Life Cycle Analysis of Interface's Bentley Prince Street Carpet vs Traditional Carpets

Katie Crowley, Pat Hurley, Marty Schneider, Jared Singer

ENVS 195: Sustainability Science with Dr. Saleem Ali, Fall 2010

While carpets are walked on everyday, it is seldom that people take time to think about how it got to where it was and how it was made. By analyzing the process of in which carpets go through in their life cycle we want to introduce the facts of traditional carpet life and present a more sustainable alternative. The current production and materials used to create the comfortable first step out of bed in the morning are in need of serious change.

When it come to tackling the issue of making consumerism more sustainable, most people initially think of commodities that they buy on a regular basis; staple goods like food, clothing, cleaning supplies, hygienic products and etc. What are usually forgotten about are good that are not purchased regularly and are nearly completely ignored. Although these products may be used every single day most people tend to over look bundles of goods. Walking into the vast majority of buildings, the first encounter you have with the infrastructure past the door is the first step you take through the doorframe onto the floor of the building. Not thinking anything of it we all have the pleasure of the softer ground beneath our feet provided by the carpet glued to the floor. While most people neglect to think anything of it, the carpet industry is one in which needs remodeling to attain a higher level of sustainability.

Interestingly enough, this industry has not be approached for being environmentally hazardous for a long time. Whether that is because it is ignored, because it is a widely accepted house hold commodity, or because there is just a lack of interest is uncertain but either way when the information provided in this paper is understood it will be very clear how truly in need for a face lift this process is. Looking into the materials used in the actual product itself is most likely overlooked because it is a comfy and cozy good. Even if informed that comfortable warm feeling beneath you feet consists of yard colored to your desire, your probably still thinking that this a great. Now, what if it was to tell you that yarn is primarily made from crude oil. While you feet might still be warm, yes its true your standing on an oil-based product.

Knowing this and taking into account traditional energy intensive manufacturing of goods, it isn't hard to realize that there must be a great deal of oil consumed in the production and transportation of these carpets. Looking at the entire life cycle of a carpet we also need to consider how it get is color, how it is installed and where they end up after they are removed. In this we hope to draw new ideas and present alternative life cycles in a more sustainable manor. In consideration of how much carpet already has been produced it is easy to see how if there is a way to recycle the product, that it needs to be done because of the abundance of recyclable material and constant depletion of raw resources.

Looking into the field of sustainability and the industry of carpeting, a man by the name of Ray Anderson who runs the company Interface Inc. This company owns twenty-six different factories and with his new approach to the manufacturing and implementation of recycling ideas we are seeing vast improvement with in his company in regards to sustainability. He realizes that too much of the material in carpets are too heavily dependent of petroleum products.

The carpet industry is one that has received very little public attention regarding its environmental impacts from raw material production, manufacturing and disposal of used products. The lack of interest in this sector of the manufacturing industry may have been caused by the universal adoption of this commodity in nearly every structure of the modern world, so common that a room seems naked without one. Carpets – traditionally known as rugs – have been in worldwide use for thousands of years, beginning as an art form and developing into lucrative trades highlighted by expensive Persian and Oriental rugs, the pinnacle of fine home furnishings. Until recently, however, the carpet manufacturing industry had remained clear of scrutiny in regards to environmental impacts – perhaps because a taboo developed that views criticizing such a homely commodity as intolerable. Regardless, the ever-controversial Environmental Protection Agency took the role of lead investigator in the research to understand the possible detrimental results of wide-scale industrial carpet manufacturing, concentrating on the Volatile Organic Compounds (VOC's) and Hazardous Air Pollutants (HAP's) released during every stage of the life cycle (Mulholland, 2001).

The majority of environmental harm that is caused by carpet production is derived during the manufacturing stage in which chemical dyes, treatments and adhesives released toxins into the air and polluted water and soil resources nearby. To understand the emission of these harmful substances each step of the manufacturing process were explained, beginning with the raw materials.

