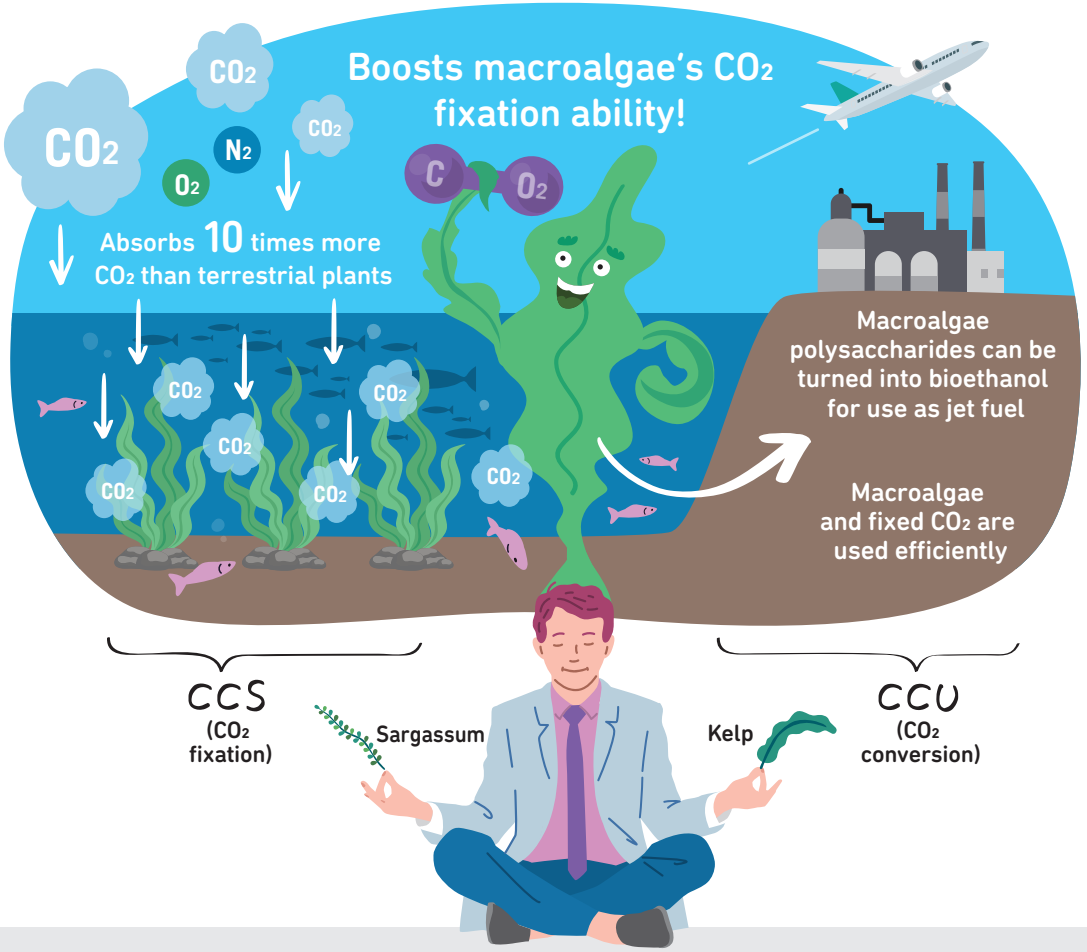
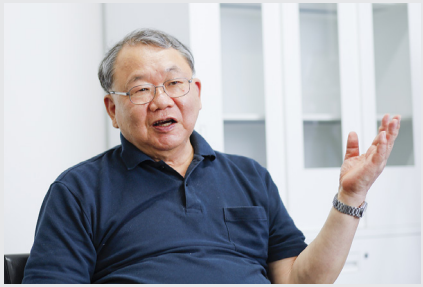
06 PROJECT

From Fixing CO_2 to Producing Energy, Marine Brown Macroalgae Play a Major Role

Redesign of Macroalgae for Highly Efficient CO_2 Fixation by Functional Modifications and Their Product Generation

What do you associate with “Blue Gold?” This term means that there are precious resources (Gold) in the ocean (Blue). The goal of our research is to realize the ultimate resource circulation system; one that utilizes the resources of the ocean to rehabilitate the global environment and produce materials. We aim to improve the CO_2 fixation rate of macroalgae and treat them as unused resources, converting them to bioethanol for fuel and for other uses. Since macroalgae farms are also places for fish to spawn and grow, this system is expected to have a positive impact on the ocean industry, too. This initiative is unique to Japan, a country surrounded by the ocean.





