

Technology Development of CCS toward Carbon Neutral by NEDO

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Shigekazu Fukunaga

**Director General,
Environment Department**

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

- 1. About NEDO**
- 2. CCS Necessity**
- 3. NEDO's Effort on CCS**
- 4. NEDO R&D and Demonstration Base**
- 5. Green Innovation Fund**

1. About NEDO



Positioning of NEDO

In order to contribute to the resolution of social issues, NEDO formulates technology strategies and project plans and, as part of its project management, establishes project implementation frameworks by combining the capabilities of industry, academia, and government. NEDO also promotes technology development by carrying out, evaluating, and allocating funding to promising projects to accelerate the practical application of project results.

NEDO's Mission

Addressing energy and global environmental problems

Enhancing industrial technology



1. About NEDO

< Funding agency supports energy and industrial technology >



Covers a wide range of technology fields, necessary for the future

Energy Systems

- System provision technology
- Energy technology such as batteries
- Technology related to hydrogen production, storage, transport, and use
- Renewable energy technology

Industrial Technology

- Robot and AI technology
- IoT, electronics, and information technology
- Manufacturing technology
- Materials and nanotechnology
- Biotechnology

Energy Conservation and Environment

- Technology to harness unutilized thermal energy
- Environmentally-friendly steel manufacturing technology
- Development of high-efficiency coal-fired power generation technology
- CO₂ capture, utilization and storage
- Fluorocarbon recovery technology
- 3R technology, including resource screening and metal refining technology
- International demonstrations, Joint Crediting Mechanism activities, and others

New Industry Creation and Discovery of Technology Seeds

- Fostering technology-based startups
- Promotion of open innovation

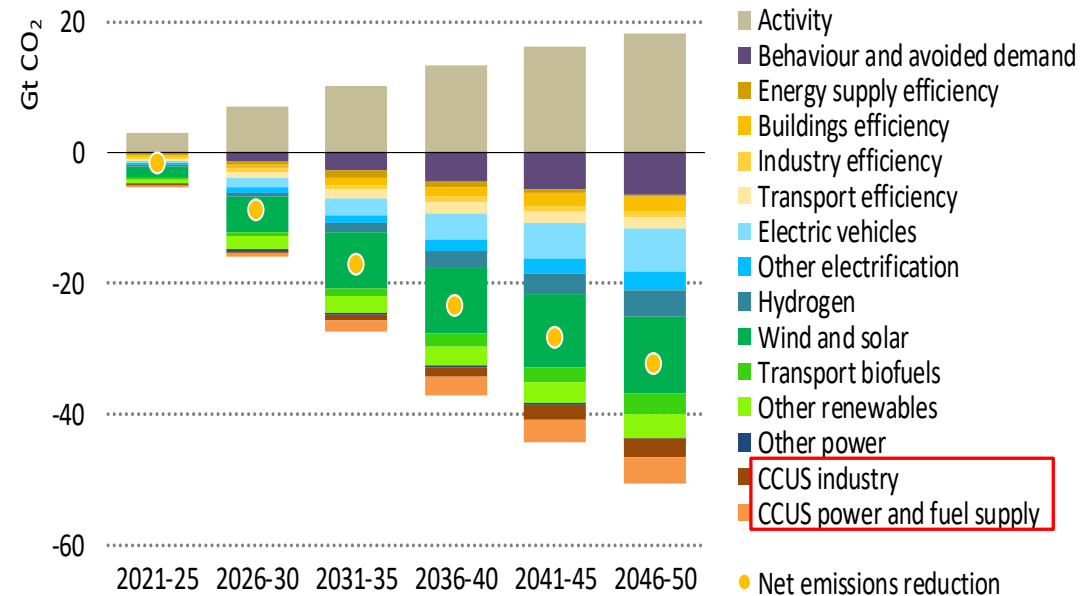
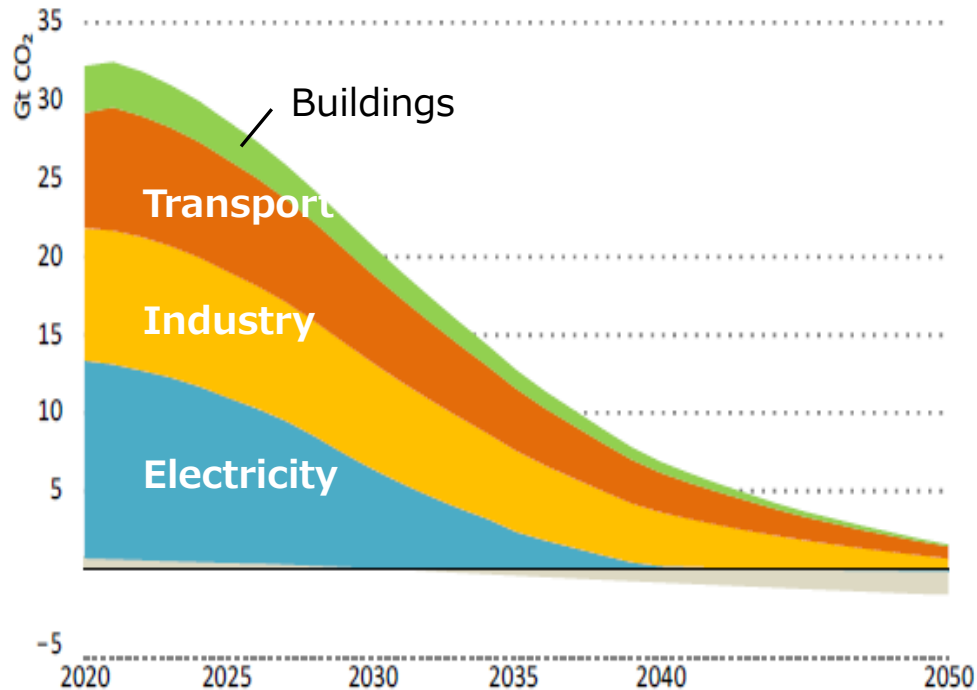


