The Role of Technology in Climate Change

How technology has helped and harmed the climate

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Technology plays a highly complex role in cause and global response to climate change. Historically, the advancement of technology has done irreparable damage to the environment, especially during the industrial revolution. Currently with the rise of AI, technology is once again back to being the primary source of environmental degradation. While it is the primary driver in many of the Earth's environmental issues, such as pollution and geological destruction, it is also humanity's biggest form of mitigation for these problems. Technology offers major solutions to help slow the degradation of the environment, this includes renewable energies and sustainable practices. This paper aims to explore the historical significance that technology has had on the environment both positively and negatively.

One of the most pivotal periods of technological advancements was the industrial revolution in the United States. This revolution also marked a major turning point between the relationship that humans had with the environment. Occurring in the 18th century, there were countless advancements made by humans in fields such as manufacturing, transportation, and complex machinery. Humanity was prospering, livelihood skyrocketed and a stable economy was finally forming. On the other hand however, smog plagued the atmosphere and heat was being trapped on Earth’s surface. All of the previously mentioned systems were largely fueled by fossil fuels and coal. The burning of these materials releases greenhouse gases, which both heat up and alter the atmosphere, degrading it over time. The exploitation of these fossil fuels also caused many habitats to be destroyed as well as mass deforestation. The industrial revolution is what many people believe to be the foundation or “start” of the rapid destruction of the environment. While it is easy to see the effects that such changes have on the environment now, it wasn’t until 1960 that a group came together to help make a change.

The Development Assistance Committee also known as the DAC would play a vital role in initiating efforts to combat climate change. This committee was formed to promote healthier development and poverty reduction, this was especially helpful in developing countries. The DAC strives to promote economic growth by setting up guidelines for people to follow while developing their cities. The DAC holds countries accountable for what they do with their natural resources while also providing welfare for low-middle income countries. By setting up these guidelines, they hold countries accountable for how they handle their finite materials. This helps reduce overall damage to the environment and also ensures the country or city is developed sustainably. There have been many technologies developed as a result of wanting to make the Earth "cleaner" and a really important but often overlooked one is recycling.

Recycling is a technology that plays an integral role in cleaning and maintaining the environment. During and after the industrial revolution, the waste management system had to be put in place as cities grew because of the trash pile up. Recycling during both of the world wars was also integral for all involved parties. Materials such as rubber and metal were conserved and often reused for war efforts. The unwanted metals, for example, helped the government develop boats and airplanes that were needed to fight the war. In 1981 Woodbury, New Jersey curbside recycling was introduced. Curbside recycling is a convenient way for everyone to recycle their materials. This would be done by simply disposing of your recyclable goods into a curbside bin that will be eventually picked up and transferred to the yard in order to be processed for reuse. While the audience is often the consumer, it is crucial that industries start reducing the use of virgin plastics and recycle as well. Companies will often try to shift blame of environmental problems to the consumer. An example of this would be the *Keep America Beautiful* ad campaign. This ad encouraged the consumer to recycle and that it is their "duty" to do so.

However, the companies running this ad were mass producers of single use plastics that were polluting and destroying the world. The concept of downcycling is also a very real risk that not many people are aware of. Downcycling is when the more a material is reused, the more degraded it becomes. All in all, recycling is fantastic. However, more regulations and policies need to be put in place in order for it to have a major effect on the environment, especially when industries are brought in question. Recycling has continuously evolved alongside growing efforts to help the climate. The reduction in mined materials also has had a positive impact on the reduction of greenhouse gases. A huge and popular technological development has been the electric vehicle.

Electric vehicles are all the rage in the modern age, in fact it's almost difficult to go on a drive and not see a Tesla. Although they seem like a more recent development they actually date back a long time. Here in the United States, the first electric vehicle was made in 1890 by American dentist and inventor William Morrison. It was an electric wagon that could go up to 14 mph, while quite slow this was a remarkable outbreak in scientific advancements. Electric vehicles were abundant, albeit not as practical as a horse, up until gas powered cars advanced beyond them. Combustion cars become more profitable and popular amongst industries, so the development to improve electric vehicles came to a roaring stop. This was until the energy crisis of 1970. During this time oil prices were at an all time high, which was caused by an Arabian oil embargo. This would also stunt American automobile industries who could no longer keep up with Japanese manufacturers, as they would make smaller and more fuel efficient cars. However, in 1990 there were many technological breakthroughs such as lithium-ion cells. This enabled modern electric vehicles to travel further distances and have a much better battery life. In the mid 2010s companies like Tesla completely shook up the market with their high performance and

