TSC Foresight

NEDO

9th IEEJ/APERC International Energy Symposium

NEDO's Activities toward building Sustainable Society

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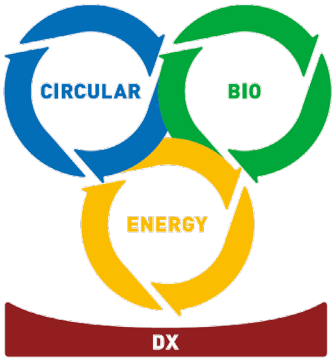
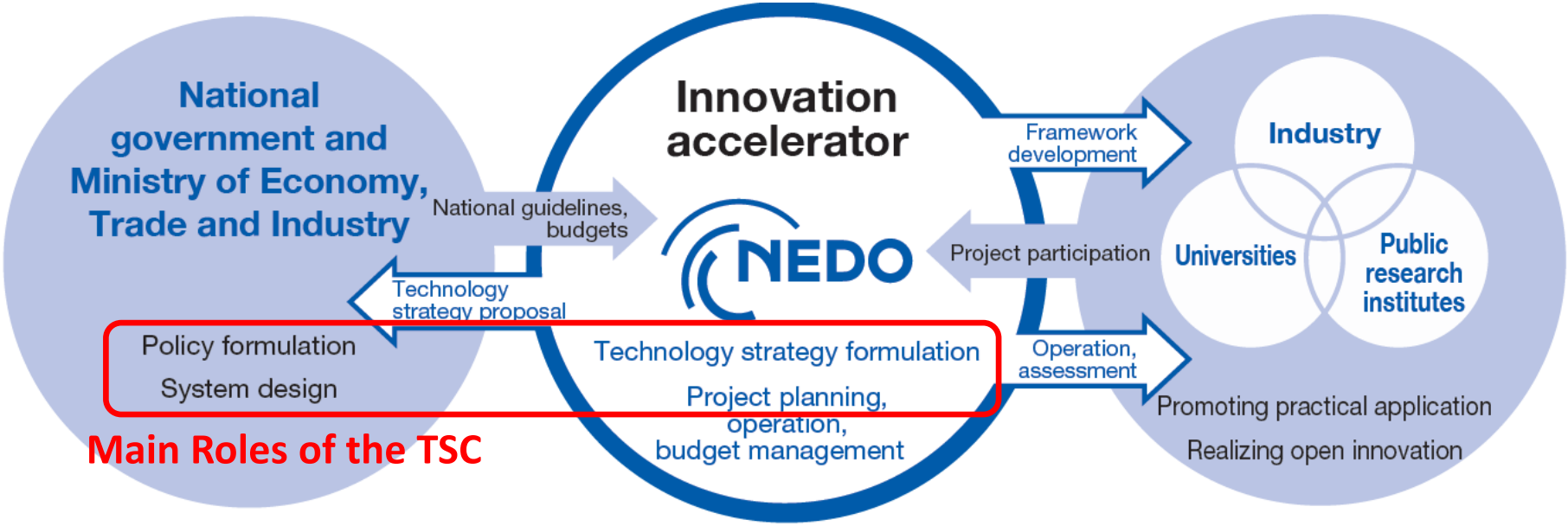


What is NEDO?

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

Organization	National Research and Development Agency
Mission	1. Addressing energy and global environmental problems 2. Enhancing industrial technology
Established	1980
Budget	1.01 billion US dollars (FY2023) + additional “funds”
Employees	1,464 (as of Apr. 1, 2023)

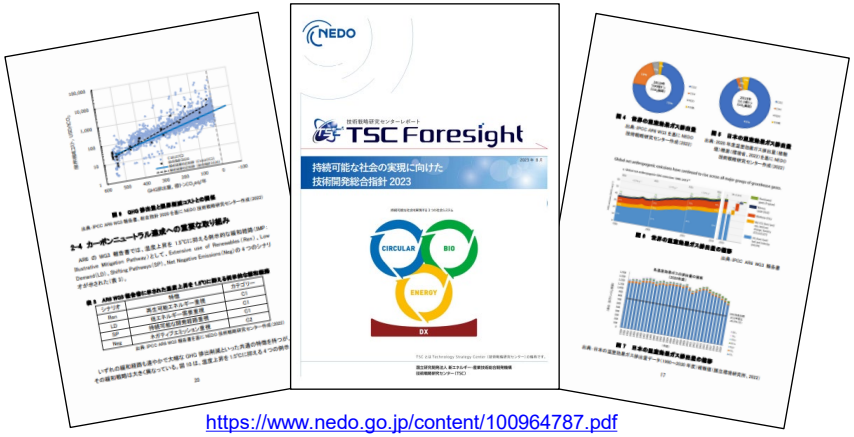


Comprehensive R&D Principle for Sustainable Society

- NEDO published the 2nd edition of “Comprehensive R&D Principle for Sustainable Society” in 2023.

