

Digital and Printed Magazines' Effects on the Environment

By
Jeannie Nguyen

Graphic Communication Department
College of Liberal Arts
California Polytechnic State University
2010

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By: Jeannie Nguyen
Graphic Communication, December 2010
Advisor: Kevin Cooper

ABSTRACT:

The purpose of this study was to show how printed magazines affect the environment with their use of paper and how digital magazines affect their environment with their electricity use from servers hosting the digital magazines. It is also to find how the printed magazine industry is reducing their paper use and how digital magazines are reducing the amount of electricity used by servers hosting the digital magazines.

Results show that printed magazines use a massive amount of paper to produce millions of magazines and that the process of getting paper produces a large amount of carbon dioxide which is a green house gas that helps cause global warming. It also found that servers hosting digital magazines use a large amount of electricity, that the common source of energy to get electricity is coal, and how environmentally harmful coal is.

Although these products affect the environment negatively, this study also found how the industry is making these products green. Printed magazines not only can use recycled paper, but can also purchase paper from sustainably managed forests. Data centers hosting the digital magazines can find a renewable source of energy rather than use coal, or to strategically organize servers to reduce the amount of electricity to cool the servers.

While the answer to how digital and printed magazines affect the environment is unclear because of the infinite amount of ways they affect the environment, this study has found how they affect the environment specifically in paper use and electricity use by servers, and that manufacturers are taking steps to make them more sustainable.

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Chapter I: Introduction

A major trend in many industries today is producing sustainable products. Sustainability means producing products without sacrificing the future generation's needs. Sustainability is especially important now, because of global warming, air pollution, and more. One of the ways people try to help the planet is by purchasing environmentally friendly or 'green' products. This causes a few industries to decline in sales, such as the print industry, because consumers believe the print industry is damaging to the environment. This perception causes many people to stop purchasing printed magazines. Because of this, many businesses create digital magazines instead to survive.

Digital magazines do not use any paper, so many consumers believe that digital magazines will save forests. However, digital magazines will be stored in servers that require energy use. Still, printed magazines require a lot of paper to be made. This study asks the questions: How do printed magazines affect the environment with their paper use, how do servers that host digital magazines affect the environment with electricity use, and what are the current trends magazine companies utilize to reduce their use of paper and electricity?

Printed magazines use several pounds of paper since each issue requires several pages. Furthermore, many issues are printed for subscribers and possible additional consumers. The magazine industry uses a large amount of paper every month to send out issues for consumers. Since most magazines do not use 100 percent recycled paper, magazines consume many trees. Trees are great resources to decrease the amount of carbon dioxide (CO₂) and therefore, decreasing trees does not help the environment. At the end of a

magazine's life, a magazine may be left in a landfill adding to the large amount of waste landfills already have.

Instead of relying on paper, digital magazines rely on electricity because they are stored on servers that are constantly on. That way, readers will always have access to an article. Since companies tend to keep old articles for future reference, energy use grows greatly because more servers are needed to keep all archives. For these reasons, digital magazines require an abundance of electricity.

Sustainability of digital magazines would depend where the electricity is from as well. For example, if a server receives electricity from a coal plant, then the server is linked to numerous emissions of CO₂. Coal plants contribute to global warming and collecting coal destroys many forests through coal mining. Coal has a high ratio between the amount of CO₂ released and the energy used from coal. It is one of the worst substances to use for energy because it produces more CO₂ than petroleum or natural gas. Coal plants tend to be inefficient at producing electricity. This means energy and heat is lost in the process of creating electricity resulting more CO₂ in the atmosphere.

The purpose of this study is to further explore the concept of sustainability in magazines, to examine how printed and digital magazines affect the environment through paper and electricity use, and to discover current trends that both digital and printed magazine companies use to reduce paper and electricity use.

Digital and Printed Magazines' Effects on the Environment

Chapter II: Literature Review

Sustainability

Sustainability and 'green' "is meeting the needs for current generations without compromising the needs of future generations." Sustainability is not about saving rainforests or decreasing air pollution. Sustainability is about making choices that considers "the environment, social equity, and economics. You can't save the rainforests unless it makes financial and social sense." Because of this, sustainability can be difficult to determine and is not obvious. Products are not simply 100 percent green or not green. Products have a balance of green features and environmentally harmful traits (Pokrandt).

It is difficult for a product to be truly green because nearly everything has a negative impact on the environment. One of the most impacting products is a human.

