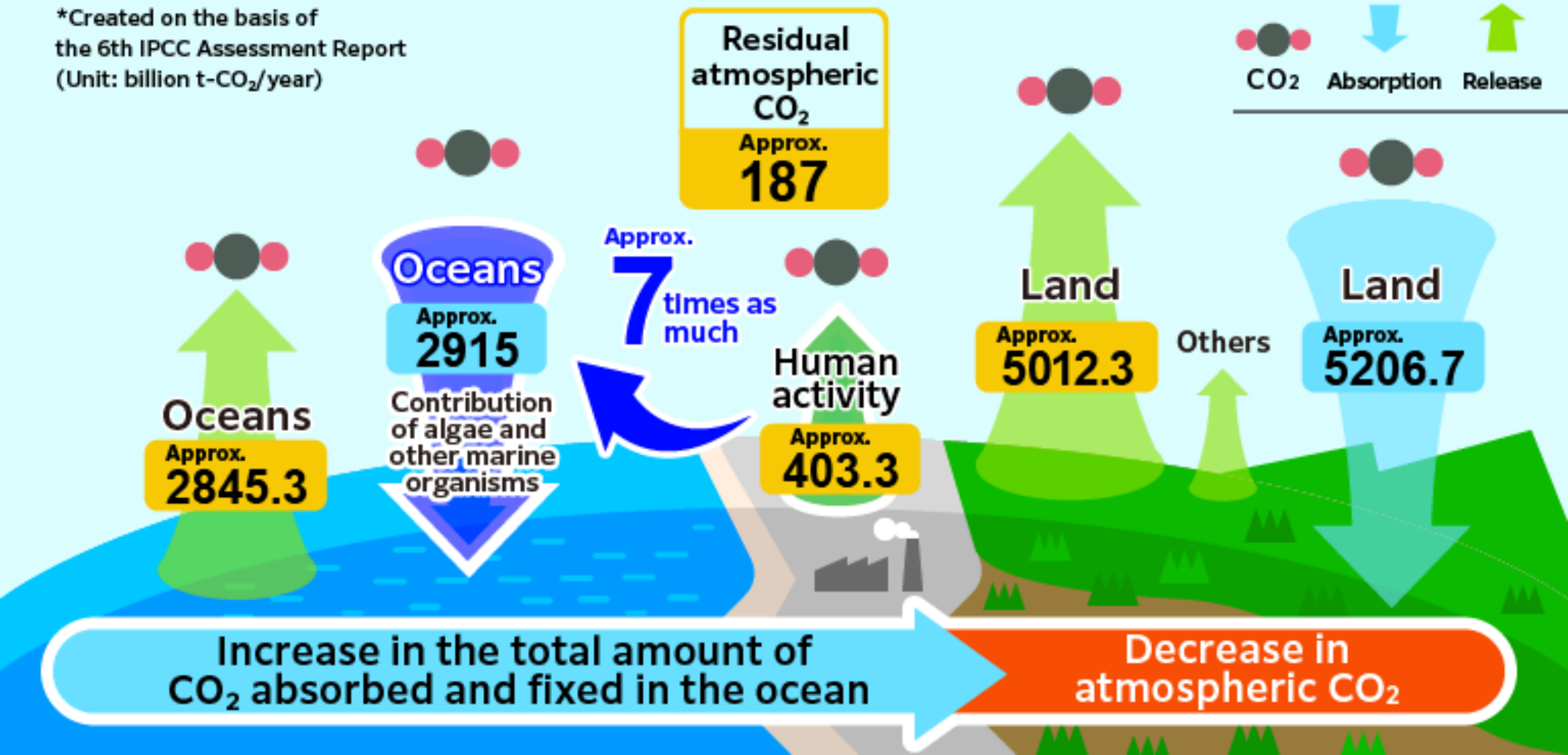
Measures to reduce CO2 emissions by marine organisms

IPCC Global carbon (CO_2) budget

NTT

*Created on the basis of
the 6th IPCC Assessment Report
(Unit: billion t-CO_2/year)



