GO GREEN

On Your Next Print

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Introduction

What is Green Printing?

What is the definition of "green printing"? The answer that comes to mind is "a method of printing that has minimal impact on the environment." This answer may have sufficed ten years ago. Today, this is not the case. Terms like "green", "eco-friendly", and "environmentally sound" are found on marketing materials of just about any large or small business. There is no clarification of what they mean. Without question, these terms add value to a brand despite the fact that there are no established standards as to what "qualifies" as green. Learning about printing methods and how they work is the focus of this book. Asking what "green printing" actually means is the important question.

Our natural resources are decreasing while global dependence on them is increasing. World population continues to grow. This raises the importance of finding sustainable industrial solutions in order to ensure our quality of life today and for future generations. There are many new options in the print and paper industry. Printers and their customers need to gain a better understanding of printing methods. Resource management and sustainability are vital in reaching this goal.

Effective resource management and green printing begin and end with technology. Both play an important role in the history of the written and

printed word. Green printing involves everything from using the latest in print technology, eco-friendly resources, and non-toxic inks and chemicals. It means developing machines that utilize renewable energy, alongside resource management of trees and recycling. Anybody interested in positioning his or her business as a sustainable operation might want to consider utilizing a green printing program in combination with the use of digital technology.

This book will demonstrate that digital technology is not necessarily more environmentally friendly than printing. Paper and ink have an obvious impact on natural resources such as trees and water. The impact of digital technology is less well-known. The fact is that the use of digital devices has significantly driven up the demand on America's electrical grid. This electricity is largely produced through dirty, coal-burning technology. The primary materials used to make a computer require mining and refining of many different metals and minerals, including gold, silver, and palladium. Because of this, digital products can hardly be considered strictly green.

Innovations in Ink and Paper

Paper is one of the most recyclable, renewable, and natural mediums for communication. If manufactured and recycled properly, paper has the potential to have a relatively minor environmental impact. The next chapter explains how the paper industry has greatly reduced the negative impact

that paper consumption has had on the environment over the last two hundred years. This is a fact that the industry has recognized and corrected itself. Today, both the paper industry and the consumer are working together to produce and use paper more responsibly. The practice of recycling paper products is already well on its way to becoming a standard business practice. While the act of putting paper in a separate bin has pretty much become second nature in many offices and neighborhoods, the processes by which that paper is received and recycled has also been improved. Post-consumer paper products are of good quality and a liable alternative to those products made with virgin paper pulp.

In many ways paper has similarities to energy with regard to its role in our environment. If energy is produced properly, consumed efficiently and disposed of with care, the environmental impact is minor. For example solar power technology versus the coal burning technology. If power is produced and consumed without regard to our natural resources and disposed of carelessly, it becomes a dangerous pollutant with dire consequences. Solar is clean and safe, while coal burning is dirty and hazardous to the environment.

The gap between green printing and careless printing is as wide as the gap between green energy and a coal-fired power plant that dumps its waste into a river. It is incumbent on consumers to study the difference in order to make an informed choice. It is difficult to imagine life without energy. It is also difficult to imagine getting by without paper.

While the practice of recycling paper has been developing for a long time, advances in environmentally friendly inks have resulted in a production process for printed products that is substantially greener than ever before. Vegetable based inks are becoming more and more popular for offset printing and can be used on any printed press. These advances have also resulted in improved quality and lower prices for sustainable printed goods. If consumers and businesses make a priority of engaging in green printing, they can feel better about producing and using eco-friendly printed materials.

The Significance of Print in the Digital Age

The world is changing rapidly and digital media continues to alter the way we communicate. In this sense, media refers to the tools we use to receive, send, and store information. Despite the promise of the paperless office, it is impossible for companies to function without paper. While digital media now presents the first real alternative to the printed page, paper products continue to be an important medium in modern life. Digital is not the best alternative for all purposes. Websites, for example, do not deliver the same look and feel or even the quick and easy access that brochures or catalogs do. Paper packaging remains the most attractive, eco-friendly, and affordable way to display products on the shelf. A printed catalog attracts a different audience than a website.

This demonstrates the fact that digital media will not be able to replace the need for printed documents any time soon. The digital age has evolved and changed the way we communicate, as well as the role of paper and printed products that we use every day. In order to successfully reach out to customers and partners, businesses need to find effective ways to blend their use of print and digital media. In doing so, companies will find it advantageous to position themselves as environmentally aware by engaging in green practices.

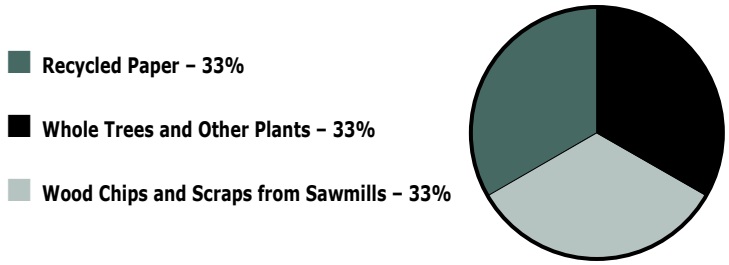
Trends in Resource Conservation

An effective green printing program begins with paper sourced from sustainably managed forests and recycled pulp. By responsibly managing resources it is possible for us not only to extend the longevity of those resources, but also to repair the damage that has already been done. A truly sustainable forest must be managed in every aspect, including the sunlight that the leaves take in, the water that flows through the branches, and the nutrients that the roots draw in from the soil. All of these factors, in their turn, depend on a series of other living organisms and inorganic materials that make up the overall ecology of a forest.

Traditionally, the term "forest management" simply referred to the profession of forestry: the industrial cultivation of a woodland ecosystem for the harvesting of wood for use in the manufacturing of a variety of commodities. This definition sufficed for

a society that was not particularly concerned about conserving resources. Up until just a few decades ago, America's wealth of woodlands seemed to be so vast that they would never run out. Now, society's attitudes are changing. With regard to paper products, forested trees still remain the principle raw material used. In 2011, about 67% of the 71 million tons of paper and paperboard consumed in US was recovered. This is ahead of the goal for 60% by 2012, set by the industry. AF&PA (American

Source of Raw Materials for Papermaking



Forest & Paper Association) in a partnership with EPA had originally set a goal of 55% recovery by 2012, which was reached five years ahead of schedule in 2007. More paper is recovered in America for recycling (measured in terms of weight) than all other materials combined (except for steel). Today, close to 40 percent of the fiber used to make new paper products in the US is from recycled sources. Paper is produced from three primary sources; recycled paper, whole trees and other plants, and wood chips and scraps from sawmills. Harvested trees account for less than 1/3 of the raw materials used for papermaking in the US. [1-3]

Today, 30 percent of paper-based commodities enter the international market, making industrial forestry important in both developing and post-industrial economies. Because paper is such a commonly used material, the paper industry plays an important role in the environmental, economic, and social well-being of people throughout the world. Unfortunately, the main goal of forestry--to ensure the long-term health of forests--often runs counter to the short-term economic needs of communities that are built near them. As a means of both atoning for the principles of sustainability and ensuring that local communities can survive, foresters have developed standards for promoting a more positive and sound approach. Forestry now entails managing both natural and planted forests, and the trend is to do so in ways that are increasingly ecologically aware.

Going Green with Printing

Today, most businesses use printed materials such as business cards, brochures, direct mail advertising and catalogs to reach out to their customers. In order to become a green business, one needs to partner with vendors that are engaged in green practices. A company is not considered truly green unless it is selective in choosing vendors that are also green.

Benefits of Going Green

Eco-friendly printing products are becoming more popular every year. This is largely because they are truly necessary for preserving the environment. This movement to go green is not merely a fad. New laws are being passed all over the country designed to promote companies that are making social and environmental improvement part of their business mission. As a result, many companies are scrambling to position themselves to take advantage of green values. In addition to the inherent benefits to the planet and the benefits of government incentives, environmental initiatives save the costs of expensive cleanups when mishaps happen. As a business culture becomes more aware of its environmental impact, trends will continue to spread and provide companies with further incentives relating to their impact on the environment.

It is our responsibility to demand all industries and individuals alike, to care for our environment. Therefore it is vital to patronize businesses that have distinguished themselves by making an effort toward a greener practice.

[1] *Municipal Solid Waste in the United States: 2010 Facts and Figures*

[2] American Forest & Paper Association (AF&PA)

[3] Technical Association of the Pulp and Paper Industry (TAPPI)

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Paper & Papermaking

The Evolution of Paper

There have been many changes over the last few decades in how we communicate and store information. As printed material continues to proliferate all around us technologies have been created to compete with it. Because of this the printed page has experienced a shift in purpose. Paper was originally developed for writing. Today there are many uses for paper. We use it at home in the kitchen, in the bathroom, in the construction trades and we even make money out of it. The list goes on and on.

If your company is considering a green approach to its printing needs, it is helpful to understand what paper is and how it is made. Then by examining the printing needs of your company, and learning about the source of paper-making and printing, you will be able to determine what is best for you. This chapter will provide a detailed picture of paper production in today's world, and will take a look at the more environmentally friendly options that have been developed in recent years.

The Development of Papermaking

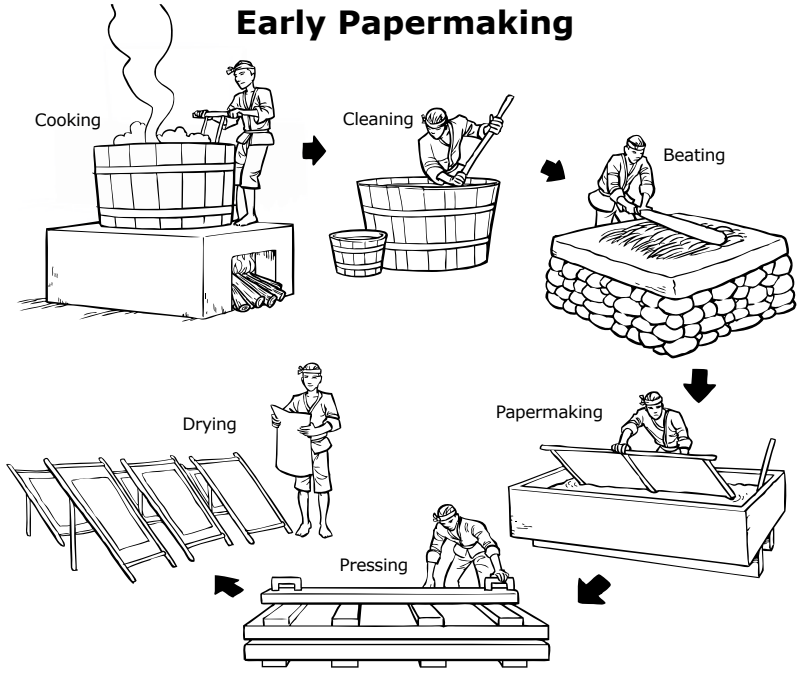
Paper is a word derived from the Greek word "papyrus." About four thousand years ago, Egyptians began weaving papyrus reeds together and pounding

them into thin sheets in order to create a writing surface.

The origin of papermaking is disputed. It is said to have been developed around AD 105 by a Chinese court official named Ts'ai Lun under the Emperor Ho Ti. Ts'ai Lun's paper was probably made of old cloth, hemp, and mulberry bark.[1] By the end of the first century, Chinese papermakers had discovered that making their paper from fast-growing bamboo was much more effective. In fact, the process of making handmade paper from bamboo is carried on today by Chinese artisans.

Since this method was first developed, the process of papermaking has changed only in the technologies that have been applied to it. Just imagine what life was like in one of the many small communities, such as Shiqiao, Huishui, and Dongkou Village. They thrived as artisan papermaking communities. As the only papermakers in the world, the process itself was a closely guarded secret. It was a powerful art that was passed down and perfected with each succeeding generation. Each was responsible for printing the important academic, literary, scientific, and administrative documents of their time. Thanks to the precision with which small villages like this worked, texts by classic Tang dynasty poets like Du Fu or Li Bo remain for us today.[2]

Papermaking in these villages began because of the clusters of bamboo that grew alongside the banks of the Yangtze and other nearby rivers. The stalks were hacked down and gathered into bundles



that were loaded onto livestock and transported back to the village. The next step was the pulping machine. Their contemporaries were still using the papyrus, stone etchings of the Mediterranean world and a knotted-rope technique used by the Incas. This made the pulping machine a technology that could have been considered like the Internet of its day. Powered by human exertion, this machine would mash the bamboo into a muddy pulp. This pulp was then transferred to a vat of cold water, which would allow each fibrous strand to float free of the others. Separated in this way, the ancient papermaker would dip a wooden framed wire net into the vat. When this flat, porous surface was submerged just below the soupy surface of the water and then raised up, it would hold a fine layer of the bamboo pulp. The pulp was layered with other pulp on a flat surface to dry.

Creating a single frame with an equal distribution of pulp across the net was (and still is) a difficult task that required the long-developed skills of these Chinese crafts people. Once dried, these sheets were ready to be printed on.[3] The Ancient Chinese printers used carved, wooden blocks that they would dip into ink by hand and then press, with great skill, onto the paper. These are the same mechanics by which Gutenberg's printing press would operate more than a thousand years later.

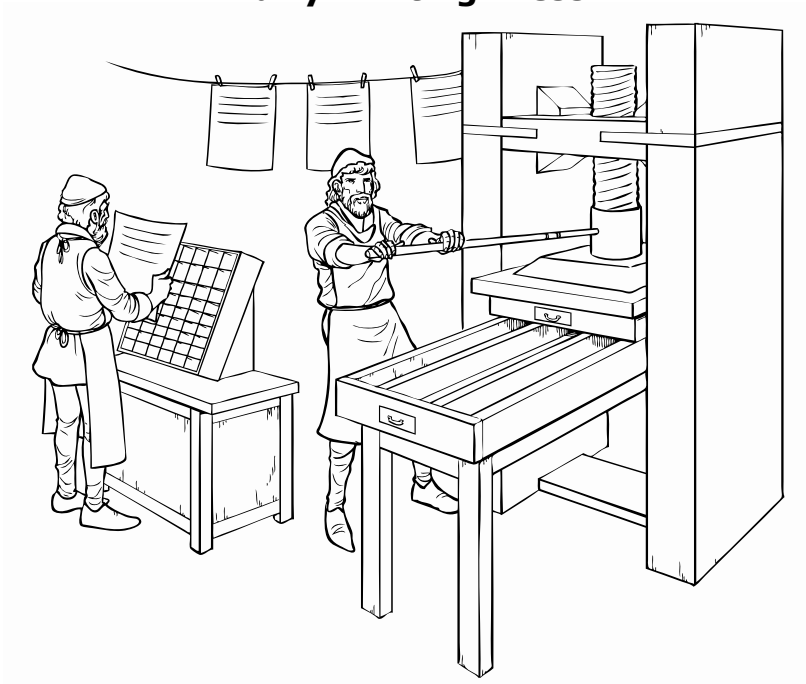
Paper remained a secret of the Chinese until AD 751, when Muslim invaders managed to gain control of a Chinese paper mill. After learning the secrets of this technology, the invaders carried the process of papermaking across the Near East and North Africa and eventually to Europe. The first paper mill was established in Spain in AD 1151. However, the technique of using wood pulp to make paper was lost for many years as it made its way east. Instead, the paper that was originally made in Europe was recycled because it was made of old cloth, which was mostly linen and cotton fiber. Because these materials were relatively scarce and expensive, only around 750 sheets could be made in a day, making paper an expensive and precious commodity.

With the invention of the printing press in 1440 by Johannes Gutenberg, paper quickly re-shaped everyday life at all levels of society. The German goldsmith's and businessman's new machine employed removable blocks fitted with interchangeable cast metal characters.[4] This did away with the laborious, time-consuming need for

copying out entire books by hand. The printing press sparked a revolution from the sciences to the arts to political thought to religious thinking. Information could suddenly be passed much more quickly with an accuracy and volume previously unknown.

The printing press arrived in the New World in 1690, when a group from Philadelphia formed a partner-ship to build America's first paper mill. The industry thrived in the eighteenth century, and among the prominent men to support papermaking in those years were William Penn and Benjamin Franklin. The Revolutionary War increased the demand for paper.

Early Printing Press



It was a crucial form of communication (reports were sent to General George Washington on scraps of

paper) and soldiers had to tear up old books to make wadding for their muzzle-loading guns.[5] Yet at that time, the continent was rife with the raw materials necessary for making paper. By the 1780s, the new nation had nearly a hundred paper mills, and that number nearly doubled by the turn of the century. These mills were primarily located in New York and the New England states. The spruce trees in that region of the country made excellent ground wood and sulfate pulp. Later, the industry expanded to the Midwestern states of Minnesota, Michigan, and Wisconsin, where there was an abundance of spruce and balsam trees. Other regions where paper mills were established were the Pacific coastal states of Washington, Oregon, and California, where hemlock, fir, and pine were plentiful, and southeastern states such as South Carolina, which were predominantly covered by pine.

