NCASI Fact Sheet

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Paper Calculator 4.0

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Overview

Paper Calculator 4.0 is a web-based tool[1] for calculating and comparing environmental impacts of fourteen different paper grades with user-selectable amounts of recycled content. Its results are based on aggregate industry data from North America (US and Canada) and Europe. The tool is based on a Life Cycle Assessment (LCA) Methodology published by SCS Global[2]. The intent of this tool is to "calculate and compare the estimated environmental impacts of different paper choices."

Use

The tool employs two methods of calculation: one using individual paper grades, and another using groups of paper products. The user chooses from fourteen paper grades and enters the quantity of paper and its recycled content. Five primary and nineteen extended impacts are summarized. Results between paper grades can also be viewed side-by-side.

Key Results

The calculator indicates that using any amount of recycled content will lower environmental impact scores for at least seventeen of the calculated impact categories across all paper grades. These impact scores increase linearly as recycled content increases, i.e. impacts of a 50% recycled content sheet show an impact score midway between that of a 100% virgin and that of a 100% recycled sheet. This assumption will not be valid for most manufacturing operations. Other noteworthy observations include:

- Data used as inputs to the calculator cannot be checked by a user to verify accuracy.
- Bioenergy use is not reported separately from fossil fuel energy use.
- The tool does not assume that biomass carbon emissions are "neutral".
- Indicator results vary widely between similar paper grades that use comparable manufacturing processes.
- Indicator results for forest disturbance, threatened species, and greenhouse gas impacts are based on assumptions for which no consensus exists amongst the scientific research community.
- Impact scores of pollutant releases are not reported as a function of individual mill configuration and control strategies. As reported these scores can be perceived as being a function of paper grade, which they are not.

Calculations

Multiple results that are difficult to explain become apparent when viewing paper grade results side-by-side, as pictured below for the uncoated bleached kraft (UBK) and uncoated unbleached kraft (UUK) grades.

		Uncoated Bleached Kraft (UBK)		Uncoated Unbleached Kraft (UUK)	
Category	Units				
Recycled Content	Percent recycled	0%	100%	0%	100%
Amount of paper	U.S. Short Tons	100	100	100	100
wood use	U.S. short tons	308	-	417	-
Total Energy	million BTUs	2,720	1,540	2,720	1,540
green house gases	lb CO2 equiv.	1,550,000	299,000	1,550,000	299,000
water usage	gallons	3,260,000	1,040,000	2,370,000	1,040,000
solid waste	pounds	50,500	21,200	46,900	21,200
Nox	O3 equiv/m3	87,500	76,400	190,000	76,400
Purchased Energy	million BTUs	1,810	1,540	1,540	1,540
Particulates	PM2.5 equiv/m3	380,000	16,200	55,700	16,200
SO2	pounds	811	227	590	227
VOC	pounds	58	14	62	14
TRS	pounds	20	13	17	13
HAPs	pounds	262	241	224	241
COD	pounds	4,470	380	984	380
BOD	pounds	697	171	349	171
TSS	pounds	754	392	1,180	392
Forest Disturbance	acres	24	0	179	0
Threatened Species	species	3	0	6	0
Ocean Acidification	pounds	207,000	83,600	279,000	83,600
Mercury Emissions	milligrams	5,160	3,170	3,150	3,170
Dioxin Emissions	micrograms	3,190	443	120,000	443

Darker cells show which percent of recycled content in the paper has the lowest value – for UBK the 100% recycled sheet has the lowest value for every indicator. Bold border boxes show values that are difficult to interpret or are unexpectedly divergent.

Based on these results from the calculator, the following appear anomalous:

- 35% more wood is required to make a sheet of UUK than it does to make a sheet of UBK. This contrasts with a reasonable expectation of very similar wood requirements, or even less wood to make unbleached kraft (UUK), given some amount of loss through the bleaching process.
- The amount of purchased energy for making 100% virgin fiber and 100% recycled fiber sheets of UUK is the same. It is also the same amount of purchased energy for making a 100% recycled UBK sheet. It is unlikely these values can be the same for these three paper grades.
- 6.8 times as many particulates (PM 2.5) are calculated as being emitted when producing virgin UBK versus UUK. This result is inconsistent with NCASI field sampling data showing variations of less than 65% between mills making these paper grades.

Results from the calculator are not only difficult to interpret for these two paper grades but also for others. For example, results show that to produce 10 tons of 100% virgin uncoated groundwood paper, about 25 acres of forests are disturbed, yet only seven acres are disturbed when making 10 tons of coated groundwood paper – asserting that more than three times as many acres are disturbed to make an uncoated groundwood sheet compared to a coated groundwood sheet. This conclusion seems unreasonable since uncoated groundwood should have roughly 20% more fiber in a sheet compared to a coated sheet, which in theory should require 20% more acres harvested, not 300% more. Such results highlight that mill locations significantly affect conclusions, rather than paper grade and recycled content. The source of such unexpected results is unclear and cannot be determined from the calculator reference documents.

Methods

Paper Calculator 4.0 is based on an LCA Methodology published by SCS Global. The methodology underpinning the calculator uses cradle-to-grave boundaries beginning with forest management and ending at final product disposal, excluding printing and use phases. It assumes the recycled content life cycle starts with the collection of used papers. The results are based on aggregate industry data from North America (US and Canada) from the RISI Mill Asset Database, the USLCI database, and the ecoinvent European database. The calculator's LCA routinely references methodologies published by SCS Global, implying they are broadly accepted, yet these approaches have not been published in the peer-reviewed literature or vetted by the LCA scientific community.

History

Created by the Environmental Defense Fund in 2005, it was bought and updated by the Environmental Paper Network in 2011. The current version was released July 2018.

Conclusion

The following points should be considered when interpreting results from this calculator:

- Impact scores obtained through the calculator, which are based on average data, may be perceived as precise and definitive. Critical aspects of the calculations that provide context and necessary nuance of underlying data are not provided.
- Impact scores are based on average data from mills throughout North America, with some LCA data from Europe. This broad averaging can automatically put impacts of manufacturing out of context, especially spatially-specific ones. For example, threatened species are highly localized and should not be associated with multiple mills in different locations. This results in impact scores that appear precise and equivalent for all mills making the same grade of paper, which is not accurate.
- Virgin paper production is inherently penalized. The chosen LCA methodologies result in recycled content in new paper being void of any environmental impact from its origin.
- The LCA methods significantly diverge from generally-accepted practices for measuring greenhouse gases. Estimations of forest disturbance, ocean acidification, and threatened species are not accepted practices in the LCA scientific community.

Additional Information

Additional calculator results and environmental impacts are available in a spreadsheet upon Member request to publications@ncasi.org.

Endnotes

1. Environmental impact estimates were made using the Environmental Paper Network Paper Calculator Version 4.0. For more information visit www.papercalculator.org
2. https://c.environmentalpaper.org/pdf/SCS-EPN-PC-Methods.pdf