MECH-322 Fluid Mechanics Climate Change Design Project: Individual Assignment

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In the 21st century, humanity is on the cusp of many incredible scientific advancements that those before us could not have even dreamed of. Scientists, such as Neil deGrasse Tyson, are already predicting scientific breakthroughs in areas such as: neuroscience that will cure mental illness, transportation that will see a mass transition to autonomous electric vehicles, and even massive developments in the medical field that will cure cancer or regrow limbs. However, even as humanity moves closer to these amazing achievements, it faces something that could stop it from ever reaping the benefit from these efforts. This humanity-ending disaster is called climate change, and every day the world continues to grow warmer as mankind marches closer toward a possible ecological disaster.

As humanity seeks to find solutions to reduce both past and future environmental damage, major technological breakthroughs are required to create the necessary tools. Amidst this need for new tools, the question needs to be asked, “Who is going to develop these technologies to combat climate change?” A multitude of professions are needed in the fight against climate change to accomplish everything from obtaining the initial funding, developing new technologies, and those who will manufacture the final product. However, few professions are capable of taking new and innovative concepts from the design boards and turning them into real world applications. The first prerequisite for a profession to be able to achieve this requires a unique understanding of the natural world, which would allow them to harness the phenomena within it to achieve certain goals.

While many professions deal with understanding the natural world, there is truly only one whose specific purpose is to harness scientific knowledge to create useful tools. These professionals are engineers. An engineer is defined multiple ways by the Merriam Webster Dictionary, one of them being, “A person who carries through and enterprise by skillful or artful contrivance.” The other noteworthy definition given by Merriam Webster is, “A person who is trained in or follows as a profession a branch of engineering.” This definition begs the question, what is engineering? Engineering is defined as, “The application of science and mathematics by which the properties of matter and the sources of energy are made useful to people.” Taking these definitions into consideration, an engineer can be considered someone who is able to apply science and mathematics to make matter and energy useful for carrying out predetermined enterprises. This description perfectly matches what type of profession is required for developing the necessary technologies to combat climate change. This unique capability places a burden on engineers in humanity’s fight against climate change as those in the engineering profession

have the unique responsibility to design, develop, and deploy new innovative solutions before climate change inflicts significant damage to society.

Engineers have the responsibility to use the natural problem-solving gifts they have, along with the knowledge they obtain to serve something greater than themselves. As previously explained, engineers hold a rather unique set of skills that are not prevalent within every person in society. This places a responsibility on engineers that is nonexistent for many other professions. While all of society has the responsibility to combat climate change, there is only so much a bank teller or gas station worker can do outside of donating funds. Engineers can do much more than simply donate funds as they are able to develop the new technologies that are capable of combating climate change. This responsibility isn't limited to engineers with degrees, rather it extends to those who have the mentality of an engineer and a capacity to utilize that mental capability. So, as engineers have a unique set of skills, there is a responsibility placed on those in the engineering profession to develop the technologies to combat climate change.

As engineers continue to develop humanity's future, there is another important factor that must be considered. First, in order to create a permanent solution for climate change, multiple strategies must be designed and implemented within society. Part of the human condition that all of humanity deals with is the mistake of focusing on one solution as the sole savior of a problem. Due to our desire to understand problems in their totality, human beings have the tendency to accept a single source as the cause of an issue and then proceed to focus on that source without considering that there may be other causes. As engineers who live in a world where there are many options for green energy production, we must push for all options to be considered. Engineers cannot simply focus on developing a few technologies such as solar and wind, rather, it is the engineering profession's responsibility to push for the development of multiple new technologies to ensure the single savior condition is overcome.

As an engineering student, the skills which I am currently learning will play a vital role in shaping the solutions I provided in the fight against climate change. In the mental creation and formation of solutions, the possible conclusions that a person can draw are only limited by that person's ability to think of them. The solutions that people devise rarely are standalone ideas but rather are the result of a basis of knowledge that a person builds from to extrapolate current theories into new ideas. For mechanical engineering, one competent of the basis of knowledge that they can pull from is the branch of fluid dynamics. The study of fluid dynamics is defined as, "the broad field of applied mechanics and applied physics, that is concerned with the behavior of liquids and gases at rest or in motion; including

pressure drops from fluid flow and aerodynamic drag forces." The study of fluid dynamics is applied in so many different scenarios throughout the modern world such as submersible vehicles, automotive aerodynamics, and all objects that fly. In each of these cases, the motion of the fluid (such as water or air) is analyzed to determine the reactions of the fluid. Engineers who study fluid dynamics hold an understanding of the possible ways to develop more energy-efficient technologies, tap into the energy of the fluids that surround us, and design countermeasures to protect humanity from the dangers posed by fluids.