The paper of this period was still made with the ancient process of taking sheets of pulp on a framed screen. By the mid-nineteenth century, inventors began to develop the methods that would lead to the industrialization of papermaking. In 1798, Frenchman Nicholas-Louis Robert, a clerk at a paper mill, devised a hand-cranked machine with a circular wire screen.[6] Paper could now be made in long sheets and rolled up at one end of the machine. In Germany, Friedrich Gottlob Keller developed a machine designed to turn wood with a revolving grindstone.[7] In the United States, English-born Hugh Burgess improved this system with the development of a chemical pulping process. He boiled wood chips

in caustic sodium hydroxide; this was referred to as the "soda process." Later, the "sulfate process" was developed by using sodium sulfate.

By the twentieth century, the age of mass-produced paper had begun in earnest. With it came the modern age of mass printing and cheap paper. Newspapers and magazines began to appear, notebooks of lined paper replaced chalk and slates, dime novels rolled off the presses. Today, raw logs, industrial wood, paper waste, and recycled paper are the chief sources of paper pulp. However, cotton, linen, and even sugar fibers, as well as other fibrous plants, are also used to make paper.

The Raw Material: Plant Fiber

Whatever material it is composed of, paper is simply a thin sheet of interlaced fibers that have been pressed together. Although the product is essentially the same as it was in the days of Ts'ai Lun, the process of making it has become significantly more complicated. The fibers are now cooked in a soup of hot water and chemicals, such as lye (which softens the fibers and makes for a smoother finish).

Plant fiber is composed of long, narrow, tapering cells. Once fully grown, a fiber cell dies and becomes hollow, leaving a thick cell wall composed of cellulose and lignin. These tough materials are what give a tree the rigid support that its extensive vascular tissue demands. And it is this network of vascular tissue in a tree that creates what we know as wood.

Just as there are a variety of plant species thriving across the many climates of the planet, there are also a wide range of plant fibers that can be used for papermaking. Bamboo, for instance, made sense in ancient China because it grew prolifically throughout the countryside of the southern regions. In North America, bamboo is far less common, even today, than hardwood or softwood.[9]

The Myth: Most of the trees are being cut down so they can make more paper!

The Fact: Less than 20% of all woods harvested in the world are being used for papermaking. Over 50% of all woods are consumed for energy and fuel use every year.

Today in the United States, over half of the raw materials used to make paper comes from recycled paper and wood waste, such as wood chips and saw dust. Papermaking does not require large, solid segments of trees. In fact, all the waste from lumber manufacturing can be used to make paper. Less than 20 percent of all woods harvested in the world is used for paper manufacturing, in comparison to over 50 percent of all woods consumed every year for energy and fuel use. Coniferous trees, such as spruce and fir, were once the preferred wood for papermaking because the cellulose fibers in this type of pulp are

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longer and therefore result in stronger paper. In the paper industry, this type of tree is referred to as a softwood, or evergreen.

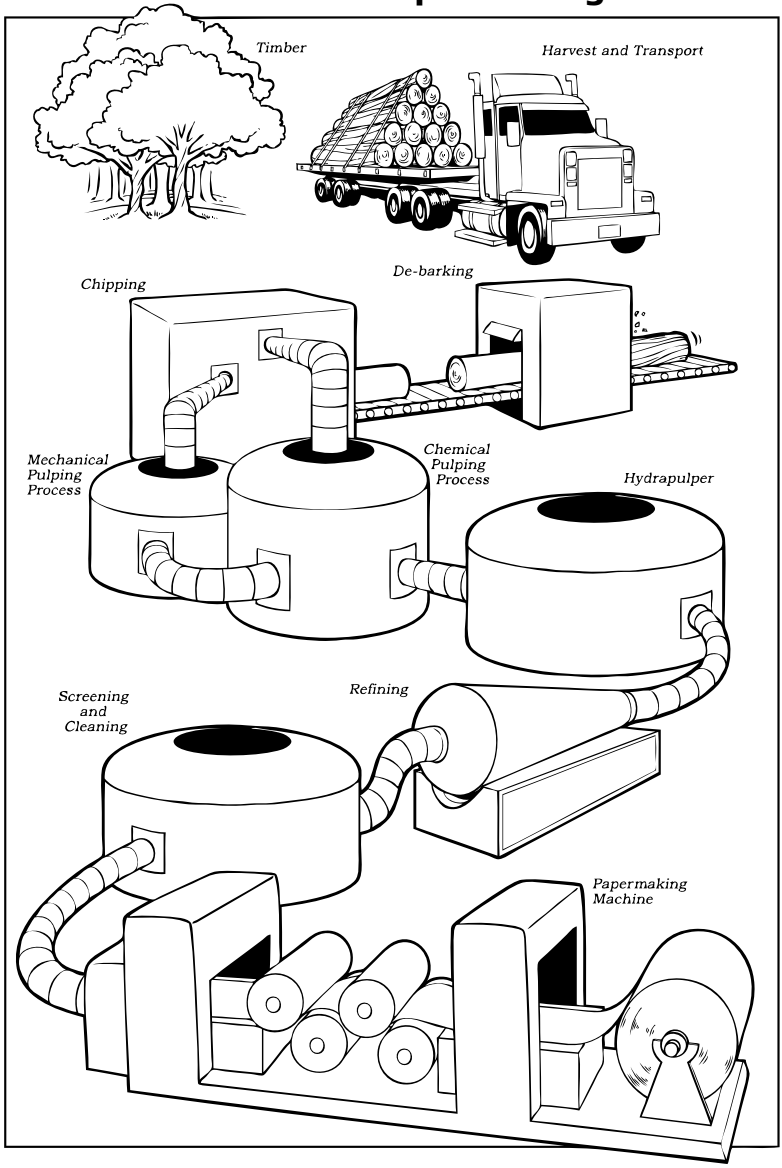
In addition to papermaking, plant fiber has been and continues to be used throughout the world to make all sorts of products, including brushes, mats, baskets, and other tools, while the use of plant fiber remains a source of raw materials in the production of rope and textiles. Within this variety of fibers, each type lends itself to a different use. Grasses are a useful material for making baskets, mats, straw hats, or other handmade materials. Palms produce rough coconut husk that can be used to make rope and brushes. Manila is a special fiber that comes from the banana family and is woven into delicate fabrics to give them durability. Fibrous material, called "bagasse," is all that is left of sugar cane after its sweet juice is extracted.

Cotton and linen fibers are used to make fine-grade papers such as letterhead and resume paper, as well as bank notes and security certificates. This material is usually acquired from waste and cuttings from textile and garment mills. These scraps are cut and cleaned, boiled, and beaten in order to prepare them for the paper mill.

Although fiber can be sourced from many different crops, trees continue to dominate as the principal origin of fiber for pulp. The majority of trees that are logged are softwood, like spruce and poplar, and contain pulp that makes low-grade types of paper, such as newspaper. There have been

more trees planted in the U.S. each year than trees harvested since 1940. There are more trees in the U.S. today than there were in 1940.

Modern Papermaking



The Papermaking Process

Industrial papermakers today, just like the craftsmen of ancient China, are principally concerned with extracting pulp fiber from the variety of plant sources mentioned above. Though the methods are quite different, the process remains the same: pulp is shaped into sheets to dry into paper.

The tools to do this have evolved to meet the increasing global demand for paper over the last two thousand years. Today, the most common method of papermaking begins with wood chips. These chips are soaked in a solution of sodium hydroxide and sodium sulfide, which instigate the chips to soften into pulp. This pulp is then refined further. Bleach may be applied to obtain the consistent white of office paper. Modern techniques allow a more exact treatment of the pulp, removing the unwanted natural elements found in wood, such as lignin, which causes paper to yellow with time and creates a bumpy coarseness. This process uses a system that transfers fluids, steam, or air through a rotating network of cylinders that press the pulp onto a moving, flat surface.

All paper has a grain direction that is oriented in the direction in how it runs through the papermaking machine. This is known as the "machine direction." Most fibers in a sheet of paper are aligned in the direction of the machine run. Fiber alignment can be slightly altered by the speed at which the pulp passes through the paper machine.

Paper Characteristics

Paper is used in many different ways, and is a highly diverse material. Even in terms of its use as a print surface, paper varies widely. For accuracy, the paper industry has come up with intricate ways to measure and grade its product, elaborately calculating such properties as grams per square meter (g/m^2), curl (deviation from flatness), and dimensional stability (absorption). In terms of printing, two of the most important properties of a sheet of paper is its smoothness and brightness. Although the varying thickness of even a rough sheet of paper may seem miniscule, characteristics such as surface contour make a big difference when the sheet is passing through the printer on your desktop. If a sheet of paper is not sufficiently smooth or thick, it will not be able to pass through the printer at all. For example, newsprint-grade paper generally has half the thickness of business-grade paper. While newsprint is designed to pass easily through the industrial printers at the offices of your local newspaper, it would likely jam up your desktop printer. Smoothness is also an important factor for determining how the paper reacts to being written on, as it affects the ease at which the ball of a pen rolls over the surface.

Paper manufacturers meticulously measure the brightness of their paper. The brightness of paper improves the quality of the printing, especially when accurate color reproduction is important. For this reason, paper manufacturers take steps to ensure that the quality of their finished product is consistent

by measuring the amount of light throughout the visible spectrum that is diffused. While this may seem arbitrary, it has been carefully standardized by the paper industry. And while brightness and whiteness are two different characteristics, the brightness values of the pulp and pigments that are used to make the paper are a determining factor in the amount of whiteness that will be achieved.

Today, consumers have many options when it comes to choosing a paper stock. Different types of paper vary in weight, thickness, texture, and finish. Each one is made with a specific purpose in mind. Printing paper can be divided in two main groups; coated paper, and uncoated paper. It is important to learn about the different groups of paper and the different characteristics that differentiate them. Both coated and uncoated papers are made in text weight and cover weight. There are different standards to measure the quality of each type of paper. Uncoated paper is measured for its opacity, brightness, and smoothness. The coated paper is measured by its coating as well as opacity and brightness.

The paper stock is usually referred to by its weight and type. For example, 70lb glossy text. The weight refers to the weight of 500 sheets of the standard size paper. Different categories have different standard sizes, which means the higher the weight does not necessarily translate to a thicker stock. The chart below shows some popular paper categories as well as the standard size for each and the range for the caliper (thickness). The weight of

1000 sheets of any paper is referred to as the M weight.

Types of Paper

Paper Category	Paper Type	Basis Weight	Average Thickness*	Basic size
Coated Text	Glossy	80lb	0.0038	25″ X 38″
Coated Cover	Glossy	80lb	0.0075	20″ X 26″
Uncoated Text	Opaque	70lb	0.005	25″ X 38″
Uncoated Cover	Opaque	65lb	0.0095	20″ X 26″

* in inches

How to Source Green Paper:

An important part of any print project is the paper selection. While it is a great idea to search for green options, it is also very important to make sure that the paper is the right choice for your project. Keep in mind that all papers are recyclable and biodegradable; this is a fact that sometimes is taken for granted. Sacrificing the right choice of paper for more recycled content or similar decisions could jeopardize the quality of the final product. If the finished product is not suited for its intended use, then the waste generated as a result of a wrong choice of stock over turns all your green efforts. This is even more important when it comes to package printing of folding cartons. For example the product that is being packaged, determines the type of cardboard that can be used to insure safe delivery of the product to the consumer. The cardboard used for a food item verses a non food item have different specifications.

Uncoated paper and paper made with more recycled contents are amongst the most desirable choices for Green printing. Coated paper is more suited for color reproductions of photographs and color sensitive materials. However, there are some uncoated paper choices available that have a very fine surface. These papers are available with a high content of post consumer waste. The fine surface makes these a good alternative to coated stock for reproduction of color photographs. The paper selection should be part of your design process and your designer should discuss the options with you in the early stages of the design. This will insure that the design and the paper complement each other and will enhance the overall look of your printed project.

Recycling Paper

For a recycling program to be successful, the paper mill requires a source of clean recovered paper. This means that the recovered paper must be effectively separated from other recyclable materials, such as plastic, glass, and metal, not to mention non-recyclable materials, such as food and other impurities.

Recycling centers accept deliveries of sorted paper and often actively recover paper from home and office bins. Once the recovered paper has reached the recycling center, it is packaged in tight bales and transported to a paper mill, where it will be converted into new paper. In manufacturing plants

where there is a lot of paper used, there is also a lot of paper recycled. These plants normally have some kind of a recycling system, which gathers the paper waste and prepares it for recycling. The recovered paper is separated into different grades.

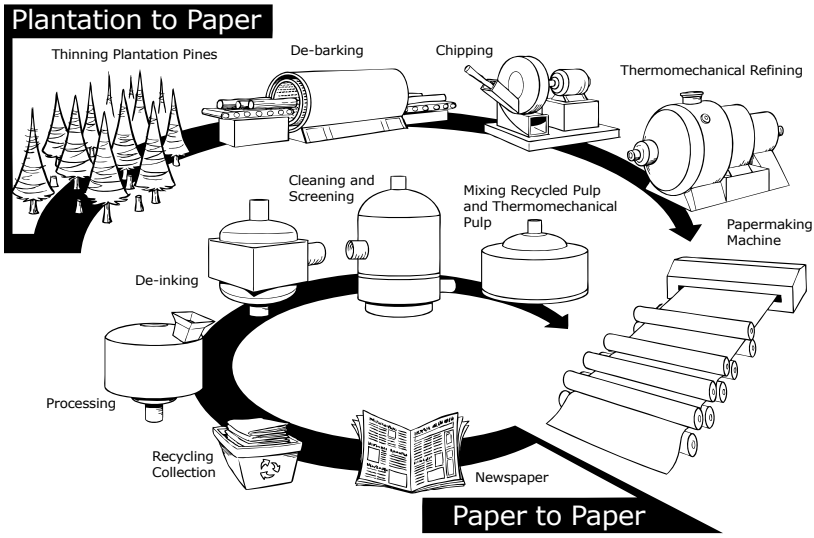
Each grade is good for a different purpose and has a different value. Waste paper has a good value; it is not wasted but reused to make new paper.

These bales are stored in warehouses and separated by grades, such as coated, uncoated, virgin stock, newspapers, or corrugated boxes. The type of recovered paper determines the grade of recycled paper that can be made from it. When the recycling process begins, the bales are transported to a large vat called a pulper, where they are submerged in a solution of water and chemicals. Inside this vat, the paper is chopped into small pieces. This mixture is heated in order to break the paper down into a mush of tiny strands of cellulose fibers. This pulp is forced through a series of screens with slots of various shapes and sizes. This process removes small contaminants, such as bits of plastic and globs of glue. The pulp is then poured into a cone-shaped cylinder that spins at a high rate of speed, removing heavy contaminants, such as staples.

Sometimes additional cleaning processes are necessary. Pulp must be laundered to remove ink and sticky residue, such as adhesives. The need for this is quite apparent. Simply look at the page of a magazine, and it becomes clear how many impurities must be removed in order to make the

fiber in that page reusable. A glossy page indicates that it is coated with a thin film of clay or some other material to give it that property. At the edge of the magazine, you will find a thicker coat of adhesive that binds the pages together. These impurities are removed through a combination of washing and flotation de-inking. This creates an inky froth that forms atop the pulp and is subsequently removed. Much of the ink in this froth is actually collected and reused in the mill. The remaining material contains small wood fibers that have washed out during the de-inking process. This can be dried and burned for energy or composted to make fertilizer. Sometimes this material ends up in the concrete that is used to pave roads. In today's world, manufacturers are always looking for new ways to use waste products.

Papermaking Process using Recycled Paper compared to Raw Materials



Recycling and reusing of waste material is not only good for the environment; it also helps the bottom line.

At this point, the pulp is a muck of fibrous material. It must be refined further to separate the fibers. During this refining process, the pulp undergoes an additional round of beating in order to make the fibers swell. The cellulose fibers that constitute the majority of paper tend to swell in diameter up to 20 percent when they are fully saturated.[11] This makes the pulp ideal for papermaking. If the paper is to be white, it is bleached with hydrogen peroxide, chlorine dioxide, or oxygen to make it whiter and brighter. If not, it will result in a brown color, such as that found in industrial paper towels.

The Myth: Paper production destroys forests, and that's bad for the environment.

