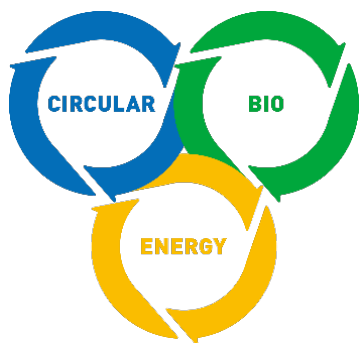




# The challenges and prospects Bio-related Negative Emission Technologies

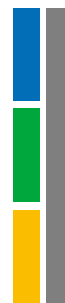
Technology Sessions  
TS3: Carbon Dioxide Removal technologies  
October 6, 2022



**Wataru MIZUNASHI**

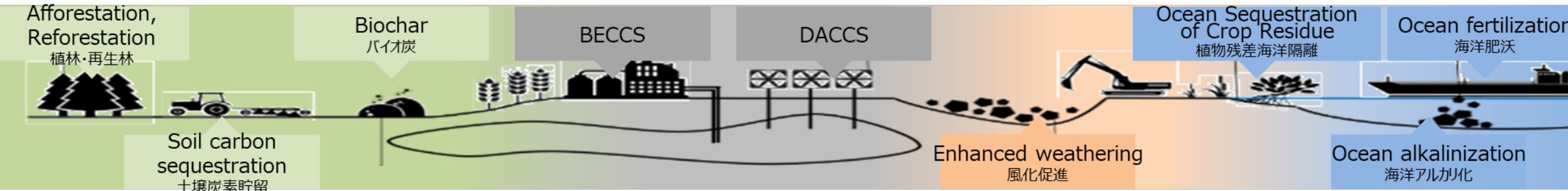
**New Energy and Industrial Technology Development Organization  
(NEDO)**

