

MECH-322 FLUID MECHANICS

GLOBAL WARMING AND CLIMATE CHANGE ESSAY:

“Future of Global Warming and Possible Solutions”

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Global Warming and Climate Change

Global warming and climate change are considered to be one and the same, however, there is a slight difference amongst them, but both are rooted from one common evil, mankind. There is a small difference between them, but let's start with definitions. Quoted from the USGS government department, they defined the difference as "*Global warming*" refers to the rise in global temperatures due mainly to the increasing concentrations of greenhouse gases in the atmosphere. "*Climate change*" refers to the increasing changes in the measures of climate over a long period of time – including precipitation, temperature, and wind patterns.". Now back to our first presumption about who is responsible for all of this.

Thanks to our atmosphere, we can enjoy relatively stable temperatures across the globe with the layers of gas protecting us from overheating or completely freezing over like the other planets in our solar system. However, the main cause of climate change is that we are changing the composition of the atmosphere. According to the EPA, Humans release over 30 Billions tons of carbon dioxide into the atmosphere every year. This has led to a 40% increase as compared to preindustrial levels. This has also happened with Methane and Nitrous Oxide levels which have increased 250% and 20%, respectively. The reason that is such a big issue is due to the fact that it creates thicker layers in the atmosphere that acts as an insulator, which in turn causes overheating of the earth. All of these gasses are released from everyday processes, whether you're driving somewhere or just staying in your climate controlled home. There is no way to go without some of these present day necessities and scientists suggest even if we could and go completely carbon neutral, the effects that we have imposed on the earth may not be reversible. What does that mean for us?

Results from a wide range of climate model simulations suggest that our planet's average temperature could be between 2 and 9.7°F (1.1 to 5.4°C) warmer in 2100 than it is today, but what does that mean for us? Of course this includes droughts in areas that don't receive much water as of now which lead to wildfires as we have seen have become increasingly common in the past few decades. These wildfires have been taking out large portions of wooded areas and homes in much of the west United States, leaving people homeless and entire ecosystems destroyed. On top of the extreme heat and wildfires, more of

the polar ice caps could melt which would lead to major flooding of largely populated areas considering that on average 30-40% of the world would live near a coastal waterline. Cities such as New York could be severely affected by this. In a worse case scenario situation, which would be the rising of 8 ft, would put the lower half of Manhattan underwater, as well as most of Ellis island, and of course Long island city as well. Some of the most monumental spots in America would be lost by the ocean.

One of the many methods in which has been suggested is to use Biomass Energy with Carbon Capture and Storage. This is the burning of biological materials such as plants in order to generate energy. This is considered to be carbon neutral because the carbon that is being burned off was also pulled out of the atmosphere. This is obviously not the best solution there is out there, but all the plants are natural and renewable as long as we could continue to plant in the demand in which is needed to supply power. This could also go carbon neutral by using carbon capture as previously mentioned which would be carbon negative, which after capturing this carbon, it would be placed below earth's surface for storage which is normal considering this is the natural process for plant decomposition and releasing of their carbon. This way is one alternative but would be very hard to fully sustain on a full size scale. It may work in smaller regions in which certain types of energy would be harder to obtain such as Alaska or more northern and desolate areas of regions where there is not as much demand for such things. Either way, it is a viable option and could help reverse the amount of carbon we put into the air. Another use with the carbon capture technology would be to use the carbon in processes in which we turn it into useful materials like carbon fiber, bricks, roads, and building materials. This is a semi-labor intensive process which could be viable but the technology isn't being pushed as much to recycle this carbon capture or to even use the capturing technology. In order to make this a better option we would need government funding and for them to place incentives around it in order to make it a more viable solution, but still an option nonetheless.