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2. CCS Necessity (1/2)

The IEA says that net-zero targets must quickly turn into real-world action. To reach our long-term climate goals, governments need to move fast to implement policies that can put global emissions into sustained decline in the coming years.

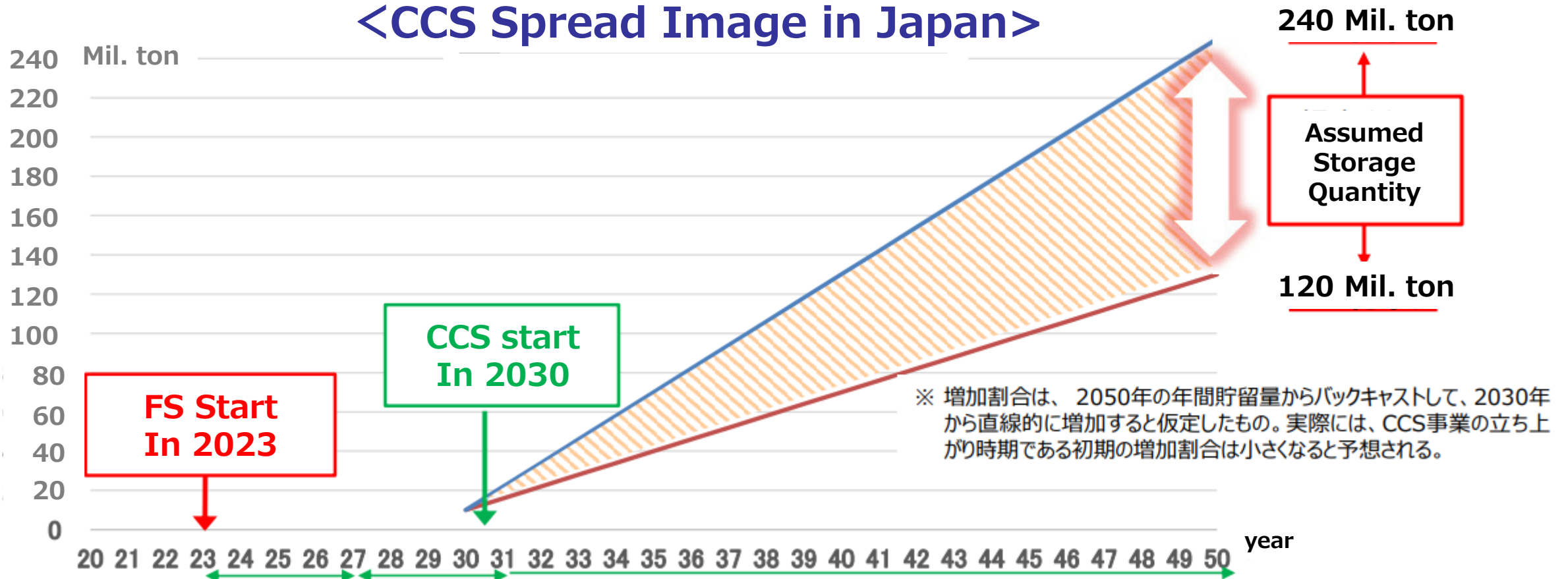
➔ CCUS/Carbon recycling is one of the solutions to reduce GHG emissions.



2. CCS necessity (2/2)

- CCS is a necessity based on IEA estimation.
- In 2050, CCS quantity is assumed as 120 ~ 240 million ton in Japan.
- In order to start CCS in 2030, FS is started in 2023, and FID will be necessary in 2026.