As humanity moves into the future of electric vehicles (EVs) the study of fluid mechanics is going to become even more essential in reducing carbon emissions as companies seek to increase the efficiency of these machines. Looking out on the road today, it is extremely easy to differentiate between vehicles with internal combustion (IC) engines and those with electric propulsion. Besides the obvious absence of a grille, electric vehicles usually look more aerodynamic compared to their internal combustion counterparts. This is because electric vehicles need to be much more aerodynamic to conserve energy, which increases the vehicles range. This increase in efficiency is helpful in the fight against climate change in many ways including simply using less energy, but also helping to increase the range of electric vehicles, which is a reason people cite for not buying EVs. This creates a need to design more aerodynamic vehicles, which requires understanding of fluid dynamics to create models that predict what forces are applied by the air flowing around the vehicle. So as humanity continues to fight against climate change, the need to continue to design more aerodynamic vehicles is required. This necessitates an understanding of fluid dynamics to create models that predict the reaction of fluids as the car drives, which allows for engineers to accurately design and develop more efficient vehicles.

Additionally, a knowledge of fluid dynamics helps humanity to tap into the energy of fluids all around us. As humanity continues in its struggle against climate change, there is a need to reduce our reliance on fossil fuels and replace them with renewable energy sources. While options like solar energy do exist, it is important not to focus on one solution and to take advantage of the fluids all around us that can provide humanity with a greater number of renewable energy sources. By having an understanding of fluid dynamics, humanity will be able to take advantage of fluids such as the air by building wind turbines that reach into the sky to tap into the energy of the winds. Additionally, fluid dynamic analysis is required to contain and harness the energy of rivers by determining the force exerted by the water and the pressure drops resulting from the hydroelectric energy generators. The last fluid energy source available to humanity is the ebbs and flows of water as the ocean goes through its tide

cycles. Utilizing turbines, engineers can tap into the immense amount of energy found within tides to produce electricity as the tides cause ocean water to rise and fall. A knowledge of fluid dynamics allows engineers to tap into the motion of these fluids, which will allow humanity to harness these different energy sources and utilize them to reduce our reliance on carbon releasing energy sources.

Finally, humanity's knowledge of fluid dynamics will also help humanity design counter measures to the consequence of climate changes. As the planet continues to slowly warm, the side effects such as rising water have started to become a problem for small island nations. However, as this problem continues to grow worse, population centers in coastal regions all over the world will soon start to face issues such as flooding. While there are multitude of solutions to these problems, one of the solutions that some cities are utilizing is updating their infrastructure to be able to handle more flooding, such as by adding pumping stations or updating/upgrading their current drainage capacity. To do this, pumps will have to be designed to carry away enough water at a large enough flow rate so that flooding doesn't occur. This must be done while considering the other preventive measures being implemented so that the pumps aren't over-engineered to the point where funds are being wasted. Additionally, when designing the new drainage system, certain factors such as how much exiting mass flow is necessary to ensure no flooding occurs must be determined; this would be done utilizing fluid dynamics. So as humanity continues to build infrastructure to protect itself from climate change, the need for a knowledge of fluids dynamics remains extremely relevant and an integral part of any set of successful solutions.

As climate change continues to become a greater threat, the need for engineers to step up and develop new technologies increases. Engineers must work to develop a broad set of technologies that are able to combat different aspects of the climate crisis that range from the increasing amount of CO2 in the atmosphere to the rising sea levels; the different problems that humanity faces require a multitude of solutions. In addition, as engineers go about creating these solutions, the need for a knowledge of fluid dynamics is incredibly necessary as humanity works to increase its energy efficiency, taps into sources of renewable energy, and protects itself from the consequences of climate change. As an engineer beginning my career, it is important to remember my responsibility within this issue and to use the talents I have, along with the knowledge I have gained, in classes such as this one to serve something greater than myself.

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