|  |
| --- |
|  |
| How Do Environmental Engineers Affect Environmental Sustainability? |
| Research Paper |
|  |
| **Prince Oliver** |
| **1/24/2012** |

Abstract

Environmental engineers create new and more efficient sources of energy, or improve upon the design of pre-existing models of the appliances and commodities. First, specific aspects of the environment needed to be dissected: air, water, fossil fuels, biodiversity, fertilizers, and affluence. Correlating with fossil fuels, environmental engineers worked with Ford Automotive to reduce carbon dioxide emissions to promote a mutual goal of a more sustainable world. The methods used to aid the in the investigation of the work of environmental engineers were the combination of normal Internet searches, resources provided by environmental science experts, and online database. The information provided from the online databases proved to be the most factual because they were written by experts in the field. Through the utilization of these sources, the broad definition of an environmental engineer was expanded. Through these things the world can better understand the work of environmental engineers and other environmental workers.

Introduction

Environmental engineers are the sanitation crew for the entire world. They create new, more efficient sources of energy, or they may improve upon the design of pre-existing models of our appliances and commodities. An efficient sustainability plan, to be implemented in the remodeling of these structures and appliances, includes the fit for purpose or function, attractiveness, and, of course, sustainability. Some of the factors that impact the projects that the Environmental Engineers take part in are the environment’s condition, and economic balance. Specifically in the environmental condition category, some of those aspects include: pollution, global warming, water sources, energy sources, and poverty. With pollution there is one variable that is a vital cause of the issue. That subject is affluence. Affluence is the amount of wealth a country possess. When was has grandiose amounts of money, one will want to spend it by buying products. To satiate this demand, big industries must produce more products. This leads to more pollution, and more resource use. It is the environmental engineers’ job to find ways to replenish resources, or to encourage a gradual decline in resource use.[[1]](#footnote-1)

Environmental Engineers

Environmental engineering is one of the “up and coming” fields of engineering. The necessity of environmental engineers is on the rise, due to the increased carbon dioxide emissions, deforestation, the depletion of aquifers, and other ecological hazards. The role the Environmental Engineers play is quite simple. They diagnose the issues going on in the environment and create new ways to make the human population more sufficient and more sustainable. So, specifically, how do Environmental Engineers affect environmental sustainability? One may believe this answer to have a simple question, but in reality their actions are not merely a “regurgitated college lesson,” but real people caring about their environment and doing something to preserve it. [[2]](#footnote-2)

Environmental utilize the fields of biology and chemistry to solve environmental issues. These issues include water and air pollution control, recycling, waste disposal, and public issues. They use their expertise to enhance their hazardous-waste management studies in which they evaluate the significance of the hazard, and provide a proposal for how the problems can be fixed. Environmental Engineers hold an estimated 54,000 jobs. This represents 3.6 percent of the jobs held by engineers in the U.S. Their employment areas usually include universities, government agencies, and testing facilities, and at multiple other corporations. [[3]](#footnote-3)

The slight increase in the quality of life in the past 50 years can be attributed to environmental engineers. Engineers have accomplished this by developing better water supplies, municipal sewer systems, and wastewater treatment procedures. With the linear growth in the auto industry, the increased study of air pollution has become prominent due to global necessity. The carbon dioxide fumes emitted from the tailpipes of automobiles contribute to global warming. The environmental engineers study the effects of the pollutants and come up with ideas to prevent or eradicate the problem. They either provide input for the newer, more fuel efficient automobiles, or they observe and provide constructive criticism for future designs. As the progression of the modern era continues, we are coming to the realization that the resources that were once bountiful in the past are now diminishing. Due to this scarcity, the price of these resources is increasing also. These resources are being stripped from the environment with little to no replenishment. As energy use continues to escalate, the engineers are obligated to find varying sources of resources and limit the damage done to the environment.[[4]](#footnote-4)