<CCS Spread Image in Japan>



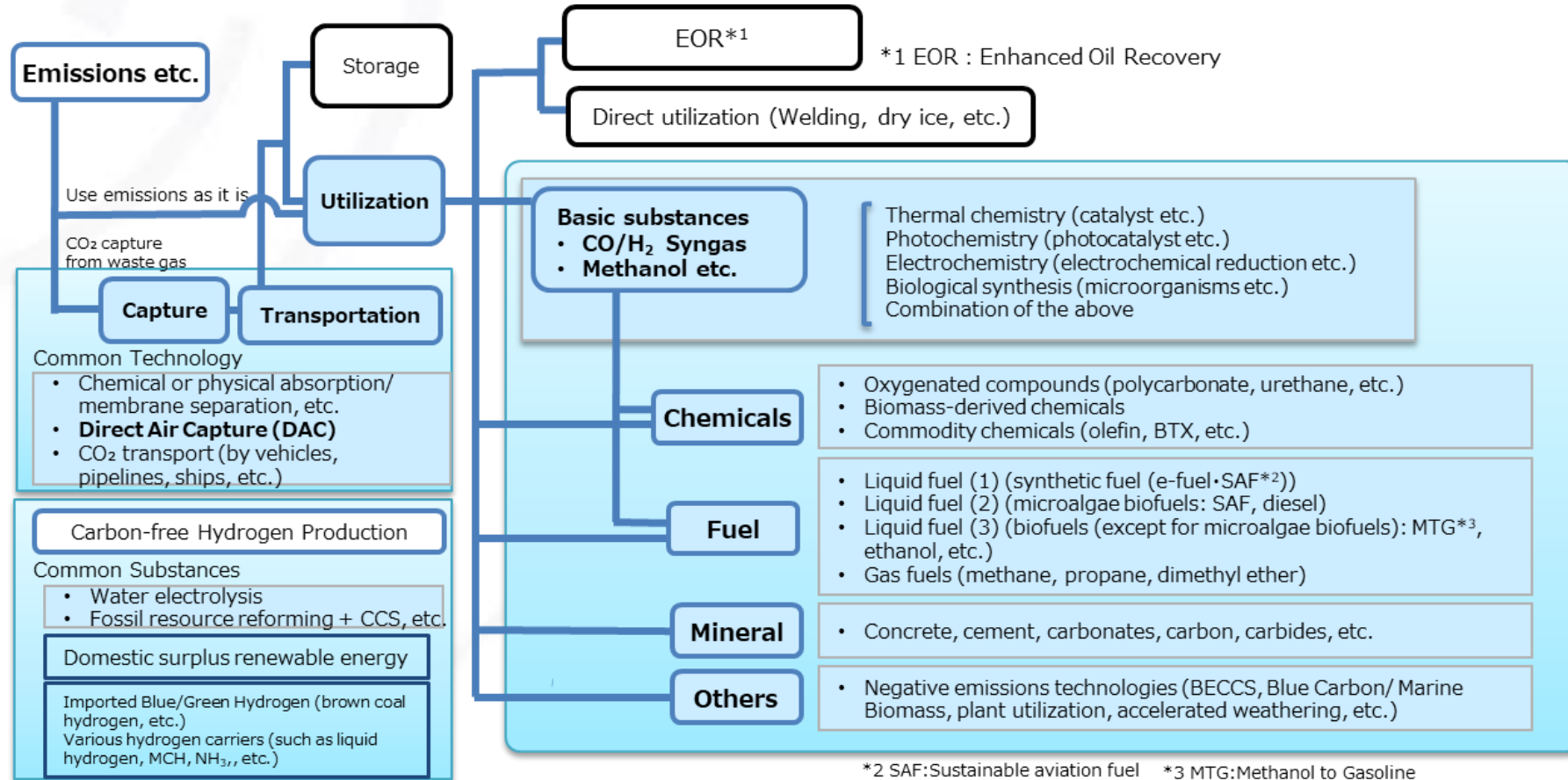
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3. NEDO's Effort on CCS

