Integrating Carbon Capture and Storage into Sustainable Aviation Fuel Supply Chains

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Introduction
- The aviation industry is responsible for 2-3% of global greenhouse gas emissions and is growing each year.
- While the land transportation industry is beginning to electrify, the aviation industry primarily uses petroleum-based fuel.
- There have been plenty of studies into alternative jet fuels but producing these fuels still creates greenhouse gases.
- The addition of carbon capture and storage systems is crucial to ensure that CO2 footprints of sustainable aviation fuels are appreciably lower than conventional petroleum-based fuels.

Case Study of Fischer Tropsch Method with integrated Carbon Capture
- The main study that was looked at was on forestry residues being used as a feedstock using the Fischer Tropsch Synthesis to create a sustainable aviation fuel.
- One of the main considerations was the International Civil Aviation Organization (ICAO)’s Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), which details the methodology for achieving fuels with lower GHG emissions rate among the ICAO nations.
- One of the approved SAF production methods is the Fischer Tropsch Synthesis.
- In the Fischer Tropsch system, the biomass is first cleaned and then put through a gasification process. After this, the syngas is cleaned and during this section the CO2 is captured using an absorbent compound.
- With a carbon capture system in place, the CO2 output was much lower than without it even with the added emissions from the capturing system. This shows that this is a viable system that could be put in place in other possible plants. When there is carbon capture implemented into the plant it is estimated to have a CO2 capturing capacity projected to be -121.83 gCO2eq/MJ. Jet fuel with carbon capture systems aren’t in place there is estimated to be greenhouse gas emissions equal to 15.51 gCO2eq/MJ.
- While this research specifically investigated forestry residue using Fischer Tropsch there are a many other SAF feedstocks that also use this same pathway, such as municipal solid waste or some of the feedstock crops, allowing the model that is represented here to be used for even more pathways.
- The implementation of carbon capture systems on SAF plants provides a viable way to get a negative CO2 output from the fuel production making it less CO2-intensive than petroleum-based jet fuel.

Future Considerations for Carbon Capture and Storage
- While the Fischer Tropsch research that was looked at is very promising there are a lot of holes in this area of study that need to be looked into more in order for CCS implementation.
- One of the main issues is that previous studies have neglected the storage component of CCS and just assume that there is an underground facility near by the plant. In actuality there are a lot of criteria and permitting requirements for a site to be deemed viable for CO2 injection and storage.
- More consideration needs to be given to the location of the fuel plants as well, since the type of feedstock that is present near as well as the storage facilities in the area vary greatly from region to region.
- Overall SAFs are a growing field and becoming a more accepted alternative to the petroleum based jet fuel. Integrating CCS into SAF production pathways holds promise for further reducing emissions relative to petroleum-based fuels and contributing toward U.S. goals to achieve zero-carbon aviation.
- Carbon Capture is a reliable way for companies to lower their CO2 output compared to other programs such as planting trees which are sporadic and aren’t able to exactly offset the amount of CO2 produced like carbon capture can.

References

Acknowledgements
I’d like to thank all the members of my research cohort and especially Rachael Conaway for making this experience extremely fruitful with all of the trips that were able to take and the guest that were brought in. I also like to thank my mentor for the experience Dr. Anne Menefee for bringing me into her research and giving me new experiences.