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Project Tundra and the Future of Carbon Capture Technologies

On April 20th, the Minnkota Power Cooperative announced its plans for Project Tundra, a $1 billion proposal to open the world's largest power plant-based carbon capture facility. The project will attach to the existing 455-megawatt coal-burning Milton R. Young Station in Center, North Dakota and is expected to sequester over 90 percent of current carbon dioxide emissions: the equivalent to removing 600,000 cars from our nation's roadways. In order to achieve this massive reduction in carbon footprint, flue gas from the coal plant will first pass through a scrubber to remove sulfates and other impurities before passing into an absorber with liquid-based amine solution. Heat will next be applied to release the amines, and the pure carbon dioxide will finally pass through a compressor to produce liquid CO_2. In this final form, the carbon dioxide will be pumped a mile beneath a neighboring coal mine, where it should be permanently stored. Once the outstanding capital is raised through investors and grants, construction of the facility is planned to begin in 2022, with the plant going online by 2025.

Even though carbon capture technologies have the potential to cut 10% of emissions by 2050 according to the 2015 Paris Climate Accord, carbon sequestration and storage are not without their challenges. This was demonstrated firsthand in our lab setting as we looked to optimize a bench-top fixed bed absorber. Using Norit RB2 activated carbon, we were able to produce adsorption breakthrough curves of carbon capture from CO_2-He gas mixture. Even across varying temperatures and concentrations though, the efficiency of CO_2 removal only reached high levels with high energy expenditure, leaving very much to be desired. This is equally demonstrated when scaled-up to the power plant setting. A normally operating coal plant utilizes around 7% of the energy it produces to run its own equipment. However, when coupled with a carbon capture facility, over 33% of energy production may be required for operation of the plant itself. While not necessarily an outcome, some experts believe this major power sink could cause the cost of coal-produced electricity to skyrocket from $30 to $96 per megawatt hour.

The fact that only two plants like Project Tundra, one in Texas and one in Saskatchewan, currently exist indicates that many economic and political barriers must still be overcome before carbon capture enters the mainstream market. The energy- and water-intensive nature of existing carbon capture plants and the inability for major scale-up of our lab-based packed bed absorber additionally present physical barriers that must be overcome. Yet, this only makes the study of new avenues and technologies even more essential. As this blog post is being written on April 24th, the Department of Energy just announced up to $131 million in funding for carbon capture, utilization, and storage (CCUS) research and development. Additionally, special funding is being allocated for coal- and natural-gas-based flue gas, as power plants like the Milton R. Young Station are still major contributors of greenhouse gas emissions. Carbon capture is an incredibly exciting field, and laboratory studies have shown great promise. However, it will be the adaptation of these processes to industrial applications over the next decade that can make the largest impact, as we all seek to create a more sustainable future.

1. Ong, Sandy (2020) "A North Dakota Utility Wants to Build the World's Largest Carbon Capture Facility at a Power Plant." *The Spectrum*.
2. United States Department of Energy (2020) "US DOE Announced $131 Million for CCUS Technologies." *Department of Energy*.