Carbon Recycling Overview

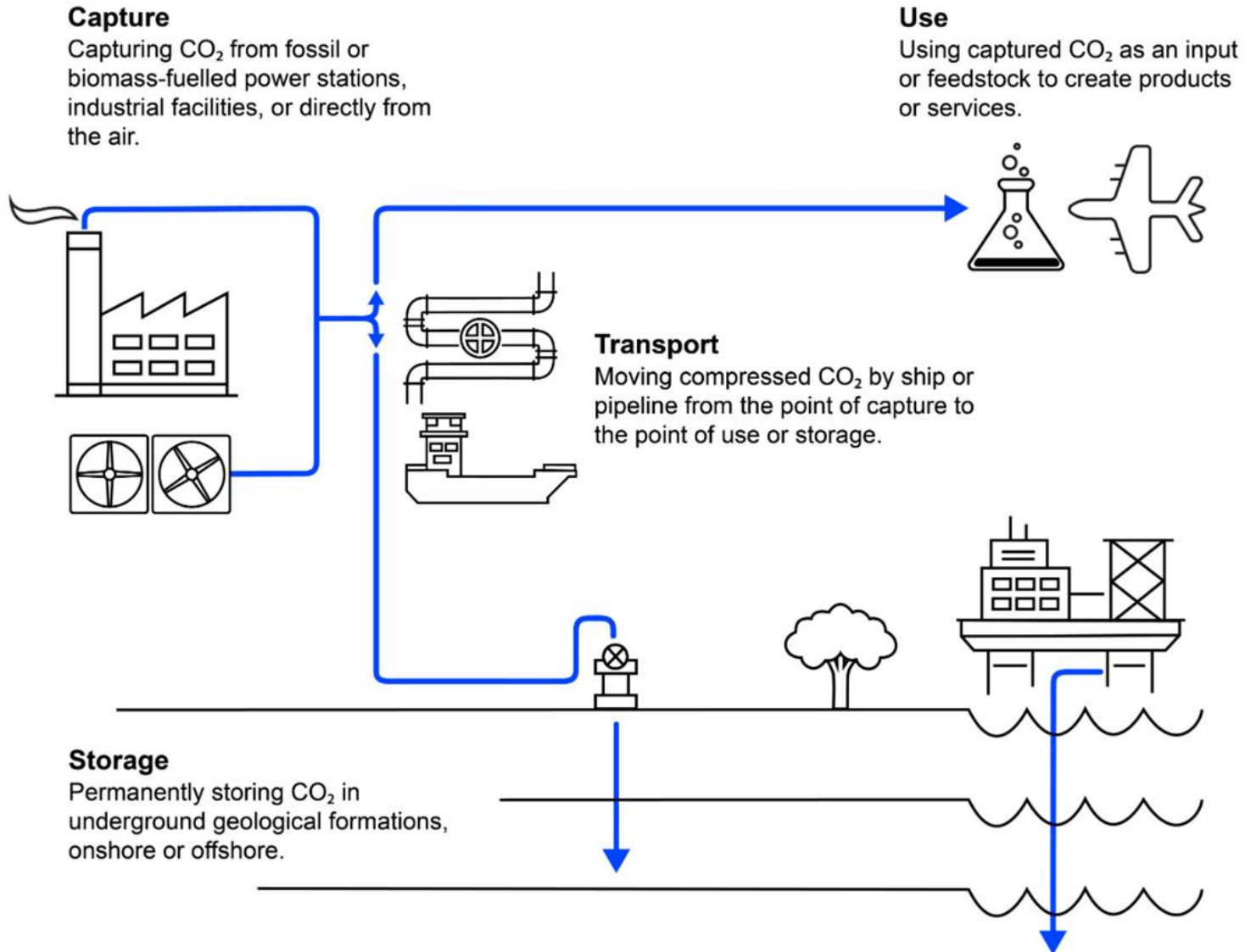


Carbon Recycling: Considering CO₂ as a resource, capture CO₂ and reuse it for concrete etc. by mineralization, for chemicals by artificial photosynthesis etc. and for fuel by methanation etc. to reduce CO₂ emissions into the atmosphere.



Source: Prepared by NEDO based on the Roadmap for Carbon Recycling Technologies (Ministry of Economy, Trade and Industry)

3. NEDO's Effort on CCS CCUS Overview

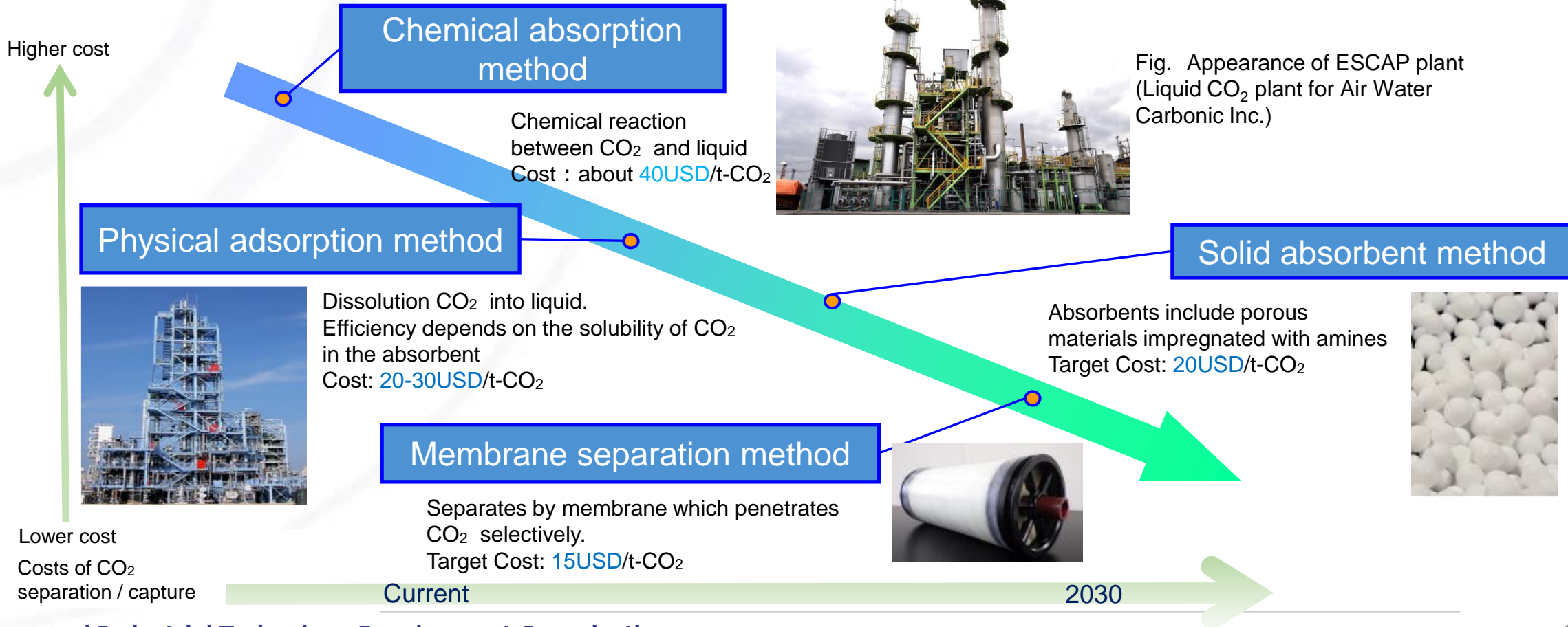


3. NEDO's Effort on CCS

3.1 CO₂ capturing and related technology



- ◆ CO₂ capture is a first step for Carbon Recycling system and reduction of its cost is critical for CR implementation.
- ◆ Finding cost and energy efficient method better than chemical absorption is the way of R&D in this field.

