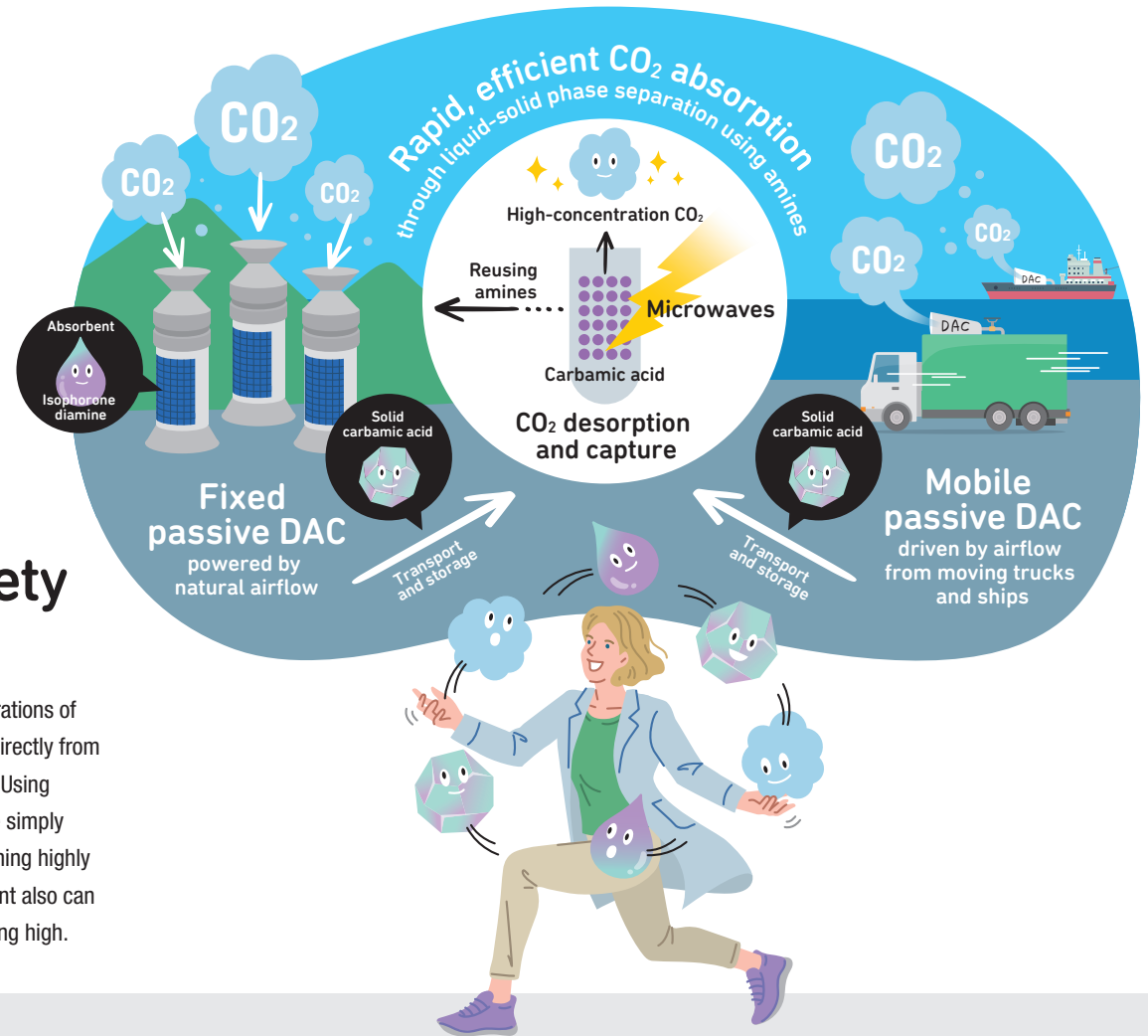


# 05 PROJECT

## World's Fastest Carbon Capture System Extracts CO<sub>2</sub> from Ambient Air Future Applications to Promote Full-Fledged Carbon-Recycling Society

### Research and Development of Passive DAC Technologies

No method of countering climate change is as effective as Direct Air Capture, or DAC. However, concentrations of CO<sub>2</sub> in ambient air were previously thought to be too low to allow the CO<sub>2</sub> to be captured efficiently and directly from the air. There is a substance called isophorone diamine that turns this conventional thinking on its head. Using isophorone diamine as an absorbent in DAC systems allows even low-concentration carbon dioxide to be simply and easily solidified for capture. The passive DAC system currently in development is capable of maintaining highly efficient CO<sub>2</sub> absorption for extended periods of time without any forced air flow. In addition, the absorbent also can be reused after absorption and release of the CO<sub>2</sub>. Expectations for practical use of this system are running high.