Atmospheric and Oceanic Carbon Cycle Model

NTT

This study targets the carbon cycle shown in 1~3

Atmospheric CO_2

Dissolving

Release

1 Exchange of atmospheric and oceanic CO_2

Dissolving $CO_2 \rightleftarrows HCO_3^-$ and CO_2^{2-}

Respiration by marine organisms

Absorption and fixation by photosynthetic organisms

Calcification

Partially release

Decomposition and sedimentation

4 Persistent organic carbon

5 Carbon in sediments

2 Organic carbon in marine organisms

3 Carbonates such as shells and bones

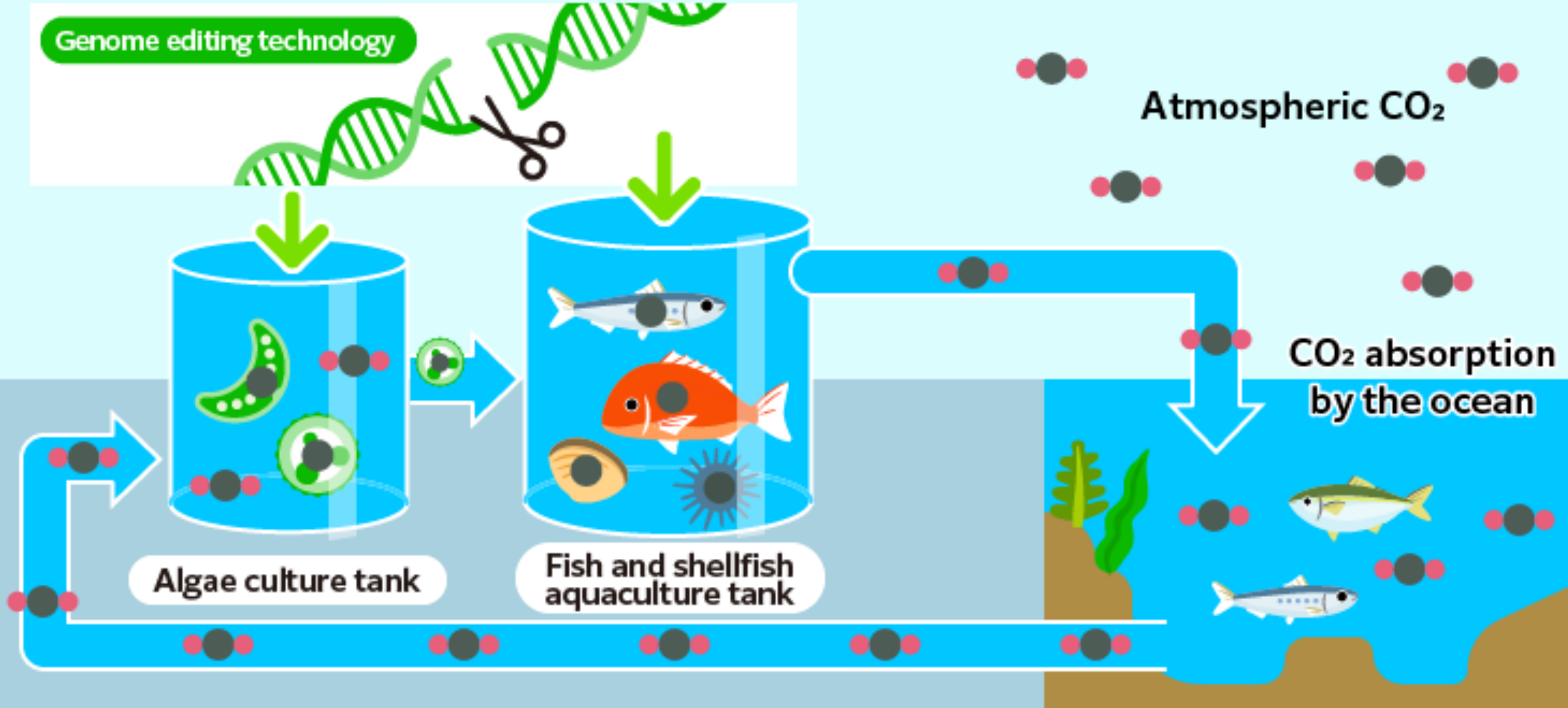
Shallow water

Seafloor and deep sea

Carbon Cycling in Land-based Aquaculture and Application of Genome Editing

NTT

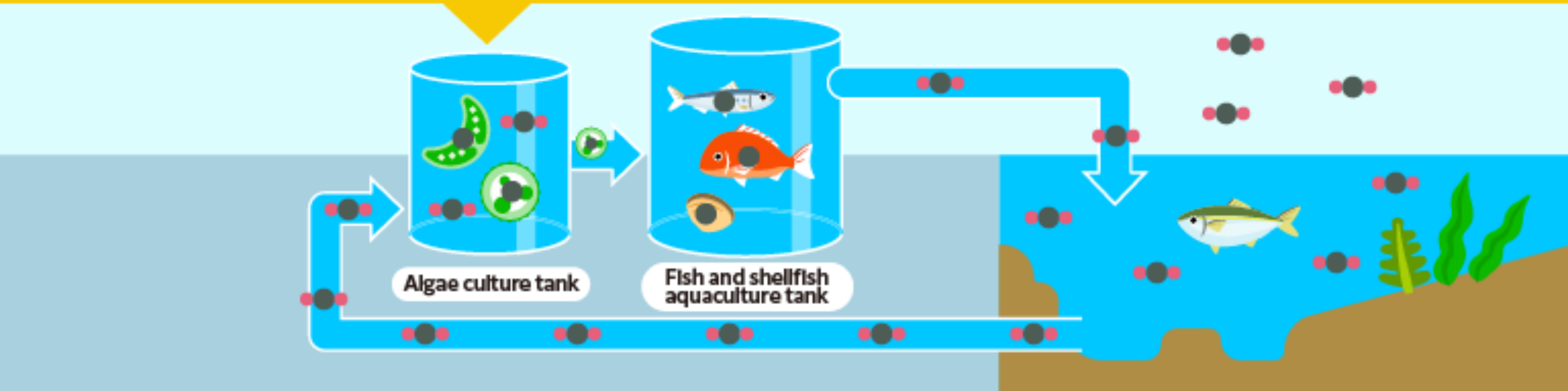
Maximizing carbon fixation by applying genome editing to both algae and fish/shellfish



Technological Initiatives and Achievements

Providing added value for algae

1 Breeding	Technological Initiatives	By applying genome editing ・Enhance carbon absorption capacity ・Enhance environmental resilience	Achievements 1 Identification of two genes that can increase CO_2 absorption
2 Culture	Technological Initiatives	Stable supply through optimizing culture conditions	Achievements 2 Start of demonstrations in outdoor environments



