The Inspiration:

For my research project, I wanted to use science to accomplish something big.

Climate change is primarily caused by an increase in Carbon Dioxide in the atmosphere. Carbon Dioxide is a greenhouse gas, meaning that it will trap radiation from the sun in the atmosphere. As a result, global warming happens.

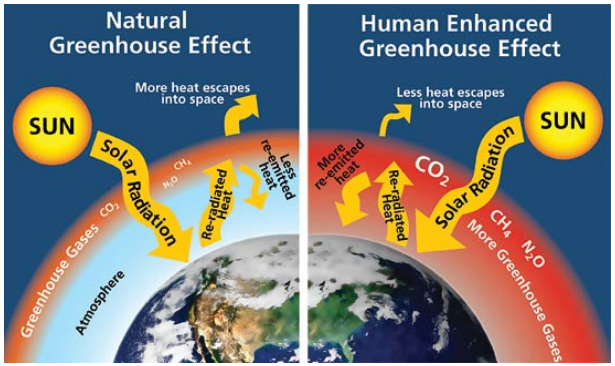


Image Source: National Parks Service (2015)

This heating is not good for the Earth. Global warming could cause the extinction of many animals, as well as an increase in extreme weather. As a result, I wanted to study existing chemical technologies which could slow down global warming.

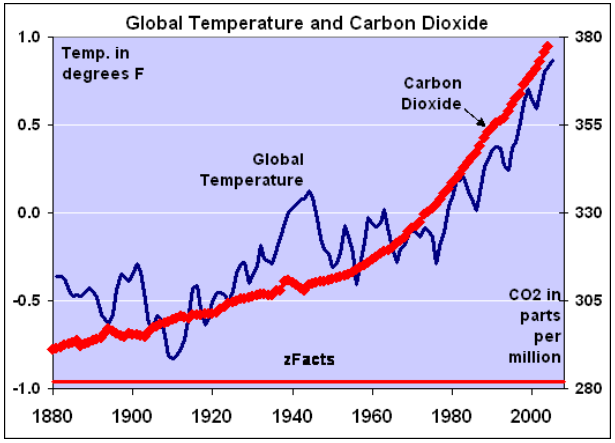
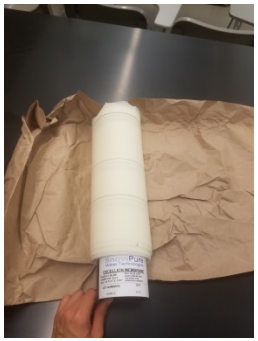


Image Source: zFacts (2006)

How to Capture Carbon Dioxide:

To capture the Carbon Dioxide, I used an ion-exchange resin called I-200 from Snowpure in San Clemente, CA. The resin was originally meant for purifying water, so it had to be chemically transformed to capture Carbon Dioxide.

The sheet came in a large 25 ft. roll, shown below. The sheet itself is made of polypropylene and in its original form has chlorine ions on it to remove positive ions from water.



After it's treated in a 90 ° C water bath and has its Chlorine ions replaced with Hydroxide ions, the exchange resin is ready to capture Carbon Dioxide. It can capture Carbon Dioxide in two hour cycles.

For one hour, when the sheet is dry, it will capture Carbon Dioxide, but once the sheet is dipped in water, the sheet will release Carbon Dioxide for another hour. The cycles can be repeated 1,000+ times.

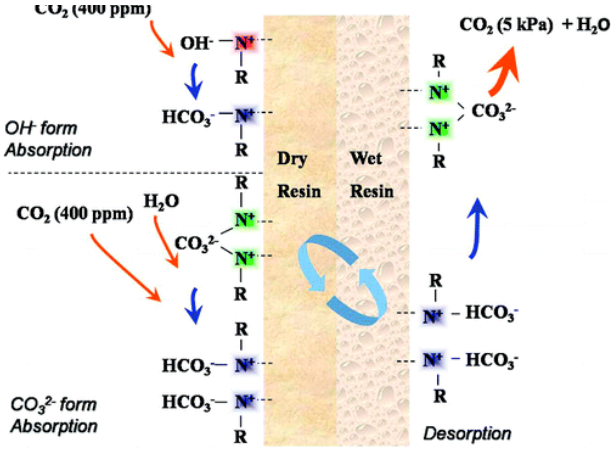
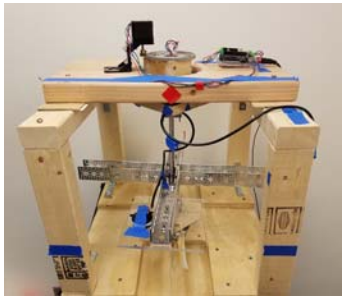


Image Source: Lackner et al (2011)

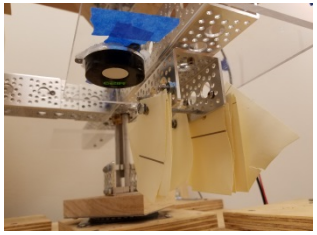
Building the Machine:

In order to capture the Carbon Dioxide, I had to build a machine that could repeat the wet/dry cycles of the resin. Further, since this machine needed to have practical future applications, it needed to be automated.



The machine has spaces for a box of water, and a release box. It rotates through these boxes and the open air to capture Carbon Dioxide.

One of the "arms" of the machine has small squares of the ion-exchange resin, shown right, as well as a COZIR Carbon Dioxide sensor.



The leadscrew (the dark long screw in the middle), as well as the two guide-rails around it, move the arms of the machine up and down, in and out of the water and release boxes when powered by a motor.

The gear shown right moves the arms between the two boxes. I then used an Arduino micro-controller and an Adafruit v2 motor shield to automate the machine.