The primary component, and the one consumer's are most familiar with, is the yarn that is the surface of a carpet. This yarn is typically made of Nylon 6 or Nylon 6,6 – but also polypropylene and polyester – and have come to replace the traditional wool carpets. All of the artificially derived choices for yarn, however, originally come from specific hydrocarbons that are refined from either crude oil or natural gas (Baneclene, 2009). The yarn arrives at manufacturing plants in either 550 lb bales or on continuous spools and up to 4 gallons of lubricant is added for easier machine processing. The fiber then goes through heatsetting, which introduces texture and twists to the yarn and results in the emission of VOC's from the lubricant and synthetic fibers (Mulholland, 2001).

The next stage is dyeing the fibers, in which two methods are often used. The first method, beck, or batch dyeing, is the submersion of fibers into a liquid dye for an allotted time. Before being dyed however, the fibers are stretched and washed, which results in the pollution of water by lubricant residue and VOC's that remained from heatsetting. The dyed fibers, which now contain oxygenated organics such as butyl hexadecanoate and butyl stearate, are once again rinsed and finally dried (Mulholland, 2001).

In the alternative method, called continuous dyeing, "dye is typically sprayed on carpet as it passes through a dye range. The dye is then steam set, rinsed to remove any excess dyes and chemicals, and dried in a gas-fired oven. Anti-soil and anti-staining agents may be applied" (Mulholland, 2001). The final stage of carpet manufacturing is the application of a woven or foam secondary backing with latex adhesive. To ensure a tight bond, the two backings are rolled together and cured in an oven. After this step, the product is ready for distribution to retailers (Mulholland, 2001).

Looking back, one can understand the final list of materials that is needed to manufacture this basic commodity. The most important component is some variant of synthetic fiber, primarily Nylon – a petroleum product whose cost and value fluctuates with the oil market price. Next, the chemical dyes, which are used to produce our favorite flooring colors, are made of such a vast list of materials that one can never narrow down the specific ingredients. However, these dyes are almost always comprised of artificial compounds whose effects on living systems are widely unknown. The latex adhesive and foam secondary backings (the woven backing is nylon) are also synthetically produced through energy-intensive means often using petroleum products and even more organic molecules (various, 2010).

We will start first with the environmental evaluation of these materials in order to grasp the potential for sustainability in traditional modern carpet manufacturing. In regards to environmental health, the process of yarn heatsetting releases .8% VOC's by weight from nylon, primarily as caprolactam – a mild toxin that was on the original EPA list of Hazardous Air Pollutants (EPA, 2000, 2009). Another health hazard from the first stages of carpet production is that "over 80% of spinning lubricant VOCs appears to be released" through rinsing or heating (Mulholland, 2001). If the potential for sustainability of this industry was to be measured strictly in regards to environmental and health hazards, this would prove a failure.

Coming from another spectrum of the sustainability discussion, the most important aspect of the success of this industry is the continuing availability of cheap petrochemicals to produce synthetic fibers. A shortage of this invaluable resource would result in the cost of carpet manufacturing increasing significantly from oil scarcity and/or reliance on more expensive substitutes such as wool. In economic reasoning, this aspect of carpet manufacturing is surely unsustainable as we reach peak oil production rates in the coming years (Heinberg, 2005). The heavy dependence on oil products to begin with signifies a weakness in terms of sustainability as the petrochemicals used by this industry results in environmental degradation at every stage of production – crude oil recovery, transportation, refining and final carpet manufacturing.