The Fact: Paper is made from a natural resource that is renewable and recyclable. In the United States we plant three trees for every tree harvested. The paper industry promotes sustainable forestry because its existence depends on it.

At the next point, the recovered paper pulp is ready to be put through the same papermaking process as virgin fiber. In fact, recovered pulp is often blended with new wood fiber in order to give the finished product more strength and smoothness

than would be possible if it were made from recovered fiber alone.

Recovered paper often contains fibers that have been recycled multiple times. However, there is a limit to how many times wood fiber can be recovered before it becomes too short and brittle. Depending on the type of wood, a single fiber can be used perhaps five to seven times before it is no longer useful. However, each time this fiber is put through the recovery process represents an instance in which the same amount of virgin wood pulp is spared from entering the resource chain. In the big picture, this can add up to entire forests of trees every year.

Most of the paper that is recovered at recycling centers is processed back into paper or paperboard products. Ideally, and in most cases, this paper is recycled into a similar-grade product. However, it is sometimes recycled into a lower-grade product than the original. Recycled fiber, like virgin fiber, can also be used for a wide variety of applications, from egg cartons to wall insulation. In any case, recycling fiber is a much better alternative than burying it in a landfill.

Sustainability is a reality that begins with how consumers and businesses purchase the products and services that touch their lives every day. Much more than simply a surface to write on, paper is now one of the most versatile materials on the planet. It is used for office paper, cereal boxes, paper towels and tissues, and is essential in many other

aspects of everyday life. Paper is a commodity that is in high demand. For this reason, a sustainable paper industry has developed to provide consumers with the products they require in a way that is environmentally friendly. Today, more than half of the raw material used to make paper comes from recycled paper and wood waste; with our efforts, we can make tree-free paper the standard for tomorrow.

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Ink & Colors

The Making of a Truly Magical Substance

Green printing, in every instance is the story of printing itself. As the previous chapter demonstrated, papermaking is an art as much as it is an industry because it draws on a number of technologies, crafts, and materials. These products have been used in industrial manufacturing and in ancient civilization. This is also true for ink. In fact, the craft of making ink goes back infinitely further into the history of man. Much like other human endeavors, it was an artisan trade. Only recently, the process to make ink was industrialized on a mass scale. However, we are now coming to the realization that some of the techniques we have used for this industrialization are unsustainable. This has prompted a return to organic materials as a more eco-friendly alternative.

All inks perform the same basic task, which is to form pigmentation in a given shape. In addition, this substance can have a wide range of colors, textures, and consistencies. All ink is composed of two crucial components: a vehicle and a colorant.

Ink in the Ancient World

Prehistoric man first used ink to draw and paint on the walls of caves more than thirty thousand years ago.[1] The very fact that we can still look upon these etchings is a testament to the lasting power of ink. However, ink has had its greatest impact on civilization with the printed word and its ability to

spread human knowledge through populations and across the expanse of time. Wherever man has passed there can be found evidence of ink. Yet there is no definitive history of ink, despite the fact that it is the very substance that allowed humanity to document history in the first place.

> ***"The palest ink is better than the sharpest memory."***
>
> **Chinese Proverbs**

Many ancient civilizations treated the creation of dyes as a high art with closely guarded recipes. This is because information has been equated with power. Many of the techniques developed in ancient times are still employed today.

The ancient Egyptians and the Chinese both developed ink in approximately 2500 BCE. These civilizations had developed stone cutting and needed a way to adorn their art and artifacts. For the colorant, these inks contained fine carbon particles known as lampblack, and gums or glues were the vehicles. Chinese ink is composed of powdered lampblack and some type of binder. The Chinese generally used brushes to apply this ink.[2]

A different type of ancient ink, known as India ink, was a liquid mixture of gum arabic, shellac,

and sodium borate as the vehicle, combined with a carbon colorant. This type of iron gall ink is fast-drying and has an intense, concentrated black color. This was useful as a drawing ink remains popular, with technical applications such as architectural drawings. One of the earliest-known documentation was discovered in the writing of the Dead Sea Scrolls, which date back as far as 150 BCE.[3] The Dead Sea Scrolls are a collection of biblical manuscripts discovered in caves near the Dead Sea.

Recording stories and ideas through the use of symbols for the sake of posterity, memory, or communication is at the heart of what writing means in any civilization. In fact, most of the great ancient civilizations that we know about, employed writing of some sort or another. These symbols have passed through the ages to our modern world, and in most cases, we have been able to translate their meaning and thus know the thoughts of those ancient men and women who recorded them. Despite the fact that ancient inks were crude by modern standards, they endured over the centuries, preserving the information that they recorded.

There was a limited palette of colors to work with in ancient times. Colors were generally limited to purple, blue, red, yellow, brown, green, white, gold, silver, and black. Because certain colors were associated with particular aspects of life, as well as the fact that some colors were more difficult than others to create, individual colors came to represent certain characteristics. Green represented growth and regeneration as well as prosperity.

White epitomized purity and innocence. Conversely, black came to represent disaster, misfortune, and suffering. However, blue was an auspicious, celestial color that represented revelation. Red represented fire and love, while purple came to represent royalty.[4]

Ancient dyes were made from natural materials such as ochre and turmeric. Some dyes were also made from the ink secreted from the cuttle fish, which used the ink to confuse its enemies. Other colorants had unpleasant side effects and were even hazardous, such as cobalt, used to create the color blue; lead, used to create the color white; and mercury, sulfur, and potash, used to make the opaque red pigment in vermilion.

The development of these materials was just one factor in the evolution of writing, but they made it possible for writing to become diversified. This was also one means by which writing became a portable medium. For example, ink writing was much more accessible than more laborious methods, such as stone or clay tablet etching or engraving on wooden plates. Long before the development of a mechanical process for producing paper, people were committing symbolic or phonetic writing systems like sumerian cuneiform, Egyptian hieroglyphics, or even the much later Latin-derived Roman alphabet to portable flat surfaces with the use of ink.

Medieval Ink

Inks in the middle ages were made of a variety of formulas. The British museum maintains several texts from the reign of Charlemagne written with

inks composed of blue vitriol, yeast, the lees of wine, and pomegranate rind.[5] During this period, writing was strictly the domain of the clergy. In fact, the Latin word "clericus" (clerk) had an association with the priesthood. Moreover, literacy itself was taken as proof that a person had taken Holy Orders.

In England, Benedictine monks established writing schools in the seventh century and they later did this in Scotland. Benedictine monasteries implemented scriptoriums, where the laborious task of writing and illuminating were carried out during daylight hours. This was because candles and flames of any kind were prohibited lest the manuscripts be damaged. Because of their diligent devotion to the toil of printing, the Irish Benedictine monks' fame spread far and wide.[6]

Parchment, made from sheepskin, was the most popular medium of this time. However, the lanolin content in the sheepskin meant that carbon ink was not ideal for printing on this surface. As a result, tannic inks were developed, and gum arabic improved the consistency of the ink.

Gall Nuts, Lithographs, & Hot Metal Typesetting

The production of ink has always been somewhat challenging. To some extent, ink substances have always faded when exposed to the elements and had limited usefulness with different surfaces. For this reason, innovative craftsmen continued to try different substances and test different mixtures. Over the past three centuries, the written word has been mechanized through the process of printing, allowing any text to be endlessly and perfectly duplicated instantaneously. The skyrocket in demand for printed paper products has had a similar effect in the development of new industrial inks. From the late eighteenth century to the present, new types of printing machines have emerged at a regular rate to meet the growing role of printed materials in the working and leisure lives of people in the industrial world.

Iron gall was the principal ink used with the lithograph, which was introduced in 1796. This machine employed a limestone slab or metal plate coated with fats and wax to shape images, such as patterns of hydrophobic or hydrophilic surfaces. The lithograph machine directed where the water-based ink would absorb into the paper.

However, as wood-fiber paper came into everyday use in Western cultures through the nineteenth and twentieth centuries, the use of iron gall ink declined. This was due to the difficulty with which the substance chemically bonds to cellulose, the principle cellular characteristic of the plant

fibers in paper. Between the fast-growing demand in the market for paper and the industry designed to produce it, ink changed in character from what it had been for nearly fourteen thousand years.

In 1896, hot metal typesetting became popular in Britain and significantly defined how letterpress printing would operate over the next century. By injecting molten metal into text-shaped cavities, an entire page (monotype) or a line of text (linotype) was made, which would then be used to press the ink onto the paper.

Oil & Ink

When traditional iron gall ink lost compatibility with new printing technology, there was a demand for a new ink formula that could work well with metallic surfaces. The answer was oil. Oil could retain liquid viscosity.

Oil-based ink became dominant from the end of the nineteenth century into the twentieth century. The concept of extracting oils from plants like flax, however, was not new. In fact, it dates back to twelfth century France. Ink is a lot like paint in that it is dry pigment particles suspended in a fluid. This fluid is called the vehicle. When the base fluid evaporates, the particles stick to the surface they have been applied to.

Purely aqueous inks like iron gall or India ink were enhanced beginning in the seventeenth century with the addition of oil-based varnishes. Adding

varnish to pigments in place of water allowed a far more precise control over ink properties. Varnish was made by boiling an organic oil at a high temperature. The viscosity was determined by the type of oil used and the time it was allowed to "cook." Further modifiers like soap or resin were added to better control the characteristics of the varnish.

Oil-based inks became more popular on account of their durability and quick drying quality. Additionally, a number of raw materials were used, ranging from vegetable oils to those extracted from animal fats such as whale blubber. The most common source was linseed oil, taken from the dried seeds of the flax plant. Walnut and rapeseed were also alternative sources.

The use of organic, largely agricultural resources began to shift to inorganic compounds beginning in the nineteenth century as industrial mining and oil extraction demonstrated that new materials could be used to create new pigments and varnish vehicles. By the early twentieth century, ink manufacturers had developed specific properties of printing ink. New industrially derived chemicals were used to manipulate more exactly the viscosity and drying time, which affect how the ink is absorbed into paper. Controlling these properties is critical to avoid "bleeding," which occurs when the ink goes beyond the target application area. The speed at which ink dries has a direct effect on the pace at which a printed page can be moved along in production without smearing.

Other inorganic materials have been used throughout the last two hundred years to further manipulate how ink behaves when it is applied to paper. Minerals such as cobalt and manganese have been added to the oil-varnish solution to affect drying time. Today, drier compounds are particularly important in multi color printing systems because different color inks dry at different rates. Extenders are substances, usually inorganic solids, that are added to ink in order to change the body of the liquid and its acceptance onto paper without affecting the appearance of the color.

Without inks, there would be no digital media. With inks, we create books, newspapers, magazines, banknotes, and most importantly we pass our knowledge and experience from one generation to the next!

This gradual development of inks, based on inorganic compounds, led to the predominance of petroleum and carbon-based ink. This eventually led to the development of toner in the 1950s and 1960s alongside the invention of the copy machine. The original photocopier toner was made of carbon sourced through coal. Eventually, as better refining technology emerged for the extraction of polymers from petroleum used for printing, toner would evolve into the inkjet cartridges used in today's home computer printers. Inkjet ink uses pigments as

the colorant instead of dyes. These inks have been improved so that they are more durable and colors do not lose their brilliance, even when exposed to natural light for extended periods. This advancement alone has been a boon for certain types of printing, such as outdoor signs.

The elastic molecularity of inkjet toner produces a manageable drying time that is unlike anything that came before it. This is primarily because inkjet toner is a dry powder, not liquid ink. For this reason, there is no need to apply a range of fluid additives to retain viscosity over a long period of time. Additionally, inkjet toner molecules are incredibly sensitive to heat. The cartridge and laser mechanism use a burst of heat to convert the powder momentarily into a liquid just at the instant that it is applied to the paper. Almost immediately, the page begins to cool, and at this point, the toner is fused to the paper. This process involves a range of synthetic chemicals to help disperse and adhere the pigments within the polymer solution to the paper. The dispersing agents, or surfactants, are important to this process and are traditionally made from substances like alkyl-sulfonates and ethoxylated alcohols.

However, there are drawbacks to all these innovations. Alkyl-sulfonates and ethoxylated alcohols, for instance, are toxic at certain levels. Additionally, the mining and extraction of petroleum, on which these inks and chemicals are based, carry a range of seriously detrimental qualities that can potentially

harm local ecosystems and, on a larger scale, cause changes to the global environment.

Aniline inks were developed for printing on plastic surfaces that contain shellac, synthetic resins, or methyl alcohol. This type of ink is made by dissolving aniline or coal tar dyes in distilled water. Then a preservative such as carbolic acid is added to prevent the formation of mold. These inks do not permanently stain fabrics and are far less corrosive than tannic gall inks. Moreover, this type of ink comes in a wider variety of colors than are available in any other type of ink. Drawbacks to this type of ink are that it is not waterproof and fades when exposed to light. In certain parts of the world, these inks are used to dye clothing.[8] For example, in Fiji, aniline inks are used to dye straw hats a particular shade of blue.

Typewriter ink was used for more than a hundred years encompassing the nineteenth and twentieth centuries. The typewriter was the primary means of composing formal personal communication. This machine made ink impressions of characters through the use of type elements and ink ribbon. The base of the ink used in these ribbons was usually castor oil because of its slow-drying properties and because it mixed well with ground coloring agents. Typewriter ribbons are loaded with ink by passing through rollers that saturate the fabric. Most typewriter ribbons have two colors, red and black. These colors are kept from merging by a partition in the ribbon itself. However, the viscosity of both inks

must be equal or the colors will blend.

Offset Printing - Four-Color Process and Spot Colors

As the printing process evolved, so did the techniques for color reproduction. Before the printing press was invented, the calligraphers would use different color inks to draw each color, as an artist would draw an image. With invention of printing press, the need for faster techniques in reproduction of color became a priority. Producing different colors meant passing the paper through the press one for each color, similar to drawing one color at a time. This caused the production time to be multiplied by the number of colors. This process was inefficient and discouraging for color reproduction.

Two color printing became popular in 1970's as the demand for printed material was on the rise. Although any two colors can be used in 2-color printing, normally black is used as the dominant color with another color ink, which is referred to as spot color. Duotone is a 2-color halftone reproduction of a one color photograph. Duotone adds a special hue and effect to the reproduction of the photographs.

Four color printing process was created to meet the demand for increased productivity and a faster less expensive production. It is also known as process color printing which uses the four primary colors of cyan, magenta, yellow and black to create a color image. The combinations of different amounts

of one, two or more of these colors create a color gamut which is sufficient to reproduce most color images. This process is used to print the majority color images today.

Duotone Color Combinations

Duotone color chart showing various combinations of black and Pantone 3305

Color Tint	0% 3305	20% 3305	40% 3305	60% 3305	100% 3305
0% Black					
20% Black					
40% Black					
60% Black					
100% Black					

Grayscale Image

Duotone Image

Process color printing requires the artwork to be transformed in to four separate color halftones. This is called "color separation," or "halftone screening". This step produces four different printing plates, one for each color. The next step is to print the four colors together by transferring color impressions to paper on a printing press.

There are other methods of full-color printing such as six-color process printing (for example

Pantone's Hexachrome system) which adds orange and green to the traditional CMYK inks for a larger and more vibrant gamut, or color range.

Color printing can also involve a one-color ink, or multiple colors of ink which are not the primary colors. Using a limited number of color inks, or a specific color ink in addition to the primary colors, is referred to as "spot color" printing. Generally, spot-color inks are specific formulations that are designed to print alone, rather than to blend with other inks on the paper to produce various hues and shades. The range of available spot color inks, much like paint, is nearly unlimited, and much more varied than the colors that can be produced by four-color-process printing. Spot-color inks range from subtle pastels to intense fluorescents to reflective metallic colors.

Digital Printing

Is digital printing eco-friendly? The paper for digital printing is mostly the same paper that is used for offset printing. The choices of paper are more limited for digital printing as the paper must be compatible with the printer. Most stocks can run through an offset press, but not all paper can run through digital printers. Normally, there are no alternatives for the ink used in digital equipment and one must use the manufacturer's brand of ink or a similar ink supplied by a third party.

The amount of VOCs released in the air varies based on the type of digital press. This varies widely

from one digital press to another. In summary, the digital printing carbon foot print mostly depends on the equipment used. Unfortunately, the life cycle of a digital printers are normally just a few short years and not enough time for a published study to help us make a greener choice!

Personal Computers and Printers

The advent of the personal computer has given rise to home printers, a development that has revolutionized printing and made it possible to create printed documents on a singular level. Early models of home computer printers used a process called impact printing, which used an electromagnetic print head to drive pins against an ink ribbon, resulting in a pattern. This created a matrix of dots that formed the image on the paper.

