

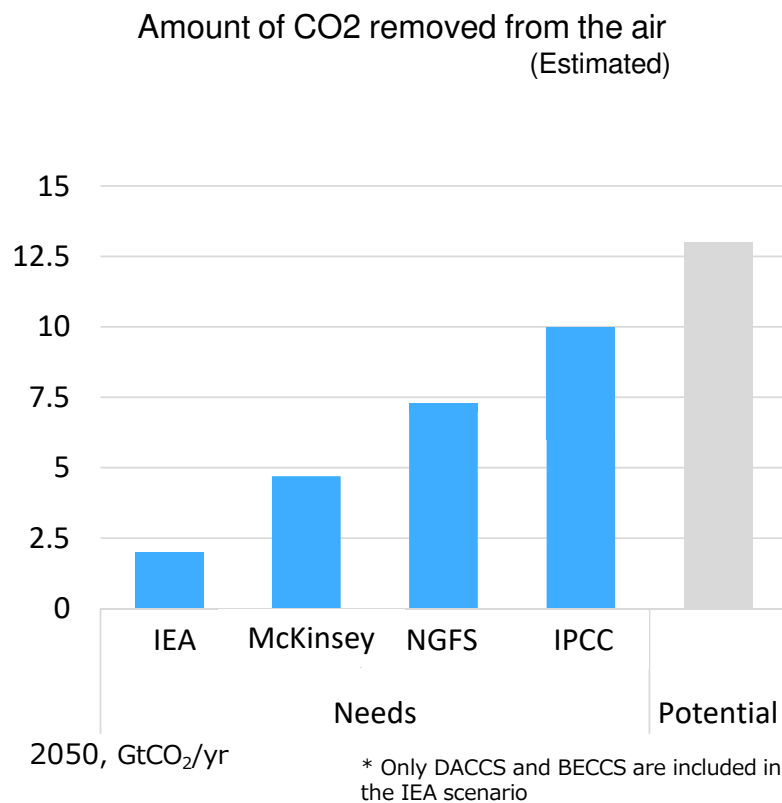
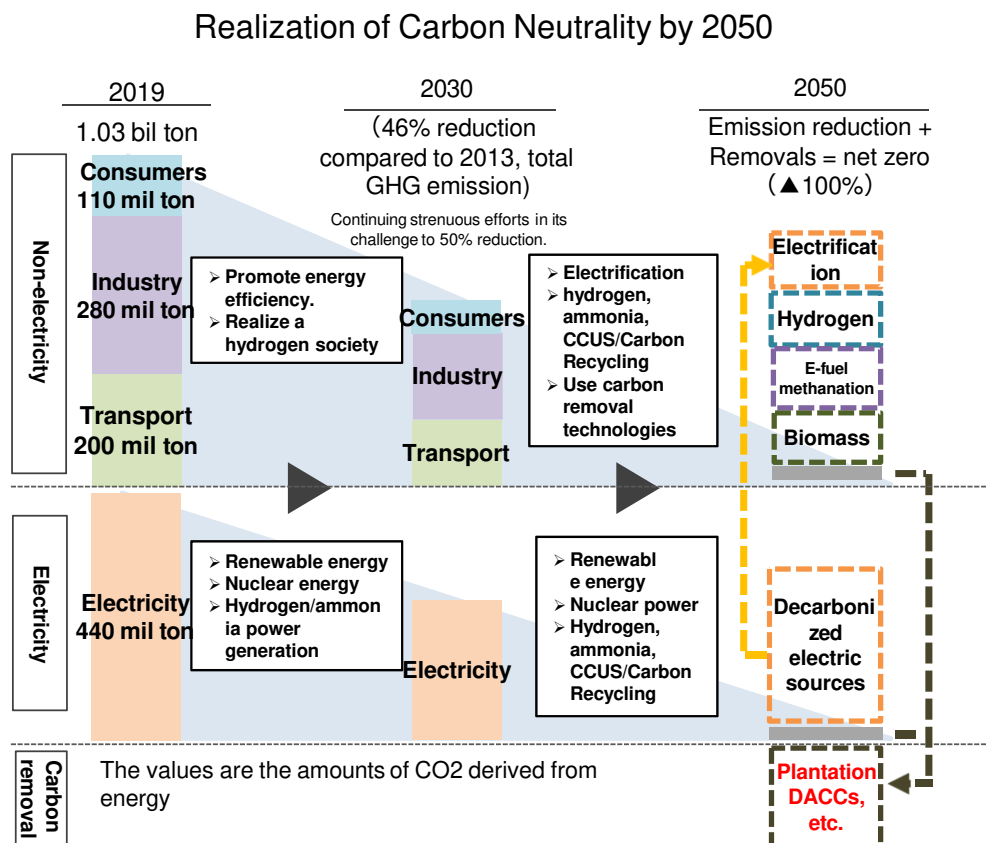
# **Direction of Government Support for Carbon Dioxide Removal (CDR)**