The majority of carpets are manufactured using virgin nylon, meaning that the fibers are first generation products that will likely be made into one product, used, and simply thrown away. An easy solution to the end-of-life disposal of this industry is to collect and recycle old carpets – a very easy feat as nylon can be re-dyed numerous times (The Carpet and Rug Institute, 2008). However, the dyeing of carpets through either method is also an area where sustainability is questionable. Because of the enormous amount of substances that are used as dyes, this research is limited as to the direct potential for sustainable carpet production, but there are principles that can be adopted to work towards this goal. Research into recycling residual dyes that are not absorbed and a move towards naturally produced dyed would result in a much smaller impact on our environment. "Both the beck and continuous dye emission studies indicate that a large fraction of the VOC emissions are released during carpet dyeing and steaming, and that water-soluble VOC's partition between gas and aqueous effluents" (Mulholland, 2001). As the research states, many hazardous chemicals are released through dyeing carpets, most of these on the EPA's list of Hazardous Air Pollutants, several known carcinogens or nervous system disruptors (EPA, 2000). This statement along suggests the unsustainable characteristics of this industry and the need to develop processes that reduce – either by prevention or sequestration – the emission of toxic chemicals into our air and water resources.

The social impacts of this industry are relatively unknown. The increasing concentrations of VOC's and HAP's in our environment are known to have adverse health effects on humans and many animals, however a great deal of research is needed to understand the full effects of increased pollution from this and many other industries. Until this research is done and stricter regulations on emissions are imposed, carpet manufacturing is likely to continue as an increasing rate as developing countries continue to consume more resources.

As can be gathered through this research, the current state of the carpet manufacturing industry represents a lack of action in the implementation of sustainable practices. However, there are institutions that have arisen in the past years, such as the Carpet and Rug Institute, that promote, encourage, and even reward manufacturers for their progress towards sustainable production. An enormous increase in the recycling of used and end-of-life products throughout the industry allows less dependence on virgin products that require energy-intensive – and often highly polluting – practices. Although companies such as InterFace, Inc. continue to develop their sustainable practices, they need to be adopted at a larger scale for the industry to realize the environmental and social (and often economic!) benefits that are possible.

<u>Works Cited for Traditional Carpets</u>

Baneclene Corp,(2009). Carpet fiber characteristics. Retrieved from http://www.baneclene.com/articles/fiber-characteristics.html

The carpet and rug institute sustainability report 08. (2009). CRI sustainability report, Retrieved from http://www.carpetrug.org/pdf_word_docs/2008_CRI_SustainabilityReport.pdf

Environmental Protection Agency, Office of Research and Development. (2000). Caprolactam Retrieved from http://www.epa.gov/ttn/atw/hlthef/caprolac.html

Environmental Protection Agency, Office of Research and Development, Air Toxics Website. (2009). Original list of hazardous air pollutants. Retrieved from http://www.epa.gov/airtoxics/187polls.html

Environmental Protection Agency, Office of Research and Development. (2003). Select resource materials and annotated bibliography on the topic of hazardous air pollutants (HAPs) associated with aircraft, airports and aviation. Retrieved from http://www.epa.gov/airtoxics/aircrafthaps/aircrafthaps_rpt.pdf

Fletcher, A. J. (2009). Carpet selection for heavy traffic applications. Retrieved from http://www.homecarpetshopping.com/heavy_carpet_traffic1.htm

Heinberg, R. (2005). The party's over: oil, war, and the fate of industrial societies. Gabrolia Island, BC, CA: New Society Publishers. Mulholland, J.A., Pitrolo, M.C., Bissram, R., & Patury, S. Environmental Protection Agency, Georgia Tech Research Institute. (2001). Air emissions from carpet manufacturing process Atlanta, GA: Georgia Institute of Technology. Retrieved from http://www.epa.gov/ttn/chief/conference/ei11/toxics/

mulholland.pdf

Various. (2010). Britannica online encyclopedia. Retrieved December 1, 2010, from http://www.britannica.com/

The Interface Bentley Prince Street's collection of solution died carpet offer a sustainable solution to an individuals choice of floor space coverings. The Life Cycle of this product can be broken down into four stages, 1. Production, 2. Installation, 3. Use, and 4. End of Life. The total energy use of the product is almost entirely in the production state of the carpets life cycle, while the installation generally contributes to less than 10% of the impact, and the use state is very small. Interface has developed a product return recycling program, called the ReEntry carpet reclamation. In 2008 alone this carpet reclaimed over 5 million square meters of carpet.