Objective (1) Breeding Algae Using Genome Editing

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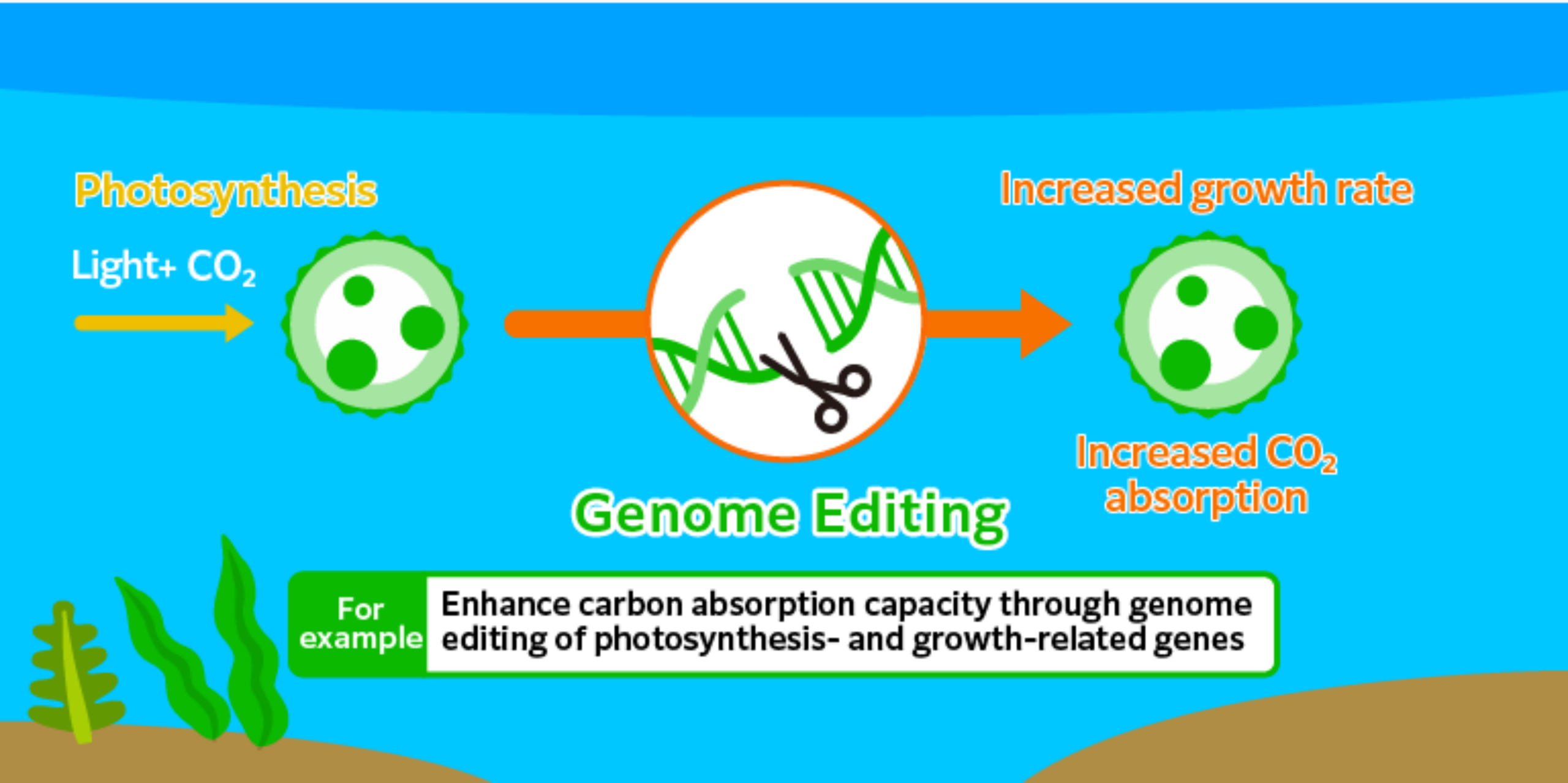
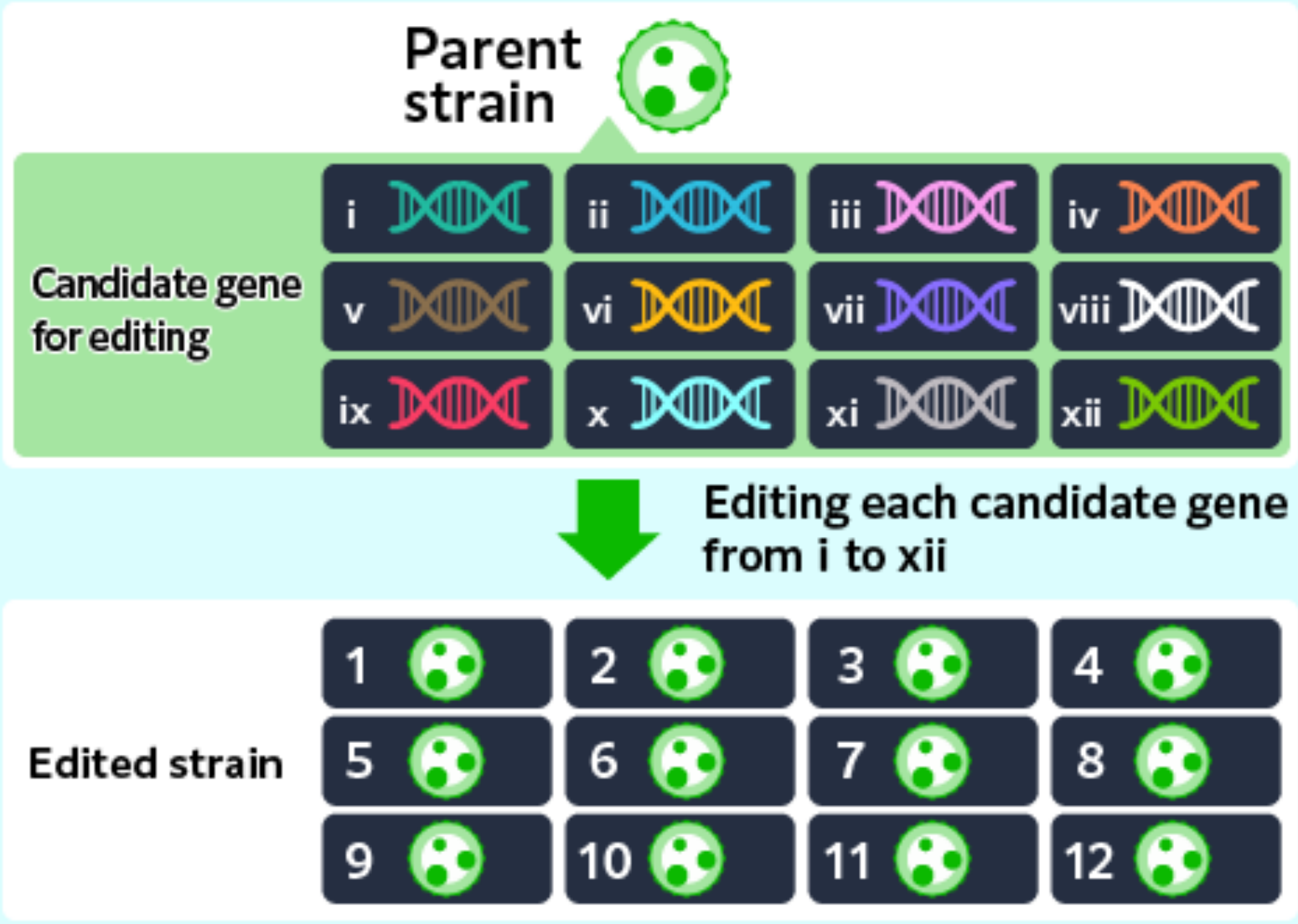
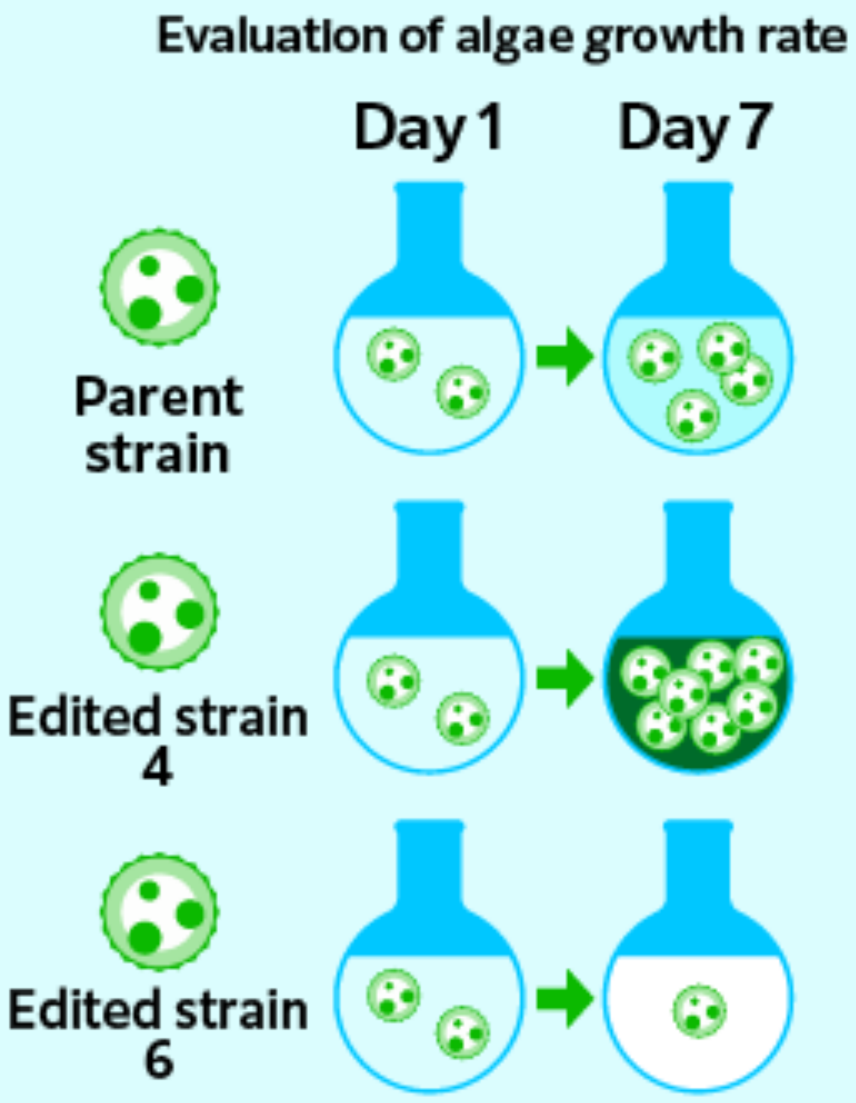