“Objective of Comprehensive R&D Principle 2023”

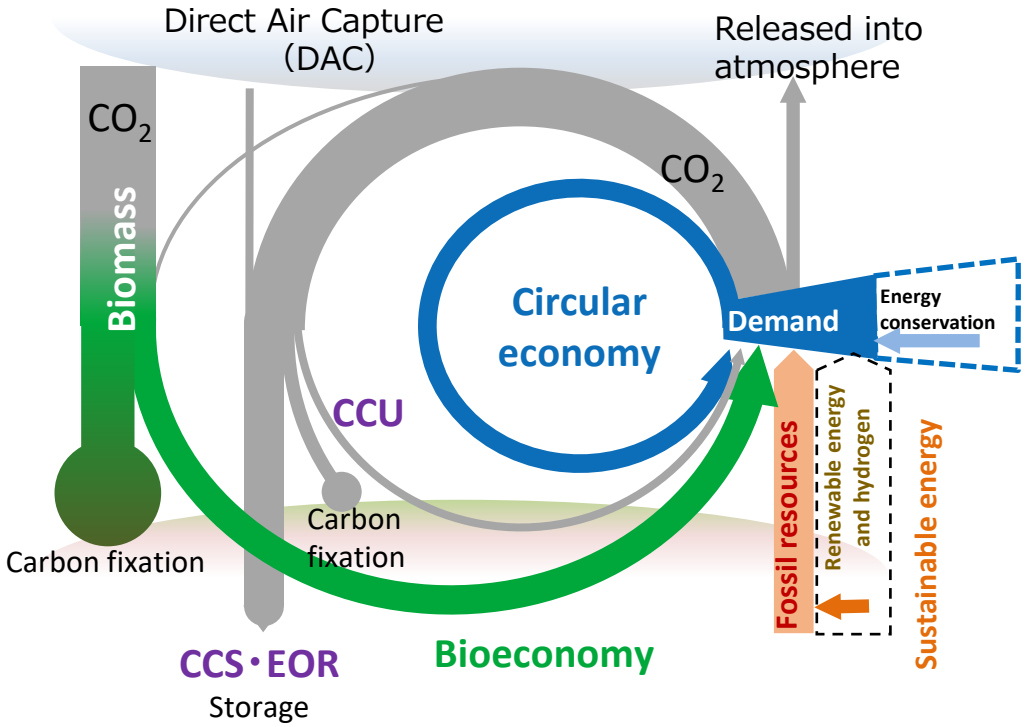
- The purpose of Comprehensive R&D Principle 2023 is to **identify and overlook of key technologies for achieving carbon neutrality** based on the latest social and technological trends, and to **advocate for the comprehensive and objective evaluation of the CO2 reduction** of these technologies.
- Additionally, NEDO expects to **provide specific calculations for several key technologies** to assist evaluating the technologies you should focus on for development and demonstration.



https://www.nedo.go.jp/content/100964787.pdf

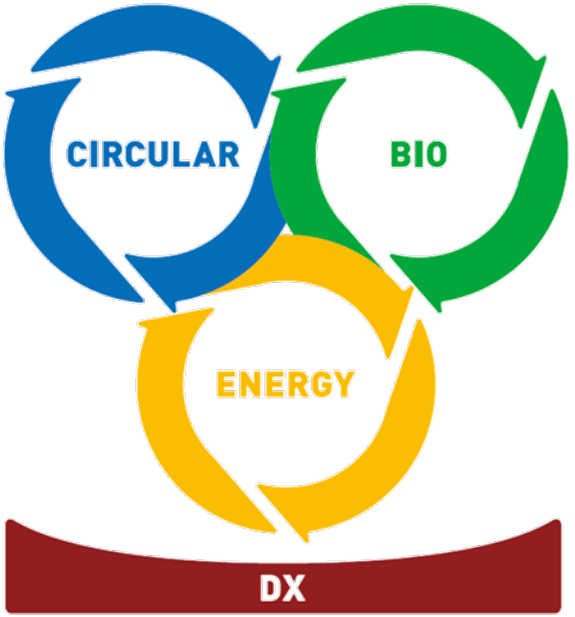
Social systems considered from the Carbon Cycle