**October 4, 2023**

**Industrial Science, Technology and  
Environmental Policy Bureau, METI**

# Importance of Negative Emissions

- To reach net-zero, carbon dioxide removal is needed to counterbalance residual emissions from sectors that are unlikely to achieve full decarbonization.
- It is estimated that 2 to 10Gt CO<sub>2</sub>/yr must be removed globally by 2050.



# Classification and Definition of NETs

- Negative Emission Technologies (NETs) are technologies that contribute to atmospheric CO<sub>2</sub> removal (carbon dioxide removal (CDR)) by capturing, absorbing, storing, and immobilizing CO<sub>2</sub> from the atmosphere.

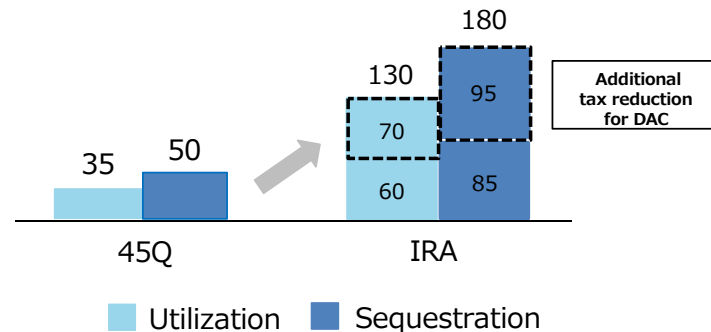
Afforestation/ Reforestation	Afforestation is the planting of trees of new areas. Reforestation is the planting of trees in forests that have been reduced by natural or human activities.
Soil carbon sequestration	Technology for storing biomass in soil (prevents CO <sub>2</sub> emission through natural decomposition)
Biochar	Technology to produce charred biomass and sequester carbon
BECCS	Technology to capture and store CO <sub>2</sub> generated by biomass combustion
DACCS	Technology for direct capture and storage of atmospheric CO <sub>2</sub>
Enhanced weathering	Technology to artificially accelerate weathering by crushing and spreading basalt and other rocks. CO <sub>2</sub> is absorbed in the weathering process (carbonation).
Ocean fertilization	Technology to artificially accelerate CO <sub>2</sub> absorption and fixation by promoting biological production through the application of nutrients to the ocean or the use of superior biological varieties.
Ocean alkalinity enhancement	Technology to add an alkaline substance to seawater to promote natural carbon absorption in the ocean.
Blue carbon management in coastal ecosystems	CDR through coastal blue carbon maintenance and regeneration such as mangroves, salt marshes, seagrasses, etc. Other carbon sequestration possibilities in coastal areas such as large seaweeds (e.g., kelp) are under discussion.
Other ocean-based CDR approaches	There are few research cases, but some approaches are artificial upwelling, terrestrial biomass disposal such as crop residues or logs, marine biomass CDR options such as large seaweed culture, and direct CO <sub>2</sub> capture from seawater

# Trends in CDR Among Major Countries

- In the U.S., the **Inflation Reduction Act (IRA)** was passed in August 2022 and **the existing CCS tax credits were expanded**. A special measure regarding DACs was added, with a **tax credit of up to \$180 per ton**.
- **Start-ups with DAC technology have emerged**, and purchase agreements have already been signed with companies in finance, IT, and international aviation, among others. In addition, **a voluntary carbon credit market for NETs has been formed** and transactions have begun.