For example: Enhance carbon absorption capacity through genome editing of photosynthesis- and growth-related genes

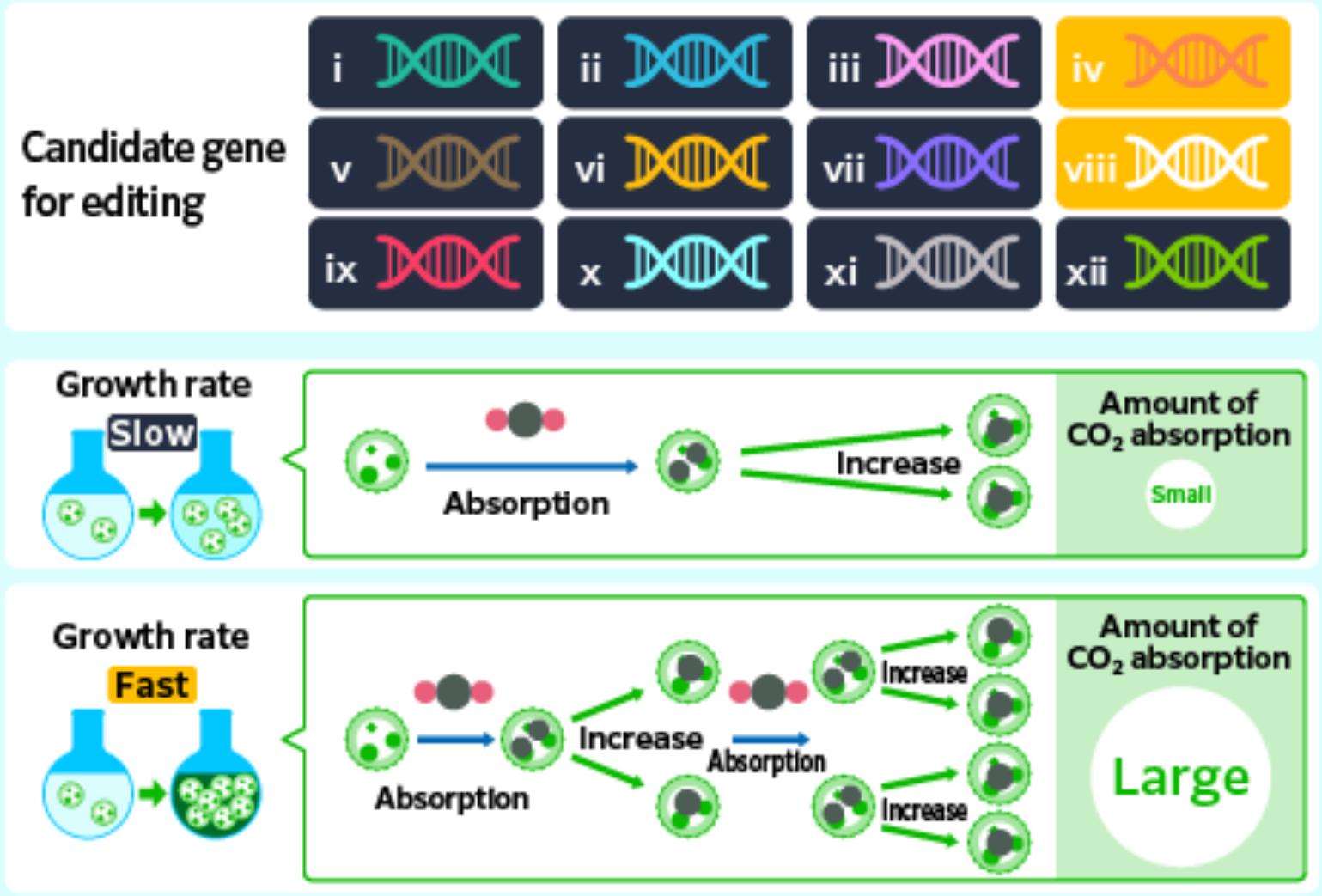
Method (1) Identifying Two Genes That Can Increase CO_2 Absorption

