

MECH-322 Fluid Mechanics

“Effects of Climate Change and the Responsibility of the Engineer”

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Climate change is an overarching issue that affects every part of our society, and will continue to do so in the near future unless drastic actions are taken. Some major effects of climate change include, but are not limited to, rising sea levels, intense heat waves, more severe weather effects, and an overall increase in global temperatures. This multitude of effects are already being experienced today and the magnitude will only increase given time if swift action is not taken. Humans are already in the early processes of combating climate change via implementing methods to create clean energy systems, as well as making changes to the vehicle industry. If these actions are further developed and implemented correctly, humans can begin to steady the continuing effects of climate change, therefore creating a better world for future generations to live in.

The effects of climate change are already evident in modern society. Effects can already be seen as “glaciers and ice sheets are shrinking, river and lake ice is breaking up earlier, plant and animal geographic ranges are shifting, and plants and trees are blooming sooner” (NASA). The glaciers and ice sheets melting directly correlates with the rising sea levels, in turn leading to the loss of land, including infrastructure such as businesses, homes, and livelihoods. It is predicted that in the next thirty years “four million acres of land will be increasingly threatened by routine flooding. By 2100, over \$100 billion worth of property could be in jeopardy as the coastlines of the U.S. continue to creep inland” (PBS). Not only will people lose their homes and things that they have worked for, but businesses will be lost, and the economy will be negatively affected. Due to the coastlines moving further inward, natural disasters such as Hurricanes, which are also becoming more intense and frequent due to rising temperatures, will have even harsher effects on cities and populations. Another major effect of climate change that is already becoming apparent is the alterations in growing seasons around the world. “Crops and livestock will be subjected to increasing temperatures, increasing CO<sub>2</sub>, and more variable water availability caused by changing precipitation patterns and access to irrigation. These factors effect plant growth and yield and environmental conditions for livestock production” (USDA). Climate change can directly affect the availability of food, and food prices, something that will heavily affect every person while doing everyday tasks such as grocery shopping. Other effects of climate change are the amount of droughts and heat waves increasing, longer wildfire seasons, and changes in precipitation patterns. This is only a brief summary of climate change and a glimpse of its effect on society, but there are, and will be, many more adverse effects that will only worsen with time.

One thing humans are in the process of developing to help combat the effects of climate change is creating clean energy systems. Clean energy is a broad term, but it includes methods of creating renewable energy such as hydrogen and solar power. Clean energy is being developed to eventually replace the alternatives, such as burning coal and fossil fuels. Oil and gas supplies are unable to keep up

with growing energy demands, and the usage of coal exacerbates air and water pollution problems, increasing buildup of carbon dioxide in the atmosphere. One possible alternative is solar power, as “Its availability far exceeds any conceivable future energy demands. It is environmentally clean, and its energy is transmitted from the sun to the Earth free of charge” (National Academy of Engineering). Solar power, while it provides multiple advantages, also has its own issues with implementation. Solar cells only have “an efficiency of only 10 percent to 20 percent”, which is incredibly inefficient compared to current methods of power generation (National Academy of Engineering). Solar cells also generate electricity at a cost of three to six cents higher than current prices and would have major issues if it scaled up to power-grid proportions in its current state. Although Solar power is not currently the greatest alternative, it is much better for the environment and the battle against climate change than continuing to burn coal and fossil fuels. This is only the beginning of solar power technology, as it is still being further developed. Given more time, the technology will only continue to improve, becoming more efficient and therefore more viable for industrial and worldwide use. Some experimental cells have managed to exceed forty percent efficiency, demonstrating that the future of solar technology is bright. Another clean energy resource is hydrogen power. Hydrogen power comes from the energy generated utilizing moving water. This makes it one of the most affordable sources of electricity. “The efficiency of today's hydroelectric plant is about 90 percent. Hydroelectric plants do not create air pollution, the fuel--falling water--is not consumed” (USBR). Hydrogen power is a great alternative to burning coal and fossil fuels, but once again it is not viable in every part of the country. While some cities and states can heavily benefit with the use of hydrogen power, some states and areas, such as landlocked Arizona, do not contain any suitable sources of flowing water that can be used to produce enough power to sustain their population. Hydrogen power is a much more efficient and “cleaner” alternative to fossil fuels, which therefore helps combat climate change. There are a multitude of different forms of clean energy that are currently being developed, such as nuclear, wind, and geothermal power that will not be covered but are also being developed in order to help stop the burning of fossil fuels and coal in an attempt to slow the irreversible effects of climate change.