U.S. DOE: 45Q credit expansion under the Inflation Reduction Act (August 2022)

\$/ton CO<sub>2</sub>



- Expand existing 45Q tax credit to include an additional incentive for CO<sub>2</sub> capture directly from the atmosphere.
- 130/ton for CO<sub>2</sub> utilization, 180/ton for sequestration.

Source: U.S. DOE, Climeworks, Carbon Engineering

DAC company (Climeworks, Carbon Engineering)

- ✓ **Climeworks announces delivery of the world's first third-party certified carbon dioxide removal (CDR)** to Microsoft, Shopify, Stripe, and others (Jan, 2023).
- ✓ **1PointFive announced the sale of 400,000 tons of carbon removal credits** from its planned first DAC facility using Carbon Engineering's DAC solution to Airbus (March, 2022).



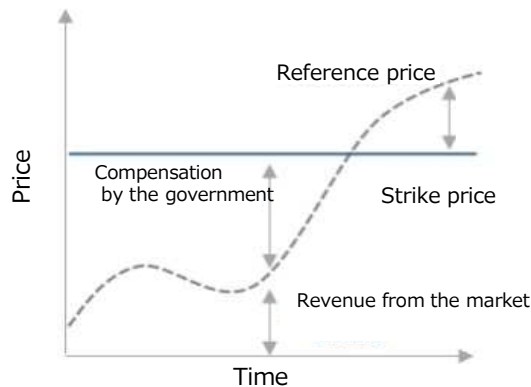
Picture: Climeworks

# Options of Policies for Market Creation and Expansion ①

- In the early stages of the market, stimulation of demand and incentive by the government is important.
- For example, the U.K. is considering a contract-based business model to provide stable price incentives for engineering methods such as DACCS and BECCS in order to expand CDR.
- Various methods are being considered and introduced mainly in Europe and the U.S. Below are examples of these methods.

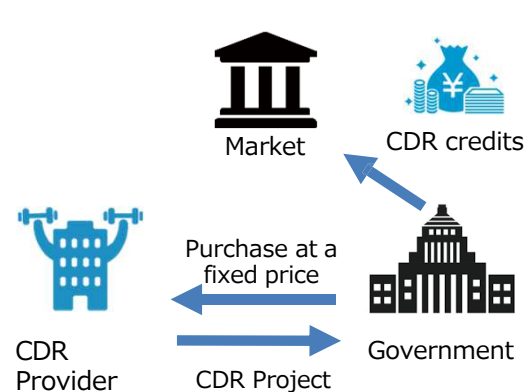
## ① Contract for Difference

✓ If the reference price is below the strike price, the government compensates the difference. Conversely, if the reference price exceeds the rights price, the difference is paid by the operator to the government.



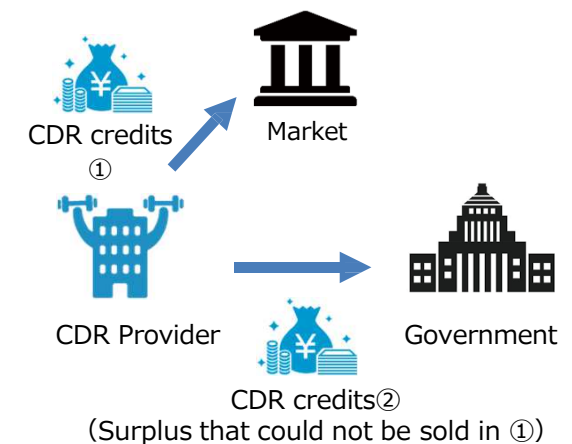
## ② Government Procurement

✓ The government purchases at a certain price for negative emissions conducted by CDR operators. The government converts the purchased amount into credits and sells them to the market.