From the moment we're born we start to have an impact on the environment. We begin to use finite resources, to create waste, and to pollute the renewable resources that are ever so delicately balanced. People have a generally depleting impact upon the resources of the earth (Pokrandt).

Since the world's population is steadily growing to seven billion, the human's effect on the environment is serious (Pokrandt). United States is extremely impacting and 24 percent of all Carbon Dioxide (CO₂) emissions originate from the U.S. (Greve).

Even products with the purpose of being eco-friendly have an impact on Earth. Biodiesel takes up land that could be used to grow food and harms the soil's health, the manufacturing

process of making solar panels involves toxic materials and emits CO₂, and most reusable water bottles are made with aluminum that is most likely collected from a mine that pollutes water (Pokrandt). Although nearly everything harms the environment, we can still control how much a product damages the planet. For example, creating a reusable grocery bag requires energy to manufacture and may release CO₂ in the process. If the bag is not used often, this product is unsustainable because the energy used to create this bag has essentially gone to waste. If the bag is used often enough, makes up the environmental costs of making the reusable bag, and reduces CO₂ emissions compared to using plastic bags, then the bag is sustainable. The reusable bag itself is not green, but rather our use of it determines how sustainable the bag potentially is (Schwartz).

There are many different metrics to use to determine how green a product is. Metrics are important to understand how sustainable a product is. “Green is cheapened if it involves designing a process or product that doesn’t work as well and is exponentially more expensive. Green should be inherently better, not just greener” (Pokrandt). Metrics makes product designers ask questions such as “Does the creation of this product or process create pollution?...Am I using the least energy possible in my creation of this product or process?...Have I considered where the materials I am using come from and where they end up when we are finished using them?” Many of these questions can be answered by a life cycle assessment (LCA). A life cycle assessment looks at “the entire life-cycle of a product to establish materials intensity/environmental effect.” The analysis will also include indirect effects such as circularity effects. An example of a circularity effect is using steel to produce steel. The life cycle assessment is very useful because it shows what makes the product sustainable and not (Schwartz).

Digital Magazines

The public generally assumes that digital magazines are healthy for the environment.

Texterity created a survey asking subscribers why they read digital magazines. The top reason, with 50 percent of the responses, was that the digital magazine is environmentally friendly. However, the average consumer does not consider a digital magazine's full life cycle which includes many unsustainable characteristics.

In Don Carli's article, "Is Digital Media Worse for the Environment than Print?" he explains that people are concerned that print is destroying our environment. "Nothing captures the essence of these feelings more vividly than the signature line appearing at the foot of more and more emails: 'Please consider the environment before printing this email.'" Other concerns are expressed through companies that strongly suggest their customers to choose paperless billing rather than sending the physical bill. "Over the past five years, the percentage of bills paid by electronic methods increased from 19 percent in 2003 to 32 percent in 2007" (ISC). Because of these suggestions, and the fact that paper comes from trees, the average consumer assumes that printed media is harmful to the environment and that digital media is not.

A digital magazine is created in an office with computers, printers, refrigerators, and more. The office's electricity use would be included in the LCA. Since a digital magazine is stored on a server that is constantly on so customers can refer to the magazine many years later, the electricity use by the server makes up most of the LCA.

U.S. data centers and servers consumed over 60 billion kilowatt hours of electricity [in 2006,] and that does not include the energy consumed by client computers or networks. In fact, recent analysis by Gartner Research indicates that datacenter energy consumption is expected to double by 2010, and its growth is unsustainable (ISC).

The United States has many different sources for energy but 50 percent of our energy is from coal plants. In 2004, only six percent of our energy sources were from renewable sources. The main issue with coal is that it has high carbon intensity. Carbon intensity is defined as the mass of CO₂ produced divided by the energy released. The amount of energy released may use the mega joules (MJ) as its unit. Coal has a carbon intensity of 92 g(CO₂)/MJ. This means for every million joules of energy produced at a coal factory, 92 grams of CO₂ is released into our atmosphere. Even if the energy is not from a coal plant, it is still most likely from a source that will produce CO₂. Natural gas and petroleum also will produce CO₂ but they both have a smaller carbon intensity compared to coal (Schwartz).