The production stage of this product accounts for 94% of the total Renewable and Nonrenewable resources used in the Life Cycle. The non renewable resources involved in the production are measured in MJ/m2. In the production stage, crude oil accounts for 50.58 MJ/m2,, 30% of non renewable primary energy used. Hard coal accounts for 25.12 MJ/m2, lignite os .94 MJ/m2, and Uranium is 14.89 MJ/m2 of the energy used. The largest nonrenewable resource used in production is Natural Gas which accounts for 70.44 MJ/m2, making it about 41.7% of all the nonrenewable resource used in the production of Bentley Prince Street's Interface carpets.

Because Interface strives to be as carbon neutral as possible, they are working to incorporate more renewable sources of energy in all stages of the carpets life cycle. The production stage of the carpet accounts for 89.5% of the total renewable energy sources in the entire life cycle of the carpet. Currently, the production of Bentley Prince Street's carpet incorporates a totally energy intake of 2.8951 MJ/m2 from renewable resources such as;

Hydropower, wind/wave power, solar energy/biomass/renewable fuels, and geothermal energy. In the production stage hydropower in the made contributor, attributing to 44% of the renewable energy sources used, with a total of 1.2739 MJ/m2 contributed. Following hydropower is wind/wave power which accounts for 1.1495 MJ/m2. Solar energy/biomass/renewable fuels accounts for .4568 MJ/m2 in the production stage and geothermal energy contributes a small .0150 MJ/m2 to the production of a meter2 of the Bentley Prince Street's Interface carpets.

The materials extracted for the production, both renewable and nonrenewable, account for the carpet creation itself. The product is constructed of four main layers. The tufted face product is on top, followed by primary backing, precoat layer, then finally the secondary backing. The tufted face product is produced from two yarn components, Nylon 6,6 and post industrial recycled Nylon 6,6. The over mass of the final carpet is based 32% on the Nylon 6,6 which is a thermoplastic produced from the polymerization of two products source from petroleum which are hexamethylene diamine and adipic acid. Because both of these are sourced from petroleum Nylon 6,6 is a limited resource.

The installation of the carpet accounts for 1.5% of the total primary energy from renewable and non-renewable resources used in the Life Cycle of the carpet. Interface recommends that Healthbond 1000 is used as adhesive, as it is certified by CRI Green Label Plus (indoor air quality testing program) and is a water based acrylic glue adhesive. The carpet itself is also certified by this initiative. The product is also to be installed following the CRI's "Standard for Installation of Commercial Textile Floor Covering Materials."

Installation of the Bentley Prince Street carpet uses for 2.74 MJ/m2 of the primary energy of nonrenewable resources, which accounts for 1.5% of the total nonrenewable primary energy used in the life cycle. These nonrenewable energy sources are most heavily found in crude oil which is used 1.53 MJ/m2 of the energy used in installation. Natural gas also contributes heavily to installation, in .83 MJ/m2 of the energy used. Hard coal accounts for .23 MJ/m2 of the energy used and lignite only accounts for .01 MJ/m2. These numbers, however are not nearly as significant as the amount of energy extracted in the production stage of the carpet.

In the installation stage, renewable resources used for energy sources seem small, however are significant when taken into consideration the pure mass of carpets installed in this way. The total energy of renewable resources used in installation is .0057 MJ/m2. 61.4% of the renewable energy used in installation comes from hydropower (.0035 MJ/m2) while .0019 MJ/m2 comes from solar energy/biomass/renewable fuels. And a small .0003 MJ/m2 of energy is sourced from wind/wave power.

The use of the carpet accounts for 3.7% of the total primary energy from renewable and non-renewable resources used in the Life Cycle of the carpet. The use stage attributes 6.28 MJ/m2 of the nonrenewable energy used. This stage accounts for about 3.5% of all the nonrenewable sources of energy used in the life cycle of the carpet. The most heavily used source of nonrenewable energy in the use stage is hard coal at 2.82 MJ/m2 which accounts for 44.9% of the total nonrenewable energy used in the use stage. This is followed by 1.48 MJ/m2 of energy sourced from natural gas, and 1.35 MJ/m2 of uranium sourced energy. The least significant source comes from lignite which attributes .04 MJ/m2.