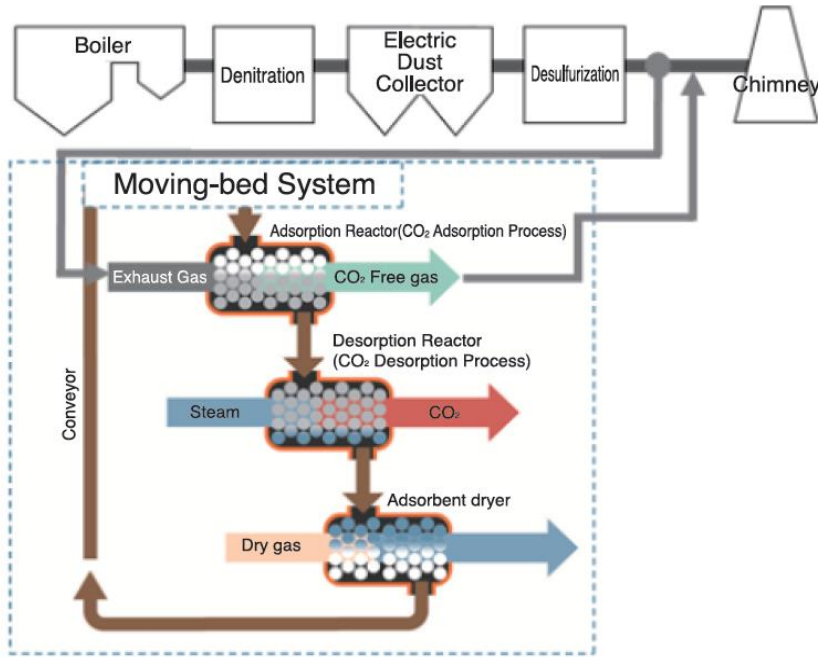


3. NEDO's Effort on CCS

3.1 CO₂ Capture



- ◆ NEDO aimed to lower costs and expand scale by developing a massive synthesis method for materials and conducting a bench-scale test using a moving-bed system since FY2018.
- ◆ Through a pilot-scale test at Kansai Electric Power Co., Inc's Maizuru Power Plant, which was started up in 2023, NEDO aims to put technology for capturing CO₂ with solid sorbents into practical use.



pilot-scale test facility

The Kansai Electric Power Company, Inc.
Maizuru power station
(Source: The Kansai Electric Power Company, Inc.)

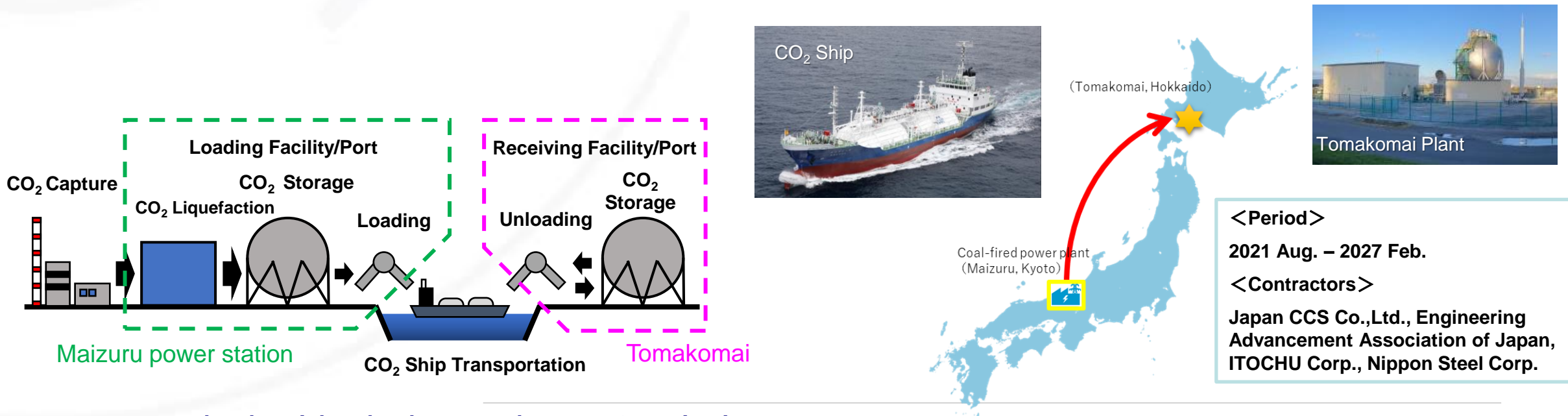
Image of the solid absorbent method (moving-bed)
for coal thermal power

< Period > 2018-2024
< Contractors > Kawasaki Heavy Industries, RITE

3. NEDO's Effort on CCS

3.2 CO₂ Transportation

- ◆ For the purpose of the safe and efficient transportation of CO₂ emitted from factories and thermal power plants for carbon recycle or CCS, NEDO will develop the integrated transportation system (CO₂ liquefaction, ship, transportation and tank storage) under optimal temperature and pressure conditions.
- ◆ 1,000 tons of liquified CO₂ vessel will be constructed and verifies above technical aspects.