The discipline of civil and environmental engineering addresses issues such as protecting the natural environment globally, improving the quality of life for humankind, and ensuring the safety and security of human society from an engineering perspective. The major roles played by civil and environmental engineers include developing the necessary infrastructures for humans to live safe, culturally fulfilling lives, and realizing policies that make it possible for human beings to live alongside nature, all based on engineering ethics.[[5]](#footnote-5)

Fossil Fuels

As human industrialization and advances in the methods used to create new structures becomes increasingly common, resource depletion and destruction of our natural environment is seemingly placed on the back burner. The environment is, simply put, a disaster in disguise. The environment looks quite appealing in most places; blue skies, white clouds, clean water. However, the ecological footprint of the global population is larger than the globe itself. Human insatiable need for the newest luxury comes at a price. These costs are not of the monetary sort, but of the environmental cost. All aspects of our environment are at risk; our water, air, earth, and our livelihood.

Fossil fuels and nuclear technologies have been a major source to the environmental health since the 1970’s. The have thousands of thermal, natural gas, and oil powered plants scattered across the world. The carbon gas emissions and non-degradable nuclear waste produced by these plants have caused serious environmental problems,such as the greenhouse effect, leading to a virtual chain reaction of ozone depletion followed by global warming and climate change. These methods of energy production have been deemed unsustainable and greatly expensive. Environmental engineers lead the way into a more sustainable future by diagnosing the problems set forth, and begin their work and research to establish a base to resolve this issue. [[6]](#footnote-6) In Paul Epstein’s contribution to a more efficient source of energy article said,

"It's the whole life cycle that leads to a trail of injuries, illness and death. Fine particles from coal power plants [kill an estimated 13,200 people each year in the US alone](http://www.catf.us/resources/publications/files/The_Toll_from_Coal.pdf), according to the Boston-based Clean Air Task Force. Additional fatalities come from mining and transporting coal, and other forms of pollution associated with coal. In contrast, [the International Atomic Energy Agency and the UN estimate](http://www-pub.iaea.org/MTCD/publications/PDF/Pub1312_web.pdf) that the death toll from cancer following the 1986 meltdown at Chernobyl will reach around 9000.[[7]](#footnote-7)

An additional downfall to the environment is the automotive industry. The automotive industry is a key source of perniciousness of the environment. All of the automobiles set on the roadway emit carbon dioxide which, in turn, endangers our air quality and living conditions. However, this trend has become apparent. Many companies are creating newer, more fuel efficient automobiles to aid the environment, or more so their company.

“Ford Automotive has recently released their 12th annual sustainability report titled "Blueprint for Sustainability: Driving Change." Sue Cischke, Ford group vice president, Sustainability, Environment and Safety Engineering stated that," The blueprint for sustainability encompasses a wide range of efforts at Ford to provide sustainable transportation around the world."[[8]](#footnote-8)

­Air

The air in which we breathe is depreciating at an undetectable pace. As the cycle of the transformation of carbon dioxide into useable oxygen goes: all biotic species in the world emit carbon dioxide when they breathe and conduct digestive processes. This carbon dioxide is emitted into the atmosphere for the use of plants to convert back into oxygen, correlating with the increase in big businesses come the copious need for resources. This means that, for example, tons of trees will need to be hacked down to quench this necessity. The increase in lumber production leads to deforestation. With a reduced proportion foliage to absorb the carbon dioxide, the carbon levels will experience a logarithmic growth. Humankind is not helping itself. Walking hand-in-hand with deforestation is China’s excessive automobile in dependence. Observe this fact: the U.S. reigns as the world’s highest pollutant contributor. Now, it has also been predicted by 2030, if China continues this increase in its automobile dependence, it will surpass the U.S. in its pollutants. This means that the projected automobiles that China uses is expected to not level off, but increase. In the video documentary "World in the Balance: China Revs Up," there was an incident where the coastline of California where there was a sudden spike in the air toxicity. Some researchers were expeditious to discover the source of the pollutants. Through the research and experiments, it was concluded that China was the culprit. It was a shocking discovery to say the least. Their pollutants consisted of faint, but still rather detrimental, samples of sulfur, mercury, and carbon. The studies showed that the pollutants traveled over 3,000 miles over the Pacific Ocean to reach the United States coastline. Not only was this threatening to observe that much pollution, but researchers then began to predict what would happen if those conditions became global. Each element presented in those pollutants have their own effects on the human body. Excessive amounts of mercury in the body can cause many of the following health issues including: thyroid dysfunction, heart and cartilage degeneration, accelerated Alzheimer’s disease, and multiple other problems. Sulfur also has harmful effects including: fatigue, asthma, rashes, and stomach problems. The two have one synergistic effect which is when they are combined they may interfere with metabolism and may create other chemical interferences in the body. [[9]](#footnote-9)