- CO_2 emissions in the **"demand"** category shown in blue are reduced **through energy conservation and substitution with renewable energy, hydrogen, and biomass**, as well as through **recycling and sharing** to **reduce the demand for energy and materials themselves**.
- Emitted CO_2 is separated and recovered, **stored in CCS**, and partially **used in CCU**.
- **Atmospheric CO_2** is **fixed in biomass** through afforestation, etc., and separated and recovered **using DAC**.



Source：NEDO Technology Strategy Center(2019)

3 Essential Social Systems for Sustainable society



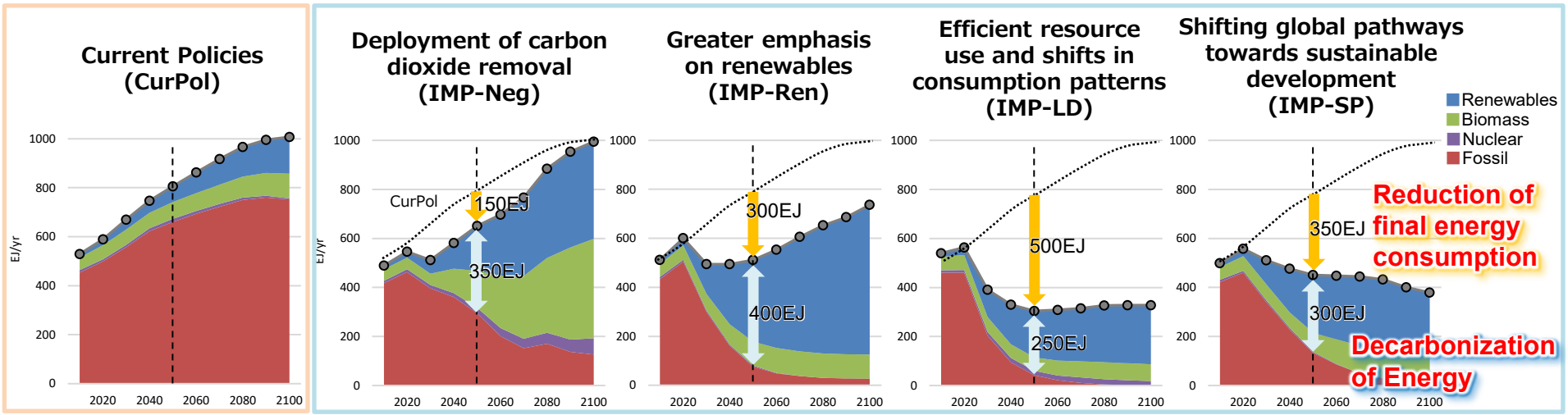
Key Initiatives to Achieve Carbon Neutrality

- Limiting warming to 1.5℃, rapid and significant GHG emission reductions have illustrated in the scenarios(IMPs) by IPCC AR6 WG3.
- Efforts to **decarbonize energy supplied**, **reduce final energy consumption**, and **introduce negative emission technologies (NETs)** are the key initiatives in each 4 scenario.
- In addition, **GHG reduction from non-energy sources**, such as utilizing CO_2 and biomass as raw materials, are also important.

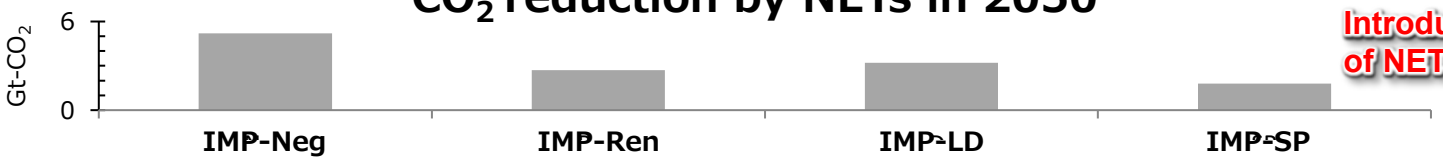
The trend of world primary energy supply in each of the illustrative pathways

