



The Impact of Sustainability on the Gravure Printing Process

Cassie Barth

California Polytechnic State University, San Luis Obispo

2008 Flint Ink Writing Contest

Executive Summary

Traditionally, the gravure printing process has not been environmentally-friendly. However, if the gravure printing industry focused on more sustainable business practices, the impact on the environment could be greatly reduced. Paper used to print on should be made with recycled fiber or virgin fiber from a managed forest. Ink should contain renewable bases rather than solvent. Solvent is the worst part of the gravure process because it is so hazardous. Water and energy should be conserved due to their limited availability. Chemical emissions need to be reduced and controlled. Corporate Social Responsibility enables companies to implement more sustainable business methods. The result is “green” products that people are willing to pay a little more for, as an alternative to non-green products.

Introduction

With the issue of climate change and other environmental concerns at hand, people are thinking more about their actions and how they impact the world. Sustainability is a way to ensure our survival and reduce ecological impacts, left by things such as production, transportation, and energy consumption. Many industries are implementing sustainable ways to reduce their ecological foot print. The printing industry, specifically the gravure segment, is by no means exempt from this new business trend. Sustainability is in fact a huge buzz word, given that the gravure process is the worst of all printing processes for the environment.

Companies within the printing industry are doing many things to accomplish this new and common sustainable goal. They are using recycled pulp along with virgin pulp to make paper. The use of solvent ink is being replaced by other inks with renewable bases or the solvent emissions are being managed more responsibly. Companies are conserving water and energy and using renewable energy when possible. They are also controlling and reducing the emissions released from paper making and printing processes.

There are a variety of voluntary environmental certification programs for different areas of the printing industry. The Forest Stewardship Council (FSC) and the Sustainable Forestry Initiative (SFI) focus on responsible forest management world-wide. Green Seal certified means that paper is made with a minimum of 30% post-consumer fiber and the energy used to produce the paper is environmentally friendly. A Chlorine Free certification is given when recycled pulp is processed with sustainable raw materials instead of using chlorine. Green-e establishes products that were produced with renewable energy, such as wind power, solar power, low impact hydropower, and biomass. These examples of certification programs in no way represent all the options available to paper manufacturers, distributors, and printers. As the environmental laws become stricter, these types of programs will most likely become mandatory. Federally, it is only required of companies to keep and submit records of toxic emissions, waste, electricity usage, etc. California has gone above and

beyond these requirements and implemented more stringent environmental laws, which is why they have no gravure printers.

Sustainability is definitely becoming one of the top priorities of the world because people want their children and their children's children to be able to enjoy the planet and everything it has to offer. Corporations, one of the biggest threats to the environment, world-wide are starting to take responsibility for their actions. This new trend is called Corporate Social Responsibility (CSR) which has many definitions, but the one that relates to sustainable printing the most is a printer or paper manufacturer's commitment to operate with an economically, socially, and environmentally sustainable focus. Many companies have found that what's good for the environment is also good for business.

The gravure printing process has traditionally had negative effects on the environment. Primarily due to the use of solvents to make the print cylinders, clean the cylinders and press, and found in the ink. If the gravure printing industry focused on more sustainable business practices, the impact on the environment can be greatly improved. Secondary research found in books, magazine articles, pamphlets, and on the internet was used to prove this point.

Methodology

Paper mills and manufacturers used to be one of the worst contributors to pollution in the environment, but are now utilizing sustainable methods. They are using virgin pulp from certified sources, such as SFI and FSC, to make paper. "Sustainability is priority one with today's paper companies," (Eckel, 17). The purpose of these certifications is to help monitor the ecological foot print of the pulp used to make paper. The pulp is made from trees in sustainably managed forests, instead of old growth timber strands or rain forests. The FSC provides companies, including printers with a chain-of-custody certification logo for all products printed using FSC certified fiber-based paper. "...major publication gravure printers—RR Donnelley, Quad/Graphics, and Quebecor World—all have FSC chain-of-custody certification," (Eckel, 18).

Once paper mills have obtained certified pulp, they usually perform some sort of bleaching process to make the fibers as bright as desired; otherwise the paper would be brown. In order to bleach the pulp, paper mills generally use a chemical process. The main chemical that has been used in the past was chlorine, but because of sustainability efforts this harsh chemical is rarely used today. Elemental Chlorine Free (ECF), which is the use of derivatives of chlorine, such as chlorine dioxide, and Totally Chlorine Free (TCF), which uses oxygen, ozone or peroxide instead of chlorine, are primarily used now. “Paper mills are no longer Environmental Enemy Number One,” (Eckel, 17). In March 2005, only 5 – 6% of the kraft pulp produced in the world was produced by TCF processes and around 75% was produced by ECF processes. This pulp was used to make the highest quality white printing and writing papers, (Bleaching by CSIRO, 2). From a financial standpoint, transitioning from chlorine based bleaching to a more environmentally friendly bleaching method will increase the cost of processing the pulp into paper; but the increase is so minimal that it is barely worth mentioning.