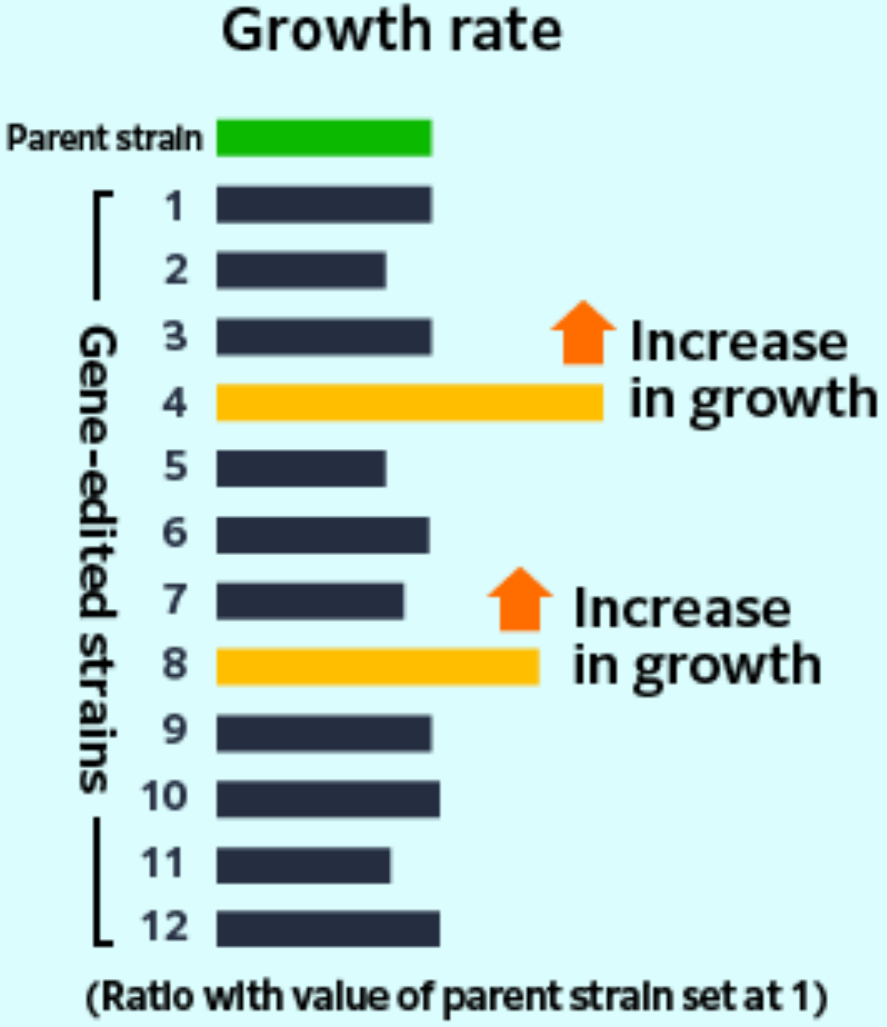




Achievement (1) Identification of Two Genes That Can Increase CO_2 Absorption

Genes iv and viii identified as genes that increase CO_2 absorption

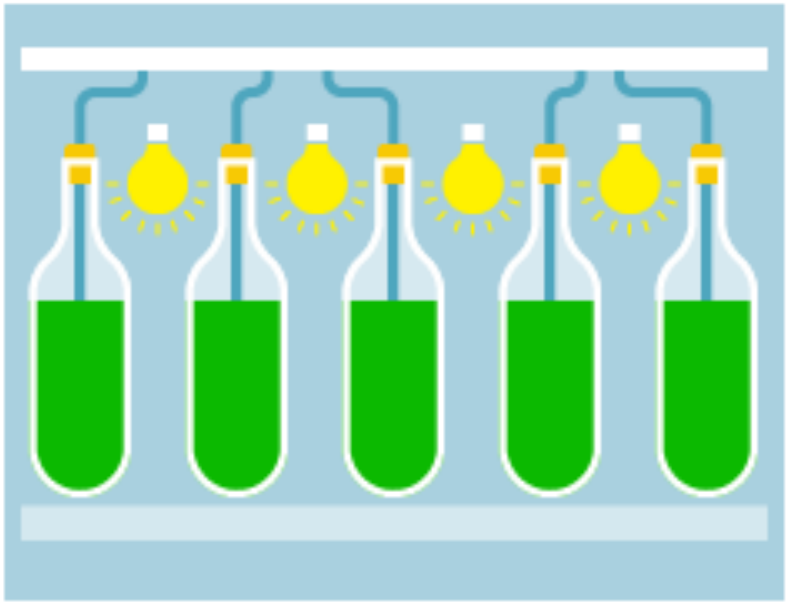




Objective (2) Optimization of Culture Condition

Development of culture environment control technology that enables stable supply in outdoor areas where environmental control is difficult.

