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# E.V.T.: A Comparison of the Relative Environmental Impact of Electronic and Traditional Methods of Publication

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# E. V. T.: A Comparison of the Relative Environmental Impact of Electronic and Traditional Methods of Publication

by **Burton B. Callicott** (College of Charleston) <CallicottB@cofc.edu>



What on the surface looks to be a relatively straightforward comparison between the relative environmental impacts of eBooks and print books turns out to be rather complicated and involves a number of slippery variables including:

- Whether or not a consumer drives to a store to buy a book or has it delivered through the mail.
- Whether a consumer downloads three books or twenty books a year.
- Whether a consumer uses a **Kindle** or a **Kindle DX** or a **Kindle 2** or a **Sony Reader** or an **Iliad** or a **Be Book** or a **Pixelar E-Reader**... or an **iPhone** or ultraportable computer or netbook...
- Whether newsprint is made up of 50% recycled content or 100% virgin wood pulp
- Whether an e-reader's source of power comes from a coal fired plant or a wind-mill
- The percentage of book copies that get returned to the publisher
- How long your **Kindle** lasts
- And, perhaps the biggest variable and the one that is proving to be the most elusive, what kinds of materials are being used to make the e-readers, where they are coming from, what powers the factories that make them, how far they have to be shipped, etc.

These are just a few of the inconstants that have to be factored in, in order to come close to a real and realistic assessment of the relative tax on the environment that comes with publishing information. For this comparison I will focus strictly on the numbers: CO2 emissions, acres of forest, Jules, therms, levels of mercury, lead, and etc. and will avoid the more crunchy, less tangible part of this discussion — the enjoyment/practicality of reading a book (or a newspaper or journal article or a textbook) on a screen versus a piece of paper — the whole experience of reading.

## eBooks

A report from **The Cleantech Group** came out in August of 2009 entitled "The Environmental Impact of **Amazon's Kindle**" which determined that if you read 22.5 books on a **Kindle** (and consequently avoid buying 22.5 new books that you would have purchased at a book store that would have required a car or some fossil fuel burning vehicle to get to), you will break even in terms of the environmental impact. This number rests largely on the amount of carbon dioxide released in the environment when processing paper and shipping books vs. the carbon dioxide released in the

process of making and powering a **Kindle**. The report states that: "any additional books result in net carbon savings, equivalent to an average of 168 kg of CO2 per year."<sup>1</sup> Because it is so hard to make the calculations and because this is such a hot topic, this was the report that many environmentalists and publishers were waiting for. Prior to the **Cleantech** report, many people had taken stabs at this issue and made some defensible estimates, but not since 2003 when a masters student at the **University of Michigan** made it the subject of his MA thesis had anyone done the real work necessary to make some legitimate claims.<sup>2</sup>

Not surprisingly though, the **Cleantech Group's** report sparked controversy and some serious challenges to its results and conclusions. First of all, it is important to note that **The Cleantech Group** is a major company that is seriously invested in technology such as the **Kindle** and other e-readers. Given that it has three trillion dollars in assets, it is not surprising that many people are concerned about the bias of this report. Much of the focus of the concern about the findings has to do with the carbon footprint of the e-readers and the resources necessary to make them. **Amazon** has not been forthcoming with information about the materials used to make the **Kindle** and the manufacturing process. The reports states that the 2nd generation **Kindle** — the ones with the electronic ink that only use power when you actually download a book and when you "turn the page" — represent the same emissions as 15 books bought in person or 30 purchased online (and delivered to your house). According to **Cleantech's** calculations, this would represent 167.78 kilograms of CO2 emitted during a **Kindle's** lifespan. These numbers we discover come not from **Amazon** but from **Marmol Radziner Prefab**, an architectural and construction firm in Los Angeles as "**Amazon** declined to provide information about its manufacturing process or carbon footprint." So, how did **Marmol Radziner Prefab** come up with the figure? According to their Website: "One of our architects recently gave the calculator a whirl..."<sup>3</sup> The "calculator" referred to here is a product life cycle calculator developed by the **Industrial Design Consultancy**. The CO2 emissions associated with the **Kindle** were based on educated guesses about the components and manufacturing to questions generated by the calculator. In a comment to a blog post by **Eco-libris**, the **Marmol Radziner** employee who made the calculation states: "This was done over the weekend as an exploration of the calculator software and should not in any way be interpreted as a scientific study. I am a little bit shocked that **Cleantech** would appropriate this post without at least asking me