Water

Human utilize this source of life unjustly by polluting it with trash, oil, fertilizers, and manure runoff. Trash in the water zone interferes with the aquatic life in multiple ways. One way is ingestion. These species are not suited to take in plastic, aluminum, glass, or shards of metal. When they ingest it, it interferes with their digestive process, ultimately, killing them. The second way trash affects the aquatic life is the external harm. Say for instance a large shard of metal or glass were to puncture the human skin. We would become debilitated for a period of time. Unlike humans, the water zones do not have doctors, band aids, or antibiotics. Their wounds will have to heal slowly over time, or they will perish. This is one of the primary sources of the decline of the aquatic diversity in our waterways.

Fertilizers

Fertilizer makes our lawns and landscapes look “pretty and nice,” but little is done to prevent it from becoming runoff and entering the waterways. When fertilizers are cultivated in a sitting body of water, a process called eutrophication occurs. Eutrophication is an irruptive boom in the growth of algae and other microscopic bacteria to grow. This is due to the added nitrogen and phosphorus compounds that enter the water. It may seem harmless at first, and not deserve a second glance, but this profound species growth is ultimately terrible for the water body. Algae have a short live span. Since all of the algae are born and the same time, they will most likely die at the same time. Just like all biotic species, the dead issues deteriorate, decompose, and leave a horrendous odor behind. The algae then get taken in by the gills of the local fish causing suffocation. This then, leads to dead zones. This is one of the primary sources of the decline of the aquatic diversity in our waterways.[[10]](#footnote-10)

Landfills

Landfills are acres of land that are cleared out to provide adequate room for trash. All of the trash that humans create cannot simply be burned because that would add even more carbon dioxide to the atmosphere, thus, rendering environmental efforts useless. So, the solution that has been executed was to let the earth decompose it naturally. This is a primitive way to dispose of pollutants. Pollution is discouraged, but in certain areas, it is permitted. Everything can just be dumped into landfills, ranging from potato chip bags to outdated hardware and batteries can be dumped at will. Batteries, when decomposed, release the acids inside that are used to generate an electric current begin to leak out. These acids then begin to seep down into the soil and soon enter the waterways with a clear result to wildlife. However, landfills do not necessarily need to be a seemingly desolate wasteland full of biohazards and corrosive garbage. They can be covered up and made into family-fun areas where children play and adults relax. Take one of Virginia Beach’s landmarks Mount Trashmore for example; it is a quaint area that these descriptions are commonly attributed. Many people do not know that Mount Trashmore is in fact a former landfill. Over the recent months, the garbage that has been covered up by green grass, and fun play areas, has begun to emit fumes. These at the moment are not too harmful to us, but it is a great example of prolonged pollution.[[11]](#footnote-11)

Affluence

A country’s affluence, or lack there of can greatly impact the environment.

