Carbon capture and storage essay

We ust also look at what to do with the captured C02 and that is where the storage part of the process comes in. The last thing to go over Is some of the state of the art designs that are paving the way for the future of carbon capture.

The Carbon Capture and Storage(CCS) process is under a lot of criticism due to the impractical designs and the amount of money that it takes to accomplish any results worthwhile. It is known to be an extremely expensive method of reducing emissions from fossil fuels[l].

The Department of Energy estimates CCS can cost anywhere from $150-$200 per ton of C02 captured, and that can add up when you start talking bout using designs in large scale power plants where they could potentially capture thousands and thousands of tons. The only thing that makes it economically viable is the fact that It would help Industries that are large polluters, like the coal Industry, to put a cap on C02 emissions. If this kind of regulation is mandated, it could be a problem for some power suppliers and financially destructive to their companies.

That is why this CCS process is still being considered for real world usage[l]. It was said by Joe Ralko, Manager of Corporate Communications for IPAC-C02, that This Is a growing Industry, and Ilke any Industry you have technology going ahead of the standards[l]. ” That is why two Canadian organizations have announced a partnership to develop a set of standards for carbon capture and storage(CCS) . CCS projects are underway worldwide and it is Important to talk about the standards for your projects when you are trying to come up with designs.

The industry Itself Is growing rapidly and it's said that it could be bigger than the natural gas industry in approximately forty years[I]. Since there are no universal set of standards governing he process of C02 extraction, transport, and sequestration, these two companies are making sure there are a set of safety standards. and site selection standards to make sure that the projects are completely safe[I]. Below, some of the designs and new technologies relating to CCS are briefly described. Keep in mind that these are Just a few different ways to capture carbon.

New designs are being implemented rapidly so It is very hard to understand every type of technology that Is out there as of today.

To understand the designs that go along with carbon capture, it is important to understand the process. The process that the class will focus on is the pre-combustion or post-combustion C02 capture. Pre-combustion capture is most applicable In gasiflcatlon plants where fuels are converted Into gas by a heating process. These fuels are burned which in turn produces a certain amount of C02 and H2.

These two gases are mixed together most of the time so it is important to 1 OFA much higher in concentration so it is much easier and less expensive to use pre- combustion capture rather than post-combustion[2].

For the project it would be easiest to do some type of pre-combustion capture because it would make everything heaper and simpler. A simple solution of this nature may be diverting the C02 produced in the brewery into a pool of algae that absorbs the C02 as part of its life cycle. Post-combustion capture refers to removal of C02 from combustion flue gas. he capture process is located downstream of pollutant controls so that the gases are less particulate.

Post-combustion C02 capture offers the greatest near-term potential for reducing power sector C02 emissions because it can be retrofit to existing coal-based power plants and can also be tuned for various levels of C02 capture, which may accelerate market acceptance [2]. One of the most recent Journal articles that has been written is about a plant in Queensland Australia that was finished in December of 2010. The plant is the third of its kind and it is an amine based technology for C02 capture from coal combustion flue gases.

The capture of C02 is at a rate of 100kg of C02/hr[3]. The flue gases are taken from the large power station gas duct downstream of the draft fan.

The whole process consists of three main steps including the pre-treatment, absorption, and stripping. The gas first undergoes a caustic scrubbing where a very hot gas is Nashed with a special solution. This cleaning removes any acidic components or particulates that you don't want in your finished product. Once this cleaning occurs, the gas goes through a blower which helps it enter the absorber column.

This absorber is where the solvent flows against the gas to capture the C02.

This mixture of liquid and gas helps remove any leftover particulates as well. The now C02 rich solvent flows through a heat exchanger that separates the C02 and water vapor that rises up a column into a condenser. The last step involves a knock out drum that separates the vapor from the pure C02[3].

The vapor is also reused and pumped ack into the system to reuse it in the next cycle. The most special thing about this plant's C02 recovery system is that it can be run for 24 hours a day, 5 days a week.

This amount of operation time can quickly add up to many hours of operation and a ' ery high percentage of carbon capture. It can also reduce operation cost due to the continuous movement of parts and the ease of operation. The article does not specify Nhat this plant does with its captured C02 but it does say that they do capture a very large amount compared to other systems that are in place around the world. This igh volume of capture also allows for gas and liquid samplings that help further research on how to pack and distribute the C02 in different ways[3].

This system of capture may be a little too advanced to insert into a small scale setting, but some of the research that has come of this process allows us to Justify carbon capture as a " hole. This plant is having success on a large scale and that paves the way for designers on a small scale such as our class.

When looking at what designs people have come up with it is good to look at both the newer designs and some of the older designs so that you can see the full pectrum of technology. One of the older processes to remove C02 from a gas stream is to use a cross-flow or a moving bed reactor.

It works by taking the gas Inside a reactor that contains an alkali-metal compound. When a chemical reaction bicarbonate[4]. After the first reaction is completed this bicarbonate is moved to a second reactor where it is heated or treated with a reducing agent such as natural gas.

This releases the carbon dioxide gas and regenerates the active material for use as the sorbent material in the first reactor. Lastly there is a C02 removal process that nvolves continuously moving a dry sorbent vertically through a moving bed reactor. his unaltered steam of gas moving at a regulated speed reacts with an active material to remove the carbon dioxide. This whole processes key is chemical absorption and without it the carbon dioxide cannot be separated from the original compound mixed with the alkali metal[4]. Below is a simple schematic that summarizes the entire cycle.

It is all based on reusing everything and making sure the carbon dioxide is separated completely from the metal. For reference, the patent number for this process is 6, 387, 337.

In the carbon capture book written by Hester and Harrison there is a section on Nhat is known as the C02CRC Otway Project. This project is being conducted in Australia and is known to be an innovative way to reduce greenhouse gas emissions.

rhe project is of global significance because of the sheer quantity of C02 that has been stored in a depleted gas reservoir deep underground. They have stored over 55, 000 tons of C02 in this underground reservoir[5]. Another reason why this project should be studied is because of its great monitoring system that makes the process a lot more comprehensive.

The project works with Just a few simple steps. The first step is taking the gas and injecting it into the depleted gas reservoir through a dedicated injection wall. A nearby well is used to monitor the injected carbon dioxide.

The next stage is to evaluate carbon dioxide storage in deep saline formations. This analysis and data collection of the underground well is very helpful in determining the amount of C02 we really could store in underground wells. The most recent development in this project is a residual gas saturation test. Five tests Nere done by pumping water underground.

These tests are still being analyzed but t is said that there could be some very pertinent information to come from the tests.

A very simple illustration can be seen below on how the whole process works and how the two stages are integrated [5]. The main thing that is drawn from all the research is that there are a lot of different technologies out there. It’s hard to say which one our group could use to solve our small scale problem, but a solution may come easier with a better understanding of the technology. A lot of capture processes have to do with the mixture of gases and separating the specific gases so that they can each be utilized.

One process we talked about was mixing gases with alkali metals while another process had a large portion of H2 involved.

For our brewery problem, the fermentation tanks produce a pretty pure stream of C02. This simplifies the problem to an extent but we can also talk about what to do with the C02 once it is separated. rhe most successful way that has been utilized so far is ground storage. Another absorb the gas naturally.

This would reduce emissions and help the growth of algae. Ne also looked at some of the best research projects that are going on in todays.