Closed environment



Algae can be cultured in an ideal environment

Open-air environment

Changes in the surrounding environment, such as weather and climate

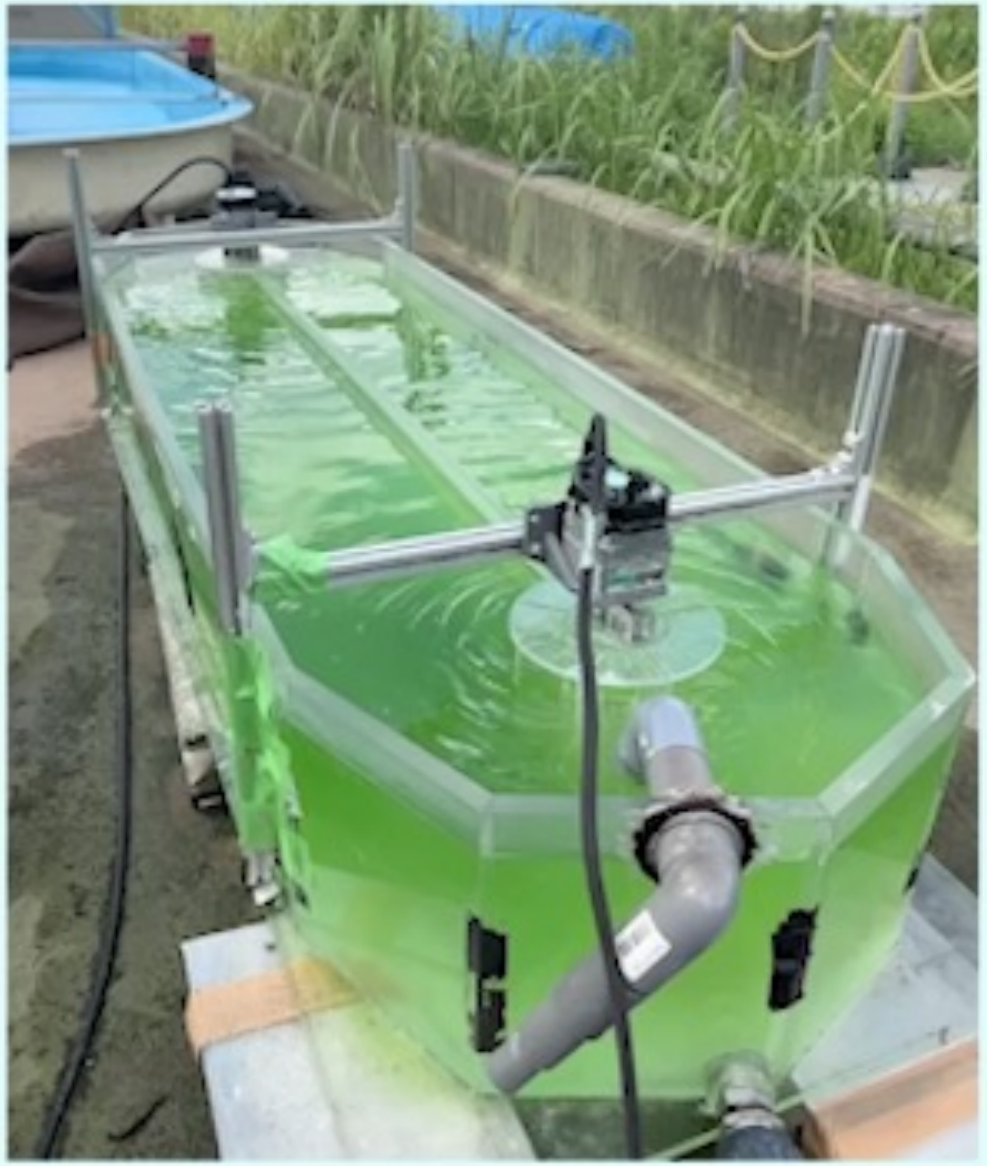
Uncontrollable

Controllable

- Composition of culture medium
- Agitation

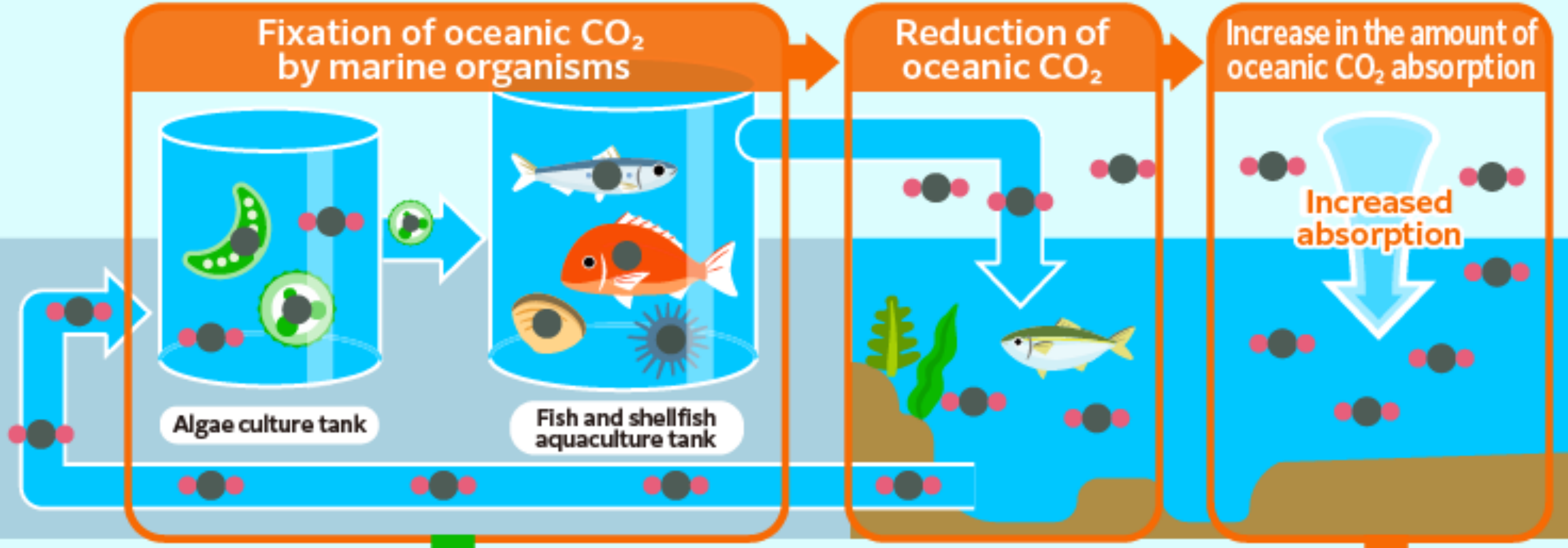
Control to create the optimum environment

Activity (2) Start of Verification of Field Cultivation



Summary

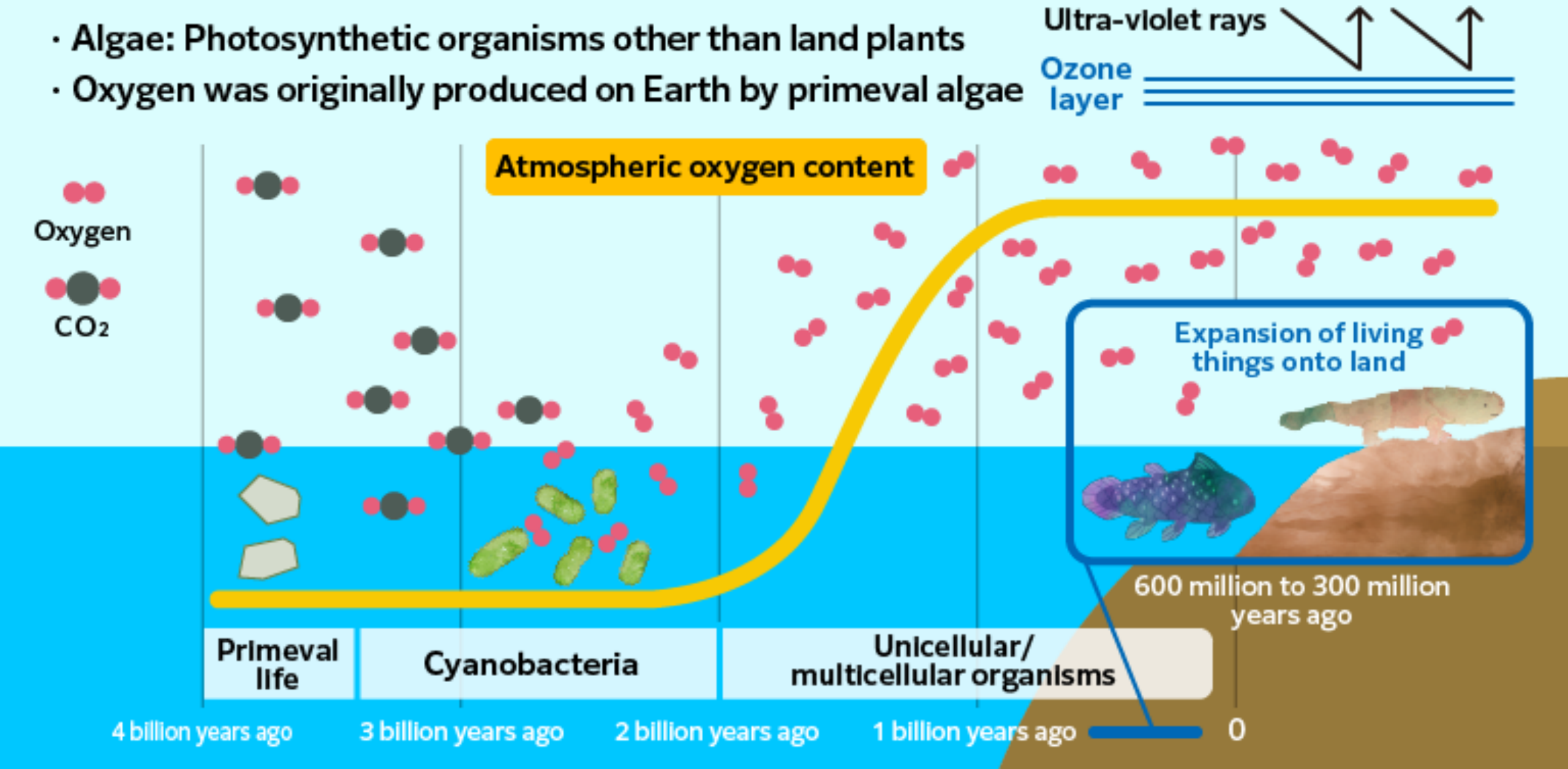
Simultaneous contribution to both environmental and food issues