“Statistics show that 14 to 20 percent of the U.S. population lives in poverty. Poverty is defined as the inability to provide for minimum survival needs, such as food, shelter and living expenses. It is a growing population within many societies, made up of adults and children alike. This article will explore the impact of this unfortunate situation.”[[12]](#footnote-12)

On the other hand, a country’s overwhelming health isn’t a major contributing factor to the health of the environment. The wealth fluctuations of multiple countries affect not only the quantity of resource use, but the type of resource. Steven Hayward, an environmentalist, wrote in an article,

“Most people don’t know that at the turn of the 20th century, the U.S. got about one-third of its total energy from burning wood—over 5 billion cubic feet a year. The switch to fossil fuels—coal, oil, and natural gas—that took place rapidly at the turn of the last century saved lots of forestland (as it had in England even earlier). But the trend illustrates an important factor in environmental transitions—the “wealth effect”. During the Great Depression the amount of wood used for energy dramatically increased while the percentage of households with telephones reversed trend and declined for the same reason. As people found themselves with less discretionary income, they sought cheaper means of energy production. Today’s “Great Recession” is seeing something similar: investment in wind, solar, and other forms of energy has declined, along with energy consumption in general.”[[13]](#footnote-13)

In summary, when a country is rich, it buys what it wants when it want. When that country’s wealth declines, it becomes more aware and alternates to another resource which is cheaper. The U.S. has taken this step by adding new ingredients like corn and such to cause a cleaner combustion process. The process then repeats in different intensities for the rest of the country’s life.

Solution Efforts

Due to the shift from the use of fossil fuels, the education of future engineers is doubted to contain lessons for the use of fossil fuel based products. Their education will consist of using cleaner, more variant resources like air and water. With this information, the change in the health of the environment will become noticeable, and will further progress the thought of a more sustainable lifestyle.[[14]](#footnote-14)

The discipline of civil and environmental engineering addresses issues such as protecting the natural environment globally, improving the quality of life for humankind, and ensuring the safety and security of human society from an engineering perspective. The major roles played by civil and environmental engineers include developing the necessary infrastructures for humans to live safe, culturally fulfilling lives, and realizing policies that make it possible for human beings to live alongside nature, all based on engineering ethics. [[15]](#footnote-15)

Thousands of thermal, natural gas and oil powered plants are scattered across the world. The carbon gas emissions and non-degradable nuclear waste produced by these plants have caused serious environmental problems such as the greenhouse effect leading to a virtual chain reaction of ozone depletion followed by global warming and climate change. These methods of energy production have been deemed unsustainable and greatly expensive. environmental engineers lead the way into a more sustainable future by diagnosing the problems set forth, and begin their work and research to establish a base to resolve this issue.

Usually, the topic of environmental sustainability is touched on generically throughout everyday life. For example, when many people are confronted with the aspect of environmental sustainability one may simply think of “tree huggers” or “Save the dolphins,” but few actually know what is actually being implemented.

“QED Connect, Inc. announced that its joint venture partner, Sofame Technologies Inc., has been awarded a contract from Butterball, a producer of turkey products in the U.S. Steve Valesko, VP of Engineering was also quoted saying, "Butterball is dedicated to being a good steward of the environment, and is pursuing many innovative environmental initiatives surrounding resource conservation, pollution prevention, and upgrades to environmental sustainability.” This statement is supported by the statistic, “The equipment, which operates at 96 percent efficiency, combines condensing recovery of waste heat from existing boilers with a new direct contact condensing burner to heat water.”

This example of the environmental engineering efforts shows that there are multiple complex processes and experiments taking place currently to eradicate environmental insufficiency.

"It's time for a new approach,'' said R. Rhodes Trussell, an Environmental Engineer and founder of Trussell Technologies Inc., in Pasadena, Calif. “The number of emerging contaminants is outstripping the country's resources for assessing the risks emerging constituents of concern aren't new. They've been an issue since the beginning of the environmental era 45 years ago, However, science keeps identifying new compounds that could pose risks, most of which are unregulated.”[[16]](#footnote-16)

Intertek, a leading global provider of quality and safety solutions participated in International Conference and Exhibition on Green Buildings along with its partner International Association of Plumbing and Mechanical Officials (IAPMO). These companies came together to propose ideas for the construction of many ecologically friendly buildings in India.