Paper can also be manufactured using recycled fiber. There are two different types of recycled fiber. The first is post-consumer fiber, which is the majority of recycled fiber; this comes from products that are recycled by the end-user, the person the product was intended for. The second is pre-consumer, which is anything that is recovered before it reaches the end-user. “Virgin paper uses between 2 and 4.4 tons of trees to produce 1 ton of pulp. Using recycled fiber takes about 1.4 tons out of the landfill to produce 1 ton of recycled fiber,” (Neenah Paper, 10). Not only does using recycled fiber consume fewer trees, less water, less energy, and fewer chemicals, but it also reduces waste in landfills. “About 55% of the world’s paper is made from recycling waste paper,” (Bleaching by CSIRO, 3).

The type of ink used when printing a job may or may not cause harm to the environment. There are pluses and minuses for using both solvent-based ink and an ink with a renewable resource base, but only the latter is not harmful to the environment. Solvent-based ink has excellent printing and color consistencies, but it is very hazardous. There have been cases of explosions in gravure

plants because the solvent in the air was exposed to a spark. Also, the ink is required to have solvent recovery units in each drier, these units are not cheap and with a drier after every single printing unit, the cost adds up. The biggest problem with solvent-based inks is if the solvent emission is not recovered, volatile organic compounds (VOCs) are released into the atmosphere. When VOCs interact with the other gases in the atmosphere, combined with sun light, ozone is produced. This is a major environmental concern.

Many inks contain ingredients that are damaging to the environment; however some are less damaging than others. Solvent-based inks can contain up to an incredulous 60% of solvents. There are other options including UV inks with less than 1% of chemicals that produce VOCs. Water-based ink is another option that has about 30% of its chemicals producing VOCs. UV ink may cost more than solvent-based ink, but it lasts 75% longer and the final product is perceived to be of higher quality because of its vibrant color reproduction. There may be viscosity problems when using UV ink because it is a higher viscosity than a typical gravure ink, therefore a viscosity reducer may need to be utilized. UV ink is harder to remove from paper, making recycling of these products difficult. Water-based ink has a lower print quality and colors are poorly reproduced. It needs longer exposures to the dryers than solvent-based inks, so the water can be evaporated, resulting in slower press speeds. Nonetheless, UV ink and water-based ink are far better for the environment than solvent-based ink.

Energy conservation is vital to a healthier environment and it starts with green power. This form of energy refers to electricity produced by renewable resources such as wind, water, and biogas. "Only 2% of U.S. electricity is generated from renewable resources," (Green-e). Using renewable resources may cost more, because companies will most likely need to buy this form of energy from an energy company, since the odds are they have no means of producing it themselves. However, there are ways that a company can use its own waste to provide much needed energy at a minimal or no extra cost. No matter how the energy needed is derived, gravure printers should use all available measures to reduce, conserve, and even reuse the energy. RR Donnelley is using energy

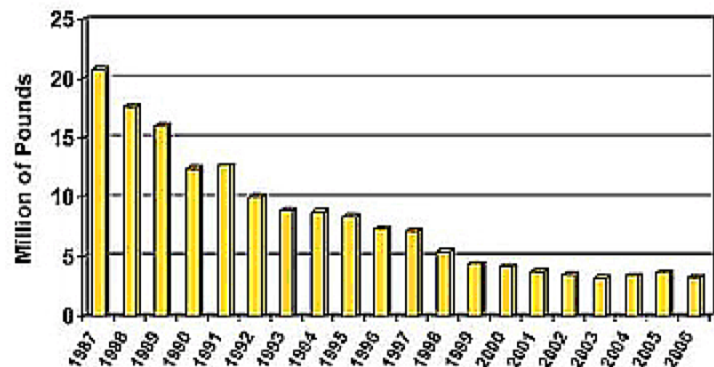
efficient ballasts and light bulbs, as well as EnergySTAR compliant computer equipment, (RR Donnelley). Quad/Graphics has reduced their energy usage by 6% because they use energy-efficient lighting throughout all their plants. Also, they use the captured solvent from the drying process to fuel the dryers and pollution control units, (Quad/Graphics).