Reference pathways

Illustrative mitigation pathways（IMPs）



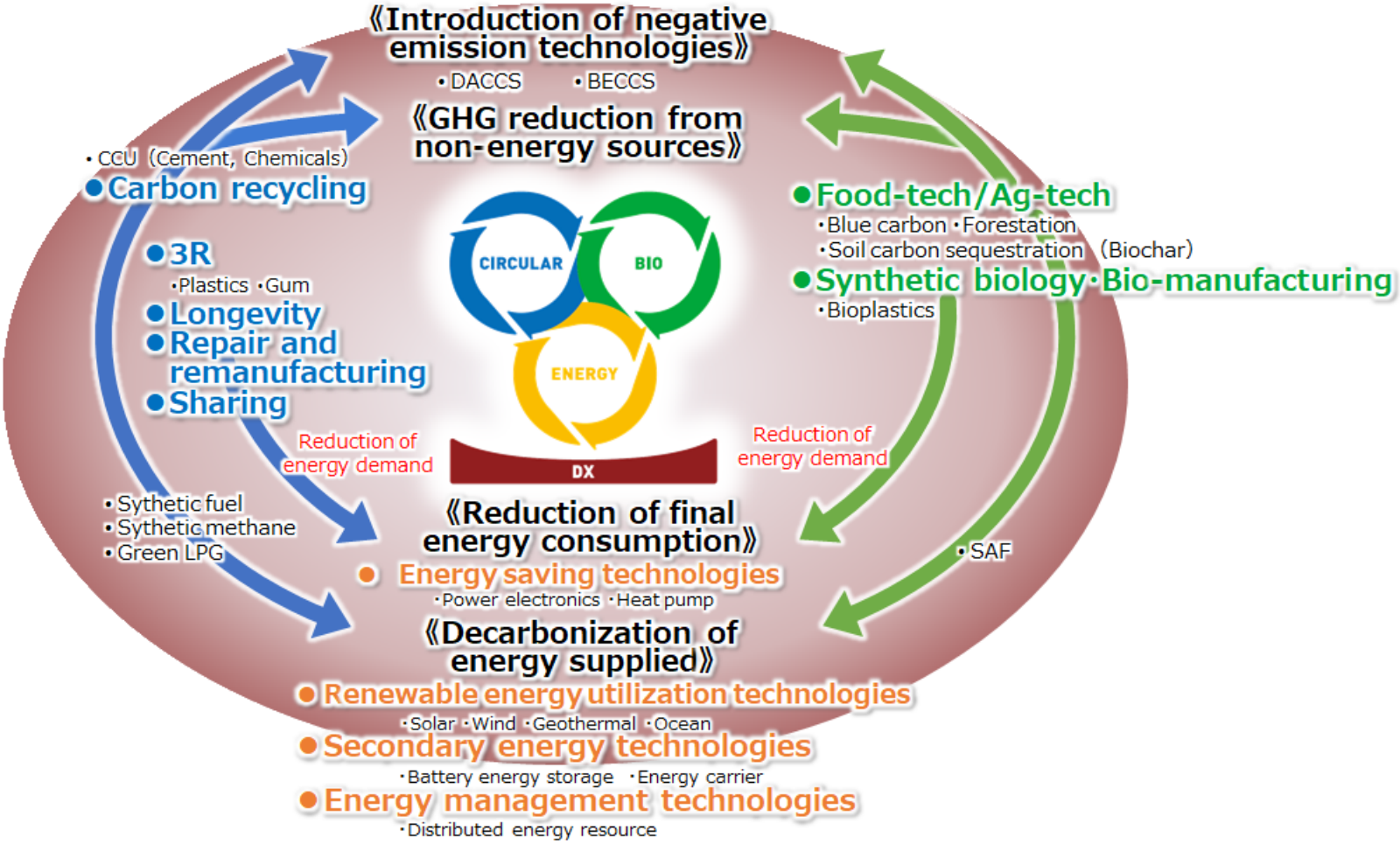
CO_2 reduction by NETs in 2050



Source : Prepared by Technology Strategy Center, NEDO, 2023, based on IPCC AR6 Figure 3.7, 12.3

Overview of Key Technologies

- The figure below shows key technologies that contribute to the "Key Initiatives" for carbon neutrality.
- It is important to promote "Key Initiatives" through collaboration and synergy among the three social systems.