“Speaking at this event, Rajesh Saigal, Managing Director, Intertek India said, "Indian infrastructure is on verge of a revolution contributing to India's growth and progress, hence, there is a vital need to provide the impetus and the organizational infrastructure to raise quality levels across the industry. We at Intertek offer total solution for green buildings which help them to consume less water, optimize energy efficiently, conserve natural resources, generate less waste and provide cost effective healthier spaces for occupants, as compared to a conventional building."[[17]](#footnote-17)

The green buildings mentioned, if produced in a mass quantity, could be an enormous boost to the environmental sustainability movement.

So, what makes a building green? First off, the home must be energy efficient. Lighting in the home is crucial. Simply turning the lights off when not in use can cut down on not only energy bills, but light pollution. Secondly, the source of the buildings power can make it green. Many of the buildings in developed countries are powered by huge electric power plants. This is one source of pollution that seems to go unnoticed throughout the population. The “Danger or Warning” signs that are placed on the outskirt fencing of the plants are only placed there simply to warn individuals to stand clear of the high voltage of electricity that is being produced there. However, the generation of this electricity that powers our everyday items like our televisions and ovens, is causing the emission of even more harmful greenhouse gases. These gases include carbon dioxide, sulfur dioxide, nitrogen dioxide, and mercury. These are basically the same gases that are the air pollution scare disclosed previously. Those signs should not only state “High Voltage,” but they should also say “Poisonous- Noxious Fumes” The paint in/on the buildings can make a difference. Paint is shockingly a tough substance to substitute. One of the substitutes was a plaster coating. This was presentable as a viable substitute because it lacks the aerosol-like toxins that paint possesses. One other alternate could simply wallpaper, but that is simply the designer’s choice. Last could be the plumbing. Plumbing tends to be another overlooked source of resource depletion. It has been recorded that the number one source of water wastes in American homes are the toilets. “The Environmental Protection Agency estimates that more than 1.25 trillion gallons of water — equivalent to the annual water use of Los Angeles, Chicago and Miami combined — leak from U.S. homes each year. For a more observant approach on diagnosing this water waste issue, simply watch the flushing process. First the toilet fills with water. Then it begins the downward cyclonic motion towards the basin. Throughout this entire process, water is consistently being gushed from the top.[[18]](#footnote-18)

Conclusion

In 1998, Anthony D. Cortese made a prediction about the future environment’s condition in his speech the he delivered at the Annual Thomas R. Camp Lecture of the Boston Society of Civil Engineers.

“We must change the relationship between the developed and the developing countries. Industrial countries must reduce their consumption of the world's resources in the face of the desperate need of developing countries to improve health and to reduce poverty, social instability and population growth. A child born in the US today will consume as much of the earth's resources and produce as much waste as more than 100 Bangladeshi children. We also need new approaches for transferring technology, for training and education, and for providing financial assistance to developing countries. These approaches must address population stabilization, improving the educational and social status of women, the international debt problem, and the need for sustainable economic strategies.”[[19]](#footnote-19)

His 14 year old prediction is exactly accurate even to this day. It is apparent that the world population was growing, and the economy is looking horrendous. However, it is hard to comprehend how such an accurate hypothesis could be made.

Through countless hours of research, many people had in mind that our environments health was lacking, and it was the environmental engineers’ job to forge ways to revitalize it, but I did find one starling, rather straight forward depiction of what would happen if the environment continued to take a beating. It was titled “The Evolution of a Manufactured Product.” The first step included the product idea. This is simply making a plan or a layout for the product in which one wishes to sell. The second step was the design. Not only was this section about how the product would look, but what materials would be needed, where they could get them, etc. The next portion consisted of the raw materials, manufacturing, and distribution and use. All of these are self-explanatory. The last part of that section was the unsettling part; end of life. Now, of course there are more than those stated aspects of product manufacturing, lurking variables and such, however, the true reality is that we are in fact killing ourselves by mass producing all of our gadgets and commodities.[[20]](#footnote-20)