## ③ Purchase of Excess Credits

✓ The CDR provider first sells the credits to the market. If there are excess credits, the government guarantees to purchase them at a fixed price for a certain period of time.



Source: Based on Business Model Consultation for Engineered GGRs

# Options of Policies for Market Creation and Expansion ②

- Various methods are being considered and introduced mainly in Europe and the U.S. Below are examples of these methods.

## ④ Tax Credits

✓ In the U.S., the Inflation Reduction Act (IRA) expands the existing 45Q tax credit for CCS and adds incentives for CO2 captured directly from the atmosphere. (\$130/ton for CO2 utilization, \$180/ton for sequestration).

## ⑤ Capital Investment and Demonstration Support

✓ In the U.S., up to 80% and 50% will be subsidized for FS and FEED for the construction of DAC hubs, respectively. In the future, support for project development, procurement, construction, etc. will also be provided.

✓ For technologies with relatively large capital investment (e.g., DACCS), this may be an effective way to increase the predictability of revenue for businesses in the early stages of commercialization.

## ⑥ R&D Support

✓ The U.S. supports R&D for a wide range of technologies, including DACCS/DACCU, ocean-based CDR, and enhanced weathering to achieve the cost target of 100\$/tCO2. In Europe, various funding programs, such as the Horizon Program, are promoting the development of various NETs technologies.

✓ Note that while it can contribute significantly to lower costs at the early stage, it does not provide long-term revenue certainty and do not directly support the expansion of the negative emissions market.

## ⑦ Incorporation of Removals into Emissions Trading

✓ In the EU, the latest revision of the EU-ETS Directive specifies that the Commission shall report to the European Parliament and the Council by July 2026 on the treatment of negative emissions in the EU-ETS.

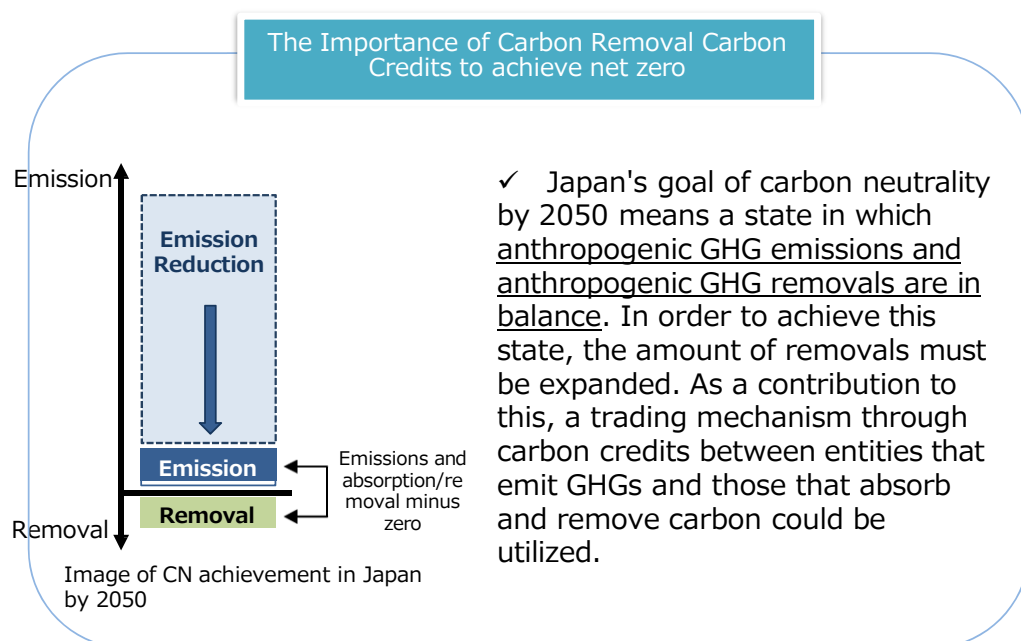
✓ The UK has also conducted a consultation on the potential use of the UK-ETS as a negative emissions market, and has started considering the inclusion of removals in the UK-ETS.