Also, coal factories have a low efficiency. Efficiency is defined as usable energy outputted divided by the total energy inputted. Coal factories create electricity by converting the heat from burning coal into electrical energy. Therefore, efficiency is equal to the electrical energy outputted divided by the heat energy inputted. Coal factories convert heat energy to electricity poorly, and have an average efficiency of 30 to 40 percent. This means 60 to 70 percent of the heat input into a coal plant is wasted and the heat is released to the atmosphere rather than converting into electricity for people to use. This extra heat causes climate change and helps increase the average temperatures of Earth (Schwartz). Since the U.S. uses “more than 60 billion kilowatt hours per year, roughly equal to the amount of

electricity used by 559,608 homes in one year” and may “double again by 2011” the amount of heat wasted and CO₂ is severe (Carli).

Besides adding CO₂ and heat to our atmosphere, coal plants link to destruction of forests.

Computers, cellular networks and data centers are connected to the destruction of over 600 square miles of forest in the U.S. One of the more significant direct causes of deforestation in the United States is mountaintop-removal coal mining in the states of West Virginia, Kentucky and North Carolina (Carli).

The average consumer does not know about the effect digital magazines have on forests since the connection is not direct or obvious. The average consumer assumes digital magazines saves forests because digital magazines do not use paper (Carli).

Furthermore, coal plants produce other compounds besides CO₂ that are environmental damaging. “Coal fired power plants are responsible for 93% of the sulfur dioxide and 80% of the nitrogen oxide emissions....These emissions cause acid rain that is destroying red spruce forests in the Northeast and Appalachia, and killing brook trout and other fish species.” Consumers assume that digital magazines are great for the environment, but looking at the full life cycle of a digital magazine, a consumer can see environmentally damaging traits (Carli).

The servers used to keep the articles online and the many other servers used to back up the files cannot last forever. Eventually, a server will break, and will be thrown out. Most materials used in a computer are unfortunately not recyclable and cannot be reused. For some servers, some materials may be toxic and should not remain in the landfill. Toxic

chemicals from circuit boards include arsenic, cadmium, chromium, copper, lead, and mercury (Jang).

Although digital magazines may correlate to destruction of forests, it does not use any paper. Since it does not use paper, it saves a large amount of waste that could go in landfills. “In 1993, the...[Environmental Protection Agency] EPA...estimated that 30-40% of US landfill volume is taken up by paper; 13% by newspaper alone” (Micales). Unlike paper, “discarded electronics make up only 1% of the USA's garbage volume” (McMahon). Since it reduces waste, there are fewer emissions of CO₂ and methane. These gasses contribute to global warming and reducing their amount will help the planet. Also, since a magazine is online, there is only a need for one copy for everyone to read. There will be multiple copies for backing up the file, but there would not be thousands of copies for each possible consumer like printed magazines. Needing only a few copies of the file also reduces the amount of waste greatly.

Printed Magazines

Since magazines print many copies for subscribers and other consumers, a large amount of paper is required. Discover Magazine prints about a million copies per issue. To get their magazine printed, they contact their paper supplier in Quebec to ship paper to the printing facility in Jonesboro, Arkansas. Printing a million copies per issue requires over 348,000 pounds of paper. To put this in perspective, this weight of paper is equal to the weight of 35 elephants. The paper is transported to Arkansas by trains and trucks producing nearly 14 tons of CO₂ (Barone).

Creating the paper for magazines also leads to many emissions of CO₂. Tree harvesting, paper production, and printing counts for approximately 65 percent of the industry's footprint (M). The United States' Department of Energy found that U.S. papermaking industry has the fourth largest industrial use of electricity in the country (ISC). Harvesting and transporting trees to the mill produces 22 tons of CO₂. Discover magazine uses lightweight coated stock and the amount Discover uses each month "releases 614 tons of carbon dioxide — making it the single largest source of emissions in the production chain." The magazine inserts in the magazine use eight tons of 50 percent recycled content. Creating the inserts alone produces 20 tons of CO₂. Discover magazine also found that each issue, from getting trees to delivering the magazine to a home, produces approximately two pounds of CO₂ and there are about a million issues printed a month (Barone).

Printed magazines also use a large amount of electricity like digital magazines. Electricity is used to image plates, run a large press that prints thousands of copies, make the digital file of the magazine, but most electricity is used in the process to create paper. Discover's LCA also includes electricity use in the office where employees conceptualize, create and edit a digital file of the magazine to send to the printer. Nearly nine tons of CO₂ is created to power computers, coffee makers, printers, refrigerators, light bulbs, heaters, and air conditioners for the Discover office in New York. Furthermore, Discover's printing facility uses 63,364 kilowatt-hours of electricity and 1,704 therms of natural gas yearly leading to 52 tons of CO₂ (Barone).