**Technology Strategy Center**

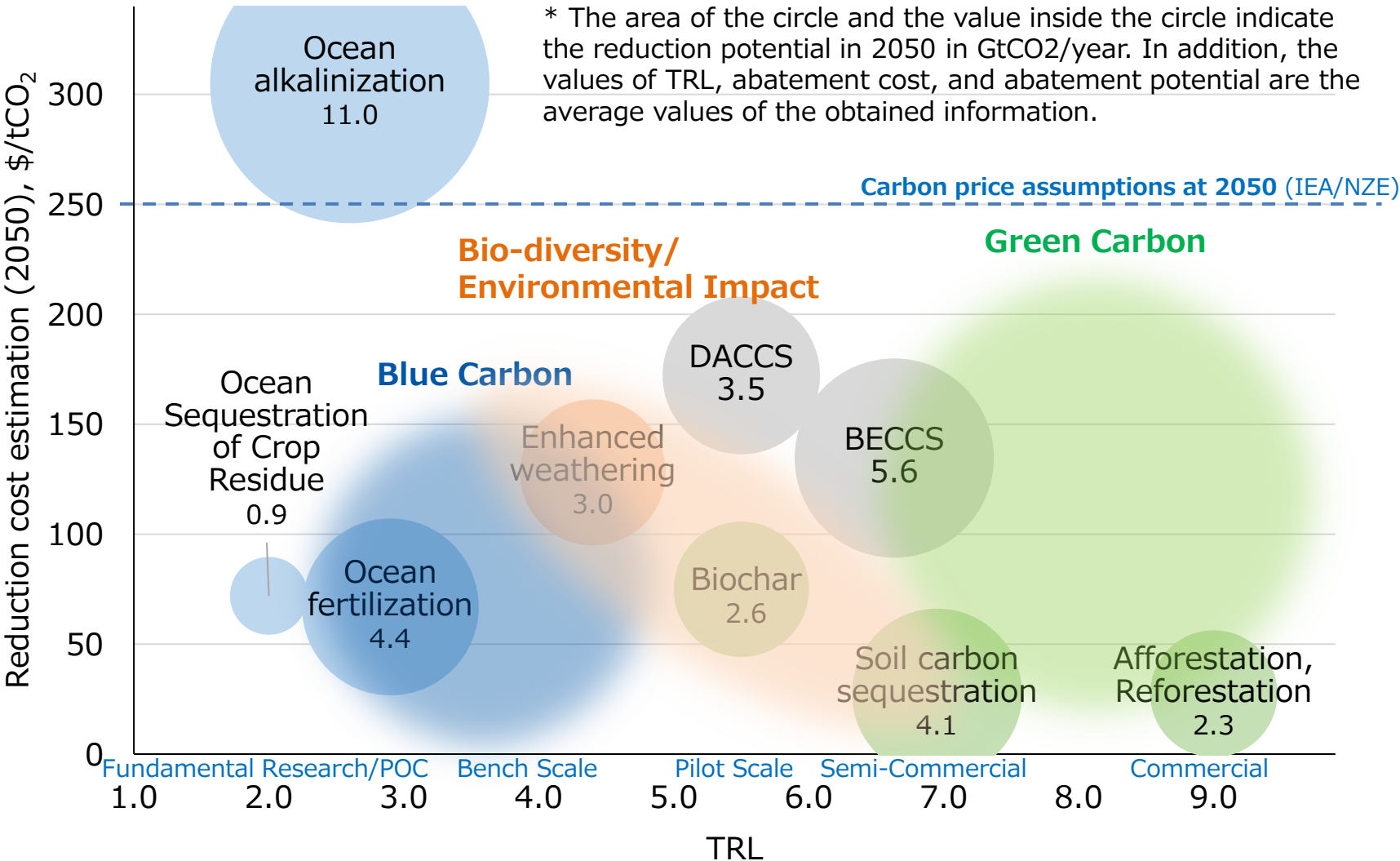


■ Negative emission technologies (NETs) are related to capture and absorb CO<sub>2</sub> in the atmosphere and contribute to removal by storage and fixation (CDR, Carbon Dioxide Removal).

Afforestation, Reforestation	Technology to enhance CO <sub>2</sub> absorption by trees
Soil carbon sequestration	Technology for storing and managing organic matter in soil (preventing CO <sub>2</sub> generation due to natural decomposition)
Biochar	Technology to fix carbon by carbonizing organic matter by thermal decomposition and burying it in the soil. One of the soil carbon sequestration technologies
BECCS	Process of extracting bioenergy from biomass and capturing and storing the carbon
DACCS	Technology that uses chemical processes to capture and separate carbon dioxide (CO <sub>2</sub> ) directly from ambient air.
Enhanced weathering	Process that aims to accelerate the natural weathering by spreading finely ground silicate rock
Ocean alkalization	Approach to carbon removal that involves adding alkaline substances to seawater to enhance the ocean's natural carbon sink.
Ocean Sequestration of Crop Residue	Method to permanently sequester most of the carbon contained in plant residuals in the ocean (preventing CO <sub>2</sub> generation by natural decomposition)
Ocean fertilization	Technology that promotes biological production by spraying nutrients into the ocean. Anticipating an increase in CO <sub>2</sub> absorption from the atmosphere



Most of the NETs are expected to have an abatement cost of \$200/tCO<sub>2</sub> in 2050, but include developing technologies such as ocean-related, enhanced-weathering, DACCS, and biochar.

