Development of Highly Efficient Direct Air Capture (DAC) and Carbon Recycling Technologies

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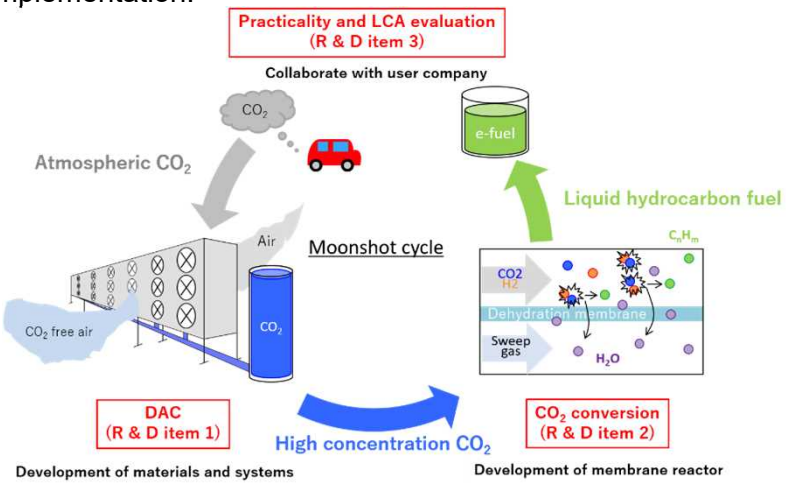
Summary

The following three items will be developed for establishing a carbon recycling technology which capture CO_2 directly from the atmosphere (Direct Air Capture) and convert the recovered CO_2 into valuable resources.

R & D items 1. "Development of high-efficiency CO_2 capture technology from the atmosphere"
(1) Develop a new solid sorbent material for capturing low-concentration CO_2, and (2) Develop a system that can recover low-concentration CO_2 with high efficiency. Since the processing volume for CO_2 separation and recovery for CCUS/Carbon recycle is one-order larger than the other processes in the chemical industry, a durable material against high flow rates and temperature/humidity changes will be developed for a bench-scale test and social implementation.

R & D items 2. "Development of CO_2 conversion technology for carbon recycling into valuable resources"
- Development of CO_2 conversion technology (FT synthesis) using an inorganic separation membrane reactor for synthesizing liquid hydrocarbon fuel from CO_2 in the highest efficiency and the lowest energy consumption.

R & D items 3. "Practicality assessment of a DAC & CO_2 conversion system using LCA method"
- Life cycle assessment (LCA) and economic evaluation of the combined DAC and CO_2 conversion process cooperating with other project and/or private companies.



Conceptual diagram of this research and development

KPI

FY2022	FY2024	FY2029
Finding out a new solid sorbent material for capturing low-concentration CO_2. Achievement of a low-temperature heat driven TSA process for a rough enrichment of CO_2 from air. Development of the water separation and hydrogen separation membranes for membrane reactor, and demonstration of the effectiveness of membrane reactors for FT synthesis in lab-scale experiments.	Determining the appropriate amine species and its supporting solid material for a bench-scale DAC test. Proposal of a process configuration of DAC system for high enrichment of CO_2 and further improvement. Conducting a primary Life Cycle Assessment based on literature search and lab.-scale test results and obtaining economic feasibility of the DAC system combined with CO_2 conversion processes.	Establishing the DAC technology providing high quality CO_2 enough for the CO_2 conversion processes. Final confirmation of the net CO_2 reduction amount produced by the entire DAC & CO_2 conversion system by applying the Life Cycle Assessment.

Implementation

Kanazawa University, Research Institute of Innovative Technology for the Earth (RITE)