In 1984, a number of disparate innovations converged with the LaserJet laser printer, which the Hewlett-Packard company retailed for $3,600.[9] Laser printers use a technology that focuses a beam of light that etches patterns of positively charged ions onto the surface of a cylindrical drum. As the drum rotates, the negative toner particles adhere to the etched patterns and are then transferred to the paper.

Inkjet printers are another example of non-impact printing. This type of printer sprays minute particles of ionized ink onto the surface of paper. Magnetized plates that project the ink determine

what shape the pattern of dots will form. Inkjet dots are miniscule and precisely positioned. The average diameter of each dot is smaller than the diameter of a human hair. Inkjet printers are capable of producing a quality of print that is comparable with laser printers, yet they use smaller moving parts and are cheaper to produce. However, the ink in inkjet printers is of a lower quality than laser toner and tends to smudge on lower-quality paper. Ultimately, print quality depends greatly on the type of paper. Standard photocopying paper will produce an adequate print, but the image will be sharper and the ink will show brighter if inkjet paper is used. The smoother the surface of the paper, the brighter the image will appear, because the surface does not scatter light the way a course paper does. Paper specifically designed to use with inkjet printers is called inkjet paper.

The ink used in the first generation of inkjet printers proved to be complicated. The pigments used in these inks were prone to clogging the machinery. This required a detergent to be added as a dispersant. Both dyes and pigments come from the same organic chemical compounds. Dyes are a solution, and their molecular structure is smaller than pigments, which are a heterogeneous mixture. Inkjet dye molecules require polar groups because the machine's plates are magnetized. This is what gives the ink a disintegrating quality that allows it to dissolve in the vehicle. Pigments, on the other hand, maintain their particle shape and remain insoluble in the vehicle without the polar groups. A printing ink

consists of vehicle and pigment. As suggested by the name, the vehicle transports the pigment from the ink fountain to the substrate.

Ink manufacturers now add a dispersing agent to prevent the pigments from clustering and clogging the machine. For this reason, pigment inks are more complicated than dye inks because they are insoluble, but their tiny size means they are more durable when exposed to the elements and ultraviolet light. Therefore, despite the fact that pigment inks are more difficult to manufacture, they last longer and can be applied to a wider variety of materials.

HAP Emissions, Heavy Metals, and Hazardous Waste

Hazardous air pollutants are any materials emitted through the air that are known or suspected to cause cancer or result in serious health problems, such as birth defects. There are nearly two hundred specific HAPS listed in the Clean Air Act.[10] Reducing HAP content is another way to lower the overall environmental impact of ink. This reduction can take place either in reformulation or by capturing the air pollutants during use. However, the Printing and Publishing MACT standard specifies that inks are compliant only when they contain no more than a 0.04 weight fraction of organic HAP.

All inks sold in the United States today are manufactured without the use of toxic heavy-metal compounds. Such as lead, arsenic, selenium, mercury, cadmium, and hexavalent chromium. In

the 1970s, the U.S. Congress enacted federal health and environmental regulations that strictly limited the use of ink formulas that contained highly toxic metals. This eventually resulted in the large-scale removal of these inks from the commercial market.

The EPA defines hazardous waste as waste material that is dangerous or potentially harmful to our health or the environment.[11] Non-solvent waste ink is not considered hazardous waste as long as it has not been contaminated with other pressroom materials. However, any ink waste that contains solvents with a flashpoint of less than 100 degrees Fahrenheit is classified as a hazardous waste due to flammability. De-inking sludge from the recycling of printed materials is considered hazardous waste for the same reason.

Green Ink

Currently, there are no government regulations or industry standards that define what makes ink "green" or to minimize how such manufactured products adversely affect consumers. By definition, biologically derived materials originating from plants, animals, or natural resources must be capable of short-term replenishment in order to be truly renewable. Therefore, any ink formula that contains petroleum-sourced material cannot be considered "green." Certainly, products that have a reduced impact on human health and the environment when compared with competing products should be considered preferable. This applies to the entire

lifecycle of such a product, including the manufacture, use, and disposal of the product.

Printing inks are usually formulations of chemical mixtures that have quantifiable properties. Therefore, it is possible to make measured assessments of their environmental impact. Today, vegetable-based inks such as soy-based inks are considered "green" or eco-friendly ink. Soy inks have less impact on the environment. During the de-inking process, the soy ink is easier to remove from the paper than regular ink. Soy inks also provide more accurate colors.

This brief description of the evolution of ink in terms of its relationship to printing tells a story that is strikingly similar to that of paper production. It describes the rise of industrial manufacturing, which prompted the use of raw materials that has led to a challenge to the ecological stability of the planet. In the case of ink, the extraction of petroleum and coal through drilling and mining has a serious, negative impact not only on the environment but on the health of those communities that depend financially on these industries.

For this reason, it is incumbent on companies to investigate alternatives to traditional ink sources. There are a variety of ways that manufacturers can modify their ink formulas to ensure that their products are more environmentally friendly. They can use biologically derived renewable raw materials while reducing the levels of volatile organic compounds (VOCs) and moving away from using hazardous air

pollutants (HAPs). In order to make inks more eco-friendly, manufacturers must come up with formulas that do not incorporate toxic heavy metals or materials that are classified as known carcinogens. In this way, they can ensure that their ink is non-hazardous. It is also important to ensure that their products do not interfere with the process of paper recycling or the biodegradation of the printed product. Sustainable ink production means the following:

- Emissions and toxic waste are reduced.
- Renewable resources are used throughout manufacture.
- When possible, ink is removed from paper during the recycling of printed materials.
- No techniques, such as foil stamping, varnish finish, or laminate, are used (because these render materials unrecyclable).
-

VOC Content

Volatile organic compounds (VOCs) are organic chemical compounds that have high enough vapor pressures under normal conditions to significantly vaporize and enter the atmosphere. The U.S. EPA's definition of a VOC is any organic compound that participates in a photochemical reaction.

In order to create ink products that have a lower environmental impact, it is important to reduce the VOC content. This is because such products produce lower emissions during manufacture and use. Over the last twenty years, ink companies have made significant investments toward reformulating

their inks to lower the VOC content while maintaining consumer requirements.

The amount of VOC in the formula depends greatly on what type of ink it is. Some inks require much more VOC content in order to be applied and dry correctly during the printing process. For example, inks that use evaporation to dry generally contain higher amounts of VOCs than do inks that dry through oxidation. Moreover, solvent-based inks generally contain higher amounts of VOCs than water-based inks. However, energy curable inks may be preferable to both since the amount of VOC is minimal upon polymerization.

Renewable Materials

The use of biological renewable materials in place of petroleum products improves an ink's overall environmental profile. Examples of such materials follow:

- Plant oils; flaxseed, chinawood, soy, corn, safflower, and other vegetable oils
- Resins derived from trees such as wood rosin, tall oil rosin, gum rosin, and nitrocellulose
- Plant-derived solvents, such as ethyl lactate and grain alcohol
- Fatty acid esters, such as tall oil fatty acid methyl ester
- Naturally renewed sources of water

The use of such materials is only the first step in the direction of ensuring that ink manufacturing is a more environmentally friendly process. Ultimately, manufacturers must refine their processes that produce air emissions, minimize energy use, filter water discharges, and control by-products and wastes. We can all promote and encourage the manufacturing of "greener" inks both by buying them and always asking for "green ink" when buying printing.

Soy Ink & Linseed Oil

One increasingly popular green alternative to petroleum-based inks for companies and consumers alike is soy-based or vegetable-based inks. This ink has a number of immediate benefits in terms of sustainability:

- Paper printed with soy-based ink is easier to recycle
- Soybeans are a renewable, organic resource that has a lower impact on the environment than the drilling and extraction of petroleum
- Soy ink has low levels of VOCs (volatile organic compounds), which results in less air pollution and fewer toxic emissions

In addition to the benefits to the environment, there are also a number of cost-effective benefits that come with using soy ink. Plus soy ink is less dependent on the price of oil. The process of harvesting the variety of soybean used for soy ink

Printed on 100% post-consumer waste recycled paper using soy-based ink

(a non-food soy called "vinegar ink") is relatively inexpensive and requires only a moderate amount of irrigation and little nutrients from the soil.

Soy ink first found success in the United States with newspapers. With high daily print runs, newspaper firms were concerned about the instability of the cost of ink, which was tied to the global oil market. To account for this, newspapers began shifting to soy ink, a domestic agricultural product. By 2004, nearly all newspapers in the United States were printing with soy ink.

A certified label is currently available on soy-ink products promoted by the American Soybean Association, guaranteeing that a product has fulfilled the basic requirements of soy-ink production designated by the organization.

SoySeal authorized by American Soybean Association

Beyond soy, there has been a return to some of the original organic resources that were used to make ink before the prevalence of petroleum-based ink, such as linseed oil. However, unlike producers in the eighteenth century, today's green ink manufacturers have the precision of modern chemical technology to isolate what is needed from linseed oil to precisely formulate the desired

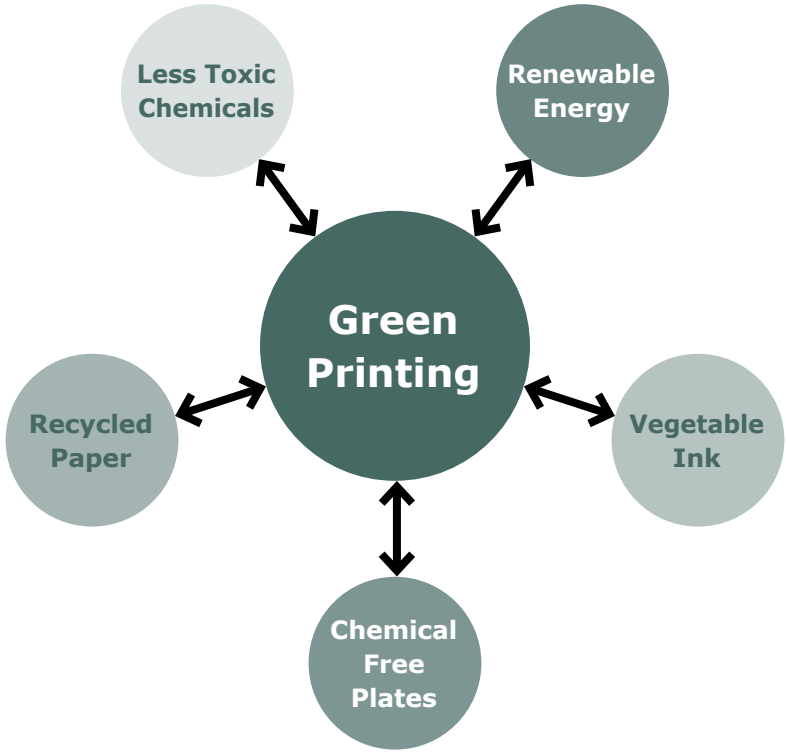
properties for a better ink. Organic ink properties vary in viscosity, absorption, flow, and drying time. Identifying and extracting biobased polymers offers the practicality of traditional inks with a markedly reduced ecological impact.

Sourcing Green Ink

For small businesses, going green involves a number of choices. By sourcing your printing needs from a company that deals with certified, sustainably sourced paper and alternative inks with reduced environmental impact, you are already well on your way to closing several major channels of pollution, waste, and foresting and oil drilling, all of which pose substantial ecological detriment to the world.

Green printers work to source the ink that they use from manufacturers who are committed to the principles of sustainability. There are many chemicals used in the printing process. Obviously, ink is one of them, but it is not the only one. Chemicals are also used in the plate-making process, in running and cleaning the printing press, and in cleaning plates.

Alcohol mixed with water is used in the conventional lithographic printing process. This solution contains isopropyl alcohol (IPA) or its substitute: fountain solution. IPA is a VOC, and it is unhealthy to the operator and the environment. Fountain solution is composed of chemical additives that control the water's surface tension. However, it produces water pollution when it is discharged as industrial waste water. Both IPA and fountain solution are detrimental to the environment.



The "chemical-free dampening system" is a new printing process that does not use any chemical agent with the dampening water. With this new chemical-free printing device, the water's surface tension is reduced without any additives—ordinary tap water is used as the dampening solution. This technology is new to the market and has not been instituted in the manufacture of printing presses thus far.

The print industry is changing rapidly. No sooner does one adaptation appear than another threatens to make it obsolete. The conventional image setter took the place of typesetting equipment

and plate setters replaced image setters. Today, chemical free plate setters are the favorite choice among environmentally friendly print manufacturers and print buyers. All this happened in less than twenty years. The capital cost of equipment in printing is among the highest in the manufacturing industry. Mostly this is due to rapid changes in print technology. The important decisions of when and what equipment to buy are faced by printers every year. Green-conscious customers can greatly affect this decision making, and lead printers to a greener path.

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Printed Paper in the Digital Age

Making the Pieces Fit

Despite the rise of digital media, paper products still proliferate across modern life. The promise of the "paperless office," now decades old, never happened. Businesses have found that websites do not deliver the same look and feel (to say nothing of results) as brochures or catalogs that customers can hold in their hands. Paper packaging remains the most attractive and affordable way to display products on the shelf. People still prefer the reality of a printout to an Internet address.

All of this suggests that digital media are not likely to bring about the disappearance of printing any more than television made the radio obsolete when it was introduced. Rather, it signals the need for businesses to adapt their printing to take advantage of the opportunities that these new mediums present. Among these opportunities is the ability to reposition printing and paper production within the principles of sustainability.

Our world is changing more rapidly than at any time in history. Words, images, and sound float freely between laptops, cell phones, and tablet computers through the pixilated world of the Internet. This chapter explores what role paper and printing play within this rapidly changing landscape.

Digital media has redefined how we communicate, work, and enjoy ourselves. Media, in this sense, refers to the tools we use to receive, send, and store information. One way to understand the new relationship between printed paper and digital media is in the office with the concept of going paperless.

The Myth: Electronic communication is environmentally neutral!

The Fact: Digital Media, which makes electronic communication possible, consumes energy. Most energy used to power such devices are generated in coal burning power plants. The dirty coal burning energy production has a serious impact on our environment.

The Emergence of Digital Media

The possibility of a paperless office first came to light in 1975, when a *Business Week* article asked what it might look like. In the piece, George Pake, a representative of the then five-year-old Xerox Palo Alto Research Center (today known as PARC), described the changes he imagined would be in place by 1995:

> [The] office will be completely different; there will be a TV-display terminal with keyboard sitting on his desk. "I'll be able to call up documents from

> my files on the screen, or by pressing a button," he says. "I can get my mail or any messages. I don't know how much hard copy [printed paper] I'll want in this world."

Pake's predictions turned out to be surprisingly accurate. Recalling what we've explored through the typewriter, it becomes clear that the paperless office is driven by that same need to develop systems that can cope with an increasingly faster-paced business environment:

> The office has changed little since the invention of the typewriter one hundred years ago. Word processing is coming on strong because businesses no longer can afford the custom approach to doing office work. Paperwork is growing explosively, and in the traditional "one-on-one" office arrangement—the secretary-boss combination—productivity is largely dependent on how fast the secretary can move her hands and feet.

As the article describes the office of the future, details about the 1975 office emerge that seem outdated today. Without any knowledge of the PC, a word processor is called a "display text-editing typewriter installation." The desktop computer has also changed office culture. The traditional image of a female secretary scrambling to please her boss now seems to be misogynistic and in bad taste.

Imagining the paperless office was important for *Business Week* readers at the time. Paper was the material on which all office-related activities

were built, feeding industries from typewriter manufacturers and office supply distributors to the paper producers themselves. The paperless office signaled a move of innovation toward a more efficient and productive office. It expressed a new possibility in which workers could deliver, store, and produce documents and other information with the click of a button.

Just as the telephone arrived in a world where telegrams dominated distance communication, interactive digital media dramatically changed the way communication was done. Users could now find content that interested them and view it at their leisure instead of being tied to network schedules. Additionally, users now had the ability to send a communiqué around the world instantly for free instead of paying for postage and waiting several days for that letter or package to be physically carried to its destination. However, unlike the relationship of the telephone to the telegram, digital communication

Sorry, honey, the Internet is down; no story tonight.

has not eliminated the need for hard-copy printed products. Conversely, as we have seen, access to high-quality personal printing actually resulted in an increase in the use of hard-copy content.

The rise of the Internet did usher in a new kind of publishing: web publishing. As the ease of this type of publishing became apparent, the proliferation of user-created web content exploded, allowing users to choose from millions of sources of content and to create their own. This transformed the digital media industry. Whereas media companies were once the gatekeepers of content, digitized content made it possible for anyone to share their content easily and gain an audience.