about the rigor of my methods, or simply doing a few more hours research on their own."<sup>4</sup> **Casey Harrell**, a coordinator for **Greenpeace** who monitors the environmental impact of consumer electronics, notes "In terms of the **Kindle** or other similar eBook gadgets, I don't know what chemicals are in or out. Companies will want to brag about their eco-credentials, so if you don't see any mention, they've [toxic chemicals] probably not been eliminated."<sup>5</sup> Electronics in general contain lead solder, cadmium, mercury, hexavalent chromium, and flame retardants which have been linked to health problems. **Valerie Motis**, a **Sony** Spokeswoman, said in an email message to *The New York Times* that the company's e-reader products are free of toxic materials, including PVC.<sup>6</sup> The European Union limits the use of these materials and will require manufacturers to recycle all electronics sold in the EU but the U.S. has no such laws. **Amazon.com** does offer free recycling for the **Kindle**, but have declined to provide any details about the program. Because the devices use so little power to operate, being able to legitimately recycle them would go a long way towards making them less damaging to the environment.

Though it is unknown exactly what kinds of chemicals and heavy metals go into a **Kindle** (and where they are coming from and where they are going), it is known that they are manufactured in China where inefficient coal fired power plants are providing the power. Shipping alone results in a significant amount of not just CO2, but countless other particulates and pollutants are strewn into the air as a result of manufacturing and shipping these products. Because global climate change is such a huge, looming concern and because CO2 is regarded as the dominant contributor to climate change, most of the discussion on this topic has focused almost exclusively on CO2, but it is important to consider other pollutants and other effects on the environment in addition to greenhouse gas emissions and climate change. Container ships burn what is called "bunker fuel," the dirtiest type of fuel on the market. One European study found that one giant container ship can emit almost the same amount of cancer- and asthma-causing chemicals as fifty million cars and release as much as 5,000 tons of sulfur oxide into the air annually.<sup>7</sup> Currently, there are over 90,000 such ships of varying sizes chugging across the world at any one time.

## Traditional Books

Despite the CO2 emissions, the pollutants, and other intangibles, whether the threshold for a **Kindle** to have less of an impact than a

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traditional book or newspaper is 15, 22.5, 30, or even 60 books, it is clear that at a certain point, the e-reader wins out over traditional print books and newspapers — foreseeing that the e-reader works properly and does not get broken. The primary reason that electronic books come out on top in terms of the environment, and this is what just about every article and report concludes to varying degrees, is due in a large part to the practices of the publishing industry. The U.S. book and newspaper industry resulted in the harvesting of 125 million trees in 2008. The pulp and paper industry is the single largest consumer of water used in industrial activities and is the third greatest industrial greenhouse gas emitter, after the chemical and steel industries. Because tree fibers are relatively short, they are difficult to process and require numerous toxic chemicals and substantial amounts of energy and water in order to transform them into clean white sheets of paper. Paper mills release pollutants including nitrogen oxides, sulfur oxides (anyone who has been near a paper mill can attest to the sulfur oxide emissions), carbon monoxide, and particulates which not only contribute to global warming but cause smog, acid rain, and respiratory problems. In addition, bleaching paper with chlorine produces dioxin, which is a known carcinogen. Another important part of this discussion that often gets lost in the focus on CO2 emissions is that 71% of the world's paper supply comes from natural forests, which, unlike tree farms, constitute an intricate ecological system that supports an incalculable number of organisms and a wide variety of life. According to a report by the **Environmental Paper Network**:

Roughly half the world's forests have been burned or cleared and converted to non-forest uses. Human activity has degraded almost 80 percent of what remains of the planet's once vast forests. These forests have lost, to varying degrees, many of their species and much of their ability to function as healthy ecosystems. Yet many of the remaining forests — including old-growth and other ecologically important forests — are still being logged for the paper industry using unsustainable forest management practices.<sup>8</sup>

To add insult to injury, printed books have the highest per-unit carbon footprint in the publishing sector. **Raz Godelink**, CEO of **Eco-Libris**, reports that only about five percent of the paper used in books today is recycled compared with 38% of the paper used in all industries.<sup>9</sup> By using post-consumer recycled paper, the publishing industry could tip the scales back towards traditional print significantly. By switching to industrial hemp instead of wood, the impact of the environment would be reduced ten fold. Hemp grows hundreds of times faster than wood, requires a fourth of the land, does not require toxic bleaching agents and requires significantly fewer chemicals and energy to produce.<sup>10</sup>