Attempting to fix problems may call for some sacrifice. Say for instance, a specific area in the world is in need of another electrical power source. The engineers have a healthy, flowing river to work with. Why not construct a dam on the river to utilize one of Earth’s renewable resources? What sacrifice is necessary for this? Well, the sacrifice is indeed altering the water flow. The water becomes impervious causing flooding on one side of the dam, and drought on the other. On the flooded end, the whole eutrophication process occurs. Along with that, the water then begins to mold new paths in the land, thus, altering the natural landscape. Altering the water flow isn’t the main problem; it is the amount of time that is needed to complete the task. One solution for this is too either, complete the project at a faster rate, or develop some way that the water can flow periodically to reduce water levels. Environmental Engineers aren’t normally the major factor of such projects relating to that, but of course they had some part. Environmental engineers should initiate most of the projects being implemented around the world. They should set guidelines that ensure the environment’s safety by setting a fixed amount of destruction that can be caused. If they begin the projects, then the amount of pollution, or destruction would not get out of hand from the beginning and

Work Cited

Biello, David. "Fertilizer Runoff Overwhelms Streams and Rivers--Creating Vast "Dead Zones": Scientific American." *Science News, Articles and Information | Scientific American*. Web. 18 Dec. 2011. <http://www.scientificamerican.com/article.cfm?id=fertilizer-runoff-overwhelms-streams>.

Cortese, Anthony D. "Second Nature | The Role of Engineers in Creating an Environmentally Sustainable Future." *Second Nature | Home*. Web. 18 Dec. 2011. <http://www.secondnature.org/history/writings/speeches/role\_engineers.htm>.

"Department of Civil and Environmental Engineering Major in Civil and Environmental Engineering." *早稲田大学理工学術院*. Web. 18 Dec. 2011. <http://www.sci.waseda.ac.jp/english/global/faculty/creative/index05.html#Cutting>.

Desha, Cheryl K. "THE IMPORTANCE OF SUSTAINABILITY IN ENGINEERING EDUCATION." *THE IMPORTANCE OF SUSTAINABILITY IN ENGINEERING EDUCATION:*. Web. 23 Nov. 2011. <http://www.naturaledgeproject.net/Documents/ICDPaper-Final.pdf>.

"Environmental Engineering: Facts, Discussion Forum, and Encyclopedia Article." *AbsoluteAstronomy.com*. Web. 18 Dec. 2011. <http://www.absoluteastronomy.com/topics/Environmental\_engineering>.

"Environmental Engineering Overview." *Sloan Career Corner Stone Center*. Web. 11 Dec. 2011. <http://www.careercornerstone.org/pdf/env/enveng.pdf>.

"Engineering in Environmental and Technological Concepts." *Engineering in Environmental and Technological Concepts* (2010): 1-13. *Engineering in Environmental and Technological Concepts*. Web. 17 Dec. 2011. <http://www.cpe.mrt.ac.lk/leve1/mot-lecture.pdf>.

"Fossil Fuels Are Far Deadlier than Nuclear Power - Tech - 23 March 2011 - New Scientist." *Science News and Science Jobs from New Scientist - New Scientist*. Web. 18 Dec. 2011. <http://www.newscientist.com/article/mg20928053.600-fossil-fuels-are-far-deadlier-than-nuclear-power.html>.

Geiselman, Bruce. "What's in the water? It's cause for concern; Contaminants in drinking water supply worry engineer; EPA works on screening methods." *Waste News* 6 Nov. 2006: 26. *General OneFile*. Web. 18 Dec. 2011.

Hayward, Steven F. "The Wealth Effect - Environmental Trends." *Home - Environmental Trends*. Web. 17 Dec. 2011. <http://www.environmentaltrends.org/single/article/the-wealth-effect.html>.