Depending where the magazine is printed, inks may include solvents. For these inks to fully dry, the solvents must evaporate which will produce volatile organic compounds (VOCs).

Volatile organic compounds create pollution and contribute to the green house effect. The green house effect is when green house gases (GHGs) reflect and trap heat waves in our planet leading to global warming. Green house gases include CO₂, methane, Nitrous Dioxide. Gravure is a printing method that releases solvents because of these inks. Magazines may use this printing method because it saves money for long runs but also produces a high standard of quality in print. Discover magazine's printing facility produces 9.6 tons of CO₂ because of the ink used to print the magazines (Barone).

Besides the use of electricity producing CO₂, transportation for employees to go to the magazine's office or to deliver magazines adds to the amount of CO₂ in our air. Thirteen percent of all of GHGs in the world are from transportation. In the LCA of Discover magazine, researchers found that about six pounds of CO₂ is produced per month for employees to go to their office. Transportation includes cars, buses, and subways. There are two employees in Discover that travel outside of the office for business and their total carbon footprint is 48 tons of CO₂ annually. To deliver magazines, the magazines are split into two sections: subscribers and newsstands. Six hundred thousand issues are for subscribers and are sent to Chicago. Three hundred thousand are sent to 213 wholesalers in the United States and Canada. Almost six tons of CO₂ is produced to send issues to the 213 wholesalers. Wholesalers then send magazines to 41,500 retailers leading to 2.3 tons of CO₂. To send out magazines to subscribers, nearly 16 tons of CO₂ are released (Barone).

The amount of Discover magazines ending up in the landfill or in recycling releases 176 tons of CO₂. Ninety percent of magazines that are not in recycling are in the landfill where they decompose and release methane and CO₂. The other ten percent go in the incinerator.

Magazines in the landfill produce 170 pounds of CO₂ where as recycling magazines creates six pounds of CO₂. Unfortunately, not many magazines are recycled. Besides reducing GHGs, “recycling saves about 1,000 pounds of solid waste, some 10,000 gallons of water, and 17 million BTU of energy per ton of paper. Furthermore, two tons of trees per ton of paper remain standing due to recycling.” These statistics shows that recycling magazines provides benefits, but only 20 percent of all magazines are recycled according to the Magazine Publishers Association (Barone).

Another negative impact printed magazines have, and the most obvious impact, is that printed magazines destroys tress. This is because most magazines do not use 100 percent recycled paper. “According to Lane Press, which prints Swarthmore’s and Middlebury’s magazines, 30 out of the 200 alumni magazines they publish - 15 percent - print on recycled paper, with the majority of those printing on 10-percent recycled-content paper” (Masterson). Most magazines are not printed with 100 percent paper for many reasons.

Editors of alumni magazines say taking their publications down a more sustainable path contains challenges that are technical (having to do with how the paper is printed), budgetary (recycled paper costs more), and aesthetic (editors are picky about their paper; the magazines, often a primary communication vehicle for the university, are expected to look good) (Masterson).

Bucknell Magazine decided to use 40 percent recycled paper for their magazine, and their costs has increased to \$5,000 per issue. However, if every magazine used only 10 percent recycled paper for their magazine, many trees would be saved (Masterson).

As noted earlier, products are not truly green but may have a few environmentally friendly features. Digital magazines produce CO₂ from their electrical use and printed magazines produce greenhouse gases from decomposing in landfills. However, digital magazines can decrease the amount of waste in landfills and reduce their CO₂ emissions by using energy efficiently. Consumers can avoid tossing printed magazines in the trash so they won't be in a landfill. Instead, consumers can keep their magazines or recycle them. Both products have positive and negative impacts on the environment.

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Chapter III: Research Methods and Procedures

The purpose of this study is to further explore the concept of sustainability in magazines, to examine how printed and digital magazines affect the environment through paper and electricity use, and to discover ways that printed and digital magazines are reducing their use in these resources. The research will find how printed magazines impact the environment with their use of paper and how they are reducing paper usage, and how digital magazines impact the environment with their use of electricity and how they are reducing electricity usage.

