The Ethics of True Environmental Sustainability in Engineering

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Introduction

In the last 20 years, climate change has become a major public concern. This has caused rising support for environmentally sustainable technologies. These technologies can range from power infrastructure, to food, and general consumer products. In general, something is environmentally sustainable if it aims to eliminate harmful effects on our planet and the environment. Oftentimes this sustainability comes from changing the way something is produced to limit carbon emissions or protect natural ecosystems. A notebook made of recycled paper instead of paper made directly from trees is a notable example of this. In other cases, it involves completely innovating the way technology functions such as swapping gas-powered cars for electric vehicles or coal power for solar.

In this paper, I explore and analyze three different areas of the ethics of sustainable technology. Firstly, and perhaps most importantly, I define what it means for something to be truly sustainable. While this may seem like a simple task, in practice it turns out to be much more nuanced. Next, I take a close look at the specific issue of electronics waste recycling. This is a notable example of how apparently sustainable practices may cause the planet more harm than good. Lastly, I analyze greenwashing, which is when companies advertise unsubstantiated claims about their environmental contributions to make a profit. As with most global scale issues, the role that large corporations play is far more impactful than any singular individual.

Methodologies

In this paper, I look at the specified topics through the ethical frameworks of utilitarianism and stakeholder theory. Utilitarianism is, in my opinion, a great way to evaluate issues that affect the entire globe. Its ability to see what outcome has the greatest net positive is

particularly useful in large scale issues like climate change. But it is not without its shortcomings. Utilitarian frameworks are notorious for being able to disadvantage small groups. Utilitarians only care about bringing the best outcomes to most people, even if that means neglecting the minority. Despite this, utilitarianism suggests that preserving the planet is in the best interest of everyone. Nobody truly benefits from destroying the environment, not even fossil fuel companies. Everyone needs a place to live. I also utilize stakeholder theory to further analyze the ethical implications of large corporations greenwashing.

What does it mean to be truly sustainable?

According to the US Environmental Protection Agency, sustainability is defined as "the pursuit to create and maintain the conditions under which humans and nature can exist in productive harmony to support present and future generations" (EPA). To preserve nature, humans must have minimal impact on the environment. Most things labeled as sustainable merely reduce the impact on the planet, not eliminate it. True sustainability means no greenhouse gas emissions, no pollution, and no destruction of natural habitat (Searcy). Otherwise, nature will not be preserved for future generations. This may seem extreme but if we want the earth to be habitable for more than a few hundred years it is completely necessary. We all have a moral and ethical responsibility to become more sustainable. At some point, if we want to continue living on earth, we must completely stop negatively affecting the environment. In the society we currently live in, this is nearly impossible and entirely impractical. Unless you are living off the grid and able to produce everything you need to survive, you will always have some negative effect on the environment whether it is emissions from shipping materials or non-reusable waste produced by throwing something away.

There are parts of our modern society that require individuals to act unsustainably despite their best efforts. In most places, people only have access to a single electric company. This means that even if they wanted to only power their house with "sustainable" energy (solar, wind, hydro, etc.) they cannot. The electric company in their area can effectively use whatever blend of power generation methods they wish and people within their coverage are forced to use these sources. To get around this, someone could create a microgrid for their own house and generate all their own electricity with renewables like wind and solar. Although, doing so is wildly expensive and impossible for most people. In this scenario, capitalism seems to fail. The consumer has no practical alternatives and therefore the power company has no incentive to switch to more environmentally friendly sources of power. There is no competition. A comparable situation occurs when we look at people living below the poverty line. Explicitly sustainable products are often more expensive than non-sustainable ones because the raw materials cost more. Most Everyone knows that organic food at the grocery store costs more than the non-organic variety. The reason is because considerable produce is lost without pesticides, requiring organic produce to be sold at a higher price to make up for the loss. Complicating this is the fact that those living in poverty often are not able to afford to buy environmentally friendly products. The financial barrier to being sustainable turns saving the planet into a luxury. The average person participating in society is often unable to live sustainably within reason.

