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Leveraging Nuclear Power: Powering Petrochemical Plants and Carbon Dioxide Mitigation through Direct Air Capture

The growing reliance on coal, oil, and natural gas as primary energy sources has resulted in a rise in atmospheric CO2 concentration from 280 ppm to 413 ppm. Over the last ten years, CO2 emissions have been increasing by approximately 2 ppm per year, resulting in numerous risks to human well-being. These risks include melting glaciers, increased occurrences of floods, heat waves, droughts, cyclones, hurricanes, and concerns regarding food security.

This poster contains a possible solution to the rapid increase in CO2 emissions. A new technology is under development which is Direct Air Capture (DAC) has the potential to mitigate CO2 emission in the atmosphere. The main challenge facing this sophisticated technology is finding a sustainable and reliable source of energy that has zero CO2 emission and could provide a tremendous amount of power. Consequently, Nuclear Power Plants may considered as major solution to this problem because they provide a sufficient amount of clean carbon-free, and sustainable energy.

In addition, this poster explores the potential of nuclear power in powering petrochemical plants and mitigating CO2 emissions through Direct Air Capture (DAC). Furthermore, the utilization of captured CO2 is addressed.

Finally, a case study, representing the integration of nuclear power with DAC and Petrochemical plant, was done by setting assumptions that a plant called “Alpha” required 120 MW and produced approximately 3 M tons of CO2/year. In order for DAC to remove that amount of CO2 released by the Alpha plant it requires 662.7 MW. The total amount of energy that a Nuclear Power plant needs to provide is 782.7 MW. It is found that 40% of typical (PWR) which produces an average of 1300MW has been used to power both the Alpha plant and DAC, and DAC consumes approximately 80% of the energy that the nuclear power plant supplies.

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