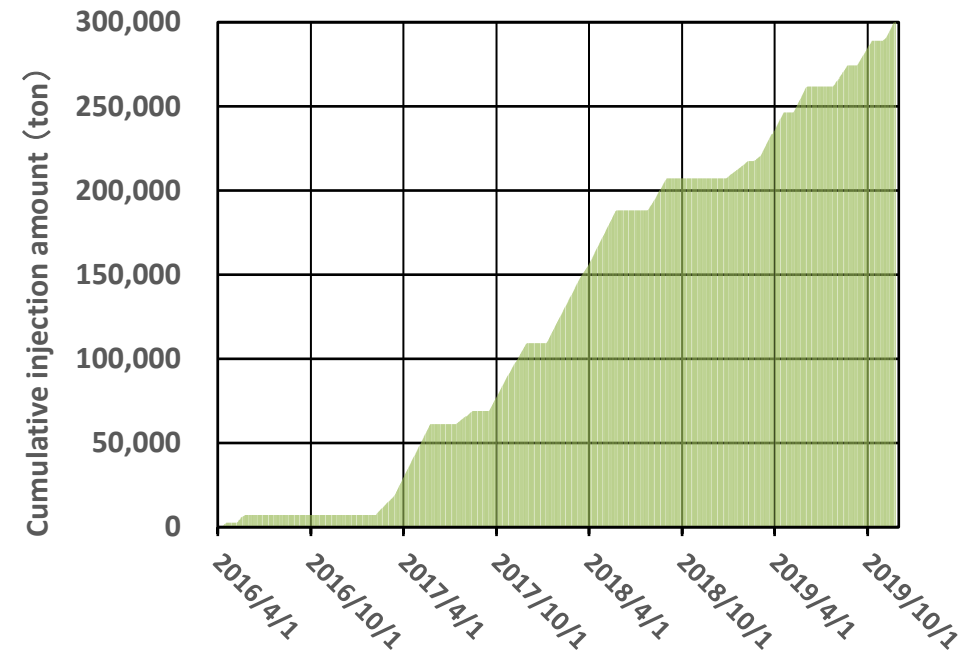
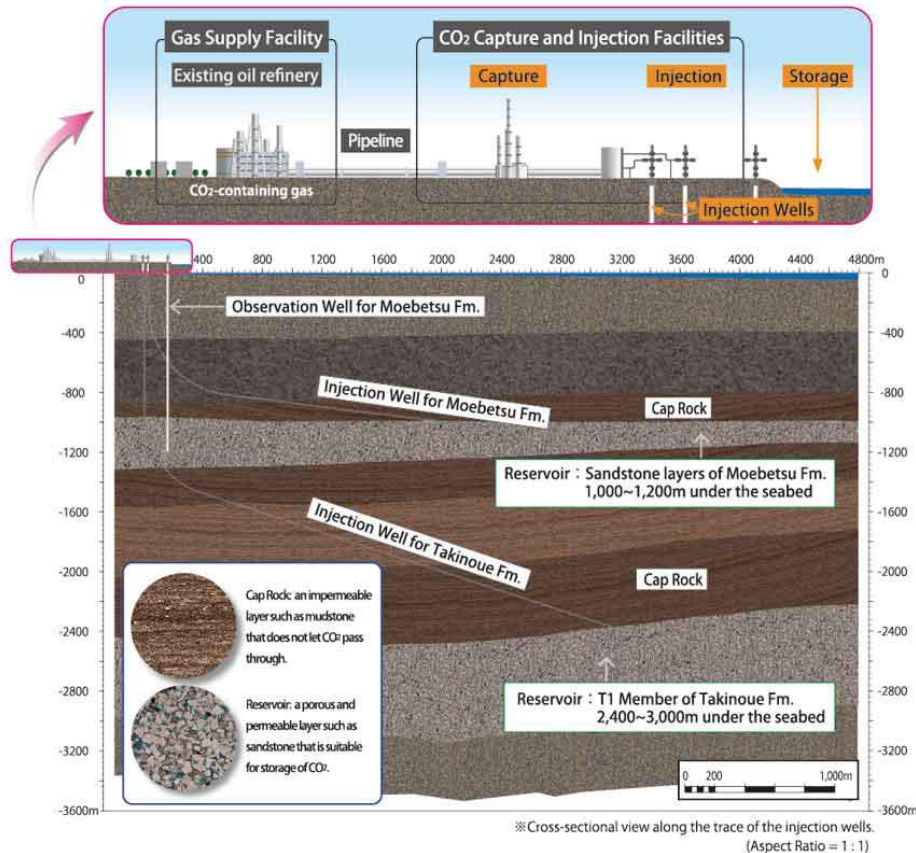