"Intertek participates in International Conference and Exhibition on Green Buildings." *Adgully* 29 Oct. 2011. *General OneFile*. Web. 18 Dec. 2011.

Jeanty, Jacquelyn. "The Effects of Poverty | EHow.com." *EHow | How to Videos, Articles & More - Discover the Expert in You. | EHow.com*. E.how.com. Web. 15 Dec. 2011. <http://www.ehow.com/about\_4613929\_effects-poverty.html>.

"Mt. Trashmore." *The Non-Elite Runner's Blog*. Web. 10 Dec. 2011. <http://www.thenoneliterunner.com/2010/06/mt-trashmore.html>.

"Nuclear As A Suitable Alternative To Fossil Fuels?" *Global Issues*. Web. 18 Dec. 2011. <http://globalissues.co.in/category/nuclear-as-a-suitable-alternative-to-fossil-fuels/>.

Shulman, Jennifer. "The Role of Engineers In Our Energy Future." *Http://www.engineergirl.org/Object.File/Master/9/624/Shulman\_Jennifer.pdf*. Web. 11 Nov. 11. <http://www.engineergirl.org/Object.File/Master/9/624/Shulman\_Jennifer.pdf>.

Swanson, Bob. "Leaks, Wasteful Toilets Cause Cascading Water Loss - USATODAY.com." *News, Travel, Weather, Entertainment, Sports, Technology, U.S. & World - USATODAY.com*. Web. 16 Dec. 2011. <http://www.usatoday.com/news/nation/environment/2009-04-05-water-toilets\_N.htm>.

"US: Greening the blue oval: Ford releases its 12th annual sustainability report." *just-auto.com* 15 June 2011. *General OneFile*. Web. 18 Dec. 2011.

"What Mercury Does To You - MercuryTalk." *Mercury Talk - Home Page*. Wikipedia. Web. 18 Dec. 2011. <http://mercurytalk.com/wiki/index.php/What\_Mercury\_Does\_To\_You>.