Food issues	Efficient production of fishery resources
Environmental issues	Reduction of residual atmospheric CO_2

Column (1) What Is Algae?

- Algae: Photosynthetic organisms other than land plants
- Oxygen was originally produced on Earth by primeval algae



Column (2) What Is Genome Editing?

Safety risks of genome editing are considered comparable to those of breeding

Genome Editing

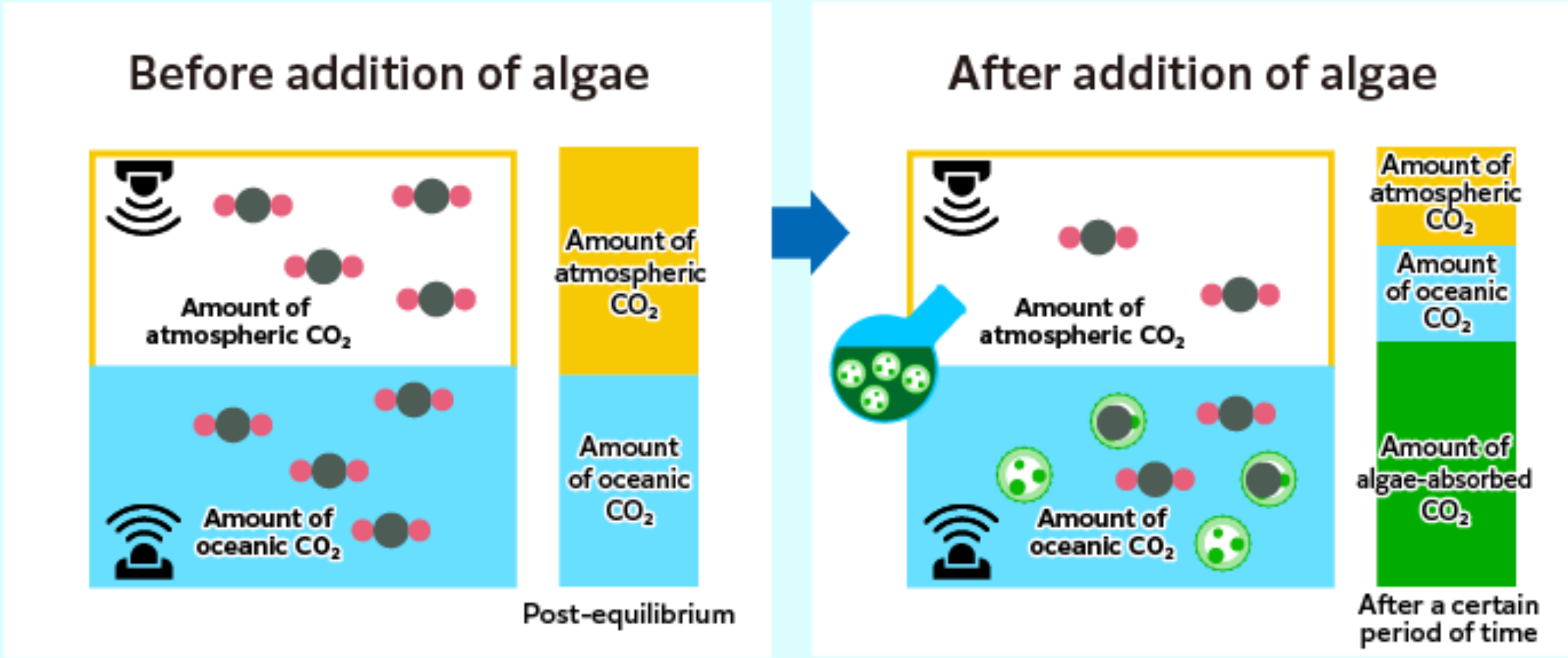
Cut the targeted genes

Genetic modification

Insert genes from another species into the genome.

Column (3) Establishing a Method for Measuring Carbon Fixation to Facilitate Carbon Credit Trading

Real-time measurement of fixation by algae based on changes in the amount of CO_2



Column (4) Significance of NTT's CO_2 Reduction Research Initiative

- NTT's power consumption is equivalent to 1/4 that of Tokyo Metropolis
- It is necessary to establish technology that directly reduces the amount of CO_2 while both saving energy and using renewable energy sources