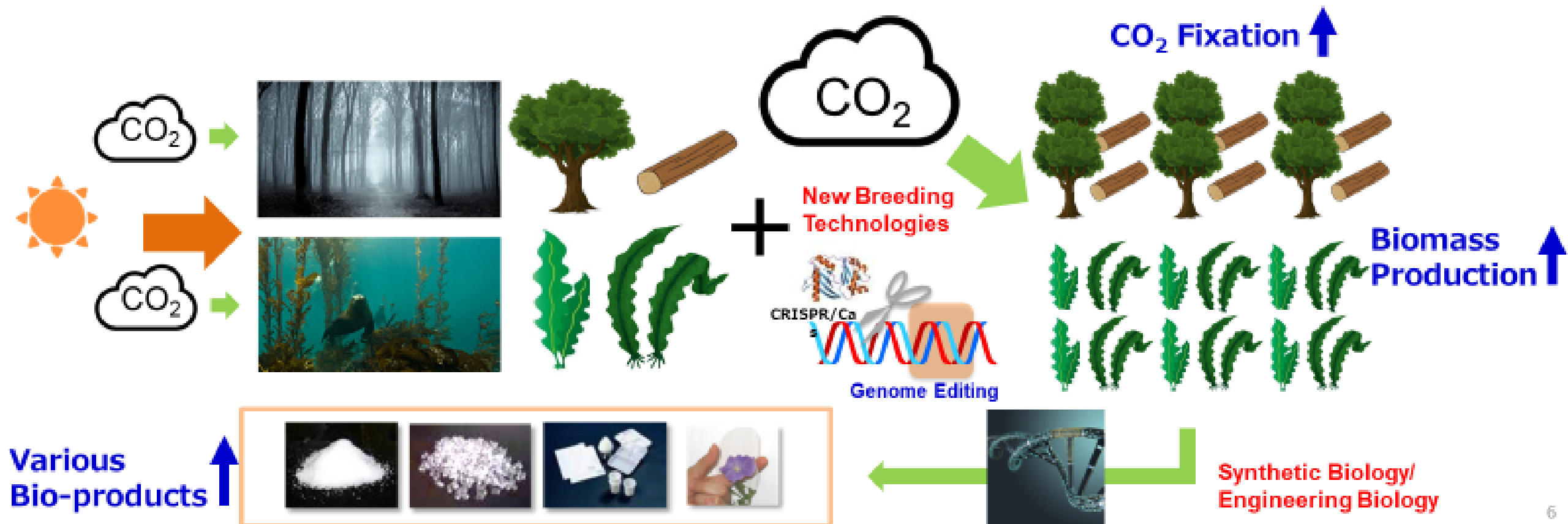


- Living organisms are excellent in **the ability to fix dilute concentrations of CO<sub>2</sub> at low cost**
- By **improving biological functions**, it is possible to **improve the amount and rate of CO<sub>2</sub> fixation** as green carbon and blue carbon.
- It is also possible to contribute to the **promotion of related industries through the regeneration of the natural environment using living organisms** (co-benefits: forestry, fisheries, food ingredients, leisure)
- On the other hand, when physically storing organic matter or inorganic minerals in the natural environment (land, sea), **it is important to scientifically evaluate the environmental impact including biodiversity.**
- Technological development for **active improvement to environment** by biological functions is also underway.





- **CO<sub>2</sub> fixation activity can be increased** by using emerging new breeding technology, including genome editing. *Of course, it is necessary to consider environmental impact, biodiversity.*
- Increased biomass from forest and marine can be **used as renewable raw material for various bio-products** through artificial metabolic pathways using synthetic biology/engineering biology.
- In order to **assess environmental value and social value**, it is **crucial to establish methodology and indicator about measuring, monitoring based on scientific evidence.**





- Negative emission technologies (NETs) are important for realization of carbon neutral. Especially **Bio-related NETs are expected** not only **low-cost CDR** but also **environmentally friendly technology**.
- In order to effectively utilize bio-related NETs technology and use forests and oceans as sustainable CO<sub>2</sub> sinks, it is necessary to (1) achieve **an appropriate balance of economic and environmental value**, (2) create **an index for evaluation of environmental value**, and obtain **related monitoring and sensing data**, and (3) **creation of economic value** through establishing business ecosystem around forests and oceans , are important.
- Regarding **economic value creation**, **new biotechnology**, such as emerging breeding technology, synthetic biology, engineering biology, etc. **is powerful tool**.
- Regarding **environmental value**, it is important to **make discussion based on scientific evidence**. That will lead to **acquire public acceptance** and also **appropriate investment** on these work.

# Thank you for your attention!

*NEDO address global warming issues as an innovation accelerator co-operating with organizations around the world.*



<http://www.nedo.go.jp/english/index.html>



## Missions are

- Addressing energy and global environmental problems
- Enhancing industrial technology



## Message from the Chairman

*NEDO serves as an **innovation accelerator** to address rising levels of carbon dioxide*