Another common practice that greatly affects the environmental impact of print publishers involves the number of copies of a given title that are sent to bookstores — particularly large chain bookstores such as **Barnes and Noble**. Book publishers send far more copies to bookstores than they ever expect to sell. The **Cleantech** report notes that 25-36 % of books shipped to bookstores are returned to the publisher. Shipping the books back to the publisher involves burning more fossil fuels which add to the CO2 emissions as well as all the other pollutants associated with engine exhaust. Books that are returned to publishers are burned, landfilled, or recycled. Paper that is landfilled produces methane as it decomposes, a much more potent greenhouse gas that traps twenty times more heat than CO2. Though more and more publishers are beginning to recycle these unused books, there is clearly a tremendous amount of waste — wasted energy and wasted resources — that affects the bottom line, at least in terms of the environment. Because eBooks require almost no storage space, can be endlessly copied, don't require shipping, and require very little energy to view, they avoid all of the environmental problems associated with producing and shipping real books.

To date, eBooks and e-readers represent such a small part of the market that the debate is pretty much just... academic at this point. eBook sales in 2009 accounted for 1.6 percent of the publishing industry revenue — 113 million of the total 24.3 billion dollars in sales. Regardless of how many books any individual avoids buying as a result of downloading them to an e-reader, there is currently no net effect on the environment. Until publishers start printing fewer books in anticipation of eBook sales — something that has not yet occurred — the debate is much ado about nothing. However, there is reason to believe that eBooks will indeed gain market share. The **Association of American Publishers** reports that sales of eBooks were up 154.8 % by the end of April 2009 and overall book sales were down 4.1 %. Some analysts predict that sales of eBooks may reach \$400 million by 2012.<sup>11</sup>

### Newspapers

On balance, newspapers do not fare much better than books in terms of the environment. Clearly there are many parallels in terms of the impact on the environment but to date newspapers do a better job of using recycled content — 40% on average — and thereby significantly reduce their toll compared to the book publishing industry. Of course, for the most part, newspapers have a very short shelf life — one day — which tips the scales back in a major way. The bitter reality for those who love the feel, smell, and experience of reading printed newspapers is that daily papers are in serious decline and the ones that are still alive are finding that there is less and less... news fit to print or rather less and less advertising dollars to pay for reporters and newsprint.

Until we reach the day when the last off-set printer gets shut down, one interesting way to regard the question of whether it is worse for

the environment to buy a printed newspaper or to read newspaper articles online on a personal computer is to factor in the amount of time spent reading. Based on a report entitled "Screening Environmental Life-Cycle Assessment of Printed, Web-Based, and Tabled E-paper Newspaper," the break even point comes at 30 minutes. If you spend less than 30 minutes reading the Web version of a newspaper (and you shut your computer down as soon as you are finished reading), you will come out ahead in terms of the environment — that is unless you power your PC with a renewable source of energy such as solar or wind power. Clearly the cut off point will vary with the efficiency of the computer and the source of power, but even an energy star rated laptop will quickly reach the point at which you will be doing the planet a favor by logging off and walking to your corner newsstand for the latest headlines.

Another tangible way to consider the impact of newsprint is to put it in terms of weight. A years worth of a daily paper weighs approximately 500 lbs on average. This is roughly the amount of paper that you get from one mature pulp tree. Every man, woman, and child in the United States uses over 700 lbs of paper and paper board a year on average (the highest percentage in the world).<sup>12</sup> Considering that the population of the United States is 308,739,000, a lot of carbon-sequestering trees are felled every year, 40 percent of them in the service of the printed page. Using a formula generated by the Environmental Defense fund that factors in the energy necessary to create, print, deliver, and dispose of newsprint, it was determined that a year's worth of *The New York Times* requires 7,316 megajules (or 2,032.2 Kilowatt-hours) and is responsible for the release of 700 kilograms (1,543 lbs) of CO2. The **Kindle** on the other hand uses 100 megajules and is responsible for only 22 lbs of CO2 to make and operate. In other words, reading *The New York Times* on a **Kindle** rather than on newsprint would be comparable to saving 50 gallons of gas and 78 gallons of CO2.

