Incorporating TerraFixing's DAC into the Allam Cycle

Summary

TerraFixing's DAC technology can be incorporated neatly into the Allam cycle. Our technology can replace the front-end purification unit while being able to capture and concentrate 9.7 metric tons of CO_2/day from the air (for a 300MW power plant). This will cost approximately 0.4 MW to run. Another opportunity for our technology lies in using the Allam cycle to power our DAC process. With energies as low as 1 MWh/metric-tonCO_2, a 300 MW Allam Cycle power plant could power 7200 metric tons of CO_2 being capture per day using TerraFixing's technology. This would equate to 2.6 million metric tons of CO_2 being capture per year.

Overview

The Allam Cycle first separates the O_2 from the air then combusts the biomaterial/natural gas/oil/biogas/coal to produce a stream of CO_2 and H_2O. This can be seen below:

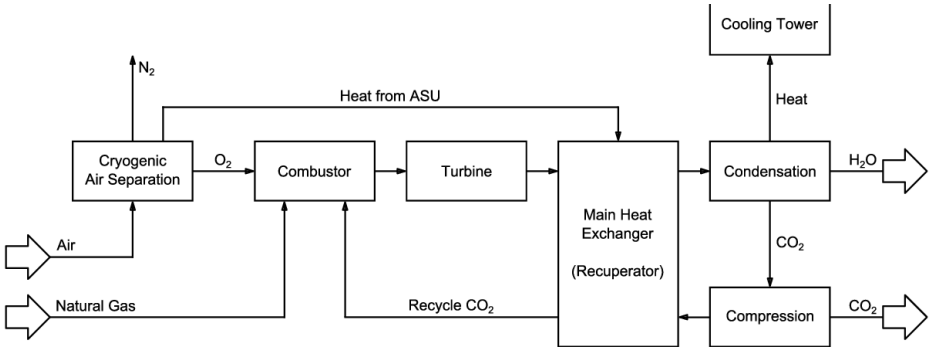

Figure 1 - PFD of the Allam Cycle

The initial step of separating the O_2 from the air is where the opportunity lies for TerraFixings DAC technology. Before I explain the opportunity, let me give you an overview of the O_2 air separation process. For a 300MW facility, approximately 3500 metric tons of oxygen are required per day (https://doi.org/10.3390/cleantechnol1010022). To do this, a cryogenic air separations unit is required such as that offered by Air Liquide which is shown in Figure 2. This unit first separates the water and CO_2 from the air in the front-end purification, before sending the inert gases of N_2, O_2, and Ar to be separated in the distillation column. So, this process already captures the CO_2 from the air. However, they do not concentrate it but release it back into the air. TerraFixings technology can be incorporated into the process and capture this CO_2 that passes through the column. Our DAC technology allows this CO_2 to be capture from the air and concentrated more than 95% to meet pipeline specification for sequestration.