## ⑧ Obligation Quotas

✓ In California State, studies are underway to make the removal of a certain percentage of emissions mandatory for purchases, and in the mid- to long-term, the introduction of such a regulatory approach could be an effective means to expand private sector demand.

# Expanding Creation of NETs Credits

- In order to promote the social implementation of NETs, **it is important to create a scheme for the use of carbon credits as an incentive for negative emission suppliers.** In addition, especially post-2050, **it will be essential for emitters to utilize removal credits as a means to offset their own residual emissions.**
- Currently, the supply of removal credits is limited, and **it will be necessary to utilize and expand new credits such as technology-based removal (DACCS, BECCS) and blue carbon** in the future.
- The Carbon Credit Report released in June 2022 indicates that the creation and expansion of carbon removal credits is one of the directions in which efforts should be made.



## Direction of efforts and concrete Measures for appropriate use of carbon credits

(Efforts on the supply side)

● **Expand creation of carbon credits to help achieve NDC**

- J-credit, JCM

● **Expand creation of carbon removal credits not under the J-Credit System**

- Promote the creation of domestic voluntary credits of natural origin
- Promote development of NETs (Negative Emission Technologies) and creation of NET credits
- Facilitate investment and procurement commitments of carbon removal credits for future generations

Source: Based on the Carbon Credit Report

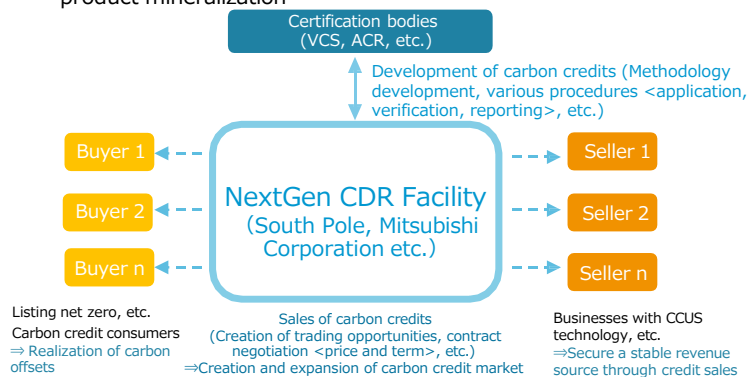
# Expand Initial Demand Toward Early Market Expansion

- In recent years, a mechanism for joint purchase and long-term off-take agreements for carbon removal projects that meet certain criteria has begun to be formed, and initial demand is being generated by the private sector.
- By creating demand signals for carbon removal at an early stage and increasing the predictability of the supply side, it is possible to accelerate investment in technology development and lower costs, thereby increasing supply. Expanding such early demand signals is important for early market expansion.

## NextGen CDR Facility

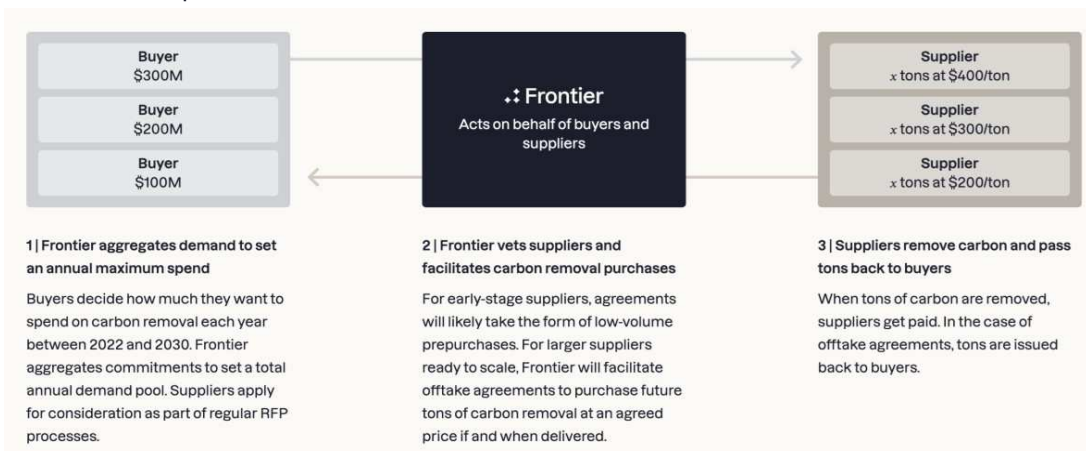
- ✓ An initiative to jointly purchase CO2 removal derived from third-party certified technology-based CDRs\* by companies participating as buyers, with the aim of promoting and spreading the use of technology-based CDRs
- ✓ Plan to purchase a total of more than 1 million tons of technology-based CO2 removal value by 2025 and provide verified technology-based CO2 removal value to participating companies by 2030