The pace of this change has been unprecedented. Television took thirteen years to reach fifty million viewers, yet Facebook added twice that number in only nine months.[1] It is therefore easy to see why society is having a hard time keeping up with this change. Innovations occur and can be relegated to niche groups until a defining event brings them to wider use. For example, the touch screen was invented in the 1970s but did not come into wide use until Apple introduced the iPhone in 2007.[2] Yet through all of this tumultuous innovation and change, digital technology has not yet developed to the point where it has rendered the printed page obsolete. The physical presence of the printed page presents users with the kind of reliability, tactility, and permanence that digital media still can not match.

Life in the Digital Age

Today, more than twenty years into the digital age, electronic media is an everyday aspect of our lives, replacing some functions that were once performed exclusively by analog or printed methods. On the other hand, digital media has opened the door to many other functions that we did not know about twenty years ago. In developed countries, reading is increasingly being done on a screen, whether it is

Life in the digital age.

a laptop, a handheld internet browser, or a portable e-book reader. Products such as these are becoming readily available on the market and seem to suggest that modes of communication and connection are

becoming more paperless all the time. Newspapers continue to close down as readerships fall, and once-crucial resources of information—such as phone books, personal ads, and business directories—have become redundant next to their online alternatives. The proof is all around: print "and paper" media has lost its role as the principal vehicle for how people receive, discuss, and store information because digital media moves information at a pace that was previously impossible.

Media has undergone a series of revolutions over the last three centuries in the Western world. With each new media, old technology that was once considered cutting edge is replaced. The invention of the printing press, for example, had an immediate impact on how books were produced. Texts as diverse as the Bible, the works of Socrates and Plato or even key political tracts were mechanically reproduced, exponentially expanding the number of books available to the public. Prior to the press, every book was a handwritten copy of another. Time-consuming and open to error, this economy of information certainly held with it a social order that many feared would disappear with the increased use of the press. Toward this, many scholars attribute the Reformation - one of the most defining shifts in European society - to information becoming wide-spread through the printing press. More recent technologies may seem less dramatic, but their effect on how we relate to information is just as important.

The typewriter is a good example. Armed

with only a paper and pen, the record dictation rate for mid-nineteenth-century stenographers and telegraphers in Britain was 30 words per minute. But as the pace of business during the Victorian period quickened, even this top speed could not meet the need for faster communication methods. The introduction of one form of what we know today as the typewriter (there is little agreement on who invented it or when) sought to solve this problem, pushing the rate up to 130 words per minute. This was a mind-boggling speed at the time, and it sparked a fear that handwriting would disappear completely.

The history of technology helps shape a more realistic picture of the relationship between digital and paper print media. Despite the revolution in our information culture, there are still a number of practical and functional limitations to digital media. In order to back up digital documents to ensure against corruption, many companies find it necessary to make duplicate hard copies. Digitally rendered files are surprisingly fragile.

Moreover, an extensive digital archive requires an array of programs suited to specific hardware architecture. This, in itself, presents a host of challenges. Staying on top of the latest software developments can be time-consuming and expensive. Other points of concern involve controlling user access and tracking changes made to individual digital documents. Companies must be able to control access to their network in order to track who can open, change, add, or delete documents. These

security concerns are serious, particularly as more sensitive material is stored digitally.

These are issues of control that companies are currently attempting to address. However, it is important to bear in mind that due to these concerns, and others, a majority of companies still keep hard-copy files as a backup to their digital archives. This large-scale diagnosis of security also applies to the everyday, personal level. People continue to print emails and web content, feeling more confident in documents that they can hold in their hands. Digital media relies on a network of necessary technologies before a single file can be accessed, while printed paper is a self-sufficient, stand-alone media.

However, to fully understand the relevance of print paper alongside digital media, we only have to look around. Billboards, signs, banners, posters, product packaging, and direct mail still prove to be viable marketing options, a fact experts believe pertains to the natural desire for tactility— the customer being able to hold the material in his or her hand. On-screen graphic design programs like Quark or Photoshop make producing a variety of attractive printed materials a far quicker, more precise process than has ever been possible in the past.

It is important to look at the pros and cons of both digital and print media. Digital media is most effective for expanding access to information, increasing how quickly it can be sent globally, and creating it with ease. Print, on the other hand, seems

to be more effective as a means of storing and presenting information in a tactile, material format. It is also a tangible material with uses that cannot be replaced digitally in many respects. An example of this is the packaging of a product. Products we purchase, such as food items, must be packaged. Even online purchases arrive in a well designed printed package.

Rethinking the effectiveness of today's paper and print industries allows us to assess how to most efficiently combine digital technology and print, as both have different costs and ecological properties. In fact, many printers and paper manufacturers are already far along this path. They have developed new ways to print and produce paper that relieve the negative impact on the environment caused by traditional methods.

Print, Digital Media, and the Environment

The public's concern about the negative environmental effects of paper use has been growing steadily for many years.[3] Truly, this is due to misinformation and false advertising. Nothing captures this concern quite like the statement that now regularly appears at many online billing sites: "Sign up for paperless billing—help the environment and save trees." When you consider that most of us print our bills and save a copy for our records, there is no difference in the methods with regard to saving trees. On the other hand, paperless billing saves many dollars for the company by shifting the cost to

the consumer. Consider the time you have to invest to get online, find your bill, and then print it on your own. This is not much different from an automated receptionist; it just benefits the vendor by shifting part of its tasks to a machine. When these savings are passed on to the consumer, we like the idea. However, when the vendor does this to reduce its customer service, we are not happy about it.

Often there is the statement that appears at the foot of many emails: "Please consider the environment before printing this email." These statements and others like them clearly imply that digital media is environmentally preferable to print. However, it is necessary to think critically about these claims in order to make a truly responsible and environmentally informed choice. Every email leaves a carbon footprint. Digital technology has a negative impact on our environment. Every day, our inbox is bombarded with spam emails. The energy needed to send, receive, and delete all those spam emails is hazardous to our environment.

As we have seen, this concern about the environment and the health of the world's forests is justified. The fact is that both print and digital media have beneficial aspects and negative impacts on the environment. For this reason, consumers need to make informed decisions about the lifecycle of the media they use. It is too easy to forget that digital technology has an environmental footprint. The embodied energy, or gray energy, that is used to manufacture digital technologies produces e-waste that is toxic to the environment. In fact, it is estimated

that manufacturing a single kilogram of plastic or metal requires as much electricity as operating a flat-screen television for up to ten hours.[4]

It is simply not true that digital technology

> ***The Myth: Digital communication is more eco-friendly than printed paper!***
>
> ***The Fact: Once you consider the carbon footprint of the energy used to make digital communication possible and the fact that digital equipment is made of non-renewable, non-recyclable materials; you will agree that digital is not quite as friendly to the environment as it may sound!***

is environmentally neutral. In fact, all energy consumption eventually has an impact on natural habitats and the environment unless that energy is attained from renewable sources. In the United States, most electricity is produced by coal-burning electrical power plants. Certainly, the energy consumed by simply operating digital media is significant, while printed materials require no additional energy to operate after they are produced. When choosing digital media, it is important to consider the consequences of purchased energy and e-waste associated with digital devices, even if these costs and consequences are not as easy to quantify

as those associated with the production of physical paper.

Additionally, consumers do not necessarily have to feel guilty for using print media. If these materials are purchased responsibly and used in a wise manner, users can significantly reduce their environmental footprint. There are forest protection certification programs that provide consumers with informed choices about the source of the fiber used to make the paper they purchase. Several of these programs include the following:

- FSC—Forest Stewardship Council (www.fsc.org)
- SFI—Sustainable Forestry Initiative (www.sfiprogram.org)
- PEFC—Programme for the Endorsement of Forest Certification (www.pefc.org)

A growing number of paper companies are making a point of identifying the environmental footprint of their products and making a lifecycle assessment. This type of investigation will help us to make more accurate assessments of the impacts of print media versus digital media.

As the use of digital media has risen over the last twenty years, it has become clear that there is a demand for both digital and print media. Neither digital nor print media alone are capable of meeting the information needs of the modern business environment for record keeping and communication. Furthermore, as the consequences of our resource consumption become clear, it is incumbent on us to

establish more efficient behaviors in all phases of our lives. Therefore, we must develop strategies to use these media in ways that are more responsible and engage in practices that are sustainable. The global environment is currently in a state that demands us to begin to make sustainable and eco-friendly choices.

An important step toward sustainability is to ensure that both print and digital media supply chains are renewable. This requires accurate, easily accessed information provided by manufacturers, retailers, and marketers as opposed to vague and unsubstantiated marketing claims. The leaders of the industrial world have a responsibility to question the integrity of their materials and products.

The Myth: Making paper consumes a lot of energy!

The Fact: About 60% of the energy required to manufacture paper in the United States comes from carbon neutral sources, which is produced on site at the paper mills.

The act of adopting sustainable print and digital media on a large scale creates the potential to alter the way resources are consumed around the world. Using sustainable print has significant benefits for the environment. However, if we continue to deplete the world's remaining natural resources in ways

that are unsustainable, the inevitable destruction of ecosystems and the pollution of waterways will result in a disaster.

One of the best ways you can help to mitigate destructive practices such as deforestation is to be aware of the supply chain associated with the paper you buy. Take steps to ensure that your paper is made from fiber that is certified sustainable. By creating a demand for responsibly sourced paper, we can save forests and protect the environment. The demand for trees offers a financial incentive for businesses to actively replace the forests they harvest. Already, the environmental movement has resulted in an increased awareness of the benefits of sustainable paper products, and over the last fifteen years, this has resulted in more than a tenfold increase in the use of recycled paper products.[5] This demand is projected to grow into the foreseeable future, as many more consumers are educated as to the importance of sustainable forest practices and the benefits of recycled products.

On the other hand, not many consumers actively consider the fact that the increased use of digital media, in an effort to reduce paper use, has actually contributed significantly to deforestation in the United States. The large-scale adoption of broadband networks and digital media alternatives require increased energy consumption. According to the U.S. Department of Energy, electricity consumption due to data centers across the country doubled between 2000 and 2006, topping more than sixty billion kilowatt hours per year.[6] This

amount was projected to double again by the end of 2011, with data centers using roughly the amount of energy needed to power more than one hundred thousand homes per year.

Electrical energy consumption has had a direct impact on America's forests because the country's energy grid runs largely on coal-fired power plants. By increasing the use of consumer electronic devices such as desktop computers, handheld slate computers, and cellular devices, we are in effect driving up the demand for coal. The process of mountaintop removal coal mining is one of the most significant direct causes of deforestation in the United States, particularly in Kentucky, North Carolina, and West Virginia. In fact, the area around the southern Appalachian Mountains, an area once blanketed by thick forests, now provides nearly a quarter of all the coal produced in the United States.[7]

There are a variety of ways that we may actually be increasing our environmental footprint through the increased use of digital media. The irreparable harm done by mountaintop removal mining is only the first in a long line of consequences that come from mining and burning coal. Power plants that are fired by coal account for 80 percent of the nitrogen oxide and 93 percent of the sulfur dioxide emissions that are generated by the electric utility industry.[8] These pollutants lead to acid rain, which has had devastating effects on the red spruce forests in the northeastern United States and throughout Appalachia. Acid rain has also led to the destruction of many fish populations in rivers and

The Myth: Paper waste is filling our landfills!

The Fact: About 67% of all the paper and paperboard consumed in US in 2011, was recovered. This rate of recycling continues to grow every year.

creeks throughout the upper Midwest and the Rocky Mountains.

Clearly, digital networks and devices will need to address their power sources before they can truly be considered sustainable. This will involve improving energy efficiency as well as finding ways to ensure that toxins used in their production are captured and recycled properly. Fortunately, the paper industry in the United States has made great strides in improving the sustainability of its practices. One aspect of this is that the majority of the industry's electricity needs are now garnered from renewable biomass and the process of sustainably managing forests. Currently, there are no certification standards (as there are, for example, with paper quality) that digital networks can meet to prove that they are environmentally friendly.

These facts demonstrate that environmental protection is not nearly as simple as merely going paperless. Despite the fact that printing is often blamed for killing trees while digital media is misleadingly branded as environmentally friendly, the reality is much more complicated. Depending

on how the information is stored and used, going paperless may actually be more harmful to the environment than storing the information on hard-copy printouts.

The real key to reducing your environmental footprint is to take the time to be informed and make rational decisions based on your needs. Consumers can help the environment by investing in brands of paper that employ sustainable forest biomass and are involved in the development of renewable energy products. Going forward, environmentally responsible companies will play an increasingly crucial part in the development of sustainable practices.

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Sustainable Forest Management

Sourcing Your Paper Responsibly

Green printing begins with paper that is recycled or sourced from a sustainably managed forest. It is helpful to understand forest management, in order to make educated and informed decisions. A sustainable forest encompasses more than just trees. Different aspects of the forest are monitored; from the amount of sunlight the leaves take in, to the water that flows through the branches and to the nutrients that the roots draw from the soil. All of these factors depend on a series of other living organisms and inorganic materials that make up the overall ecology of the forest.

Traditional forest management, often referred to simply as "forestry," is the industrial cultivation of a woodland ecosystem for the harvesting of wood for use in the manufacturing of a variety of commodities. With regard to paper products, forested trees remain the principle raw material used to produce all paper. A constant flow of virgin fiber is needed as paper cannot be recycled indefinitely. During the pulp making process, the paper fibers become shorter, coarser and stiffer, until it becomes too short and unusable after five to seven cycles.

The global paper consumption is expected reach 446 million tons by 2015, according to GIA

(Global Industry Analysts Inc.). The demand for recycled fiber is also increasing which promotes recycling of paper and paper products all around the world. Europe and the U.S. are approaching the recycling rate of 70% for all paper products consumed by them. This is up from less than 50% recycling rate in year 2000. Today, 30 percent of all paper-based commodities enter the international market, making industrial forestry a very important pillar in both developing and post-industrial economies.

Forests and the paper industry play a central role and have a large impact on the environment, as well as on the economic and social well-being of peoples throughout the world. The main goal of forestry is to ensure the long-term health of forests. Often the forest has a lower priority to the short-term economic needs of local communities. To ensure the that local communities can survive, foresters have developed standards for promoting a more positive and sound approach to forestry based on the principles of sustainability. This type of forestry entails managing the needs of both natural and planted forests.

The United States and other countries that are fortunate enough to have vast forests, employ techniques that encourage the natural improvement of woodland ecosystems, and take steps to mitigate ecological damage from human activities. One such technique is called "prescribed burning." This reduces hazardous fires and abates overall greenhouse gas production. Foresters in this scenario regulate the reach and procedure of logging throughout the

parcel of land for which they are responsible.

Prescribed Burning

With the technique of prescribed burning, fire is used in a controlled manner to naturally occurring vegetative fuels under specified environmental conditions. It is mandatory that pre-cautionary steps be followed to confine the fire to a predetermined area and to accomplish the intended objectives. These objectives generally include the conservation and expansion of forested landscapes.

Effective prescribed burning:

- requires the deliberate and skillful application of fire,
- must be conducted during exacting weather conditions,
- requires set boundaries where the fire will take place.
- must have predefined results.[1]

Prescribed burns must be well-planned endeavors in order to achieve the desired results. Firebreaks must be strategically placed in order to prevent the fire from spreading out of control. In order to achieve the proper results, the fire is applied by skilled, well-trained individuals using a variety of techniques. These individuals must be highly educated in the ways in which weather can influence how a fire behaves. Moreover, they need to be prepared to handle any changes in fire behavior.

When done correctly, prescribed burning is one of the most cost-effective methods for forest management, particularly for pine-covered regions. It is a tool that provides multiple benefits for both the forest and the animals that live there.

Prescribed burning accomplishes this by controlling undesirable vegetation and low-value trees and shrubs. Over time, a continuous program of prescribed burning actually changes the species from a mix of herbaceous weeds that provide little benefit to human populations to a mix that is more useful as food for both humans and wildlife.[2] This altered vegetative mix also makes water, sunlight, and soil minerals and nutrients more available to the surrounding pine trees that make up the forest. There are a variety of reasons why prescribed burns are carried out. These reasons include the following:

- Controlling undesired vegetation
- Improving wildlife forage and habitat
- Reducing potential wildfire hazard
- Improving access and aesthetics of the forest [3]

In order to fully understand each of these objectives, it helps to consider the lifecycle of a typical 40-acre pine stand and examine how applied burns can affect it. For example, if the timber of this area has been harvested and the landowner wants to replace the trees with pine seedlings, prescribed burning is a logical option. Prior to planting these trees, the area needs to be prepared by spraying herbicide to control competing vegetation while

the land is fallow. After the vegetation dies in the succeeding weeks, it becomes a fire hazard. One way of eliminating this hazard is through a prescribed burn.