Fund Project for Carbon Neutrality

Green Innovation Fund Projects

(converted at the exchange of 1 USD = 150 yen)

- To achieve carbon neutrality by 2050, Government of Japan established a fund of about **18B USD (2.7T JPY)** as part of NEDO. The fund will be executed over a ten-year period.
- METI/NEDO seeks the commitment of the company managers to persevere in challenging these goals.
- Currently **20 projects** are underway

Project cases (For more information, please check https://green-innovation.nedo.go.jp/en/)

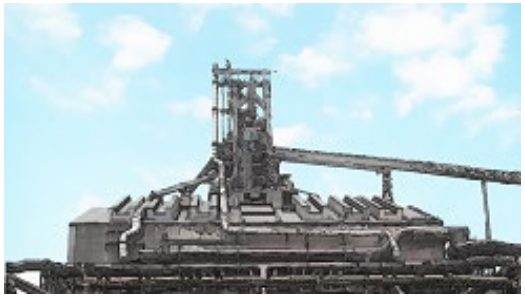
Cost Reduction for **Offshore wind** Power Generation

Hydrogen Production through Water Electrolysis Using Power from Renewables

Large-scale **Hydrogen Supply Chain** Establishment

Development of Technology for **CO2 Separation, Capture**, etc.

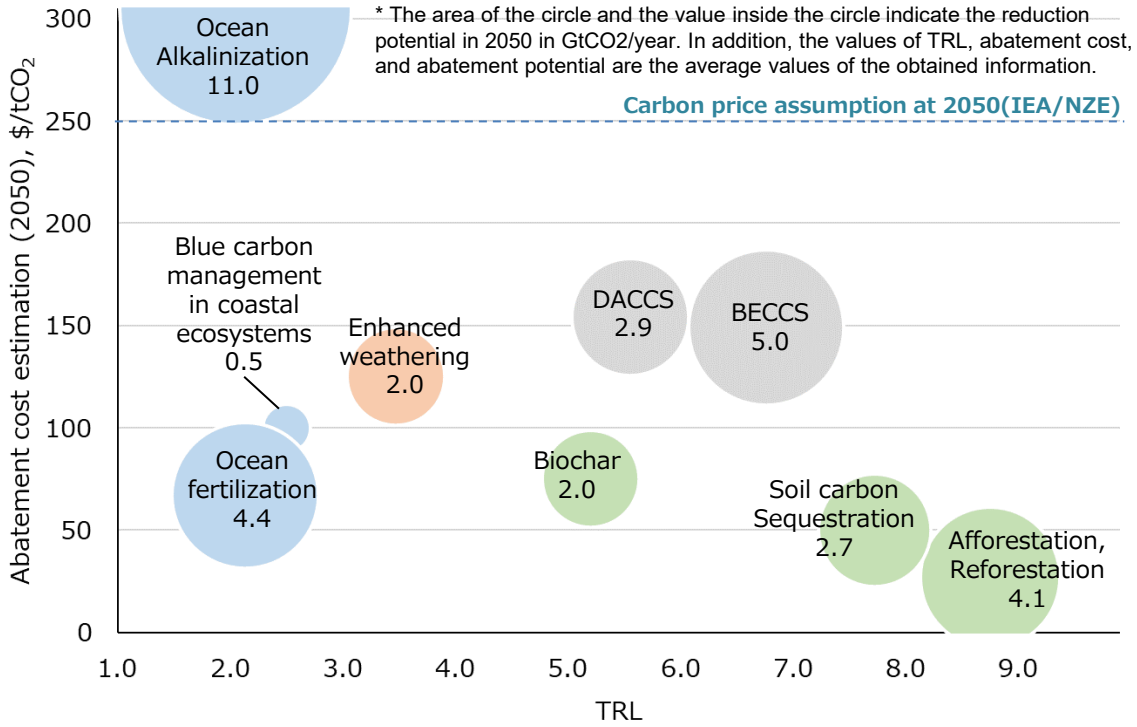
Development of Technology for Producing **Fuel Using CO2**, etc.



Hydrogen Utilization in Iron and Steelmaking Processes

Negative Emission Technologies(Cost, Potential, TRL)

- Most of the NETs are expected to achieve abatement cost of **less than $200/tCO2 in 2050**, although some technologies, such as ocean-related, enhanced-weathering, DACCS, and biochar, are in development.
- DACCS and BECCS have definite CO2 removal effect, but **costs need to be reduced**.
- NETs, which accelerates natural phenomena, has excellent features for low-cost CO2 removal, but they are **need to evaluate scientifically the CO2 removal effect and environmental impacts, co-benefits**.
- NEDO is developing technologies for DAC, blue carbon, biochar and enhanced weathering in the moonshot project and GI-fund project.