The use stage of this carpet accounts for 8.7% of the total renewable primary energy sources in the life cycle of the carpet, through sourcing .2806 MJ/m2 of energy. Hydropower is a heavy renewable contributor to the use stage with .1563 MJ/m2 being sourced. The is followed by .1189 MJ/m2 being sourced of wind/wave energy and .0041 MJ/m2 of solar energy/biomass/renewable fuels being primary sources. Geothermal accounts for .0013 MJ/m2 of the energy sourced in the use stage of the carpet.

The end of life of the carpet accounts for 0.8% of the total primary energy from renewable and non-renewable resources used in the Life Cycle of the carpet. Only 0.7% of the total non renewable primary energy source in the life cycle of the carpet come in the end of life stage. Of these 1.28 MJ/m2 of energy used in the stage, 44.5% are sourced from natural gas, attributing .57 MJ/m2 of energy. This is followed by the next largest contributor of energy from crude oil at .47 MJ/m2, Uranium at .1 MJ/m2 and hard coal at .09 MJ/m2. The lowest contribution of renewable energy in the end of life stage comes from lignite at only .05 MJ/m2.

The end of life stage also only accounts for 1.6% of the total renewable energy used in the life cycle of the carpet, at .0532 MJ/m2. The largest source of this renewable energy in the end of life stage comes from solar energy/biomass/renewable fuels, which contributes .0384 MJ/m2 of energy. This source is followed by .0103 MJ/m2 contributed by hydropower, .0042 MJ/m2 sourced from wind/wave power, and .0002 MJ/m2 sourced from geothermal energy sources. The environmental impact of the end of life stage of the carpet is greatly reduced because of efforts made in the Bentley Prince Street ReEntry carpet reclamation program.

The total life cycle of a Bentley Prince Street carpet consumes about .4614 m3 of water per m2 of carpet. The waste attributed to the carpet is about 6.37 kg/m2 of non-hazardous waste, .19 kg/m2 of hazardous waste, and .003 kg/m2 of radioactive waste. The production stage accounts for the greatest percent of all of these waste measurements, and water consumption. Other environmental impacts of the carpets life cycle can be described as acidification, eutrophication, global warming potential, ozone depletion, smog, and abiotic depletion. It is estimated that the production stage of the carpet accounts for 100% of all abiotic depletion, 91.98% of the eutrophication involved in the life cycle, 89.69% of the acidification, 80.62% of the global warming potential, 75.47% of the ozone depletion, and 66.26% of the contribution to smog. The installation stage accounts for 11.01% of the ozone depletion 2.32% of the contribution to smog, 1.66% of the acidification, 1.6% of the global warming potential, and only .51% of the eutrophication. The use stage accounts for 12.64% of the ozone depletion, 6.66% of the acidification, 4.55% of the global warming potential, 2.13% of the eutrophication, and only 1.76% of the contribution to smog. Finally, the end of life stage accounts for 29.66% of the contribution to smog, 13.23% of the global warming potential, 5.37% of the eutrophication, 2% of the acidification, and .87% of the ozone depletion. It has been found that most environmental impacts occur during the extraction of raw materials, and the virgin Nylon 6,6 is the largest contributer to 60% of the global warming impacts found in the production stage of the carpet. However, because of Interface's use of recycled yarn and post consumer recycled fillers, the company is moving forward to reduce the impacts of carpet production. There initiatives alone have lower the global warming potential and Bentley Prince Street will continue to work towards a full use of recycled products.

<u>Works Cited for Interface Carpets:</u>

The Green Standard. Environmental Product Declaration: In Accordance With ISO 14025. City of Industry, California: Five Winds International, n.d. Print.

The Carpet and Rug Institute. Standard for Installation Specification of Commercial Carpets. Dalton, Georgia: CRI Inc., 2004. Print.

