

# **Humanity's Biggest Threat**

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There are many threats facing human existence such as world wars and extinction level meteor impacts. However, the largest threat is not nuclear weapons or random mass extinction. It is the preventable disaster of climate change. Climate change will impact every aspect of human life if further warming is not prevented. Global flooding, severe drought, drinking water, and habitable land are just a few examples of the main impact areas. Despite these challenges, there is still hope for mankind in the form of green energy technology. This essay aims to discuss the threat of climate change and the various energy production methods that could be used to prevent this crisis.

The greenhouse gas effect was first discovered in 1856 by Eunice Foote. Foote noticed that carbon dioxide trapped heat from the sun and even proposed that such heating could occur on a global scale if there was sufficient carbon dioxide in the atmosphere [1]. Nevertheless, we proceeded to use fossil fuels to power the industrial revolution, and the use of these fuels has only gotten larger since. It wasn't until the late 1950s that scientists began to worry about climate change after it was demonstrated that CO<sub>2</sub> content in the air is rising every year as a result of industrial emissions. About twenty years later, most scientists had come to the consensus that action needed to be taken to avoid global warming [2]. Scientists have since observed the planet's average temperature rise every year at alarming rates.

Climate change is predicted to have disastrous impacts on virtually every aspect of human life. From where we live to the water we drink and the food we eat, nothing will be unaffected by climate change. According to NASA, climate change could impact the production of corn and wheat as early as 2030. They predict that corn crop yields could decrease by about 24% while wheat yields could increase by about 17%. These changes would be due to rising temperatures, shifts in rainfall patterns, and changes in surface carbon dioxide concentrations [3]. The EPA warns that increased temperatures and changes in precipitation patterns will lead to harmful algal blooms and diminished reservoir water quality, respectively [4]. It is well-known that climate change causes rising sea levels by melting the polar ice caps. However, the impact of rising sea levels goes beyond reducing the coasts. According to the European Environment Agency, rising sea levels can also change soil in coastal areas and bring contaminants. Additionally, the harsh weather and high soil carbon dioxide concentrations will increase erosion and cause desertification [5]. The point is hopefully clear by now: climate change could cause the end of human civilization as we know it, if nothing is done to prevent it. However, not all hope is lost. There are several technologies that can help prevent climate change.

Since the 1800s, we have been coming up with different ways to produce and store electricity that do not involve fossil fuels. Electrochemical devices (like fuel cells and batteries) date back to the 1800 and have been massively improved since then. There are more modern ways of producing and storing electricity though. Semiconductor solar cells, concentrating solar devices, and hydrogen storage are all modern methods of energy production and storage. Semiconductor solar cells were first manufactured in

the 1950s and operate according to quantum mechanical principles. Concentrating solar devices simply focus energy from the sun to heat oil or steam which powers a turbine. Along with concentrating solar, liquid salt tanks can be used to store excess thermal energy which can then be used to run the turbine at night. This represents another modern method of storage. Solar energy can also be used to power an electrolyzer to generate  $H_2$  and  $O_2$  from water. The hydrogen gas can be compressed and stored in a tank. This process is essentially storing energy from the sun as hydrogen gas. The stored hydrogen can then be used to operate a fuel cell stack to produce electricity at night. The main problem that this application of solar panels on a large scale is the efficiency of conventional solar cells. There are two reasons for low efficiency. Most commercially available solar cells are made of silicon, which suffers from massive recombination losses when above a certain thickness. This prevents silicon solar cells from absorbing all the light that they theoretically should be able to and thereby lowers the efficiency. The other limiting aspect is the design itself. It is well known that the theoretical limit on single-junction solar cells is about 30%. This efficiency is low, but it can be crushed simply by changing the design and materials. If different semiconductors are used with multiple p-n junctions (instead of just one), the efficiency can be as high as 80%. In fact, the current record for most efficient solar cell is about 45%.

Throughout this essay, I hope it has become clear that climate change is the single largest threat to human existence. It will make drinkable water more scarce, crop yields lower, and habitable land area smaller. That is not to say that we are doomed. There are plenty of technologies that could be used to prevent the climate crisis. There are numerous methods of power generation such as semiconductor solar cells, concentrating solar cells, and fuel cells. There are also many ways to store energy, such as compressed hydrogen, molten salt, and conventional lithium ion batteries. These technologies are constantly improving in almost every way (even cost). It is clear that we have the tools to solve this problem, so whether or not humanity is doomed for extinction comes down to our choice to implement the available technology in a way that ensures carbon neutrality or even negative carbon emissions.

## References

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