To make matters worse, even "sustainable" technologies are oftentimes not truly sustainable. Take wind power turbines as an example. Wind power offers a fantastic greenhouse emission free source of energy, but the large fiberglass blades cannot easily be recycled. Because the blades need to be replaced every 20 years, giant swaths of land must be used as landfills to dispose of the old blades (Searcy). This leads to pollution and destruction of natural habitat to

make these landfills. If we continue to use more wind power, eventually we will run out of space to discard the blades. Despite wind power being associated with being eco-friendly, they are not actually truly sustainable in the long term. For them to be truly sustainable, the discarded blades would have to be completely recyclable or biodegradable and their manufacture would have to be 100% emission free. Another example of this is environmental veganism, which has become a popular trend in recent years. Livestock contribute to a significant amount of global greenhouse emissions. Going completely plant based effectively eliminates an individual's carbon footprint from animal produced greenhouse gasses. Ironically, the CO_2 emissions from shipping produce such as avocados or bananas overseas almost negate any carbon positive benefit of eating a vegan diet. In short, many "sustainable" practices are still damaging our planet in some capacity. To truly eat sustainably, someone would have to exclusively eat food grown locally. These eco-friendly practices certainly mitigate damage, but they certainly do not stop it. Being completely sustainable is a daunting task and humanity has a long way to go before we reach that point.

This research suggests that the future is not particularly promising for a cleaner environment, but there is still hope. Shifting public and corporate attitudes and actions to become a truly sustainable society cannot happen overnight. It would involve fundamentally changing the way we produce our products and our lifestyle. These social and industrial shifts will take several decades to fully take effect. Expecting anything to be truly sustainable in the near term is unrealistic and we must instead focus on gradually changing the way in which we live and work. Even if we are damaging the planet, the harm we do should progressively be lessening. By continuing to choose the lesser of two evils in terms of environmentalism, we can slowly progress towards a point where a truly sustainable planet is within reach.

E-Waste

In modern day society, technology improves at an alarming rate, and it only seems to be getting faster. With this increase in technological development comes the need to replace outdated systems, namely electronics. Vast amounts of resources go into creating electronics and much of it ends up going to waste within a few years. (EPA) This raises many questions about the sustainability of the manufacture of electronics and what should happen to this electronic waste (also known as E-waste).

Printed circuit boards (PCBs) are an inexpensive and space efficient way to implement a circuit into a device that are present in virtually all electronics. But, the manufacture of PCBs is extremely chemically intensive. (Gordon) These chemicals are used to etch the boards with strong acids along with lead-based solder to electrically connect components to the silicon boards. These materials are very damaging and pose major environmental risk if they end up local water supplies via spills or mishandling. Another major concern related to the manufacture of PCBs is the sourcing of materials. Many sources of clean energy require rare earth metals such as cobalt and dysprosium to function properly. (EPA) The mines for these metals are often in places where the environmental regulations are lax, resulting in destructive mining techniques and chemical spills.

Every year the world produces more E waste than the last. (EPA) Currently, most E waste is sent to landfills to be buried with other trash. Electronics commonly have lead, bismuth, and other dangerous heavy metals in them that pose risks to environmental damage if they are not properly contained. Also, landfills are not effective long-term solutions as there is only so much space on earth in which we can bury our garbage. One common alternative to dumping in

landfills is to recycle the E waste. By doing so, precious metals such as gold, platinum, and cobalt are not wasted. (Gordon) But recycling does not come without its own issues. Recycling is expensive and oftentimes not profitable to do so without government regulation. Also, recycling facilities are often in places with little to no labor laws, resulting in many E waste recycling centers taking advantage of child labor and dangerous working conditions. (EPA) Despite recycling's eco-friendly associations, E-waste recycling involves incinerating the boards leaving behind the precious metals. Burning boards not only emits a great significant amount of carbon dioxide, but it also releases toxic chemicals into the air. Also, the matter left behind after incineration is sent to landfills to be buried. This contaminates the soil and chemicals can leach out of the ash and end up in the groundwater, affecting crucial drinking water supplies.

