Engineering a Sustainable Future:

The Responsibility of Engineers in Fighting Climate Change

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In recent years we have seen that human activities have had a negative impact on the world as a whole due to the increase in greenhouse gases. This has caused major shifts in the earth's climate such as melting glaciers, extreme weather events, and rising sea levels. Due to these disturbances happing we as engineers have a social responsibility to help and put our knowledge to use and help the world develop new technologies and innovate our current technologies to be more sustainable. We can help develop new and innovate existing technologies such as energy-efficient buildings, renewable energy sources, sustainable transportation, and carbon capture technologies.

First off energy-efficient buildings are often overlooked as a way to decrease energy demand and carbon emissions. Some things are as mundane as just changing out the air filters on a regular basis so as not to overwork the HVAC system, but engineers can get involved is focusing on designing buildings that overall reduce the amount of energy that they consume. Sustainable buildings are focused on reducing the need for energy and petting less demand on the energy grid. This can be done by designing buildings that take advantage of the sun to heat their buildings or using the wind to aid in natural ventilation. This dynamic cooling can be achieved with automatic shades, proper use of natural lighting, and trees. There is one aspect of a building that is a large contributor to using too much energy is the building not being insulated and sealed correctly. We can incorporate the use of double-paned windows, improving current insulation materials with more modern solutions such as insulating concrete. The sealed building takes much less energy to heat and cool as there are no leaks venting out the building's controlled atmosphere thus causing the HVAC system to work harder and pulling more energy. While it seems like putting more electronics inside of your building will be another key to reducing the need for energy. We can integrate current buildings with automation systems such as automatic blinders, smart thermostats, and ventilation ducts that can blow the hot or cold air where it most needs to be. Switching out your old appliances and lights is another key to making a building sustainable. New appliances are designed to be much more efficient in what they do, things such as motion-sensing lights can know when you enter or leave a room saving energy when not being used. Finally, we can make buildings have no footprint on the energy grid by incorporating renewable energy right into the building itself. We can install solar panels and whined turbines onto the roof or on the outer walls of buildings to reduce their energy intake.

These design changes and modernization of current buildings will significantly reduce energy intake, doing this can free up more money since it won't be spent on running a building and can be used to boost the economy.

Carbon capture technology seems like an idea far in the future that we would struggle to accomplish. Thankfully we live in the future and carbon capture is a real and proven technology that works. There are a few problems with it currently that are holding it back from being mass-produced and implemented everywhere. Carbon capture is a very expensive technology as it came onto the world stage recently and due to this, it is not cheap. To aid in this engineers can design more efficient manufacturing processes and streamline the design of carbon capture facilities so that they can be built quickly and efficiently. Carbon capture is also a highly energy-intensive process as of now the current process of carbon capture is to use a chemical mix to capture the carbon and then have that solution heated to pull the carbon out and have it stored. This process uses a massive amount of energy as heating up that chemical solution takes a lot of heat, the industry right now is designing carbon capture facilities that use waste heat from power plants to heat the solution. This is not a sustainable option if we wish to get rid of fossil fuel power plants in the future but if we convert to nuclear or even fusion reactors in the future these facilities can be installed there and can be heated by waste heat produced by the reactor. Engineers can make these systems cheaper and more effective overall as a means to reduce the cost and make it much more palatable for countries and politicians to fund and install carbon capture technologies in their countries. This is only one half of the carbon capture system however as once we pull the carbon out of the air what will we do with it? Right now it is stored in massive gas tanks above the ground similar to storing natural gases. It has been brought up that if these tanks are breached it completely undoes what the carbon capture technology was put in place to do. To deal with this issue massive underground storage facilities have been proposed similar to the disposal of nuclear waste from reactors. They might not go as far as sealing the tanks in lead and thick concrete but they will be stored safely and efficiently in deep underground bunkers where it would be very difficult to have the tanks get breached. It is the responsibility of the engineers to not only design these new technologies but design them in a way that is feasible for the world to implement them safely and efficiently.

Sustainable transportation refers to any form of transportation that is designed to minimize its negative impact on the environment. We as engineers need to help improve these systems and integrate them into our current transportation grid. The United State are particularly at fault for this as the high reliance on cars and car-centric infrastructure has a significant impact

on how much we pollute. We can help solve this by beginning to use trains and trams as a more common way of travel in the US. Trains are much more efficient at moving mass from one point to another. The main reason we do not use this and much as other countries is that America has not fully supported the idea of trains as they don't seem as good for travel. This is objectively correct as the United States train network is outdated by modern standards, especially in the area of passenger trains. European and Asian countries have already or are in the process of switching to Mag-Lev trains which travel at ludicrous speeds and are more comfortable to ride than a traditional train. Having fewer people use individual transportation methods such as cars and instead utilize trains and trams will make the streets less clogged and reduce the emissions from having fewer cars drive. The real problem will be designing and overhauling US cities that are centered around cars, especially the more west you go. We must make it more convenient and pleasurable for the average commuter to go and ride a train than it is to drive a car and find a parking spot every day to get the most out of what we can when implementing a new transportation system. If we cannot get everyone to use public transportation then we must keep innovating cars, major leaps in battery storage and quick charging have meant that EVs are now a realistic possibility for the average person to buy and use day-to-day. These vehicles being powered by renewable energy or nuclear power would result in a large sector of pollutants in a city being eliminated almost entirely.

Overall as engineers, we have a social responsibility to our local communities and the world as a whole to use the knowledge we have gained in the workforce as well as in school to improve the climate crisis as much as we can and help at a worldwide scale. We must design these new and emerging technologies so they are cheap and easy to integrate into our current society and make them safe and effective to use. Innovating and modernizing already existing infrastructure is key to making sure that we leave no stone unturned on our way to reverse climate change.

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