Another source of pollution that is being altered in order to help combat climate change is the vehicle industry. Internal Combustion Engines (ICEs) have been and continue to be a large source of pollution, which in turn drives climate change. When comparing “many internal combustion engine mid-sized vehicles, they create, on average, 150.4 grams of carbon dioxide equivalent per kilometer (g CO<sub>2</sub> eq per kilometer)” (SAE). Due to the sheer amount of emissions created by ICE vehicles, the alternate, so-called electric vehicles, have begun development. Electric vehicles have zero tailpipe emissions, making them much more environmentally friendly when compared to ICE dependent vehicles. Although electric

vehicles themselves are environmentally friendly, the environmental impact of their creation can “vary greatly because the electricity used to power these vehicles can be sourced from many different types of power plants. Nuclear, wind, and hydro plants generate the smallest environmental burden, but they only account for a small amount of energy when compared to the large amounts that coal and natural gas produce” (D.U.Quark). Overall, electric vehicles are much more efficient after they have been produced and are on the road, but still heavily contribute to global warming depending on how they are produced. If electric vehicles are produced using renewable energy sources, they will go a long way in helping slow climate change and its effects. The electric vehicle industry is also still in its infancy, and will only continue to improve with further innovations in their technology.

When focusing on how society is working to combat climate change, engineering stands behind it all and truly powers everything. Engineers are the ones who are working to create renewable energy sources and improve the technology behind sustainable energy. Engineers are the ones responsible for creating electric vehicles and improving the efficiency of ICEs in the meantime. Engineers are the people who have the ability and know how to combat climate change, but should they have to bear the responsibility? I believe that engineers should be the ones who are responsible for helping society prepare for the future in combating climate change. All engineers should strive to educate themselves on how they can create less pollution in any field that they work in. Whether they work on engines, sunroofs, or in power plants, they should always attempt to find ways to become more efficient and lessen the effects of climate change. I believe engineers should also work to spread awareness of how different products have differing effects on pollution, and therefore climate change. The average person does not understand what effect they may be having on climate change when they learn about solar power or hydrogen power, and it should be the responsibility of engineers to educate them on such information. Engineers will be the ones who truly drive the development of clean energy systems and change the vehicle industry for the better.

Climate change is an issue that has already begun to rear its ugly and irreversible effects on society, and it will only continue to grow worse without effective actions being developed and taken. Effects such as rising sea levels, increases in global temperatures, and changes in growing seasons are currently affecting our society, and by 2050 will only become increasingly worse. Engineers are already beginning to combat this with the creation and further improvements of clean energy sources such as hydrogen power and solar power. Not all of these clean energy sources are currently economically or physically viable in all areas, or are not currently very efficient, but are all healthier alternatives to burning coal and fossil fuels. Another way engineers are working to combat climate change is by creating emission free electric vehicles and working to improve the ways that said electric vehicles are produced.

With enough time, such technologies will continue to improve, but they must be implemented efficiently now to help slow the effects of climate change. I truly believe all engineers should strive to learn how they can reduce pollution in whatever field they end up working in, and should help to spread awareness of clean energy versus current energy usage. Engineers will be the ones who push society forwards in the fight against climate change, or they will be the ones who ultimately fail to do so. Saving the world from climate change rests on their shoulders, and they must be prepared.

## Works Cited

- “The Effects of Climate Change.” *NASA*, NASA, 2 Mar. 2023, <https://climate.nasa.gov/effects/>.
- Brangham, William. “Report Shows Devastating Economic Impact of Rising Sea Levels along American Coast.” *PBS*, Public Broadcasting Service, 14 Sept. 2022, <https://www.pbs.org/newshour/show/report-shows-devastating-economic-impact-of-rising-sea-levels-along-american-coast#:~:text=The%20report%20says%20that%2C%20in,U.S.%20continue%20to%20creep%20inl> and.
- “Growing Seasons in a Changing Climate.” *Growing Seasons in a Changing Climate | USDA Climate Hubs*, <https://www.climatehubs.usda.gov/growing-seasons-changing-climate>.
- Make solar energy economical*. Grand Challenges - Make Solar Energy Economical. (n.d.). Retrieved March 15, 2023, from <http://www.engineeringchallenges.org/challenges/solar.aspx>
- Nickischer, A. (2020, April 14). *Environmental impacts of internal combustion engines and electric ...* Retrieved March 15, 2023, from <https://dsc.duq.edu/cgi/viewcontent.cgi?article=1068&context=duquark>
- Bureau of Reclamation*. (2005, July). Retrieved March 15, 2023, from <https://usbr.gov/power/edu/pamphlet.pdf>
- Charbonnier, M. and Andres, M., “A comparative Study of Gasoline and Diesel Passenger Car emissions Under similar Conditions of Use,” SAE Technical Paper 930779, 1993, <https://doi.org/10.4271/930779>.