Electrical engineers must be conscious of the way their designs may affect the environment. According to deontology, their duty is to create the best product for a given problem and sustainability is a key aspect of this. Every printed circuit board produced requires harmful chemicals to be used in production and are extremely difficult to dispose of. Even when they are recycled, there is a lot of toxic waste produced as a byproduct. One solution to this is biodegradable circuit boards (Guna). While they lack some of the performance of traditional silicon boards, biodegradable boards are a great alternative. When discarded, the boards can decompose back into the soil in a few years, effectively eliminating the need for E-waste landfills. They are also nontoxic, so the soil that is produced from the decomposition is still fertile enough to harbor plant life and any runoff will not harm aquatic life. The metal used in the boards is also easily salvageable without the need for toxic chemical processes. However, their thermal, structural, and dielectric properties are worse than traditional circuit boards (Guna). But, in applications where the boards will not be facing elevated temperatures or extreme vibrations,

biodegradable boards are an extremely desirable alternative (Guna). These circuit boards are already being implemented and will hopefully become the standard in the coming years.

Clean energy sources often require rare earth metals such as neodymium, dysprosium, and praseodymium to function. These metals are mostly only found in China, where emissions standards are extremely lacking. Because of this, to produce sources of green energy such as wind turbines or solar panels, environmentally destructive mining methods are used alongside emission billowing machinery. To make matters worse, we would have to dramatically increase the amount of these rare earth metal mines in order to create enough green energy sources to replace fossil fuels. This obviously makes these "clean" energy sources unsustainable. To make renewable energy sustainable, we need to source rare earth metals in an emission free process as well as solving the issue of the blades being unrecyclable. (Rodriguez)

Green washing

As climate change and the destruction of natural ecosystems around the world continues to increase every year, more people are becoming passionate about creating a sustainable future for our planet. I would even go as far to say that most people have adopted some form of environmentalism into their lives in during the past 10 years. Whether it is being more conscious about energy usage, purchasing a fuel-efficient car, or even just recycling. All of this has caused there to be increased demand for environmentally friendly technologies. This demand for eco-friendly tech has not gone unnoticed by corporations. Companies have capitalized on the opportunity to make profits by selling "sustainable" products. But, these claims of sustainability are oftentimes unsubstantiated.

When companies exaggerate their own environmental impact to make more money it is called greenwashing (Client Earth). Companies know people are willing to pay more money to reduce their negative impact on the environment and will charge more for their goods and services. By doing this, companies exploit consumers with false claims about their dedication to the planet to make a bigger profit. Greenwashing is harmful not just to consumers, but also to the environment. It disincentivizes companies from investing in a sustainable future because lying about environmental contributions is considerably less expensive than investing in a cleaner planet or changing their business practices.

Greenwashing was a major issue in the 80's and 90's. Specifically, fossil fuel companies like Chevron would run advertisements about their commitment to saving the environment even though they were effectively doing nothing about it. These ads would show scenes of natural beauty and endangered animals with narration talking about Chevron's "commitment" to saving the planet (Client Earth). This approach misled consumers into believing that big oil companies were doing work to offset their environmental damage to increase their profits. Objectively, this is ethically wrong on multiple fronts. I will use stakeholder theory and utilitarianism to analyze this. For one, these companies were knowingly polluting in extreme excess, which is harmful to people living on earth (everyone). They also were lying to their stakeholders while exploiting consumers to make a bigger profit. Under both utilitarian and stakeholder theory ethical lenses, greenwashing is wrong. More recently, companies have not been lying about their contributions but are instead "distracting" stakeholders from their wrong doings.

Dominion power for example, the electric company that services Charlottesville and Richmond Virginia has undertaken numerous questionable actions negatively affecting the environment. Dominion provides substantial sums of money back to their communities by

sponsoring youth athletics, festivals, education, and healthcare for people in their service areas (Dominion). While these are morally good actions for a company to take, it can be argued that they are only doing this so that the local population and their customers will continue to tolerate their actions. Richmonders notoriously dislike Dominion power, and for good reason. Despite mass support for cleaner energy sources, Dominion continues to be primarily powered by coal and natural gas (Sierra Club National). They also make the breakdown of their power sources incredibly difficult to find. Their website provides numerous misleading graphics about their "commitment" to going green despite most of their facilities being fossil fuel based. They also continue to build new facilities that are powered by coal and natural gas. Recently, Dominion had to pay out a million dollar fine for knowingly dumping millions of gallons of toxic chemicals into Quantico creek, which is not even close to the first time they have knowingly polluted a watershed (Sierra Club National). They have also faced lawsuits for predatory price hiking and knowingly building unnecessary infrastructure to justify charging consumers more for their power usage. The list goes on and on for environmentally and morally questionable wrongdoings for Dominion. The reality is that Dominion can do whatever they want because they effectively have a monopoly on providing electricity to their service areas. Companies like Dominion choose to invest in community programs rather than their own power infrastructure not because they believe in doing good, but because it is the least expensive way to ease adverse public opinion of them.