One of the most sustainable practices in which we already do would be nuclear fission energy usage. Nuclear energy production itself produces zero emissions, which means no CO₂ into the atmosphere. This is a huge deal right now considering the climate change crisis in which we are experiencing right now. Coal alone produces 4,172 pounds of CO₂ for every ton that is burned. That would only produce enough energy to power one average household for 3-4 months whereas a Nuclear power plant could provide over 700,000 homes with power. As compared to other sources of renewable energy, research shows that it would take about 75

times more land for wind turbines to produce the same amount of energy that a nuclear power plant would provide. A study was done and 93% of the time that a nuclear power plant is running, it is at maximum power output. As compared to coal and wind, which run at 44% and 59% efficiency, respectively. These statistics show that Nuclear energy is clearly a much more viable resource of energy that we can currently access and maintain, but people are afraid of another accident to happen again like what happened with Chernobyl or Fukushima. To be fair, they are justified when they push back against Nuclear energy because these meltdowns destroy not only lives but whole cities and ecosystems. There are now much more strict regulations in place to help prevent these catastrophes from happening, which only happened twice over the past half a century since we began using Nuclear energy, so the odds of something like that ever happening again are very slim. As for known resources for engineers, Nuclear is arguably the best direction we can take to ensure that we try to get as carbon neutral as possible.

One of the most promising aspects that could potentially change all energy sources as we know it would be fusion energy, which is a type of nuclear energy as well but it is more stable and there is no threat of melting down like there is with fission. It is still being highly researched but the technology isn't quite advanced enough to support this type of energy making. These type of reactors are powered by a nuclear reaction of light nuclei smashing together and rearrange into other nuclei as a constant chain reaction which leads to energy emission. So much energy emission in the form of heat that these reactors can get up to 15 million degrees Celsius, or so we originally thought. China has successfully run a fission reactor just last month that lasted over a thousand seconds or roughly 17 minutes, but during this time, the reactor reached an estimated 70 million degrees celsius which is still not come even close to touching the record temperature for a fission reactor, however, those other experiments did not run for even a minute. As of now, these reactors can push out about 10MW, but are estimated by 2035 to produce around 500 MW worth of electricity. This would provide around 100,000 homes with power with only producing 20% of it's expected power output. It is an engineer's dream and hopefully will have the first ones up and running for usage by 2035.

Finding a clean and good way to produce electricity and energy is essential to ensure our future generations have a clean world to live in once we're gone. There are many viable options and hopefully with further advancements in technology and steps in engineering to make

everyday usage items more efficient we can help save the planet and hopefully reverse the effects we have left on this planet. We all must join together and work as a team to achieve these goals or else Mars may be our last viable option to rebuild.

CITATIONS

Andlinger Center for Energy and the Environment. "10 Facts About Fusion Energy via Magnetic Confinement." *Andlinger Center for Energy and the Environment*, Princeton, 30 June 2016,

acee.princeton.edu/acee-news/10-facts-about-fusion-energy-via-magnetic-confinement/#:~:text=Fusion%20energy%20is%20what%20powers,reach%2015%20million%20degrees%20Celsius.

"Causes of Climate Change." *US EPA*, Environmental Protection Agency, 23 Feb. 2022, www.epa.gov/climatechange-science/causes-climate-change.

Greenpeace UK. "What Are the Solutions to Climate Change?" *Greenpeace UK*, 2 July 2021,

www.greenpeace.org.uk/challenges/climate-change/solutions-climate-change.

Herring, David. "Climate Change: Global Temperature Projections | NOAA Climate.Gov." *Climate.Gov*, 26 Oct. 2021,

www.climate.gov/news-features/understanding-climate/climate-change-global-temperature-projections#:~:text=Results%20from%20a%20wide%20range,gases%20that%20human%20activities%20produce.

Shahzad, Umair. "Global Warming: Causes, Effects and Solutions." *ResearchGate*, University of Nebraska at Lincoln, 1 Aug. 2015,

www.researchgate.net/publication/316691239_Global_Warming_Causes_Effects_and_Solutions.