After investigating and analyzing the carpet industry, it becomes painfully clear that the process of producing these carpets must become more sustainable. Too much of the materials rely on one quickly diminishing material, petroleum. Carpets, with an average life span of around

10 years (Fishman, 1998), should not be relying on such unsustainable a resource. Not just the fuzz of the carpet is petroleum based. The backing that holds the fuzz in place is also made of petroleum based synthetics, as are the adhesives that attach the carpet to the floor (Swanson, 2009). An item that relies on a resource that takes millions of years to produce should, theoretically, be valued and cherished with the utmost care. Unfortunately, this mindset has never been the case with oil, so we are now facing a case of figuring out what do when the resource runs out. Here is where Ray Anderson comes in.

His company, Interface Inc., owns 26 different factories on four different continents. For most of his life, he has turned out a million pounds of his petroleum-laden fabric every day. But, now, Anderson has a very ambitious goal. He wants his carpet making business to become completely sustainable. Not just sustainable in the sense that the carpet materials are renewable, he wants the energy for his factory to come from sunlight. He wants to harvest “yesteryear’s carpets, recycling old petrochemicals into new materials…” (Anderson, 2008) He wants to produce with no waste and no emissions. Many have wondered what caused this intense attitude shift in one of the leaders of the industrial world. Anderson points to a book he read four years ago, The Ecology of Commerce, by Paul Hawken. This book, he says, convinced him that industrial leaders are the leaders of environmental devastation and are the only ones with the power to stop it. Anderson was “dumbfounded by the impact of the industrial system on the environment (Anderson, 2008). So, Mr. Anderson decided to make some changes.

First, Anderson wants to start leasing carpets. This would entail remaking the borrowed carpets into new carpets when his customers are done with them. This would guarantee, though, that no carpet sits in a landfill forever, as the petroleum fails to break down. The hardest part of this project would be finding a way to break apart the threads, a long and strenuous process, to remake the carpet. But, when you compare it to the process, and effects, of harvesting crude oil, Anderson says, the effort would pay off (Fishman, 1998). In 2007, Anderson's vision came to fruition. He developed a process to separate the carpet fiber from the backing, allowing that fiber to be sent back to the supplier where, with the help of a little virgin material, it would be made into new carpet. The backing is also recycled into new backing; and, finally, the plastics that cannot be used are sold to suppliers for other industries, "putting a value on what was formerly viewed as a waste product," while ensuring that their product turns a profit (Interface, 2008). Finally, Anderson developed a releasable adhesive that is attached to each corner of the carpet tiles. While making it infinitely easier to recollect the carpet for reuse, this also cuts down on petroleum use from the glue, as well as the VOC's that the glue emits.

Second, Anderson wants to fix the problem that is the dying process. As mentioned earlier, the ingredients that make up carpet dyes are synthetically made. Every time the dye goes down the drain, resources are lost. Anderson has completely revolutionized the 5,000-year process. Rather than soak the spools of dye in giant pots of boiling water, discarding the dye after, Anderson figured out how to recycle the dye. He unspools the raw yarn, sending it through a series of boxes. One set of boxes sprays the dye onto the moving strand of yarn, one sets the dye by steam, and one dries. At the end of the process, the yarn is rewound and the excess dye is captured and reused (Fishman, 1998). This procedure has allowed the company to reduce its water use by 80% per unit since 1996 (Meezan, 2010).

Anderson has made it clear that when talking about sustainability community relations must be highlighted as well. Social interaction is key to a healthy society. Through community outreach, Interface employees have over 27,000 volunteer hours to their name over the last two years, while the company itself has given over one million dollars to charities (Interface, 2010).