There is a growing consensus that American corporations in general, cannot be trusted to do anything other than doing whatever they can to make a profit. Dominion is just one example of a company that has exhibited unethical practices to make more money. The free market is clearly not sufficient to regulate companies when it comes to the environment and, therefore,

they must rely on government regulation. Companies are so driven to increase profits for their shareholders that they will knowingly destroy our planet to do so.

To counter this, companies are often evaluated using the "triple bottom line" metric or TBL to evaluate their positive impact on the globe (Searcy). Historically, businesses were only evaluated on the financial bottom line, which effectively measures how much profit the business can produce. This obviously does not correlate to positive social or environmental impact because it is often in a company's best economic interest to be unethical (child labor, mass greenhouse emissions, false advertising). The TBL not only considers the profits of a company, but also people and the planet. This is often referred to as the three P's. Of course, there are no quantifiable ways to measure societal and environmental impact. This is measured qualitatively through stakeholder sentiments. This allows for consumers to see which businesses are upholding their commitment to the environment and decide on what to support monetarily. The TBL negates the deception of greenwashing by allowing consumers to verify what corporations are doing to become more sustainable.

Greenwashing goes further than just deluding consumers' opinion about a company's actions. It is also being used to delude the public into misunderstanding their own role in conserving the planet. Big oil companies like BP and Chevron pay for advertisements that encourage people to see their own carbon footprint. Meanwhile, these same companies are responsible for a massive amount of total global emissions, and they are fully aware of it. By running these ads, companies can shift the responsibility to be sustainable from themselves onto the public (Kaufman). What is even worse, is that the environmental impact of individuals is far smaller than that of corporations. Just one hundred American corporations are responsible for 71% of global emissions (Kaufman). In short, even if every person on earth somehow magically

lived entirely sustainably overnight, global emissions would not even drop by half. This allows

them to continue to pollute, which is much less costly than switching to more sustainable

methods, meaning more profit. It should not be the responsibility of the consumer to reduce their

own effect on the environment when corporations are exploiting our planet's natural resources

for profit.

The sentiment that individuals making sustainable lifestyle changes can have a significant

impact globally when compared to corporations is a lie we have been told that we spend more

money. This is not to say that people should not switch to more environmental lifestyles. At

some point we all must become more environmentally conscious of our actions. That being said,

we should direct our focus on the larger issue of corporations that are significantly contributing

to environmental destruction and try to stop it.

Conclusion

As with many global scale issues, sustainability is more nuanced than one may originally

believe. Everyone on the planet has a moral and ethical responsibility to protect the environment

and strive for a sustainable future. To reach true sustainability, all of humanity's negative impact

on the environment must be eliminated. True sustainability requires drastic changes to social,

economic, and industrial norms. These changes will take decades to undergo. "Sustainable"

technologies like wind power and solar turn out to only be the lesser of two evils. But, if we

continue to reduce our negative impact on the environment, we will one day reach true

sustainability. One particular issue within sustainable technology is E-waste, which pollutes the

environment and is difficult to recycle. There has been recent research into biodegradable printed

circuit boards that are easy to recycle and require no toxic chemicals to manufacture. This is

extremely promising as we continue to progress technologically because now replacing outdated electronics will not harm the earth. Greenwashing is also a major moral issue that society continues to struggle with. Companies need to be held responsible for their verifiable contributions towards sustainability. They also often redirect the responsibility of reducing emissions onto the consumers with advertisements advocating that individuals must reduce their carbon footprint, despite being to blame for most global carbon emissions in order to profit. To obtain a truly sustainable future for us all, large corporations must be regulated and held responsible for their negligence and harmful effect on the environment.

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