Historical research will be used to find how the magazine industry affects the environment with paper usage and how businesses are reducing their use. Historical research “is an attempt to establish facts and arrive at conclusions concerning past events.” (Levenson) This research will note the green methods to reduce paper use related and note how effective these methods are. It will focus on an article, “Redefining Green Print” by Kathryn Lancioni, which will answer “How did Monroe Litho, in less than five years, turn our initial environmental campaign from a raw concept to receive one of the broadest certifications of sustainable print manufacturing?” (Lancioni) This article includes information that Monroe Litho strives to be green by getting paper that has a sustainable forestry certification.

Another article titled “SFI Forest Certification Continues Rapid Growth” from US Newswire will be used to further discuss one of the sustainable forestry certifications that Monroe Litho uses. An article called “American Forests: A Truly Eco-Friendly Magazine” from Katrina Marland will also discuss how using sustainable forestry certified paper makes the magazine *American Forests* environmentally friendly. This study will also look into the

article “The Real Deal on Greening Your Data Center,” written by Matthew Sarrel, to find ways that digital magazines can be more environmentally friendly. The article will include methods for servers to not waste energy, the primary reason digital magazines effect environment. The study will also interview Don Carli who is the executive vice president of SustainCommWorld and also the author of “Is Digital Media Worse for the Environment than Print?” to learn more about sustainable trends that printed and digital magazines are using.

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Chapter IV: Results

This chapter focused on methods that printed magazines companies used to decrease their paper use and methods that digital magazines companies used to decrease their electricity use. Chapter three also noted that this study will interview Don Carli but he was not within contact's reach.

Printed Magazines

Printed magazines downfall in terms of being green is their massive use of paper. Being able to create the paper and printing on the paper takes up most of a printed magazine business' carbon footprint.

The 2008 study 'Environmental Trends and Climate Impacts: Findings from the U.S. Book Industry,' co-sponsored by GPI and the Book Industry Study Group, found that tree harvesting and paper production and printing accounted for a total of 65 % of the industry's carbon footprint, while a publisher's office operations accounted for less than 7% (J.M.)

It is difficult for printed magazines to use less paper when magazines are made of paper. However, instead of reducing the use of paper, companies are making their use green. One of the current trends in the printed industry to make their use of paper more environmentally friendly is achieving certifications on sustainable forestry. It may seem ironic to be environmentally friendly when using paper, but using paper from a sustainably focused managed forest can be green.

When I tell people that I work for American Forests magazine, I get some interesting reactions. Some of my less-informed acquaintances will smirk and say, 'A magazine? For an organization that is against cutting down trees? Isn't that just a little ironic?'

What these people don't realize is that in the world of publications, American Forests magazine is exemplary in the specific precautions it takes to ensure the most responsible use of our natural resources (Marland).

Sustainable forestry would treat forests as a “natural, renewable resource...[their] use must be at all times responsible, with great respect for the ecosystem that provides us with so many products and benefits” (Marland).

One of the certifications businesses try to achieve is the Sustainable Forestry Initiative (SFI) certification to show their green initiative. “SFI’s premise is that responsible environmental behavior and sound business decisions can co-exist. SFI-certified companies practice sustainable forestry on all lands they manage” (*Lancioni*). SFI is a strong growing program encouraging many companies to manage forests responsibly. Their 2008 Progress report shows “a four-fold increase in SFI chain-of-custody certifications.” Further, the program is so popular that “at the end of 2008, the SFI program had 154 million acres (62 million hectares) of certified lands across the United States and Canada, 407 chain-of-custody certificates at 1,020 locations, and 39 fiber sourcing certifications—and the numbers continued to climb in 2009.” The program is widely accepted and even has well known organizations endorsing it such as “the American Consumer Council, the Competition Bureau of Canada, TerraChoice’s North American Environmental Choice eco-logo program or marketplace surveys” which shows how trusted the SFI program is. SFI also invests in forestry research and in training programs on responsibly forestry. To ensure genuine quality and accuracy, SFI follows “U.S. Federal Trade Commission, the Competition Bureau of Canada and ISO 14020's nine principles for Environmental Labeling” (US Newswire).

The SFI program is large and has several different types of certifications businesses can achieve. There is the SFI forest certification, which shows that the program participant is following SFI's standards for "responsible forestry practices." There is also the SFI chain-of-custody certification which tracks fiber content of a product's life cycle because product may contain fiber from certified lands, non-certified lands, or recycled content. For forests who are not certified, there is the SFI fiber sourcing certification. Participants of this program would have legal raw materials that are from "responsible sources, whether the forests are certified or not" (SFIprogram.org).