Once the trees are planted, it takes up to fifteen years for the seedlings to grow into pulpwood-sized trees.[4] During that time, the trees occasionally become crowded in ways that may stunt their growth. In cases such as these, foresters may be brought in to thin the trees. In turn, such operations may result in increased sunlight on the forest floor, causing an influx of vegetative growth. In such cases, a prescribed burn can keep the vegetation in check. Furthermore, a prescribed burn can enhance the habitat for many species of wildlife, by increasing accessibility and stimulating plant growth for winter forage.

Planted Forests

Many countries with limited natural woodland currently pursue planted forests in order to meet the increasing global and domestic demand for paper and timber products. In 2005, 30 percent of the earth's surface was natural forest, with planted forests making up 7 percent of that area. The United Nations' Food and Agriculture Organization (FAO) argues that these tree plantations are vital to countering the negative impact of global warming by absorbing up to 1.5 gigatons of carbon every year. This is actually somewhat comparable with the current rate of deforestation. Additionally,

these planted forests also help in the reclamation of natural forests through the promotion of healthy soil and water regeneration to rehabilitate damaged agricultural land.

Planted forests will continue to play an important role in the world's ecological health. These forests keep the wood available for potential industrial production, and have become an increasingly critical source for future wood supplies. In the coming decades, the importance of planted forests is expected to steadily increase as wood becomes an increasingly vital resource. This importance lies not only in its use as an industrial material but also for its role as a competitive source of bio-energy. In addition, trees counteract the potentially disastrous effects of climate change. Planted forests also play an indirect role in reducing the loss of natural resources. An FAO survey of 95 percent of countries with planted forests found that potential industrial wood production from planted forests amounts to two-thirds of global wood production.[5] In fact, by the year 2030 it is projected that the area of planted forests will increase by 30 percent and that wood production will increase up to 50 percent.

This demonstrates the increasingly important social and environmental role that planted forests play in the conservation of natural forests, the protection of soil and water, and the rehabilitation of degraded landscapes. As deforestation continues at an alarming rate, planted forests have significantly reduced the loss of forested areas and reduced the demand to harvest natural forests. Because of this,

wood-based industries such as papermaking are increasingly adapting their supply chains to planted forests. In fact, wood from these planted forests is, in effect, a renewable resource and environmentally friendly.

Identifying Sustainability

The goal of forest management is to establish a balance between the increasing demand for forest products and the need to preserve the ecological health and diversity of natural forests. This balance is critical for both the preservation of forests and the economic development of forest-dependent communities.

Sustainable forests are carefully managed so that trees that are cut down are replaced with seedlings that eventually grow into mature trees. This idea comes from the view that the forest is not only a working environment, producing products such as paper, but a habitat for wildlife. The goal of sustainability is to ensure that industrial resources are always available, and also to ensure that natural habitats are reasonably preserved. Sustainability is a common sense approach to maintaining natural resources. Properly managed forests will contain trees that are a variety of ages and, ideally, species as well. By replacing trees as they are felled, the forest is constantly renewed. By avoiding clear-cutting and carefully selecting trees for harvest, forest habitats are not wiped out but are instead allowed to exist alongside industrial harvesting.

Deforestation, Climate Change, and Food Insecurity

✣ Human encroachment and logging destroys forests

✣ 20% of global CO_2 emissions are caused by deforestation

✣ Trees cool the atmosphere and "store" greenhouse gasses

GLOBAL WARMING

LOSS OF BIODIVERSITY

LOSS OF NATURAL RESOURCES

DEFORESTATION
30 million acres lost every year

✣ Flooding and soil erosion result from deforestation

FOOD INSECURITY

✣ Forests are home to over 70% of animals, plants, and other organisms

✣ 1.6 billion people living in poverty depend on forests for their food, fuel, and livelihoods

✣ Billions of pollinator bees have lost their habitat

Additionally, sustainable forests greatly add to a community's natural environment and attract tourists such as hikers and bird watchers, further adding to economic health. In fact, sustainable forests can only continue to exist if they produce a profit and provide employment for the people who manage them. This employment not only consists of the jobs directly related to managing and maintaining forests but also includes tourism, industrial jobs, and many other types of occupation.

Over the last fifteen years, the debate for a sustainable approach to forestry has become an actual and practical force through a number of nonprofit, charitable organizations, such as the Forest Stewardship Council (FSC) and the Sustainable Forestry Initiative (SFI). Both the FSC and the SFI are among today's leading voices for developing standards on both national and global levels for effectively promoting sustainable practices in forestry. Whereas the FSC created a framework for mapping sustainable forest management at the international level, the more recently established SFI exemplifies how these standards have inspired a reliable and meaningful chain-of-custody certification in the United States and Canada.

The Ecosystem Approach

Forest management in recent decades has focused on balancing environmental, sociocultural, and economic interests. Corresponding efforts within the framework of conservation have led to

the development of the ecosystem approach to forest management. This is a holistic approach to sustainability that emphasizes the conservation of biological diversity and the entire habitat that relies on the forest. The need for such an approach first began to surface in the 1980s with major public challenges to conventional forest management approaches, particularly in the American Pacific Northwest.[6] With these challenges came a large body of literature on ecosystem management and ecological stewardship. In fact, the term "ecosystem management" originally referred to an approach that was largely based on a comprehensive understanding of ecological processes. However, in recent years, the term has come to describe socio ecological systems, meaning that people and their institutions are now considered components of ecosystems. This is thought to be a more realistic way to approach resource management.

The ecosystem approach was laid out by the Convention on Biological Diversity (CBD) more than a decade ago.[7] The CBD defined this approach as a strategy for the integrated management of land, water, and living resources that promotes conservation and sustainable use in an equitable way. By this definition, the ecosystem approach applied to forest management is an integrated strategy of managing land, water, and wildlife in a manner that promotes conservation and sustainability above all. This approach is in effect a set of general principles that can be applied in a wide range of circumstances.

Therefore, the ecosystem approach does not identify any particular operational procedures, is based on the application of scientific methodologies to attain its goals. Yet while this approach may seem to place biological diversity over human economic development, it does take into account that human beings are an integral component of many ecosystems.

In reality, the ecosystem approach as defined by the CBD was never intended to provide specific prescriptions for forest management. Instead, it is an internationally agreed on, set of principles that describe desirable attributes of forest management systems. This approach has therefore led to some controversy, as different players in the world of forest management have proposed guidelines for making the approach operational.

Standards for Sustainability

The 1992 United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro sought to define sustainable forestry. Policy makers, leading scientific researchers, social and environmental advocates, and industrial leaders from around the world worked together to establish the practical scope and purpose of a sustainable forestry industry. It was in this spirit of finding a solution-focused consensus that the FSC was founded at the close of the conference.

As a nonprofit organization with a worldwide

reach, the FSC works to establish an international platform whereby a sustainable chain-of-custody can be guaranteed by standardizing how source forests are managed.

The 6th FSC General Assembly 2011 in Kota, Kinabalu, Sabah, Malaysia, brought together nearly five hundred members from eighty countries, each with a different perspective on the priorities of sustainable forest management. This meeting demonstrates the mission that the FSC is devoted to, which is to encourage dialogue between NGOs (nongovernmental organizations), the scientific research community, social and environmental advocacy groups, and business leaders all over the world. With offices in forty six countries, the FSC works as a link between these interest groups to devise strategies and standards for trademark assurance and accreditation that best meet the needs of an individual country. The 7th FSC General Assembly will be held in Seville, Spain.

The independence of the FSC is integral to the value of its certification. That is why each nationally based FSC office is financially independent of the international FSC body. The visible value of what this nonprofit organization does takes the shape of the FSC label. The label's certification guarantees that any wood-based product bearing its logo was produced from a sustainably managed forest. This helps assure green-conscientious consumers that the product is the result of industrial practices guided by principles that have the social, economic, and ecological well-being of future generations at

their core.

In order to be certified by the FSC, a foresting team enters into a direct consultation with its national FSC body. Working with each forester individually, a schedule is drawn up outlining the key objectives of the certification criteria. The span of these objectives is wide. Specifically, the forestry operation must demonstrate or achieve the following:

- Compliance with all applicable laws and international treaties
- Uncontested, clearly defined, long-term land tenure and use rights
- Recognition and respect for the rights of any indigenous peoples on the land in question
- A commitment to the maintenance of the social and economic well-being of forest workers and local communities, following the conventions of the International Labour Organization (ILO)
- An equitable use and sharing of the benefits derived from the forest
- An active campaign to reduce the environmental impact of logging activities by maintaining the ecology and integrity of the forest
- A clearly elaborated management plan subject to regular, continuous updates
- Active monitoring and assessment measures of the forest's overall condition, its management, and its social and environmental impact

- That any high conservation value forests (HCVFs) under management are maintained according to the appropriate UN regulations
- A continuing commitment to reducing pressure on and restoring natural forests whenever possible

The FSC certifies not only industrial foresters but also those businesses that deal largely in paper products. In terms of green printing, this directly involves presses, printers, and copy centers that depend heavily on paper products, which in turn helps customers in making ethical choices about their purchases. The FSC inspired a number of organizations to work toward establishing sustainable forestry management standards within their specific countries, like the United States and Canada-based SFI.

Foresters, conservationists, members of the scientific community, and policy makers were invited to contribute to the discussion and debate that went into deciding on the 9 principles, 13 objectives, 34 performance measures, and 102 indicators that make up the 2005–2009 SFI Standard. The standard is reviewed every five years, a process entirely open to the public. This offers a channel for the most recent scientific research to be incorporated to ensure that the standard is addressing the most relevant issues in forestry. The review to define the standard for 2010–2014 began in 2008 and took effect January 1, 2010. The aim of the SFI Standard is to actively address key environmental, social,

and economic forest values, such as water reserve quality, biodiversity, harvesting, and regeneration.

The SFI's mission complements that of the FSC with a stronger focus on the explicit conservation and evaluation of biodiversity within managed forests. This places a range of concerns within its agenda, including

- the impact of a forestry operation on water quality,
- the measures taken for the protection of water bodies and riparian zones within forested lands,
- the continual monitoring of shifts in habitat quality,
- the protection of unique habitats with endangered species in mind.

Establishing a wood or paper product's pathway from the forest to the factory to store shelves is how the SFI helps put sustainable forestry in the hands of business owners and consumers. With the SFI chain-of-custody certification label, buyers can see the exact percentage of sustainably forested wood fiber in a product, even if it is sourced from multiple forests. This label is recognized internationally and is a clear, concise way for establishing a market-based tradition for sustainable forest management. With only 10 percent of the world's forests certified by a third party organization today, the SFI is making leaps and bounds in bringing responsible forestry certification to the mass market by working with major retailers and manufacturers like Walmart, United Airlines, Xerox and Home Depot.

Without clearly defined standards of what qualifies as sustainable forest management, green printing would remain a vague idea. However, thanks to the work of independent, third-party certifying bodies around the world, like the FSC and the SFI, the term "green" really means something; businesses and customers are empowered to turn how they outsource their printing needs into an active campaign to promote a more responsible industrial management of the planet's resources. Small choices in this way help shape the larger push for improving the social, economic and environmental well-being today and that of the world we will leave for future generations.

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Printed on 100% post-consumer waste recycled paper using soy-based ink

Green Printing

The Way of the Future

Today, environmentally conscious consumers demand greener products. Now more than ever, consumers are educated about what they buy and how it is produced. While the printing needs of small businesses remain diverse, communication and marketing materials, such as in-store signage and brochures, remain an essential part of advertising for most businesses.

The digital age has made it faster to provide information to consumers, while marketing materials help businesses get a lion share of their market. Though it is difficult to compete with the speed at which we can spread the news via the Internet, it is hard to imagine how one could take home a box of cereal on a CD or another form of digital media.

Businesses need printing and printed products in one form or another. Marketing materials such as mailings, fliers, and brochures, as well as indoor and outdoor advertising media like posters and billboards, are all items that small businesses need to communicate with their clients.

Another demand that calls for printing is information, such as instructions, FDA labels, warnings, and other pertinent messages that are needed to educate and inform consumers. For instance, when you buy a product it is essential to have the written information included in case it

needs instructions such as assembling.

Most small businesses do not have the resources to print what they need in-house. Obviously, the ability to purchase a press and finishing machinery would be a costly investment for a company that does not specialize in printing. For this reason, the most sensible and convenient route is to work with an outside company to meet one's printing needs. Small businesses are therefore left to hire a design and production team. However, in order to truly go green with printing, businesses must ensure that they partner with companies that have been engaged in green practices. Everything that has been demonstrated in the preceding chapters, from the ecological hazards associated with printing to the outsourcing options available today, must be taken into account. Choosing an ethical but cost-effective printer is an important task.

So far, we have seen the extent to which the industries surrounding printing have evolved over the last three hundred years. More importantly, we've seen how recent sourcing techniques, technologies, and processes have emerged within papermaking and ink production to actively reduce or eliminate their negative impact on the environment. This chapter will help with information in how to make a prudent decision about purchasing your company's printing needs in a green and inexpensive way.

Walk the Walk

The first step in going green is to define what

green printing is and know what to look for. Here is how I define "green printing":

"Green Printing is an innovative and environmentally friendly method of printing that reduces the overall carbon footprint of the final printed product, by using less chemicals, less energy, and more recycled and/or sustainable materials."

This requires one to think behind the label. It means considering all of the green printing options, instead of just asking for a green logo. Below are some valid questions to ask:

Does green printing make a real difference?

This is a good question, which may cross anyone's mind when making a decision to go green. The answer is not quite that simple. Green printing makes a big difference in many cases and not as much in other situations. For example, offset commercial printing has a wide range of options and green options that are available for most products. Digital printing, on the other hand, has limited green options. This does not suggest that you should consider offset printing if your project is best suited for digital printing. The simple answer would be, in most cases the green option substantially reduce the impact on the planet ecology, and in some cases not as much. This depends on the nature of your print project and your specific requirements.

Should we go paper-less, and use digital instead?

Digital devices consume electricity. Dirty coal

burning electrical power plants release a substantial amount of green house gases in to the atmosphere. Considering paper comes from the earth and then it is recycled back to the earth, it is a much greener option. The best option is to have an open mind, and consider all aspects of your project when making a decision between using a digital form or paper.

How can we choose paper that does not contribute to deforestation?

You can be sure that the paper is sustainable, by requiring a chain-of-custody certification stamp on all your printed products.

The FSC or SFI-certified label on a printed project means that the wood used in producing the paper comes from a forest that was managed according to the principles and standards of sustainable forestry. Below are examples of the FSC and SFI label

What type of eco-friendly ink should I ask for?

One way that print organizations can increase their green awareness is to use printing ink the is as earth-friendly as their paper.

Non petroleum-based inks, derived from organic materials like soybean or linseed oil, are now available on the market. These inks work effectively to counteract the ecological damage associated with

the industrial inks and toners that we have become accustomed to, which contribute to an unhealthy reliance on fossil fuels and the release of greenhouse gases into the atmosphere.

Are some printers more sustainable than others?

Green printing involves integrating innovative technologies with eco-friendly raw materials. The new printing presses are more efficient than older printing presses. There are considerable difference between printing companies when it comes to sustainability. Green Printing companies purchase new equipment based on their sustainability value as well as other features. As previously discussed, one of the best ways to cut down in printing hazardous waste is by using chemistry free plates. The Chemical Free Plating System requires absolutely no chemicals, toner, or ink ribbon. It is therefore very sustainable, easy to maintain, and more efficient to operate because it does not require processor maintenance or chemical disposal. With regard to both time and money, this process compares favorably with the traditionally plate making techniques. The equipment is smaller, uses less electricity and reduces cost by eliminating the cost for chemicals or electricity for baking the plate.

New technology eliminates wash water. Using a chemical free system, an average commercial printer can save 12,000 gallons of waste water. New technology eliminate the need for make-ready paper and saves trees.

Operating with greener equipment also means users will lower the amount of energy that their press consumes, further reducing their overall carbon footprint. Printers can also link up how they work with local initiatives promoting renewable energy sources like wind or solar energy.

A sound recycling program can benefit a printing company by providing income from the recycled materials, as well as helping the environment. Most often, much of paper that can be recycled end up in the waste bin due to the fact that there are not enough recycled bins near the production machines. This waste can easily turn to profit by purchasing and placing recycled bins in all areas of production.

How do I choose a green printer?