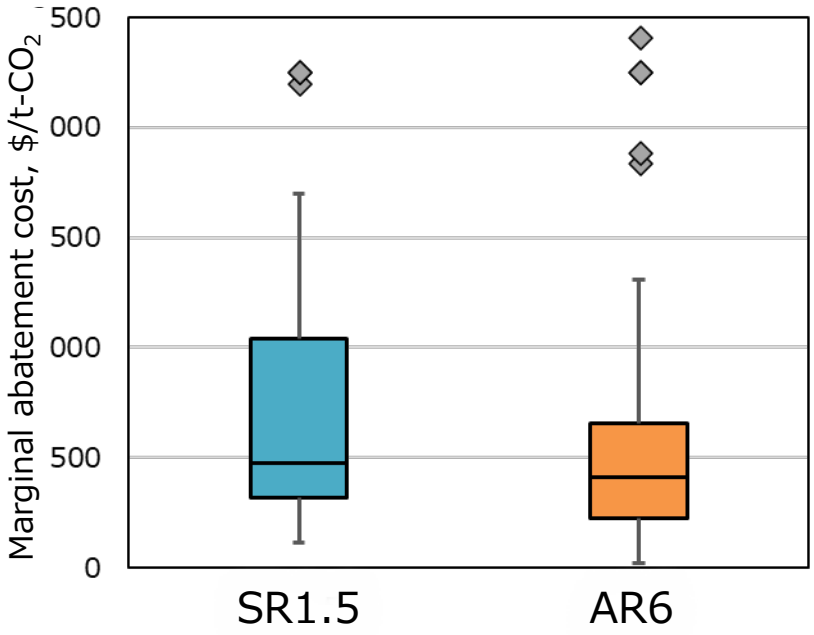


Marginal abatement cost

- **The marginal abatement cost** ※ under the 1.5℃ scenario in IPCC AR6 (2022) can reach **$200～700/tCO$_2$ in 2050**. It tends to decrease compared with the value in the IPCC special report, Global Warming of 1.5℃.
- The costs of technologies for carbon neutrality such as PV, wind power and battery storage have been continuously reduced. However, **disruptive innovation** is necessary in various technological fields in order to reduce the marginal abatement cost further to the value that the world can accept.

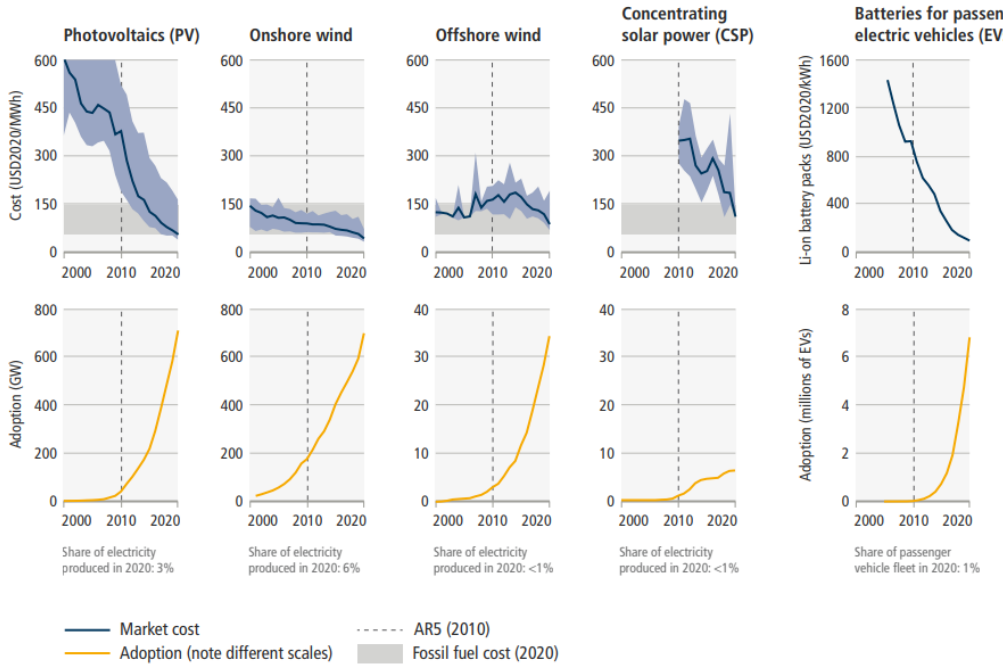
※the cost incurred to reduce an additional 1 ton of CO_2 emissions