Another popular and similar organization to SFI, is the Forest Stewardship Council. FSC certified paper "does not simply mean recycled paper, as many believe." This organization only gives accreditation to companies that are responsible in the production and consumption of forests (Forest Stewardship Council.) They also do not allow "conversion of natural forests into use for timber, or allow the use of dangerous pesticides. It must also respect the rights of any of the forest's indigenous people, and maintain the ecological integrity of the forest." Any product with the FSC logo on it comes from a forest that has been responsibly maintained and harvested in a sustainable manner" (Marland). The following list is a summary of FSC's principles they expect businesses who want to be FSC certified to follow:

- Principle 1.*** Compliance with all applicable laws and international treaties
- Principle 2.*** Demonstrated and uncontested, clearly defined, long-term land tenure and use rights
- Principle 3.*** Recognition and respect of indigenous peoples' rights
- Principle 4.*** Maintenance or enhancement of long-term social and economic well-being of forest workers and local communities and respect of worker's rights in compliance with International Labour Organisation (ILO) conventions
- Principle 5.*** Equitable use and sharing of benefits derived from the forest
- Principle 6.*** Reduction of environmental impact of logging activities and maintenance of the ecological functions and integrity of the forest

Principle 7. Appropriate and continuously updated management plan

Principle 8. Appropriate monitoring and assessment activities to assess the condition of the forest, management activities and their social and environmental impacts

Principle 9. Maintenance of High Conservation Value Forests (HCVFs) defined as environmental and social values that are considered to be of outstanding significance or critical importance

Principle 10. In addition to *compliance* with all of the above, plantations must contribute to reduce the pressures on and promote the restoration and conservation of natural forests (Fsc.org).

Besides using paper from an environmentally conscious source, printed magazines can also use recycled paper to save trees. Colby College uses 100 percent recycled paper for their magazine and has saved 1,576 trees. Many trees can be saved if magazines use as little as ten percent recycled paper (Masterson). Recycling the magazines will also decrease waste because we are reusing material. If paper is being recycled, there will be less material in the landfill resulting in a decrease of greenhouse gases. “With all we do to keep our magazine as eco-friendly as possible, the final step is yours to take. Please, when you have finished enjoying this magazine, pass it along to others to enjoy, and don't forget to recycle! Together we can grow a greener future for our planet” (Marland). However, this method is not very popular because of the costs of using recycled paper as mentioned in Chapter two.

Digital Magazines

Digital magazines mainly impact the environment from their use of electricity to keep magazines available on the Internet. Further, their source for electricity is often coal which is an inefficient source. This leads to wasted electricity converted into heat and add GHGs. Companies make their data center more efficient to decrease electricity use, and also get electricity from renewable sources such as solar power.

A simple way to help make a data center more efficient and green is to have it organized and spaced out in a strategic matter. “Types of equipment—such as storage or application servers—should be grouped together for easier management. In addition, instead of cooling one huge area that is only 25 percent full, divide the facility into isolated zones that get populated and cooled one at a time.” Also, facilities should alternate rows of cold and hot. That way, cold air flows to the hot area and in the hot area, a vent can pull the hot air out. This will decrease electricity use to keep the data center cool (Sarrel).

Facilities should also consider rack density. Rack density is the number of computers in each shelf. The higher the rack density, the more room the data center will have, and more electricity is necessary to power and cool the rack. Racks should be cooled with water or forced air. “The IBM/Syracuse project converts exhaust heat to chilled water that is then run through cooling doors on each rack.” A solution like this reduces the use of electricity to cool the data center, and cuts about 35% of the cost to do so (Sarrel).

Data centers also should not have any raised floors because heat naturally rises up and it’ll push cold air down. Another problem with raised floors is that it is more difficult to support the weight of the servers, especially high-density rack. “A 42u rack populated with 14 3u servers can weigh up to 1,000 pounds.” Companies should also check the manufacturer’s specification of the computers to know what temperature to keep the data center room at. Newer equipment is able to withstand a warmer temperature. Companies have found that keeping data centers as high as 72 degrees still saves a lot of money. “Check the manufacturer's specifications on existing equipment before raising the temperature and monitor performance and availability afterward” (Sarrel).