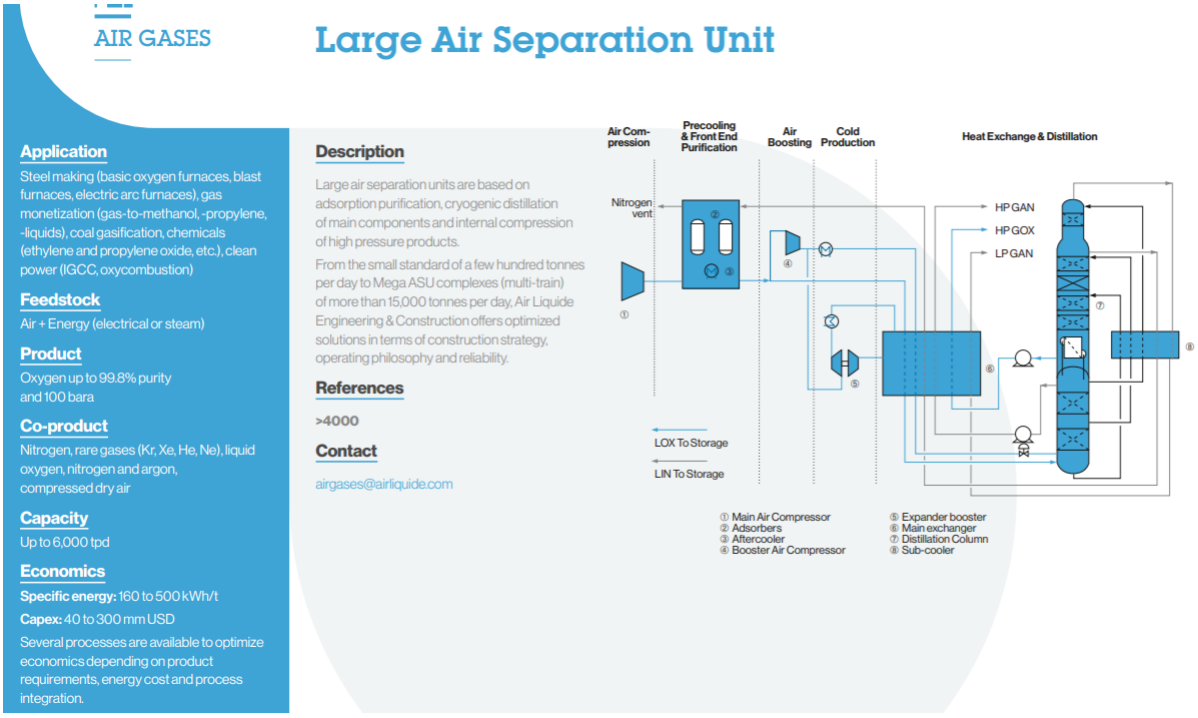

Figure 2 - Air Liquides air separation unit

By incorporating our technology into a 300MW Allam Cycle power plant, we can capture and concentrate the 9.7 metric tons of CO_2/day that pass through the air separation unit. This will require 0.4 MW of power from the 300MW power plant to be able to capture the CO_2. This was incorporated into the PFD of the Allam Cycle from before (Figure 3). It should be noted that a large portion of this energy penalty is already paid with normal front end purification but without capturing the CO_2.

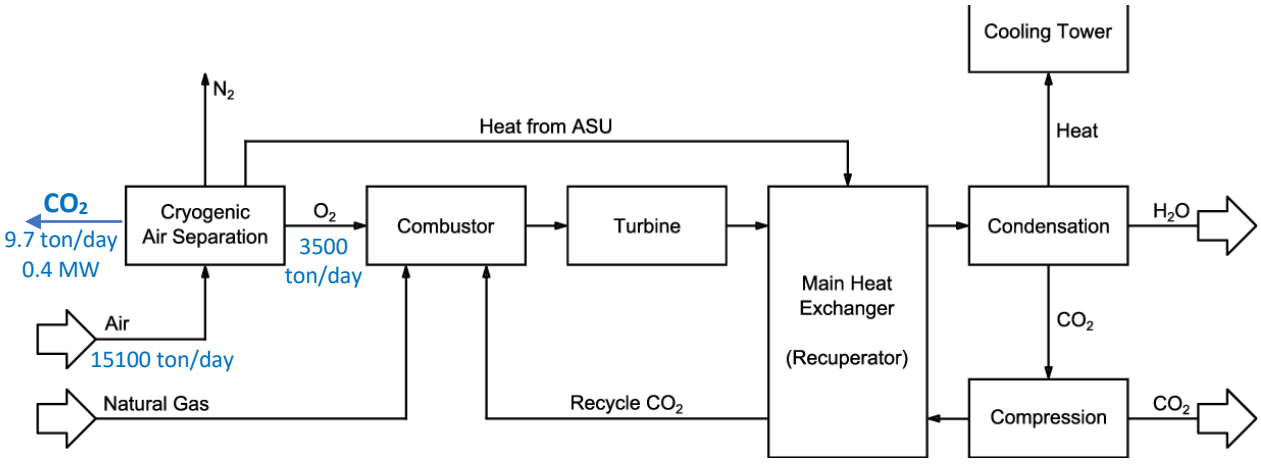

Figure 3 - PFD of the Allam Cycle including TerraFixing's technology

The Allam cycle can also be used to power TerraFixing's DAC technology. This technology thrives in cold and dry conditions in places like Canada, Alaska, Greenland, Norway, Antarctica, Russia, Finland, Iceland, Svalbard, and the Tibetan Plateau. In these cold conditions, energies as low as 1MWh/metric-tonCO_2 are achieved. For a 300 MW facility, this would mean being able to capture 7200 metric-tons of CO_2 per day. Over the course of a year, this would equate to capturing 2.6 million metric-tons of CO_2 per year.