

Achieving Carbon Neutrality and Hydrogen Economy

- Creating a Sustainable Future with 'KDS-DAC™', Which Combines CO₂ Capture with Hydrogen Generation -

Daishinku Corp. (President: Minoru Iizuka) is pleased to announce that it is developing KDS-DAC™, a direct air capture (DAC) system that will capture CO₂ affordably and provide a cost-effective approach to generate hydrogen, aiding the transition to a hydrogen economy.

KDS-DAC™ targets

- CO₂ capture cost ¥30 per kg-CO₂ (market rate: ¥90–130 per kg-CO₂)
- Hydrogen price ¥600 per kg-H₂ (market rate: ¥1,650–2,200 per kg-H₂)

Note: ¥600 per kg-H₂ is the goal for the 1st step; the goal for the 2nd step is ¥300 per kg-H₂.

Development of the new DAC system 'KDS-DAC™'

The KDS-DAC™ is designed to solve two bottlenecks in transition to hydrogen economy. The first bottleneck is that DAC technology remains an unaffordable and inefficient method of carbon capture. To capture large volumes of CO₂ at the low concentration of 0.04% in the Earth's atmosphere, conventional DAC systems must be large, reducing the number of places where they can operate and making them prohibitively energy-intensive. The second bottleneck is hydrogen prices. With high transport costs and electricity costs, hydrogen prices remain high, obstructing the transition.

In an entirely new approach, Daishinku's upcoming KDS-DAC™ will address the problems of CO₂ capture costs and hydrogen pricing at the same time with a three-step cycle of CO₂ capture and hydrogen generation, as illustrated in Figure 1.

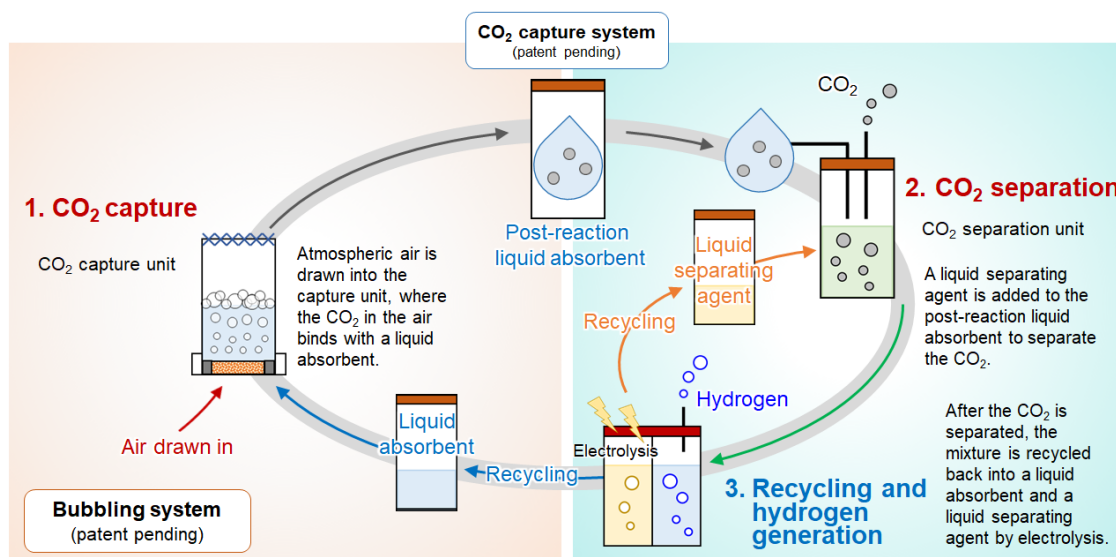


Figure 1: Overview of KDS-DAC™

KDS-DAC™ offers an affordable method of CO₂ capture for the following reasons:

- The agents are recycled, enabling lower running costs.
- The system is practical, consisting of a simple tank and electrolysis unit.
- Because hydrogen is generated when the agents are recycled, the system enables the sale of CO₂ capture and hydrogen.

Achieving Hydrogen Economy

For the hydrogen economy to be feasible, hydrogen prices must be lower. In the case of hydrogen fuel, hydrogen cars will only proliferate when filling the tank with hydrogen costs drivers just half the price of refueling a car with gasoline. In the case of power generation, hydrogen power generation will only proliferate when hydrogen power plants generate power at a similar cost to nuclear power generation.

- **Benchmark for hydrogen fuel**

A hydrogen car costs approximately ¥4.0 per kilometer, while a gasoline-powered car costs ¥8.5 per kilometer

Note: Calculation on the basis that gasoline costs ¥170 per liter and allows the car to travel 20 kilometers per liter and that hydrogen costs ¥600 per kilogram and allows the car to travel 150 kilometers per kilogram.

- **Benchmark for hydrogen power generation**

In the case of Japan, hydrogen generates power at approximately 1.2 times the cost of nuclear power generation, with hydrogen costing ¥600 per kilogram.

Given that atmospheric CO₂ concentrations are relatively high in sites of energy transition, KDS-DAC™ will capture CO₂ efficiently and cost-effectively if it operates in the vicinity of a thermal power plant or other carbon-intensive power plant. If a hydrogen power plant is located on the site of a carbon-intensive power plant, the cost of transporting hydrogen would be significantly reduced, making the cost of power generation at such power plant similar to that of nuclear power generation. Such hydrogen power generation would also offset the CO₂ emissions from the carbon-intensive power plants, helping the provider to reach net-zero emissions, even with its existing power plants.

Creating a Sustainable Future with a Circular Business Model for CO₂ Capture and Hydrogen Generation

Amid an increasingly severe climate crisis, KDS-DAC™ has the potential to reduce carbon footprint while generating economic benefits. This technology will mark a first step toward carbon neutrality and a hydrogen economy. As an organization committed to making a genuinely positive social impact, Daishinku Corp. is strengthening partnerships with other companies to accelerate the rollout of KDS-DAC™.