Another trend to save energy is to switch from Alternating Current (AC) current to Direct Current (DC) (Sarrel). The United States uses AC grids to power homes because AC can transfer a lot of energy at once to increase efficiency and converts the large amount to a smaller safer amount to homes. “All of this conversion wastes up to 50 percent of electricity and generates excess heat” (Sarrel). Technology has improved since first the first grids were made and the country could switch to High Voltage Direct Current (HVDC) which is more efficient than AC. This would reduce organization’s electricity use, reduce heat, and thus reduce GHGs (Schwartz). The switch from AC to DC is growing that “many server manufacturers—including HP, IBM, Dell and Sun—are making DC power supplies available on some or all of their server lines...to make the switch from AC to DC easier” (Sarrel).

Chapter three noted that this study will use information from an interview with Don Carli. Unfortunately, Don Carli was not reachable. However, his article *Print vs. Digital Media: False Dilemmas and Forced Choices* included what digital magazines can do to lessen their use of electricity. Digital magazines can also be green by using servers certified under EnergyStar. EnergyStar is a program coordinated between the EPA and the United States Department of Energy. The program determines how efficient products are with energy such as computers, monitors, printers, scanners, washing machines, and more. Companies can also use The Electronic Product Environmental Assessment Tool (EPEAT). The tool helps the company choose green products by comparing and contrasting them. These products include computers, notebooks, and monitors. “EPEAT provides a clear and consistent set of performance criteria for the design of products and provides manufacturers with the ability to secure market recognition for efforts to reduce the environmental impact of their

products.” If a product is certified with EnergyStar or uses devices recommended by the EPEAT, the product will optimize their use of energy to lower CO₂ emissions (Carli).

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Chapter V: Conclusions

This study asked the question: How do printed magazines affect the environment with their paper use, how do servers that host digital magazines affect the environment with electricity use, and what are the current trends magazine companies to reduce their use of paper and electricity?

With the information presented, this study has found that printed magazines greatly affect the environment from the use of paper. Printed magazines use a large amount of paper and to print a million copies, the weight of the copies could be equal to the weight of 35 elephants (Barone). Tree harvesting, paper production, and printing counts for approximately 65 percent of the industry's footprint (M). Creating inserts and the cover stocks produces a large amount of CO₂. Although printed magazines' main effect on the environment is paper use, printed magazines' can reduce their paper use greatly since a printed magazine is made of paper. The study has found that instead of reducing paper use, printed magazines make their paper use green. Printed magazines can do this through sustainable tree harvesting.

The study also found that the servers hosting digital magazines use up a large amount of electricity. In 2006, ISC found that data centers in the US use 60 billion kilowatt hours of electricity. Also, 50 percent of our energy is from coal plants which have a high carbon intensity. Coal creates 92 grams of CO₂ for every megajoule of energy it provides, and is inefficient at creating energy. Data centers can become more sustainable by using a clean

energy source to provide electricity to their servers, switching from AC to DC electricity, avoid raised floors, and space out servers strategically to cool them efficiently.

There is no product that is absolutely green or not green. Products have a mix of positive and negative traits. Although printed magazines use up many tons of paper, printers can make their use of paper green by buying paper from responsibly harvested forests. And although digital magazines use up many kilowatts of electricity, data centers reduce their electricity use by strategically placing their servers to make sure they are cooled efficiently. While the answer to how digital and printed magazines affect the environment is unclear because of the infinite amount of ways they affect the environment, this study has found how they affect the environment in specific areas and that manufacturers are taking steps to make them sustainable.

Works Cited

“About FSC.” *Forest Stewardship Council*. FSC. Web. 09 May 2010.

<<http://www.fsc.org/about-fsc.html>>.

Barone, Jennifer, Amber Fields, Karen Rowan, and Jessica Ruvinsky. “The Paper Trial.”

Discover, 29.5 (2008): 58-63.

Carli, Don. “Is Digital Media Worse for the Environment Than Print?” *MediaShift*. PBS, 31

Mar. 2010. Web. 09 May 2010. <<http://www.pbs.org/mediashift/2010/03/is-digital-media-worse-for-the-environment-than-print090.html>>.

Carli, Don. “Print vs. Digital Media: False Dilemmas and Forced Choices.” *Institute for*

Sustainable Communication. ISC, 14 Apr. 2010. Web. 08 May 2010.

<<http://www.sustainablecommunication.org/resources/white-papers/false-dilemmas-and-forced-choices>>.

“Factoids.” *Institute for Sustainable Communication*. ISC. 2 Mar. 2010. Web. 02 May 2010.