1. "Environmental Engineering: Facts, Discussion Forum, and Encyclopedia Article." *AbsoluteAstronomy.com*. Web. 18 Dec. 2011. <http://www.absoluteastronomy.com/topics/Environmental\_engineering>. [↑](#footnote-ref-1)
2. Shulman, Jennifer. "The Role of Engineers In Our Energy Future." *Http://www.engineergirl.org/Object.File/Master/9/624/Shulman\_Jennifer.pdf*. Web. 11 Nov. 11. <http://www.engineergirl.org/Object.File/Master/9/624/Shulman\_Jennifer.pdf>. [↑](#footnote-ref-2)
3. "Environmental Engineering Overview." *Sloan Career Corner Stone Center*. Web. 11 Dec. 2011. <http://www.careercornerstone.org/pdf/env/enveng.pdf>. [↑](#footnote-ref-3)
4. Cortese, Anthony D. "Second Nature | The Role of Engineers in Creating an Environmentally Sustainable Future." *Second Nature | Home*. Web. 18 Dec. 2011. <http://www.secondnature.org/history/writings/speeches/role\_engineers.htm>. [↑](#footnote-ref-4)
5. "Department of Civil and Environmental Engineering Major in Civil and Environmental Engineering." *早稲田大学理工学術院*. Web. 18 Dec. 2011. <http://www.sci.waseda.ac.jp/english/global/faculty/creative/index05.html#Cutting>. [↑](#footnote-ref-5)
6. "Nuclear As A Suitable Alternative To Fossil Fuels?" *Global Issues*. Web. 18 Dec. 2011. <http://globalissues.co.in/category/nuclear-as-a-suitable-alternative-to-fossil-fuels/>. [↑](#footnote-ref-6)
7. "Fossil Fuels Are Far Deadlier than Nuclear Power - Tech - 23 March 2011 - New Scientist." *Science News and Science Jobs from New Scientist - New Scientist*. Web. 18 Dec. 2011. <http://www.newscientist.com/article/mg20928053.600-fossil-fuels-are-far-deadlier-than-nuclear-power.html>. [↑](#footnote-ref-7)
8. "US: Greening the blue oval: Ford releases its 12th annual sustainability report." *just-auto.com* 15 June 2011. *General OneFile*. Web. 4 Jan. 2012. [↑](#footnote-ref-8)
9. "What Mercury Does To You - MercuryTalk." *Mercury Talk - Home Page*. Wikipedia. Web. 18 Dec. 2011. <http://mercurytalk.com/wiki/index.php/What\_Mercury\_Does\_To\_You>. [↑](#footnote-ref-9)
10. Biello, David. "Fertilizer Runoff Overwhelms Streams and Rivers--Creating Vast "Dead Zones": Scientific American." *Science News, Articles and Information | Scientific American*. Web. 18 Dec. 2011. <http://www.scientificamerican.com/article.cfm?id=fertilizer-runoff-overwhelms-streams>. [↑](#footnote-ref-10)
11. "Mt. Trashmore." *The Non-Elite Runner's Blog*. Web. 10 Dec. 2011. <http://www.thenoneliterunner.com/2010/06/mt-trashmore.html>. [↑](#footnote-ref-11)
12. Jeanty, Jacquelyn. "The Effects of Poverty | EHow.com." *EHow | How to Videos, Articles & More - Discover the Expert in You. | EHow.com*. E.how.com. Web. 15 Dec. 2011. <http://www.ehow.com/about\_4613929\_effects-poverty.html>. [↑](#footnote-ref-12)
13. Hayward, Steven F. "The Wealth Effect - Environmental Trends." *Home - Environmental Trends*. Web. 17 Dec. 2011. <http://www.environmentaltrends.org/single/article/the-wealth-effect.html>. [↑](#footnote-ref-13)
14. Desha, Cheryl K. "The importance of sustainability in engineering education." *The Importance of Sustainability in Engineering Education:*. Web. 23 Nov. 2011. <http://www.naturaledgeproject.net/Documents/ICDPaper-Final.pdf>. [↑](#footnote-ref-14)
15. "Department of Civil and Environmental Engineering Major in Civil and Environmental Engineering." *早稲田大学理工学術院*. Web. 18 Dec. 2011. <http://www.sci.waseda.ac.jp/english/global/faculty/creative/index05.html#Cutting>. [↑](#footnote-ref-15)
16. Geiselman, Bruce. "What's in the water? It's cause for concern; Contaminants in drinking water supply worry engineer; EPA works on screening methods." *Waste News* 6 Nov. 2006: 26. *General OneFile*. Web. 4 Jan. 2012. [↑](#footnote-ref-16)
17. "Intertek participates in International Conference and Exhibition on Green Buildings." *Adgully* 29 Oct. 2011. *General OneFile*. Web. 4 Jan. 2012. [↑](#footnote-ref-17)
18. Swanson, Bob. "Leaks, Wasteful Toilets Cause Cascading Water Loss - USATODAY.com." *News, Travel, Weather, Entertainment, Sports, Technology, U.S. & World - USATODAY.com*. Web. 16 Dec. 2011. <http://www.usatoday.com/news/nation/environment/2009-04-05-water-toilets\_N.htm>. [↑](#footnote-ref-18)
19. Cortese, Anthony D. "Second Nature | The Role of Engineers in Creating an Environmentally Sustainable Future." *Second Nature | Home*. Web. 18 Dec. 2011. <http://www.secondnature.org/history/writings/speeches/role\_engineers.htm>. [↑](#footnote-ref-19)
20. "Engineering in Environmental and Technological Concepts." *Engineering in Environmental and Technological Concepts* (2010): 1-13. *Engineering in Environmental and Technological Concepts*. Web. 17 Dec. 2011. <http://www.cpe.mrt.ac.lk/leve1/mot-lecture.pdf>. [↑](#footnote-ref-20)