Ask any printer if they are green and you will get the same answer: "Yes!" But are all printers green? Contrary to what most printers might claim, not all printers are actually green. Unfortunately, there are no established standards which would certify a printer as a green printer, or otherwise. Some printers have done an excellent job transforming their business into a greener and more eco-friendly business. Some others may like to use the label, "green printer" in their advertising so they can satisfy customers. It is important to know the difference and make an informed decision. Choosing a green printer sends a message to all printers that they need to change if they want your business. We all say that we want a greener and healthier environment. But are we doing our part to promote eco-friendly business alternatives? If you are serious

about protecting our environment and would like to help promote green printing, the following few steps can be helpful to choose the right printer:

- Start by visiting the manufacturing plant and taking a tour. Ask your printer to show you what they do that sets them apart from other printers, and why they claim that they are a green printer.

- Ask them if they are a certified member of any forest management organizations, like the FSC, or the FSI? If they are; it is also good to know how long the company has been a member. The longer they have been environmentally conscious, the better. Ask your printer to show you what it means to be certified by such organizations, and what they do differently as a member of that organization.

- Ask if they use chemical free plates. Making a plate could use a significant amount of harmful chemicals that need to be disposed of. The chemical-free plate process eliminates the need for any chemical and it is the greenest way of making plates. Some of this information may also be available on your printer's website.

- Ask for the age of their equipment, especially their printing presses. The newer the equipment, the more efficient and less wasteful, and the higher the quality.

- Find out if your printer is in full compliance with all environmental regulations. Take a tour of their facility and ask them to show you what chemicals they use and how they dispose of them. It is much

easier to compare two print manufacturing facilities after you actually take a tour of the plant.

- Ask what type of inks they use every day. Look at the label on a can of ink while taking a tour. There are many vegetable based inks available and green printers use vegetable based inks for most of their work instead of a petroleum-based ink, which has a high VOC.

- Ask the printer about their recycling program. Find out what they recycle and what procedures they use. During the tour of the plant, ask the tour guide for a show-and-tell of their recycling procedures.

Is green printing a lower quality printing?

For businesses, one of the biggest concerns is always quality. Companies know that it makes no sense to go green if it results in an inferior product. Admirable ethical commitments will make little difference if a printing company cannot satisfy the needs of its customers.

There is not any reason for concern as printers utilizing green technology are normally more advanced than those not concerned with the environment around them. The stunning quality of chemistry-free and process-less plates have caught the attention of many print buyers worldwide. While recent technological developments like this are clearly better for the environment, they also present vast improvements in printing quality.

Printers were once extremely concerned that vegetable-based inks lacked vitality. However,

vegetable-based inks have a much better ink holdout and less dry back than petroleum-based inks. Whether printing on coated or uncoated sheets of paper, and particularly on synthetic papers, technologies have quickly resolved some of the quality problems once associated with vegetable-based inks.

Recalling the issues that were addressed earlier in this book, digital media software gives a green printer the ability to create a truly impressive precision of image preparation. Digital and print technologies now supplement each other as tools. A blended use of these mediums enhances a company's ability to reach its customers.

Does it cost more to go green?

It costs no more to go green than it costs your company to source its printing from a reputable printing company. Green printers invest a great deal into their equipment, stay current with all new technologies, and comply with all local, state, and federal regulations. Therefore, you are receiving more value in a green package than you could expect from a printer with decades old technology. Looking for the cheapest bargain in town will lead to the just that; cheap quality, no customer service, and a lot more you did not pay for or care for. The only real cost associated with buying green is the additional cost to print on a sustainable paper to meet your green requirements. This cost can be minimal if you already using a printing company with green technology.

Beyond the peace of mind that comes with knowing that you have taken the responsibility to minimize how your business affects the environment, as well as gaining the ability to produce a finer, high-quality product, green printing provides a clear marketing opportunity. A long-lasting, genuine client base, who would appreciate your green initiatives, will easily pay off for the extra cost that you may have incurred.

How much will it cost my customers?

Green printers consult with each customer directly, planning out a project's pricing to meet their unique budget. Although quality ink is more expensive, generally vegetable-based inks cost less to produce than those that are petroleum-based. Paper made from recycled post-consumer is slightly more expensive than virgin wood fiber paper. Traditionally the higher the percentage of post-consumer waste contained within the paper, the higher the price. However, the price points for post-consumer waste products are trending downward and the percentage of the post-consumer waste content in recycled papers is trending upward. Green printing products will continue to become more affordable as demand for them increases, which seems to be the outlook across the market. That outlook projects that green printing is not merely an alternative way to print, but it is future of printing.

Are the benefits of green printing really worth the overall effort?

There are numerous misconceptions about

green printing that continue to be believed by people. Contrary to these beliefs, soy inks and recycled paper do yield high-quality printouts and are virtually indistinguishable from printouts on virgin paper. Once you understand the benefits of green printing, it becomes clear that it is just a smarter way of doing business.

Green Printing: From Idealism to Practical, Cost-Effective Business Sense

The goal of sustainability, which encompasses everything from forest management to industrial process waste reduction to the development of new sources of clean energy, is rooted in idealism. However, scientific research has followed this progressive thinking to provide clear evidence that supports the serious threat to the health and sustainability of the world as we know it, shaping a powerful, practical message to go green.

Going green is less of an alternative daily approach to commerce than an increasingly popular method of cost-effective business and industrial practices. In this sense, going green is really only preparing for what will be the normal standards of business practice within the next decades. This preparation may seem intimidating at first, but by carefully weighing out what options are available, you can smoothly and effectively link your company to truly green printing processes.

Clearly, green printing has been steadily

gaining momentum for years. Not too long ago, it was mostly practiced by activist groups and small enterprises wanting to do good. Today, green printing has become a priority of large companies and government agencies alike, and has taken strides toward being established as a standard business practice.

> ***"Paper has been an integral part of our cultural development and is essential for our modern life. Paper helps to increase levels of literacy and democracy worldwide and plays an important role in protecting goods and foodstuffs during transit. Paper is made from renewable resources, and responsibly produced and used paper has many advantages over other, nonrenewable alternative materials."***
>
> **World Wildlife Fund, Guide to Buying Paper**

While activist groups continue to promote green printing as a matter of principle, others have begun to realize that it is good for business too. Even aside from the fact that green printing is better for the environment, it also provides businesses with a valuable alternative to standard printing, allowing them to reduce operational costs, while increasing sales and improve their bottom line.

Adopting a Green Strategy

Green printing is a uniquely practical environmental solution. Usually, initiatives that benefit the

environment are economically more costly than the processes they seek to replace. However, green printing is actually a great way for companies to save money.

An effective green printing strategy begins with the reduction of the carbon footprint of office printing. While the conversion to green ink is one effective way of reducing the carbon footprint through a reduction in VOCs, a more immediate way to reduce this footprint is through a reduction in paper usage and energy usage. The economic savings of this can add up to hundreds of dollars a month. One easy strategy to reduce paper usage in your office is to set your printers and copiers to default to duplex, or two-sided printing. This simple step can potentially reduce paper usage by as much as 50 percent.

A more comprehensive step toward reducing your carbon footprint is to consolidate devices such as printers and copiers. The heated fuser sections of these devices use a considerable amount of energy. The average office printer consumes approximately 40 KWh per month and the average office copier consumes upwards of 285 KWh each month. For a medium sized business with multiple copiers and printers, the cost of powering these devices can add up to thousands of dollars a month. If a company can consolidate their devices, they can significantly reduce their energy consumption.

Companies that want to protect the environment can also drill deeper to develop green printing

practices. This includes such things as orienting designs in ways that avoid excess bleeding and large areas of ink. When this is not possible, project sizes might be reduced to cut down on waste. This has the additional benefit of cutting costs. Besides reducing reading content and duplex printing, there are several ways to reduce page count. This would include widening margins, using a smaller font size, and reducing the number of graphics used throughout your documents.

When printed materials require a coating on the finished product, such as brochures and book covers, be sure to use biodegradable coatings. Also, for printed materials that require a binding, use plastic coils made from recycled materials.

Adjusting daily print habits can also have a big impact on paper consumption. It is always a good idea to plan ahead and print only the number of copies needed to cut down on waste and printing expenses. Also, by regularly updating mailing lists to ensure that only customers that merit printouts receive them can reduce your carbon footprint. Finally, by placing recycling bins near trash cans and copy machines, you can ensure that excess printouts are captured and properly recycled.

Being a Smart Green Buyer

There are immediate benefits of sourcing from green printers today. However, there are no fixed set of standards that receive the backing of

an official government body or the endorsement of a widely accepted third-party organization. Such organizations that exist include the FSC for sustainable forestry or the Soy Seal for certified soy ink manufacture. Without such standards, a printer could very well describe its services as "green" without ever actually engaging in such practices. As we have seen in this chapter, going green as a printer is a serious shift that requires a number of initially difficult changes throughout an operation. This means that while using sustainably sourced paper in a traditional press is a positive step, it is less green than a firm that makes a full-scale change.

Despite the lack of standards and guidelines, there is a set of generally accepted characteristics that describe green printing practices. Ask your printer if the company practices green printing as described by these characteristics. Some of these characteristics are as follows:

- Recycled paper and energy-efficient computers and equipment
- Chemistry free platemakers
- Recycling excess and waste materials, such as paper, ink, and solvents
- Utilization of vegetable based ink

The move toward green printing is an important one. Numerous toxic substances are typically associated with the traditional printing process. Petroleum-based inks rely on a non-renewable resource that produces high levels of VOCs that can

pollute the air and water supplies. Moreover, the elevated presence of VOCs in the air and water can lead to serious health problems, such as cancer and birth defects. Additionally, the use of virgin pulp to make paper and the process by which it is produced is also harmful to the environment.

Green printing is a better, safer alternative that has the potential of transforming the entire printing industry. There are many ways in which green printing can mitigate environmental damage. This movement has inspired companies to identify alternative sources of materials to produce paper. These sources are more environmentally sustainable and yield paper that is as durable and attractive as paper sourced from virgin pulp.

Green printing also reduces our dependence on petroleum and this is not just limited to soy-based inks. As this motivation takes hold, companies are springing up to meet the demand, producing computers and equipment that are more energy-efficient. Some have even begun to use wind and solar energy to power their presses.

All of the innovations taking place in green printing result in a reduction of the levels of toxins and waste materials being released back into the environment. By going green, companies are moving away from the environmentally destructive methods of the past and moving toward improving the overall conditions for their employees and the general public. There may appear to be some ambiguity still with choosing a green printer. The following

chapter provides a practical framework to help clear this fog, highlighting those signposts most easily recognizable in an authentic green operation.

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Conserve
save energy
Use Organic
Recycle & Reuse
GREEN
on your next print!

Final Words

The Choice is Clear!

In the previous chapters you have seen how the history of printing has evolved over the last few centuries and more rapidly in recent years. Today, in the digital age, anyone interested in sustainable operations and protecting the environment has to consider the benefits of green printing versus digital communication. Both methods of communication can (and should) be used in concert to effectively communicate with clients. However to be a truly informed customer, one must decide which form of media is "greener."

Consider the issue of inputs and renewable raw materials. Printed communication uses paper as its primary material. Paper comes mainly from trees, which is a renewable resource if harvested properly and recycled. Forest product companies rely on trees for their continued existence and take great care to "renew" their main resource. The forest products industry plants 1.7 million trees per day, more than three times what they harvest. Paper is also biodegradable. On the other hand, manufacturing a computer or a digital device requires the mining and refining of many different metals and minerals (including gold, silver, and palladium). These are non-renewable resources, given that an individual cannot just "plant" a metal or mineral, and it takes centuries for the metal or plastic to degrade.

Another advantage of paper and printed pieces is the fact that when it comes to energy

consumption, 60 percent of the energy required to manufacture paper in the United States comes from carbon neutral sources, which is produced on site at the paper mills. This compares favorably to the electronics industry, which obtains over 90 percent of its power from the national power grid, a large part of which is greenhouse-gas-emitting, coal-powered plants.

Online and Electronic Alternatives Are Not Always Green

Although electronic alternatives offer a paperless method of accessing information, they are by no means greener or safer for the environment. The transaction of sending information electronically burns electricity. The environment is forever marked by the emissions from the power plants needed to produce the electrons to power the Internet. The landfills are also impacted because they will eventually hold hardware and other electronic trash, which are not recyclable. Compare this to the fact that paper is made from trees, which can be continuously planted, harvested, and then recycled. By replanting and nurturing forests, we perpetuate a never-ending cycle that enhances the earth and creates a natural sink for the carbon dioxide generated from such activities as electronic communication. In this way, forests are the true green economic engine across the world.

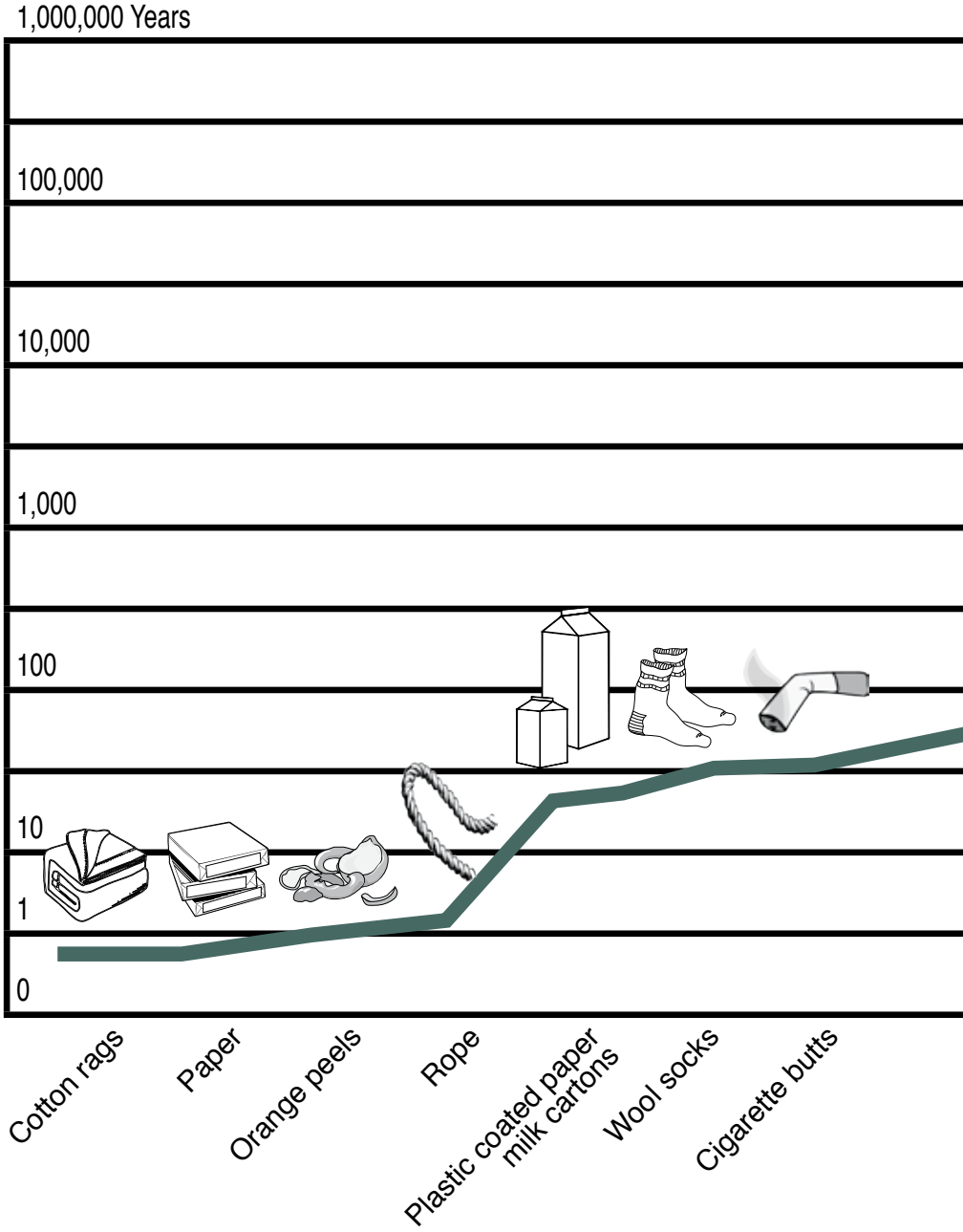
As the awareness about our environment grows, so does the recycling of used products.