3. NEDO's Effort on CCS

3.3 CO₂ Storage -Tomakomai CCUS Demonstration Project-



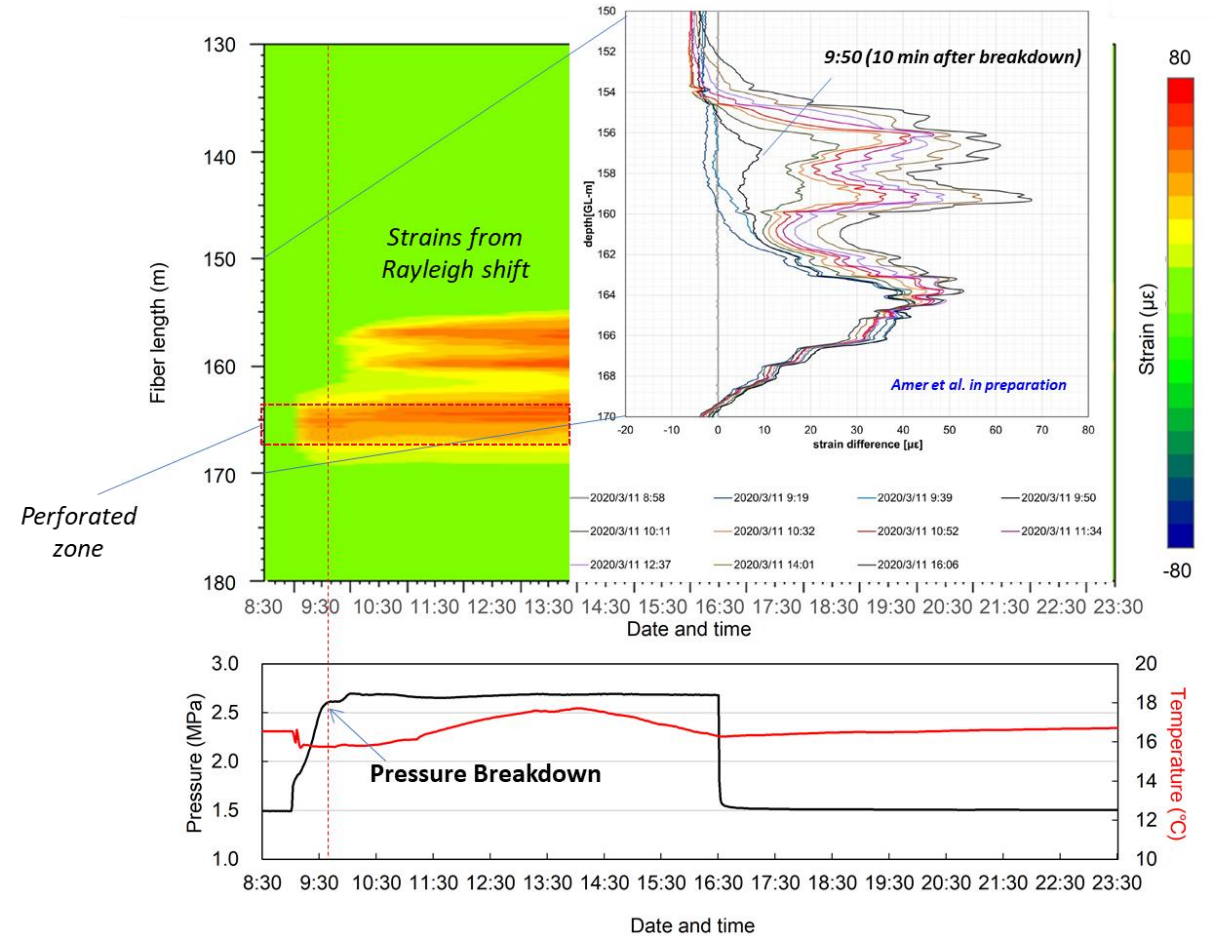
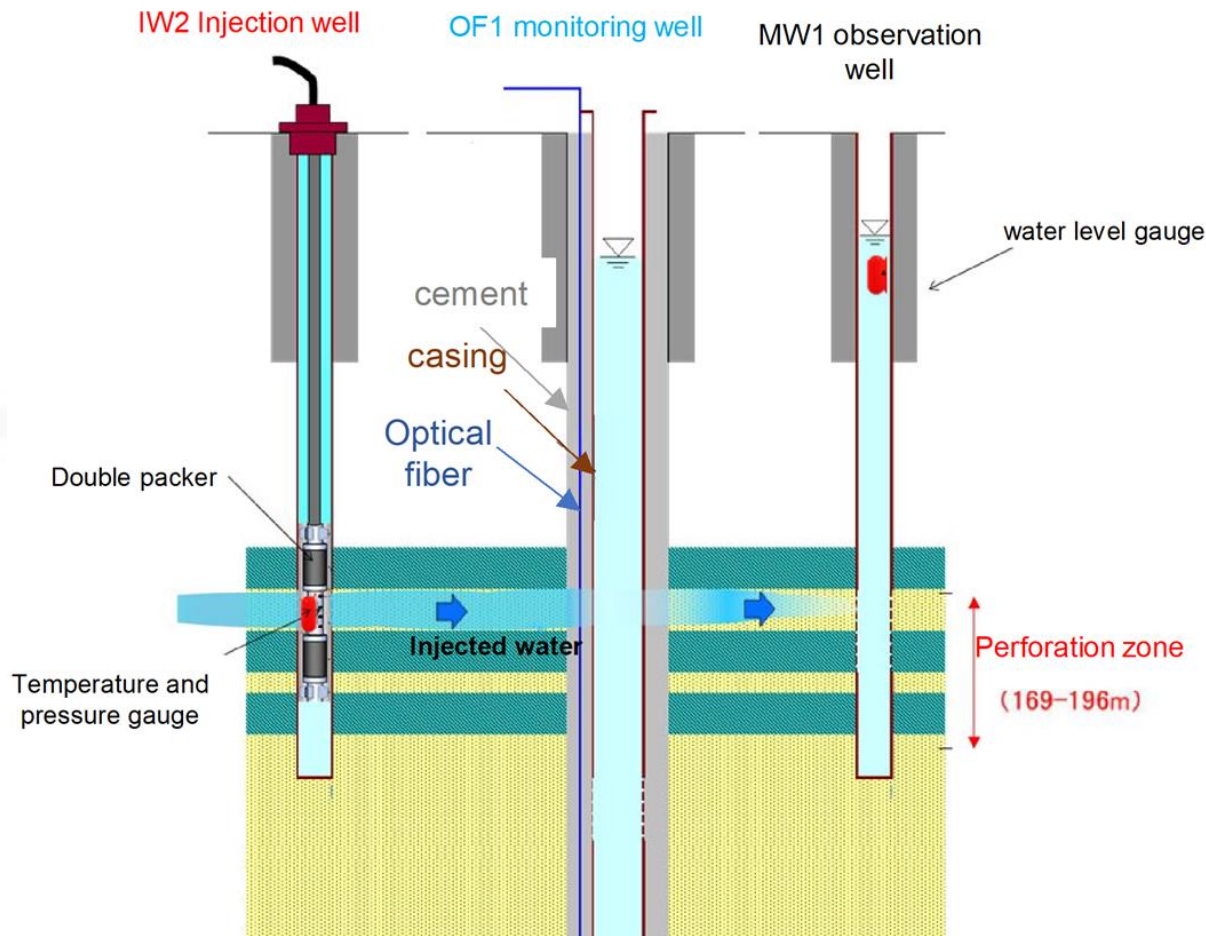
- ◆ To demonstrate the viability of a full-chain CCS system, from CO₂ capture to injection and storage in Hokkaido.
- ◆ CO₂ was captured from Exhaust gas of Existing Oil Refinery.
- ◆ CO₂ was injected to two reservoirs, Moebetsu formation(1000-1200m), Takinoue formation(2400-3000m).
- ◆ 300,000 tons of CO₂ was injected offshore reservoir in Tomakomai, one of large port city in Hokkaido.