<<http://www.sustainablecommunication.org/resources/fast-facts>>.

“FSC Principals and Criteria.” *Forest Stewardship Council*. FSC. Web. 20 Oct 2010.

<<http://www.fsc.org/about-fsc.html>>.

Greve, Adrienne. “Climate Change Policy.” Physical Science 320: Energy, Society and the

Environment. Performing Arts Center Room 124, San Luis Obispo. 08 Mar. 2010.

Lecture.

ISC. “Which Medium Is More Sustainable? Paper or Digital?” *Institute for Sustainable*

Communication. ISC, 16 Jan. 2010. Web. 02 Mar. 2010.

<<http://www.sustainablecommunication.org/resources/articles/which-medium-is-more-sustainable-paper-or-digital>>.

- Jang, Yong-Chul, and Timothy Townsend. "Leaching of Lead from Computer Printed Wire Boards and Cathode Ray Tubes by Municipal Solid Waste Landfill Leachates." *Environmental Science & Technology* 37.20 (2003): 4778-4784.
- Lancioni, Kathryn. "Redefining Green Print." *Graphic Arts Monthly* 1 Feb. 2009: 16. *ABI/INFORM Global, ProQuest*. Web. 21 May. 2010. <<http://proquest.umi.com/pqdweb?did=1650465051&sid=1&Fmt=3&clientId=17870&RQT=309&VName=PQD>>.
- Levenson, Harvey R. *Some Ideas About Doing Research in Graphic Communication*. Atascadero: Good Neighbor and Services, 2001. Print.
- M, J. "Book Industry Getting Greener." *Publishers Weekly* 256.49 (2009): 12-13. *Academic Search Elite*. EBSCO. Web. 16 Oct. 2010.
- Marland, Katrina. "American Forests: A Truly Eco-Friendly Magazine." *American Forests* 115.1 (2009): 4. *Academic Search Elite*. EBSCO. Web. 16 Oct. 2010.
- Masterson, Kathryn. "Alumni Magazines' Discovery: It's Not Easy Being Green." *Chronicle of Higher Education* 55.8 (2008): A18-A19. *Academic Search Elite*. EBSCO. Web. 08 May 2010.
- McMahon, Patrick. "E-waste Flooding Landfills." *USA TODAY*. Gannet Co. Inc., 21 Jan. 2002. Web. 2 Mar. 2010. <<http://www.usatoday.com/news/nation/2002/01/22/usat-recycle.htm>>.
- Micales, J. A., and K. E. Skog. "The Decomposition of Forest Products in Landfills." *International Biodeterioration and Biodegradation* 39.2-3 (1997): 145-58. *ScienceDirect*. Web. 8 May 2010. <<http://www.sciencedirect.com/science/article/B6VG6-3SWKBF6-7/2/b2b45ee1c5ea369c510e35dfc4f437f1>>.

- Pokrandt, Rachel. "What is Green?" *Technology Teacher* 69.6 (2010): 5-10.
- Sarrel, Matthew D. "The real deal on greening your data center." *eWeek* 27.2 (2010): 16-18.
Academic Search Elite. EBSCO. Web. 17 Oct. 2010.
- Schwartz, Peter. "Engines and Efficiency." Physical Science 320: Energy, Society and the Environment. Performing Arts Center Room 124, San Luis Obispo. 13 Jan. 2010.
Lecture.
- Schwartz, Peter. "Introduction to Energy." Physical Science 320: Energy, Society and the Environment. Performing Arts Center Room 124, San Luis Obispo. 4 Jan. 2010.
Lecture.
- Schwartz, Peter. "Life Cycle Assessment." Physical Science 320: Energy, Society and the Environment. Performing Arts Center Room 124, San Luis Obispo. 8 Mar. 2010.
Lecture.
- "SFI Forest Certification Continues Rapid Growth." *US Newswire* 19 June 2009. *Expanded Academic ASAP*. Web. 13 Oct. 2010.
- "SFI Standards and Certifications." *Sustainable Forestry Initiative*. SFI. Web. 19 Oct 2010.
<<http://www.sfiprogram.org/sfi-standard/index.php>>
- Texterity, Incorporated. "Profile of the Digital Magazine Reader." Third Annual Business and Consumer Digital Magazine Reader Survey. (2008) May 21, 2008.
<<http://info.texterity.com/info/reader-research/>>