Becoming a Leading Maritime Nation by Expanding Macroalgae Farming and With CO_2 Resource Conversion Technology

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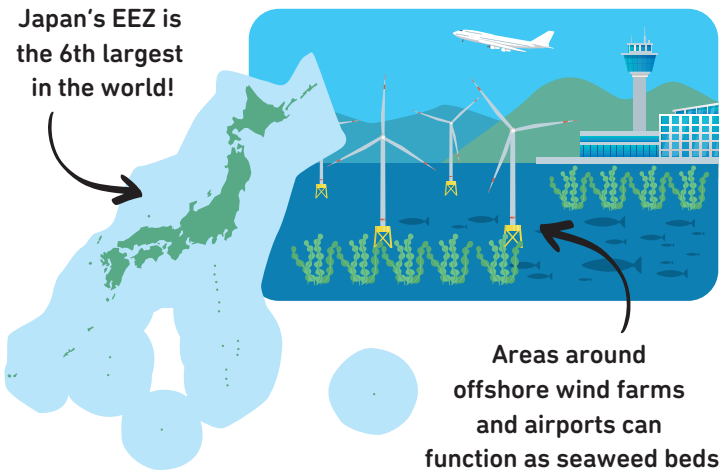
This macroalgae cultivation technology wasn’t possible anywhere in the world until now. Our technology to produce bioethanol from macroalgae is also a world first. If we can combine these two technologies to allow for widespread use of bioethanol that can replace fossil fuels, it will benefit the environment tremendously. Japan is an island nation that is well-suited for social implementation of these two technologies. Although Japan is dependent on other countries for much of its energy supply, we hope these technologies will help Japan contribute to the world going forward.

From Fixing CO_2 to Producing Energy, Marine Brown Macroalgae Play a Major Role

» The Outstanding Hidden Abilities of Macroalgae

As a result of extensive genetic research focused on selective breeding to enable macroalgae to fix CO_2 more efficiently, it is now possible to cultivate all species of macroalgae. Presently, we are planning to expand the cultivation areas within Japan's exclusive economic zone but beyond the immediate vicinity of offshore airports and wind farms, while simultaneously conducting tests at various ports in Japan. Plants fix CO_2 through photosynthesis, but compared to terrestrial plants, large macroalgae have an overwhelmingly superior ability to fix CO_2. They can also contribute to energy production and the ocean industry. For these reasons, macroalgae are praised as "Blue Gold" capable of restoring and conserving the global environment. By using the inedible parts of macroalgae like sargassum that are rarely consumed by humans, we can avoid competition with food production.



» Will Airplanes Fly Using Macroalgae-Based Fuel?

The polysaccharides that macroalgae produce through photosynthesis can be converted into ethanol and used for airplane jet fuel and other forms of energy. A key role here is being played by newly invented ***arming yeasts*** that increase the efficiency of sugar breakdown.

KEYWORD

Arming Yeasts

These yeasts have enzymes resembling arms that are arming on the yeast surface. Using these yeasts to catalyze chemical changes helps the breakdown of sugars and other unused resources that do not readily decompose, making ethanol easier to produce.

FUTURE VISION

2025

Start a System Combining Newly Developed Technologies

We will operate a new system that combines our proprietary macroalgae cultivation and ethanol-producing yeast technology.

2027

Aim to Become a Leading Exporting Nation

In addition to conserving and restoring the environment, resource-poor Japan may be able to reduce its dependence on imported fossil fuels for energy.

2029

Welcome the Age of Aviation Energy Self-Sufficiency

We aim to increase macroalgae production to 210 tons per hectare per year, increase CO_2 fixation to 8 to 10 kg-CO_2 per m^2, and increase the CO_2 fixation rate to 200 times that of terrestrial plants. Our objective is to contribute to aviation energy self-sufficiency by 2030 with macroalgae-derived products.

Implementation Kyoto University, Kyoto Institute of Technology, Mie University, Green Earth Institute Co., Ltd., Kansai Chemical Engineering Co., Ltd.

Project Introduction Video https://www.youtube.com/watch?v=F95Kte8ZIno&list=PLZH3AKTCrVsVm3UN1x40WW_QK-cEXaoo3