Every year since 2001, Interface has tracked financial contributions, volunteer hours, employee training hours, and family social events. This program, called SocioMetrics, aims to measure Interface's impact on people. In order to be sustainable, investments must be made in educating others. Without the spread of knowledge, the actions of Ray Anderson would turn into just another flicker of a movement. That is why these social capital statistics are tracked. The company has also pledged to offset their carbon emissions from commuting by planting trees. Interface has planted over 7,000 trees in the U.S. and 500 in Canada (Dunn, 2008). By 2020, Anderson wants to have a zero carbon footprint. Interface has recently committed to produce Environmental Product Declarations, based on Life Cycle Assessments, on all of their products by 2012 (Anderson, 2010). This transparency will put more of a focus on what goes into producing a product, rather than just what is contained in it. As Anderson says, the business industry must

"lead, first by correcting its own flawed ways, and then by re-inventing its future. That future must become one of sharing and connecting in transparency and unrelenting commitment to do the right thing for Tomorrow's Child." (Anderson, 2010)

So, Anderson has, for the most part, succeeded in furthering the environmental practices of the carpeting industry. The cutthroat competition of the capitalist system, however, has often made it hard for environmental gains to pay off economically. Often, when companies "go green" there are too many costs that have to be dealt with. Anderson, though, claims that his company has actually profited off his turn toward sustainability. The savings, he says, are made through the reduction of waste, mainly from dyes. According to Anderson, "From our 1996 baseline, we have reduced waste by about 52%. That has generated, in real dollars, $372 million of cost avoidance." This savings has generated a two-thirds growth in sales, with a doubling of profits, since the start of the sustainable program (Anderson, 2008). Interface declares itself the world's largest manufacturer of modular carpet (Interface, 2010), yet their brand name continues to grow. The popular environmental website, treehugger.com, did a feature on the company, saying to "file this one in the 'how to do it right' category" when talking about "going green" as a business (Dunn, 2008). Publications such as Fast Company, Fortune, and BusinessWeek have also written about Interface's move towards sustainability, saying that the company is "doing well by doing good." (Anderson, 2010)

So, all things considered, Interface should be the carpet any environmentally minded consumer should buy. Specifically, their CoolCarpet would be the best choice. Interface, through offsets, balances all net carbon emissions from the life cycle of this carpet, deeming the product climate neutral. The "life cycle" includes, "raw material acquisition, manufacturing, transport, use and maintenance, [and] disposal or recycling." (Anderson, 2008) The actions of Ray Anderson have helped to change the aspirations of the business world. Anderson has shown that it is possible to emphasize social and environmental well-being, while maintaining economic clout. Still, Anderson makes it clear that there is not yet a sustainable company on Earth. His vision for the future, he says, is to have "zero scrap going into landfills and zero emissions into the biosphere. Literally, our company will grow by cleaning up the world, not by polluting or degrading it." (Anderson, 2008) With businessmen like him, the future of sustainable business practices seems to be in pretty good shape.

<u>Works Cited for Comparison:</u>

Anderson, Ray. "Interface Chairman Ray C. Anderson on Sustainable Design." Corporate Design Foundation. 2008. Retrieved 2010 from

http://www.cdf.org/issue_journal/interfaces_chairman_ray_c._anderson_on_sustainable _design-4.html.

Anderson, Ray. “Is Interface’s Sustainability Strategy Still Relevant.” Greener World Media. 2010. Retrieved 2010 from http://www.reuters.com/article/idUS63901833720101109.

Dunn, Collin. “Interface Carpet Keeps Cleaning Up Its Act.” Treehugger.com. 2008. Retrieved 2010 from http://www.treehugger.com/files/2008/04/interface-carpet-cleans-up.php.

Fishman, Charles. “Sustainable Growth – Interface, Inc.” Fast Company. 1998. Retrieved 2010 from http://www.fastcompany.com/magazine/14/sustaing.html?page=0%2C2.

Interface. “Sustainability.” 2010. Retrieved 2010 from http://www.interfaceglobal.com/Sustainability.aspx

Meezan, Erin. “Interface Reduces Water Use 80% per unit since 1996.” The Natural Step. 2010. Retrieved 2010 from http://www.naturalstep.org/it/usa/interface-reduces-water-use-80-unit-1996.