Marginal abatement cost in 2050



Source : Prepared by Technology Strategy Center, NEDO, 2023, based on IAMC 1.5°C Scenario Explorer hosted by IIASA、AR6 Scenario Explorer and Database hosted by IIASA

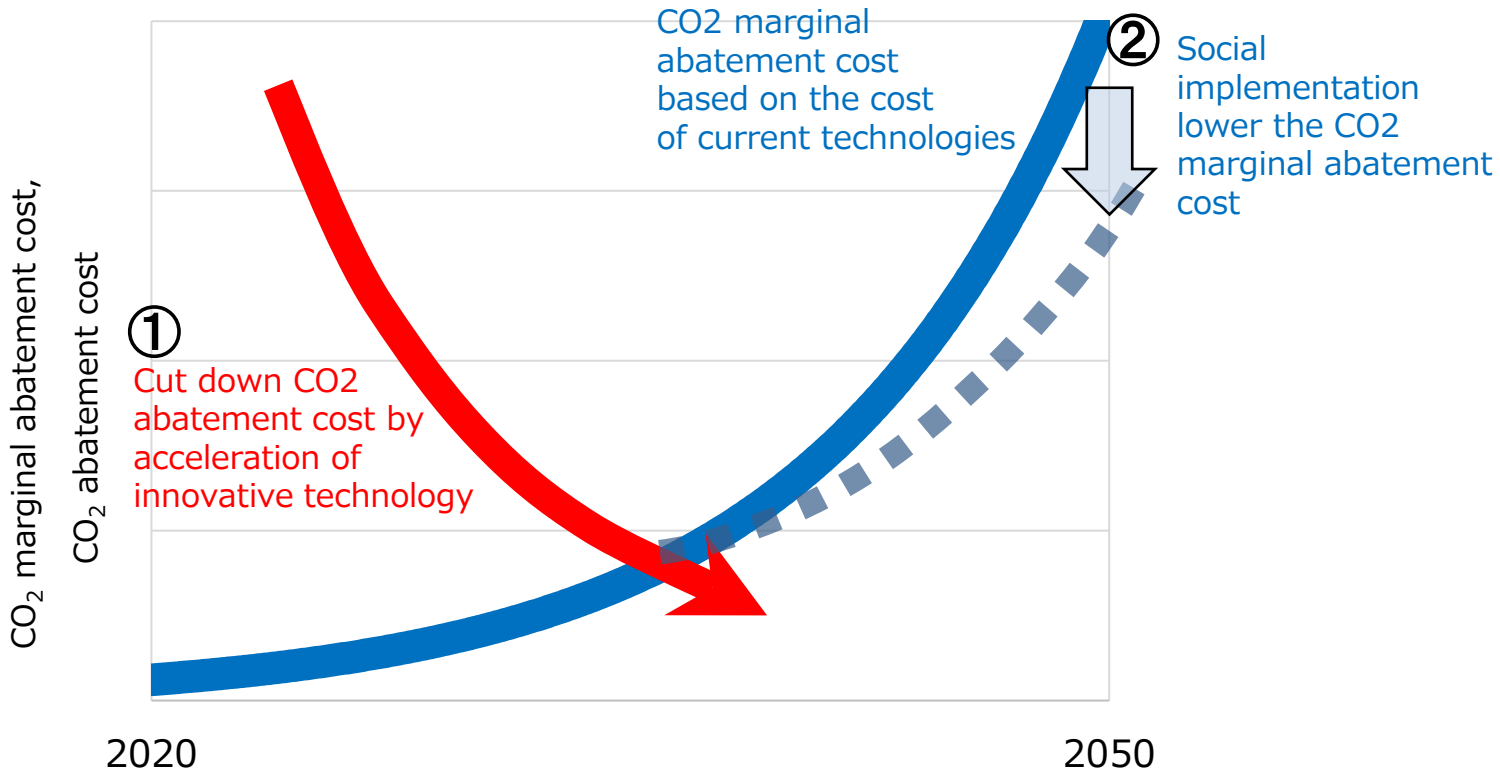
Cost and installation of Key Technologies



Source : IPCC AR6 Figure SPM.3

Reduction of abatement cost by acceleration of technology development

- Progress in the R&D of an innovative technology (e.g. PV, wind, battery, etc.) lowers the CO_2 abatement cost (red).
- Assuming that the rapid social implementation starts at the intersection of CO_2 abatement cost and marginal CO_2 abatement cost, the social implementation cuts down the marginal CO_2 abatement cost significantly, leading to dramatic reduction of countermeasures.



