31,800
In relation to 800,000 tonnes of office paper (average annual consumption in Germany)			
	65,900,000	278,000,000	25,400,000,000

Table 2: Emission reductions achieved through the production of recycled paper as opposed to production of fresh fibre-based paper made from pulp from southern regions

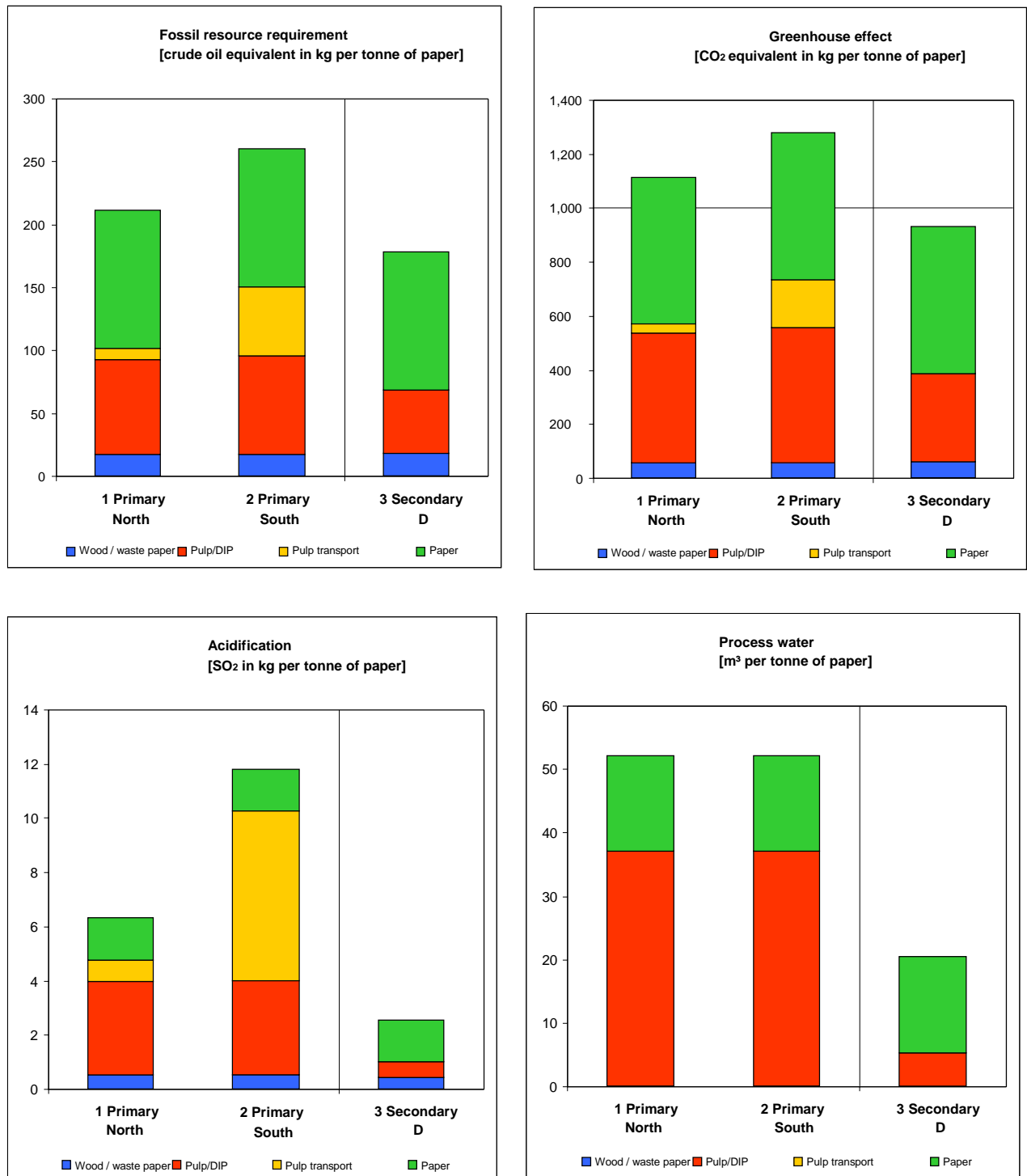


Figure 2: Results of the environmental comparison between fresh fibre-based and recycled paper using the indicators of fossil resource consumption, greenhouse effect, acidification and process water