\* DACCS, BECCS, enhanced mineralization, biochar, product mineralization



## Frontier

- ✓ Launched in April 2022 by Stripe and others to leverage the Advanced Market Commitment (AMC) concept, which promotes the development of carbon removal technologies by guaranteeing future demand. They have committed 1 billion dollars worth of permanent carbon removal technology between 2022 and 2030. Currently committed to purchase \$5.6 million (equivalent to approximately 9,000 tCO2) for 15 carbon removal-related startups.



Source: (Left) Based on press releases by Mitsubishi Corporation and MOL (Right) Frontier Homepage, CNBC



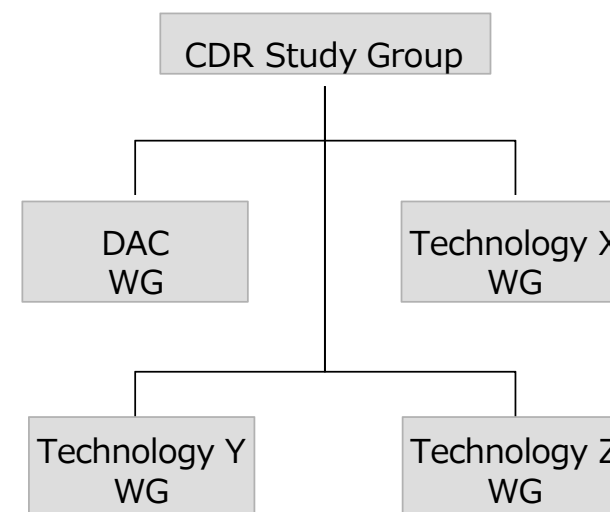
# How CDR Rules Should be Formed

- It is important to implement **consensus building on the necessary rules and share knowledge in an appropriate forum**, taking into account the development status of each technology, the difficulty level of data acquisition, and other conditions. **It is also necessary to have a framework to consider what we should work on for each technology.**
- **Working Groups will be established** to formulate MRV methods necessary for creating carbon credit and discuss other rules. The establishment of MRV methods will be **coordinated with the compliance carbon markets.**

**Table: Policies for each category of rulemaking related to CDR**

Classification	Policy
① Role of CDR in climate change countermeasures	Build consensus on the need for CDR through activities of international organizations such as the IPCC and IEA, outcome documents of multi-negotiations such as the G7, and multilateral initiatives.
② Definition of CDR (scope and technology)	Clarify the requirements for CDR (permanence, time required for removal, etc.) and the technology categories to be included in CDR, both domestically and internationally.
③ MRV method, etc., focusing on ways to calculate the removal effect of CDR	Promote research on methods for measuring the effects of removal and develop MRV methods necessary for crediting, etc.
④ Rule formation specific to each technology	Consider 'consultative bodies' to study standardization strategies, such as establishing a forum for interested parties to gather and discuss rule formation policies.

**Image of working groups (WGs)**



※Ocean based CDR and Enhanced weathering are other candidates.