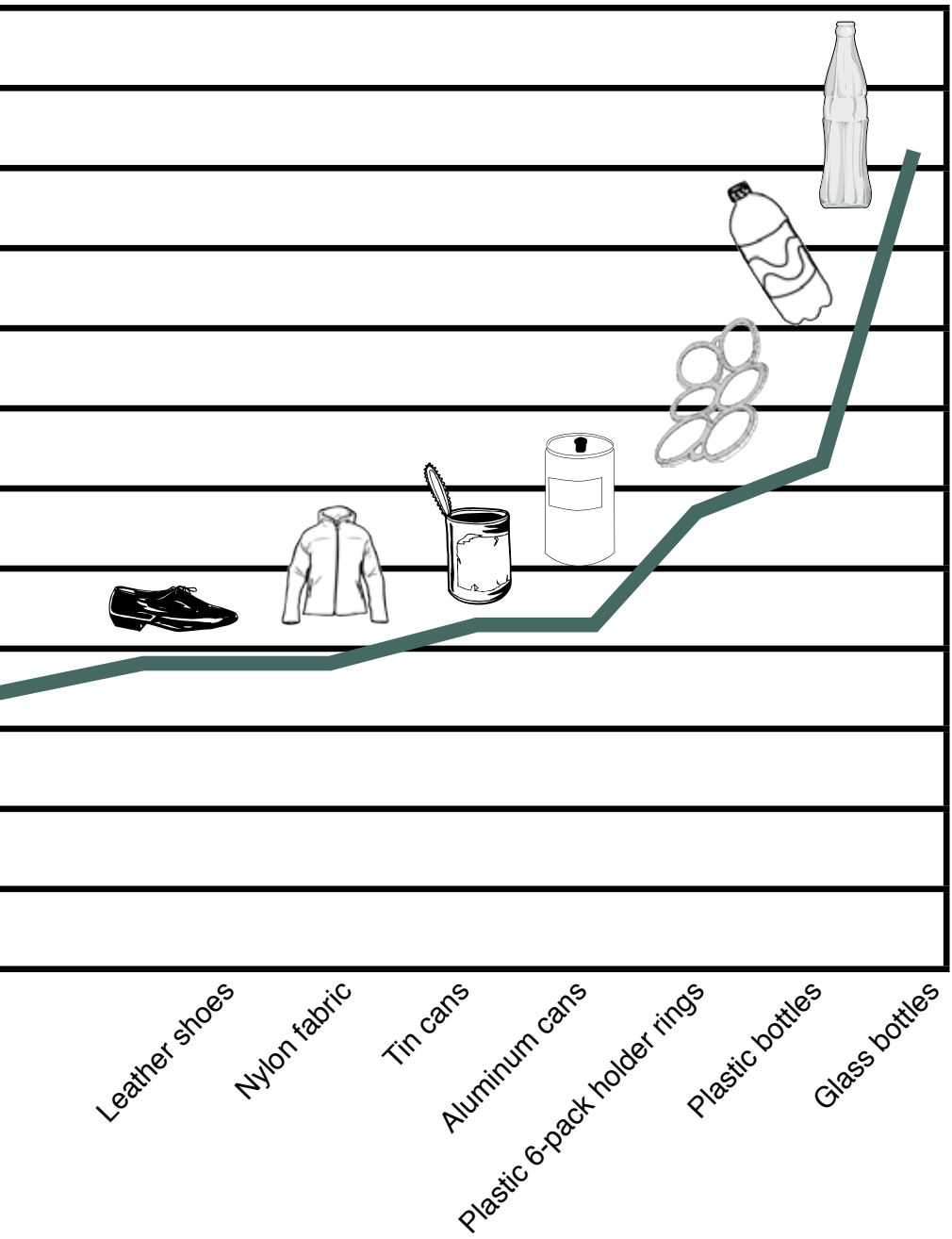
Today, nearly 70 percent of all paper in the United States is recycled annually. In comparison, only 18 percent of electronic devices are recycled, and only a small portion of this 18 percent can be reused for other products.

E-waste is the nation's single largest toxic waste export. These products are generally shipped to third-world nations.[1] Such waste will stay on the earth forever, and we will eventually feel the effects of it. Digital technology is relatively new, and we are yet to discover the long-term effects of it on our lives. We discuss the effects of paper verse digital in our environment, we should also consider the adverse effects of digital media on our bodies. Most people spend a substantial portion of each day in front of a computer screen, or looking at the small screen on a handheld device, which could weaken eyesight or result in other physical or psychological

Electronic Junk Yard

How long does it take to biodegrade?





Printed on 100% post-consumer waste recycled paper using soy-based ink

damages that are yet to be discovered.

These are some interesting facts, courtesy of International Paper:

- Twenty percent less CO_2 is used per year by a person reading a daily printed newspaper versus a person reading web-based news for 30 minutes a day.
- On average, it takes 500 kilowatt-hours of electricity to produce 440 pounds of paper, the typical amount of paper each individual uses in a year. That's the equivalent of powering one computer continuously for five months.
- It costs an estimated $2.8 billion of energy to leave computers sitting idly overnight in the United States.[2]

The paper industry has had much more time to figure out how to be eco friendly and responsible. In time, the electronics industry may do the same. But until then, paper and printed materials have the upper hand when it comes to being sustainable. And while a balance is required between the two methods for effective communication, it is important to consider the above facts when finding that balance. It is widely believed that electronic media of any kind is "green" because it does not use paper. After considering the facts, one must conclude that substituting paper with electronic media is not always the greener choice.

Benefits of Going Green

The popularity of earth-friendly, innovative products is on the rise, as sustainable products are

truly necessary for preserving the environment. The movement to go green is not merely a fad but an important, responsible, and popular choice. There are now companies that have been developed with the sole purpose of tracking firms specializing in developing green technologies. New laws are being passed all over the nation to promote companies that are making social and environmental improvement part of their business mission. The states of New York and California recently passed new laws that will officially recognize environmentally conscious companies. Known as B Corp laws (for "benefit corporations"), these laws create a new corporate class to recognize for profit firms that create a positive impact on society.[3] For reasons such as this, many companies are scrambling to position themselves to take advantage of the benefits offered by thinking green. It is demand that drives business.

Many business owners are under the impression that changing their processes to fit in with a more eco-friendly business model is excessively expensive and time-consuming. Though it is true that environmentally friendly products and equipment often cost more to purchase, in the long run this investment can save businesses money, and the benefits will be passed on to the next generation. There are many government-supported programs that help pay for purchasing energy-efficient equipment and going green. For example, rebates are available on many electronic devices that meet specific requirements for the conservation of energy.

In addition to the inherent benefits to the planet, taking environmental initiatives eliminates the cost of expensive cleanups when mishaps happen. Moreover, as a business culture becomes more aware of its environmental impact, it tends to experience positive results:

- Putting green initiatives into place helps a company achieve savings in energy costs.
- Recycling, energy conservation, and energy-efficient office equipment all save money by cutting costs.
- Investing money in business changes often saves money in the long run, and lead in to new businesses.
- Going green can improve productivity by encouraging employees to be more efficient.
- Taking environmental initiatives increases employee morale.
- Being known as a green company can attract talented employees and new customers.

How to Be a Green Business When It Comes to Printing

This book has provided you with information statistics, and facts about printing and digital media in terms of sustainability. With this awareness, you have the power to make a well-informed decision for your company with regard to how it manages its impact on the environment.

Today, there are many businesses using sustainability as a marketing tool, though not all eco-friendly claims are credible. This is also true when it comes to the printing business. Many printers use the conventional methods of printing for most customers and switch to eco-friendly ink or recycled paper only when asked by a customer. Consumers are now paying more attention to product labels in search of a more organic and eco-friendly product. Because green printing is becoming more popular, it seems that all printers are claiming they are greener than their competitors. This is good because it promotes green printing more rapidly, but it also creates an environment that makes it harder for those who are actually doing it right to compete. It is important to know the difference and patronize printers that are actually green.

Ten Steps to Becoming a Green Business

As you consider buying green, you should also consider going green. The U.S. government has developed a ten-step program to becoming a green business, which you can find at its official business website. SBA.gov is an official U.S. government site that helps small businesses understand the legal requirements and locate government services supporting small business communities around the nation. Here are the ten steps recommended by SBA.gov:

Step 1: Comply with Environmental Regulations

As a green business, you should practice what you

preach. This means complying with all environmental regulations relevant to your business. Compliance not only protects the environment but also protects your business from fines and legal action that could be imposed by the government. Consult the Environmental Regulations[4] section of the Green Business Guide[5] for more information.

Step 2: Develop an Environmental Management Plan

Running a green business means creating an environmentally friendly, energy-efficient workplace. A sound environmental plan[6] will help minimize your company's eco-footprint and encourage green business practices throughout your organization.

Step 3: Build Green

If you are opening a business in a new or remodeled building, make sure you build green by installing energy-efficient heating and air-conditioning systems, appliances, equipment, and lighting. To learn more ways to build green, visit the following resource: Small Business Guide to Energy Efficiency.[7]

Step 4: Buy Green Products

It is important to consider buying environmentally friendly products that are:

- made from post-consumer, recycled materials,
- bio-based,
- non-toxic,
- rated energy efficient, such as ENERGY STAR®,[8]
- renewable and recyclable,

- produced locally, such as organic food that is grown in your area.

Step 5: Adopt Energy-Efficient Practices

The prudent and conservative use of energy is one of the easiest and most cost-effective steps you can take to cut costs, increase profitability, and create shareholder value. Given the potentially high returns and minimal risk, implementing energy-efficient practices is at the core of most business environmental-management strategies. Take these steps to get started:

- Conduct an energy audit on your home-based business or commercial building to quickly identify areas where you can save energy costs.
- Purchase ENERGY STAR®[9] appliances and office equipment.
- Provide energy saving tips to your employees.
- Look for green power and renewable energy sources.

Step 6: Reduce, Reuse, Recycle Wastes

Most businesses can save a substantial amount of money simply by reducing waste. In addition to lower removal costs, waste reduction measures help cut costs on raw materials, office supplies, and equipment. By streamlining your operations to reduce waste, you may also be able to enhance your overall efficiency, productivity, and public image.

Implement waste management procedures throughout your operation, including the following:

- Use post-consumer, recycled products.
- Eliminate the use of excessive product packaging materials.
- Optimize the use of paper products; use both sides of each sheet of paper, re-use grocery bags and other bags.
- Participate in recycling programs, such as the U.S. Environmental Protection Agency's (EPA) WasteWise program.

For more information, visit the SBA's Waste Management Guide.[10]

Step 7: Conserve Water

The increased demand on our nation's water supply is threatening human health and the environment. By implementing a water-efficiency program, not only can you help conserve this precious resource but you can also cut the costs associated with buying, heating, treating, and disposing of water.

- Have your local water agency conduct a water audit at your facility to identify conservation opportunities.
- Conserve water using the best available technology and water-saving equipment utilities.
- Minimize discharges to sewer and wastewater.

Step 8: Prevent Pollution

Every business generates waste. For some, it may be only wastepaper or dirty water. Other businesses

may generate hazardous or toxic wastes that require special handling and disposal. For resources to help you prevent pollution, consult the SBA's guide to Pollution Prevention.[11]

Step 9: Create a Green Marketing Strategy

If you are starting a green business, you need to market yourself as one. Adding green claims and eco-labels to your marketing strategy will enhance your brand image and secure your market share among the growing number of environmentally concerned consumers.

Step 10: Join Industry Partnership and Stewardship Programs

The EPA sponsors a wide variety of industry partnership and stewardship programs that aim to reduce the impact of industrial activities on the environment.[12] These partnerships will help you build relationships with other green business owners in your industry, and a brand that's credible with your customers.

There are many resources available from SBA to help you with all aspects of your small business, such as becoming a green business and taking advantage of the opportunities available to you as a green business. Check out SBS.gov for more information.

Print and Don't Feel Guilty!

If you need to print a page or an email you received, go ahead and print it. One sheet of copy or office

printer paper has an equivalent carbon foot print of turning a 100W light bulb on for about 5 minutes.

If you are interested in reducing your carbon foot print, here are things you can do:

Turn the lights off when it is not needed.

Turn off your computer at night; surf the internet only when you need information.

Turn your heat 2 degrees lower.

Car pool when you go grocery shopping.

Eat your pizza cold instead of turning on a large oven on for 1 or 2 slices.

Finish your plate of food and don't waste the vegetables you don't care for.

And list goes on and on. If you do all that and still you would like to conserve, put a recycling bin near your office printer. There are many ways we can reduce our carbon foot print before we get to a point that we need to worry about printing a one page document or even 10 pages or more. Next you see "consider the environment before printing this email", how about a better response that says; I wish you would consider the environment by not sending me unwanted emails. I would rather see 10 sheets of paper in my back yard on my compost pile than breathing in the CO2 from a Coal burning power plant. Let's not overdue this paper conservation and ignore the damage caused by growing number of computers. Once upon a time, before the age of digital technology, paper

technology was popular. Back in those days, people ignored the damage done from clear cutting the forest and chemicals and other waste that going in to our water supply. Now, that we have experienced all the problems from producing the paper without concern for the environment, the industry has made positive changes. We must be responsible and not over use computers and digital technology. Considering all the facts, I conclude that paper and printing products are more environmentally friendly than digital media.

Make Green Printing a Priority

By choosing to print green, you are sending a powerful message to your audience that you care about the environment and the impact of what our actions today may have for the future of our children and our planet. One may think that the answer is to forgo printing in favor of digital media,[8] but that does not always work.

As we learned in previous chapters, digital is not as green as it is believed to be. Printing goes back centuries and has helped us get where we are today in terms of technology, science, and medicine. Can you imagine what our lives would be like if printing had never been invented? For many years, printing has been an essential part of our daily lives, and it has not destroyed our planet. In fact, it has actually enhanced our well-being by advancing medical research, technology, and the sharing of information from one generation to the

next. Without the help of print, we would not have the technology of digital to enjoy today. Digital is a relatively new technology, and it will take some time before we experience or even learn about its possible adverse effects on our daily lives.

Today, we are busy enjoying the new dimension digital technology has added to our daily activities. Digital is changing the way we do things and the way we share information, but it has yet to prove it will ever be a replacement for print. The print business has decreased in recent years, as books and catalogs are placed online instead of print. However, we should also consider the substantial growth that the print business had experienced over the past 30 years due mostly to digital technology and the ease of desktop publishing. Print is here to stay, so let's print green!

If you are serious about green printing, you should take a few hours to visit the print facility you are considering for your next print project. As discussed previously, almost all printers claim that they are green in one form or another. The most important step you can take toward choosing a green printer is to visit several printing plants and make a visual comparison. Once you visit two different printers and take a tour of their manufacturing facility, you will form a quick opinion as to which is greener. Without a tour of the facility, it is almost impossible to distinguish the difference, once you see for yourself, you will be surprised how different two printers can be.

Here are a few tips that will help you buy smart when it comes to buying green printing:

- Start by choosing a reputable green printer and take a tour of its plant.
- Ask your designer to choose a size for your project that yields less waste when using a standard-size sheet.
- Choose a paper that is either made with more post-consumer recycled materials or certified by a third-party eco-friendly organization.
- Make sure your project is certified by FSC, FSI, or PEFC, which should include the certification logo printed on your materials.
- Ask for chemical-free plates.
- Ask for soy-based or vegetable-based inks instead of petroleum-based inks.

It would take a little extra effort on your part, and it may add a little to the cost of your project to go green. However, this is a small price to pay for a cleaner environment. As more people become conscientious about green printing, it becomes more simple and standard. We sometimes take for granted the air we breathe and the nature we enjoy. If you ever visit a place in the world with polluted air quality or industrialized pollution, you will appreciate nature more than ever. It's easy to take for granted a blue sky until you've seen one that is gray from pollution. There are those who are leaders, and those who follow them. Be a green leader and clear the path for a healthier future for your children and

for generations to come.

Sustainability for all resources and waste products are important for life on Earth.

Go green on your next print!

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[2] Hutchison, B. (2009, June 30). Electronic vs. Printed Communication: The Sustainability Battle. *Arandell*. http://www.arandell.com/arandell-paper/electronic-vs-printed-communication-the-sustainability-battle/.

[3] Makker, S. (2012, June 15). B-Corps: The Socially-Aware Corporate Movement. Article 3. http://www.article-3.com/b-corps-the-socially-aware-corporate-movement-97667.

[4] http://www.sba.gov/content/environmental-regulations.

[5] http://www.sba.gov/content/green-business-guide.

[6] http://www.sba.gov/content/environmental-management.

[7] http://www.sba.gov/content/energy-efficiency.

[8] http://www.energystar.gov/index.cfm?fuseaction=find_a_product.?.

[9] http://www.energystar.gov/index.cfm?fuseaction=find_a_product.?.

[10] http://www.sba.gov/content/waste.

[11] http://www.sba.gov/content/pollution-prevention.

[12] http://www.sba.gov/content/environmental-management.

[13] http://www.techsoup.org/learningcenter/internet/page3090.cfm.

Printed on 100% post-consumer waste recycled paper using soy-based ink