innovative self titled electric car. What caught modern people's eye the most with electric vehicles is that they don't use gas. This saves people money in the long run and also drastically cuts back on CO2 emissions. The biggest barrier that is stopping the electric vehicle take over is just how expensive they are. Combustion cars are still much cheaper and more profitable than EV's so industries are less likely to invest into them. However as concerns over the environment grow people are becoming more incentivized to purchase EV's. It is important to note, the development of EV's is incredibly energy intensive and releases many greenhouse gases into the atmosphere. Most of which come from the mining of their materials and the engineering of the car itself. Energy is another question that arises when discussing climate change. What forms of energy can replace the burning of fossil fuels? There are actually many fantastic ways of generating energy that are reliable and ever advancing.

Wind power and hydropower are both technologies that involve generating energy without the use of fossil fuels, these are classified as renewable energy sources. Wind power is sourced through wind turbines capturing the kinetic energy of wind and creating electricity through it. Wind-turbines have been around for centuries but are having a spike in popularity as interest in the environment increases. They are especially popular in locations that have high winds and are mostly flat. There are even a few offshore massive wind turbines that capture the ocean breeze and power a large area. Hydropower is similar to wind power, except it harnesses the power of flowing water. Both technologies use a turbine both small scale and large scale, such as dams. Hydropower is highly efficient and reliable as a power source, as waterflow can be better controlled than the wind. While both of these sources are great to slow greenhouse gas emissions they still raise many concerns in the environment as well as the ecosystem. Wind turbines for example are known to kill many birds and bats. Birds that migrate a certain route

everywhere can accidentally get caught and killed by a wind turbine that was not there previously. There is also concern with the land that windmills take up as it could be destroying habitats that animals live in. Hydropower is the same way, the development of this technology destroys natural waterways. Hydropower can also have an effect on water health in one's community. Unlike wind turbines, hydropower industries are actively developing strategies to mitigate the damage they cause. Some of these technologies include fish friendly turbines and systems that minimize ecological disruption. There is one renewable energy source that outshines these two by being way safer for the ecosystem, and that is solar power.

Solar power aims to harness the photons of the sun and convert it into energy via the use of solar panels. The idea of solar panels dates back centuries to 1839, when physicist Edmond Becquerel discovered what he called the photovoltaic effect. Scientists wouldn't fully test or use this discovery until about 1954 when the creation of the first practical solar cell was made. Solar power was mainly used for space exploration before it became gradually accessible for use down on Earth. Once again, popularity spiked with the 1970s energy crisis as any form of renewable energy was sought after. During this time many governments and researchers invested into finding ways to improve the efficiency of solar power. With the groundbreaking development of perovskite cells and thin silicon the cost of production and purchase decreased and the efficiency increased. Solar panels can be found at many peoples homes and even to this day industries are still finding ways to make them more affordable for everyone. Solar panels' biggest downfall is that there is no optimal way to store the power it gains. So even still fossil fuels outshine solar power as a more affordable and arguably more efficient source. However, storage such as chemical batteries are another ever evolving technology that aims to fix this issue. Solar farms, which are giant fields of solar panels, also pose an issue when it comes to deforestation. Solar

panels are humanity's most reliable and widely accepted form of renewable energy that is still being developed and improved to this day.

The rise of AI has been fantastic for humans, or has it really? Employment has decreased, energy usage has spiked, kids aren't learning anymore, and the environment is suffering. AI demands an absurd amount of storage and energy and these facilities are popping up everywhere. An example of this would be in Loudoun County, Virginia. This county has the largest concentration of data centers in the world. The development of these facilities has destroyed forests, lowered community happiness, and spike the cost of living in this area. This is the most recent and most impactful example of how modern day technology is actively playing a role in destroying the environment. However, AI can also assist scientists in mapping and early detections of issues involving the ecosystem. AI is incredible, but policies need to be put in place soon or else it'll be too late.

In general, understanding technologies' role in climate change is difficult. On one hand it is easy to call it the main source of environmental destruction. Humans destroy habitats and ecosystems with technology, and most of the time all of these negative side effects are just to produce even more and potentially dangerous technology. However, at the same time humans need technology to even have a chance at salvaging and helping the environment. The development of systems that help manage and resupply/reuse materials instead of harvesting more and more from the Earth is crucial. Renewable energy is taking huge steps in cutting back greenhouse emissions and finding cleaner energy sources. Electric vehicles and recycling also ensure that the everyday person feels as though they are helping the climate which makes them increase happiness. Ultimately, it is humanity's choice whether or not technology becomes our savior or our killer.

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