The other part of this whole debate that has not been touched on to this point and is often ignored in these discussions is the energy required to run the massive data servers that are the backbone of the Internet and enable us to access content online, including books, newspapers, magazines, journal indexes, etc. One of the most remarkable innovations of the **Kindle** and other e-readers is the scant amount of power that it takes to operate them — they only require energy when they are downloading info and when you "turn the pages." The "liquid paper" technology fixes the words on the screen every time a reader advances to the next page and then completely shuts down. Since the screen is not backlit, it functions very much like a real book most of the time. Even when e-readers are drawing power, they can be extremely efficient. To download an entire book or newspaper a **Kindle** uses about .014 kwh. This remarkably energy efficient technology belies the other side of the picture, though, where 24 hrs a day 365 days a year,

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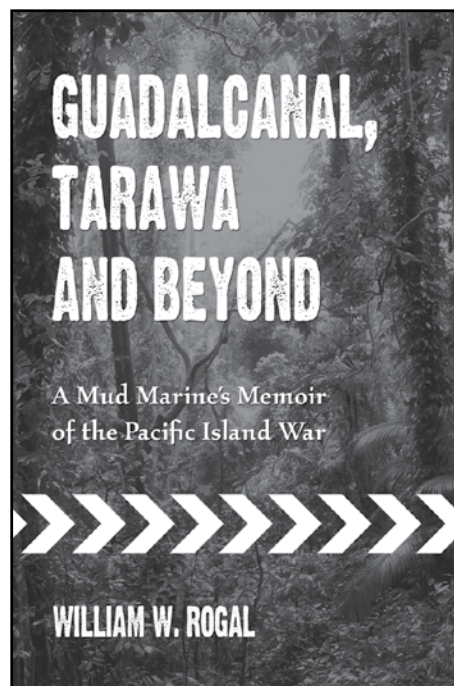
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**Amazon, Barnes and Noble, The New York Times,** and other vendors of e-content are utilizing huge computer servers that draw a significant amount of power: approximately 1.5% of the entire electricity usage for all of the United States goes to power data servers. About half of this energy is coming from coal fired energy plants which is very dirty and is responsible for huge amounts of greenhouse gas emissions. What is often forgotten in the debates over the effects of coal fired power plants is the coal mining process itself. Much of the coal that we are burning today, especially in the southeast part of the country, comes from a mining process called mountain top removal where coal companies literally explode entire mountains to expose coal seams. This process is utterly devastating to the local environment and, because it requires so few people, is equally devastating to the local economy.

The bottom line for those truly concerned about the environmental impact of books, magazines, and newspapers there is little solace. Until our energy, paper, and e-readers come from clean, renewable sources, publishing will have a negative effect on the environment. For those who want to minimize the impact today, consider walking or riding your bike to your local lending library. 🌱

**Endnotes**

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**Rumors**  
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married her partner on April 3. **Julie** says she is definitely coming to the **Conference** in November. Can't wait to see her!

Just heard that **Doug Henderson** director of the **Loudoun County Public Library** in Leesburg, Va. since 1997, will be moving to Charleston this August to become executive director of the **Charleston County library system**. **Henderson**, a veteran with 34 years of library service, is filling a vacancy created in late 2008 by the death of **CCPL's Executive Director Thomas Raines**. **Henderson** has a two-year contract. Since **Raines'** death, **Cynthia Bledsoe** has served as the library's acting director and will continue to serve as the deputy director.

Just back from the **Timberline Acquisitions Institute** in Timberline, Oregon. Talk about spectacular places! **Timberline Lodge** was built by the **WPA** and dedicated by **FDR** in 1937. It was also cold! (I had a fireplace in my room and you better believe that I used it!). Even though it was 90 degrees in Charleston, there was snow on the ground in Timberline. People were skiing and snowshoeing! The **Institute** was opened dramatically by a bagpiper (**Andrew Hart**). I love bagpipes so I was charmed! Anyway, saw people I knew. **Joan Petit** gave an invigorating presentation about social networking. And I found out that she and **Mathew Ismail** <[mdismail@aucegypt.edu](mailto:mdismail@aucegypt.edu)> (see **ATG** v.19#2 April 2007, and **ATG** v.21#2 April 2009) used to work together in Cairo! In fact their children used to play together! Small world, these libraries!

The **Institute** is run by **Scott A. Smith** (**Alibris** and also in library school at **Kent State**), **Faye A. Chadwell** (**Oregon State University**; did you know she has North Carolina roots?), and **Nancy Slight-Gibney** (**University of Oregon**, who is big on budgeting and benchmarking). The **Lodge** has a very inviting and friendly atmosphere and what a different place the West is from **Charleston** and the East! **ATG** has been running advertisements regularly and we hope to have a report in

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