Water Conservation is just as important to saving our environment as using renewable energy. According to Creative Action, only 2.5% of the water found on earth is considered fresh water, with 70% of that frozen in polar ice caps—that leaves humans less than 1% of useable water. Paper mills and gravure printing plants use water to make pulp, produce paper, cool processes, and provide energy as steam. Appleton Coated, a paper manufacturer, reuses the water used in their paper-making process through a closed loop system and any excess is treated in an on-site water treatment plant before discarding. Since 2001, their water usage has decreased by 35%, (Appleton Coated, 8).

Chemical emissions into the atmosphere are a huge problem in the printing industry, and particularly in the gravure process. The primary cause of the bad emissions is the solvents from the ink used while printing. However, RR Donnelley is good at recovering most of the emissions that are released by their gravure printing presses. In 2006, they released approximately 3.8 million pounds of Toxics Release Inventory (TRI)-regulated compounds, mostly toluene from their gravure operations, and recovered more than 97% of the toluene. Table 1 shows the reduction of the total amount of toluene released since 1987,

(RR Donnelley). Toluene is a chemical that is commonly known as a solvent in printing ink. The sustainable way to handle the use of this chemical is to recover it as it evaporates from the ink, or better yet use an ink that does not contain Toluene or any other solvent.

Table 1. RR Donnelly TRI History for Toluene



By Cassie Barth

There are legal standardization organizations that help control the emission of green house gases, such as the Environmental Protection Agency (EPA) in the United States. Green house gases are defined as any gas that gets trapped in the earth's atmosphere and contributes to climate change. The EPA introduced the TRI program in 1986 under the Emergency Planning and Community Right-to-Know Act. The gravure printing industry is required to annually report the types and amounts of toxic chemicals that are released each year into the air, water, and land as well as information on the quantities of toxic chemicals sent to other facilities for further waste management. Concern for the environment has traditionally been a matter of legal compliance and responsibility was assumed by individuals and businesses. Companies are now voluntarily making a sustainable impact with three major goals: environmentally sustainable products, a zero-waste business, and energy supplied only by renewable sources, (Blais, 46).

Individual companies are adopting CSR practices, which is helping them function with their new sustainable goals. As a matter of fact, 650 organizations world-wide are publishing voluntary sustainability reports in accordance with voluntary Global Reporting Initiative (GRI) guidelines, (Carli, 168). The printing industry is making this information readily available to the general public. RR Donnelley and Myllykoski have posted portable document format files (PDFs) containing their sustainability reports in its entirety on their web sites. According to a study titled "Corporate Environmental Governance," conducted by the UK Environmental Agency in November 2004, 85% of sixty research studies over the last six years showed a positive correlation between environmental management and financial performance. All in all, CSR will help the gravure printing industry grow and expand into successful and sustainable companies.

Results

The impact of sustainability is continually growing in the printing industry, including the gravure segment. Alternative ways of bleaching pulp to make white paper are slightly more expensive—but there is less of a negative impact on our environment, and you cannot put a price on

a better future. Reducing or eliminating the use of solvents in ink is not only good for decreasing harmful emissions, but it is also great for moving away from dependence on non-renewable fossil fuels. However, this continues to be a struggle for gravure because of the nature of the printing process. Conserving water and energy consumption is logical because there is not a limitless supply of either at the moment. Energy efficiency and control of emissions have the best opportunity to prevent climate change, but not every company is participating. The more companies control and reduce their harmful and VOC inducing emissions, the better off the environment will be, resulting in less green house gasses in the atmosphere. CSR is a critical element to any business strategy. The gravure printing industry will benefit with the addition of CSR into their management systems, because the value created will have a positive effect on cost savings, increased efficiency, and also the environment.

Concluding Remarks

The sustainability of a product needs an analysis of more than just recycled paper content or UV ink content. How a product is printed, distributed, used, and recovered is just as relevant as the raw materials it is made from. "Using 100% recycled fiber in your catalog or magazine paper could actually be less environmentally friendly than using raw fiber from certified forests when you consider the impact of transportation, pulp and paper-making and energy consumption," (Pond, p82). The gravure printing industry is only a small section of the global movement towards a more sustainable world. David Blais has commented that within every segment of this industry, the impact of making the gravure supply chain more green is simply endless.

The customers and consumers also play a role in the success of making the gravure printing industry truly sustainable. When a business knows that there is a market for a certain product or service, they will produce it. If the same business determines there is no market for such product or service, odds are they will not produce it because they will only generate minimal revenue, if any at all. Donald Carli discusses the fact that there are an estimated 63 million adults in North America

who have healthy and sustainable lifestyles. He then states that these same people spend \$226.8 billion in the US marketplace for goods and services with a focus on health, the environment, social justice, personal development and sustainable living. Fortunately, there is a market for sustainable print and people are willing and/or prefer to purchase “green” printed pieces. It is important to remember that sustainability is a journey rather than a destination.

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Revised Outline

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