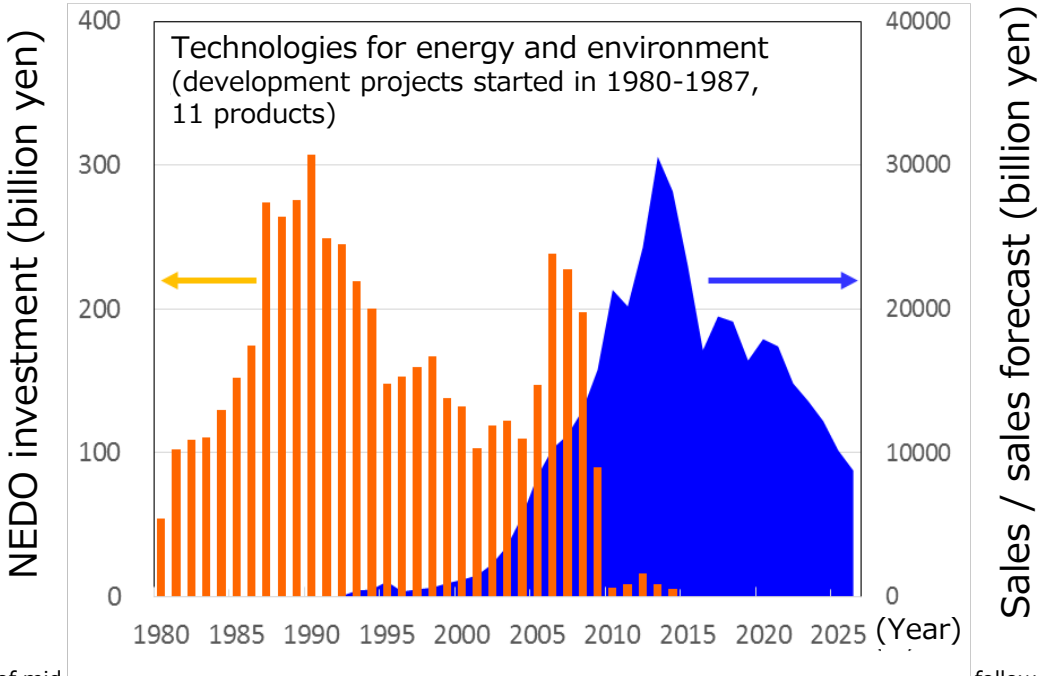
Importance of early start of innovative technology development

- It is important to start technology development as early as possible and to accelerate innovation since it takes about **20 years until the beginning of the product sales** in the filed of energy and environment according to the NEDO's analysis on the previous projects.

Technology field	Average period for NEDO investment	Average period from development to sale
Energy and environment	17 years (6～34 years)	20 years (6～34 years)
Industrial technologies	6 years (1～15 years)	7 years (3～14 years)

11 products, including solar power generation, wind power generation, and residential heat pump water heaters, which started development between 1980 and 1987

29 products, including continuously variable transmission for automobile、power semiconductors, which started development between 1998 and 2002



Source : "Investigation on the outcome of mid- and long- term projects for research and development: Analysis based on the data in follow-up research by NEDO" (NEDO)

Summary

- According to IPCC AR6, the CO2 abatement cost in 1.5℃ scenario can reach approximately \$200～700/tCO_2 in 2050. Disruptive innovation is essential to reduce the cost to levels acceptable to the world.
- To achieve carbon neutrality, innovation is necessary in key technologies such as decarbonization of energy supplied (renewable energy, hydrogen, etc.), reduction of final energy consumption (energy-efficient technologies, recycling technologies), and introduction of negative emission technologies. Additionally, non-energy-related GHG reduction sources such as raw-material conversion are also crucial.
- Since technologies in the energy and environmental sectors often take a long time to be implemented in society, it's crucial to initiate them early, accelerate their development, and promote their social implementation.
- The issue of global warming cannot be solved by Japan alone; it is a critical challenge that requires international collaboration and rule-making to address collectively on a global scale.

Thank you for your attention!