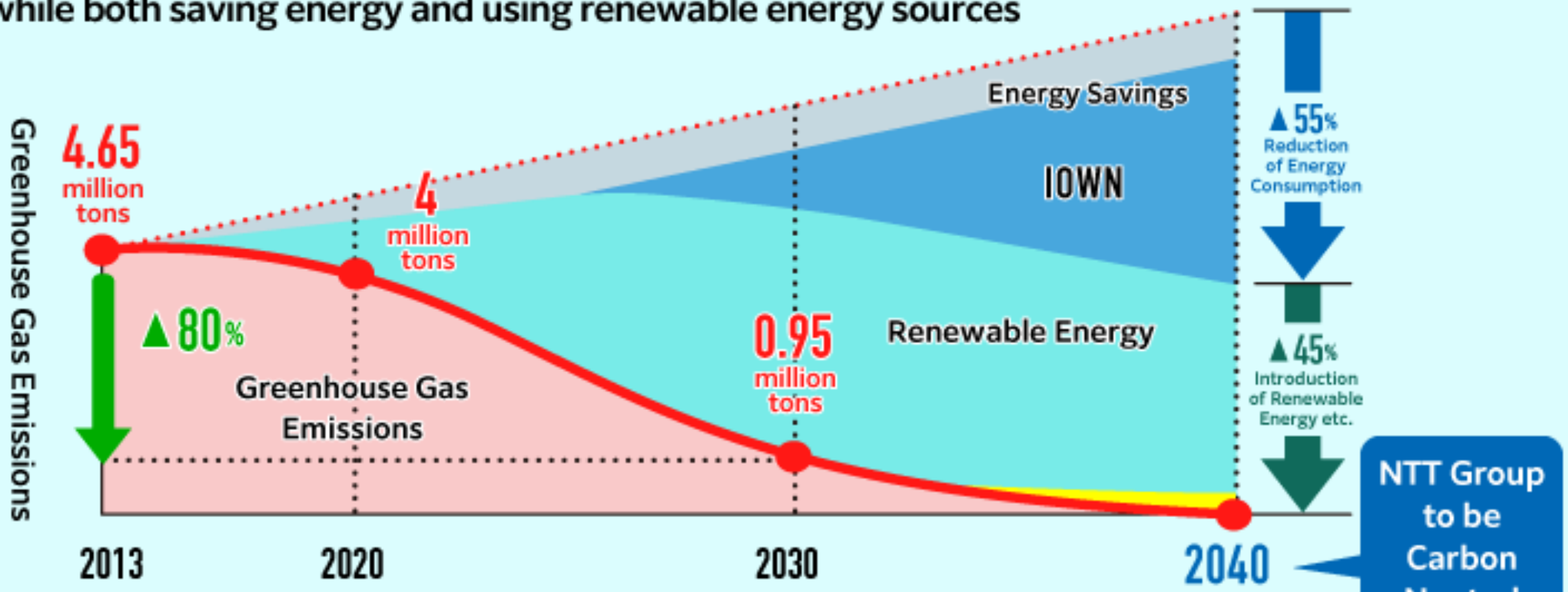
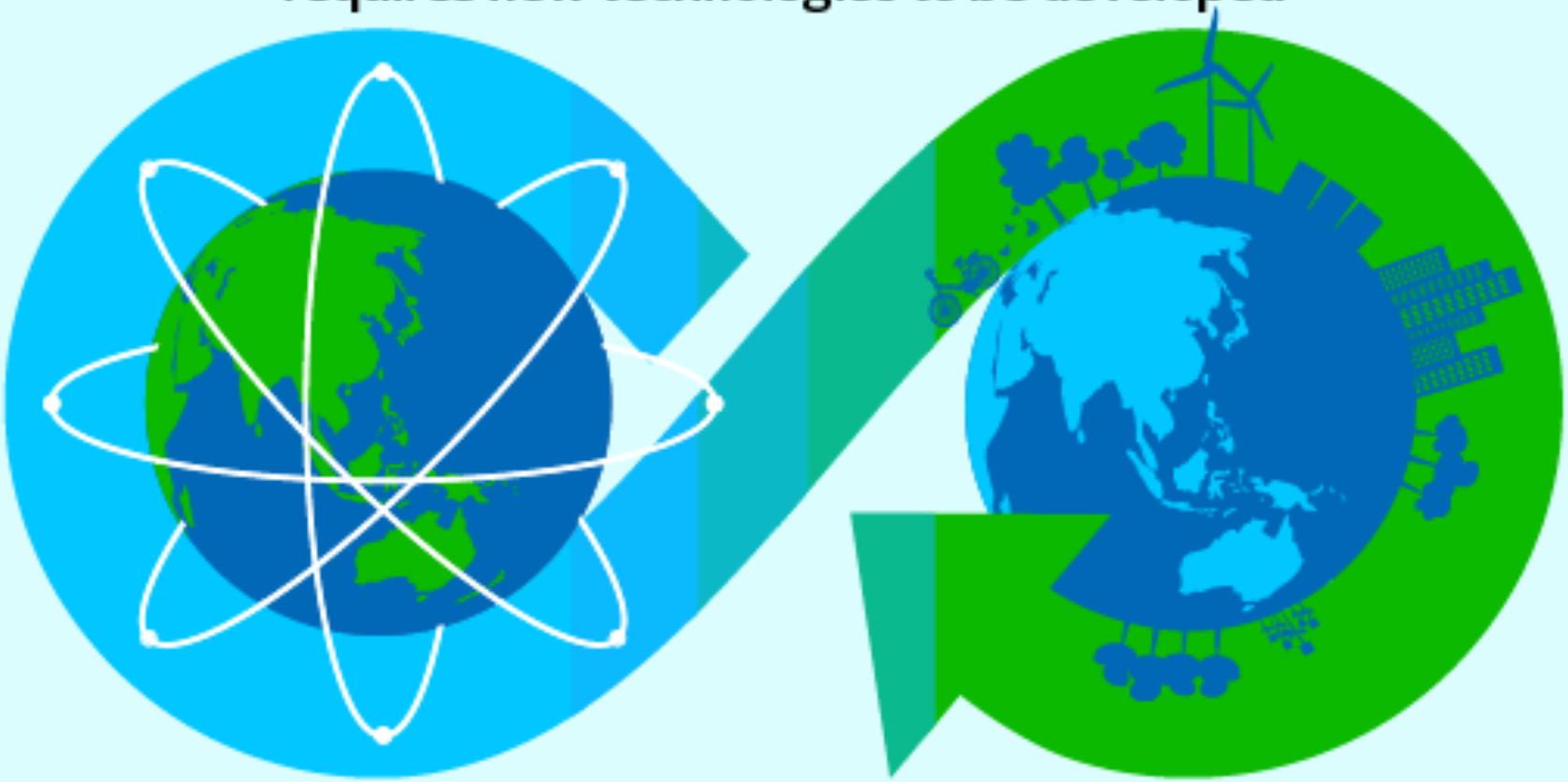


Illustration of NTT Group greenhouse gas emission reductions (domestic and overseas)

Column (4) Significance of NTT's CO_2 Reduction Research Initiative

Reducing CO_2 emissions, which have been increasing in line with technological advancement, requires new technologies to be developed



Improving Prosperity for All Peoples and Cultures

Ensuring the Positive Coexisting of Nature and Humanity

Solving social issues using algae as a starting point