### Fateful Encounter with Key Compound in Achieving CO<sub>2</sub> Capture

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We were initially researching DAC using catalysts, but in a stroke of luck we happened to hit upon isophorone diamine. We then decided to change direction and began to work on absorption and solidification of CO<sub>2</sub> without a catalyst. While our initial goal is to solidify and collect CO<sub>2</sub> efficiently, in the future, we envision taking this a step further. Solidified CO<sub>2</sub> can be stored for extended periods, remains stable in transport, and can be extracted when needed, making it a prime candidate in supporting a carbon-recycling society as an alternative to conventional fossil fuel resources. As this carbon resource is obtained from the atmosphere, it has been dubbed SkyCarbon®.

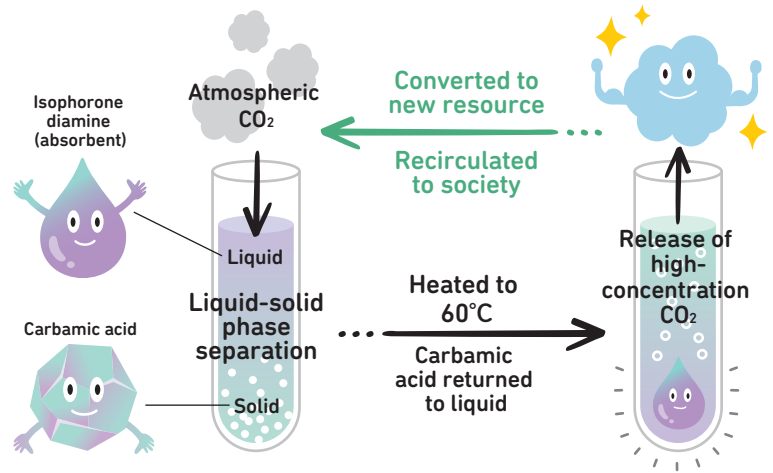
**World's Fastest Carbon Capture System Extracts CO<sub>2</sub> from Ambient Air  
Future Applications to Promote Full-Fledged  
Carbon-Recycling Society**

>> **Presenting the Optimal CO<sub>2</sub> Absorbent**

This passive DAC system captures air from all directions using only natural air flow, with no additional energy input required, resulting in a superior system that captures CO<sub>2</sub> without the additional costs required in forced-air systems. CO<sub>2</sub> absorbents used thus far have been hampered by slow reaction speeds and inefficiency, but we discovered that through the mechanisms of liquid-solid phase separation using isophorone diamine as the absorbent, CO<sub>2</sub> can be captured extremely efficiently and collected as a stable solid for storage and transport. This system has achieved capture rates among the highest in the world.

>> **The Earth's Atmosphere:  
A Resource Repository**

Microwaves of wavelengths near those used in microwave ovens can be produced using electricity, with the further advantage of being able to heat objects efficiently and be targeted with pinpoint accuracy. Microwaves heating captured CO<sub>2</sub> separates the CO<sub>2</sub> from the absorbent, allowing recovery of nearly



100% pure CO<sub>2</sub>. The highly concentrated captured CO<sub>2</sub> is repurposed when converted into energy, plastic materials, or other products. Furthermore, since the absorbent also can be reused after separation from the CO<sub>2</sub>, completing development of this system can lead to a full-fledged carbon-recycling society. Incidentally, this DAC system can be installed in cities and other locations to gather ambient air from any direction, and it can also be used with cars and ships, so the system may become a common sight in societies of the future.

**KEYWORD**

**Liquid-Solid Phase Separation**

This is a process of separating substances in a mixture, for example the separation of water and oil in salad dressing. This phenomenon causes the liquid absorbent to separate from the solid material that has absorbed CO<sub>2</sub>, giving the absorbent increased CO<sub>2</sub>-absorbing capacity and allowing capture of even more low-concentration atmospheric CO<sub>2</sub>.

**FUTURE VISION**

2025

**Gather Knowledge and Create a Test System**

We will first create a test system bringing together various technologies from the universities and companies involved in the project.

2027

**Demonstrate Effectiveness with Twin Towers**

We will verify the performance of a mid-sized, fixed passive DAC system using two towers: an intake tower and an exhaust tower. The goal at this point is to determine the prospects for achieving carbon neutrality or carbon negativity.

2029

**Make DAC a Common Sight**

We plan to complete the development of a system capable of capturing 100 kg of CO<sub>2</sub> per month using a single tower, integrating the functions of the intake and exhaust towers. This DAC system will be installed on a university campus.