CCS Demo. Plant CO₂ Injection Result

3. NEDO's Effort on CCS

3.4 CO₂ Storage Technology - Fiber Optic Sensing -

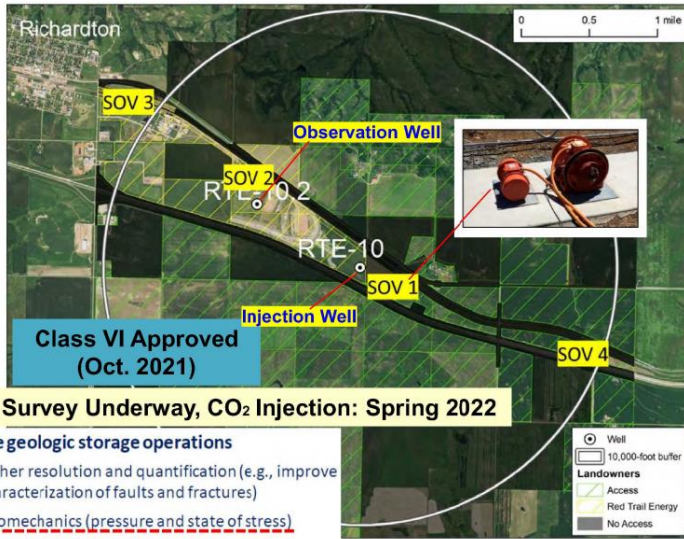


3. NEDO's Effort on CCS

3.4 CO₂ Storage Technology - Fiber Optic Sensing -



Fiber Optic Sensing for Multi-purpose Data Acquisition (DTS,DAS,DSS) and Permanent Monitoring for CO₂ Storage

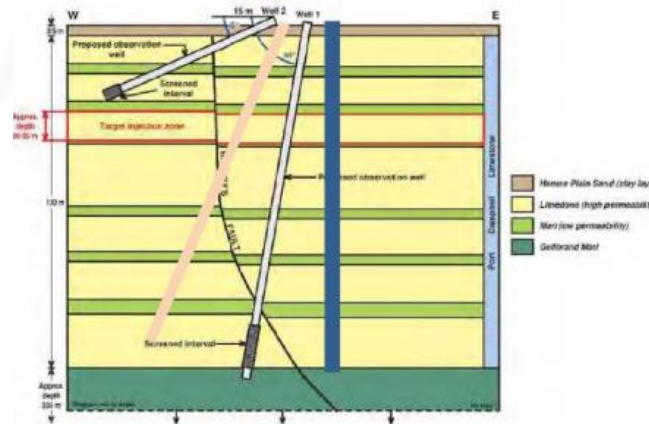


- US/DOE**
- Optimize geologic storage operations
 - Higher resolution and quantification (e.g., improve characterization of faults and fractures)
 - Geomechanics (pressure and state of stress)
 - Enabling real-time decision making

@North Dakota

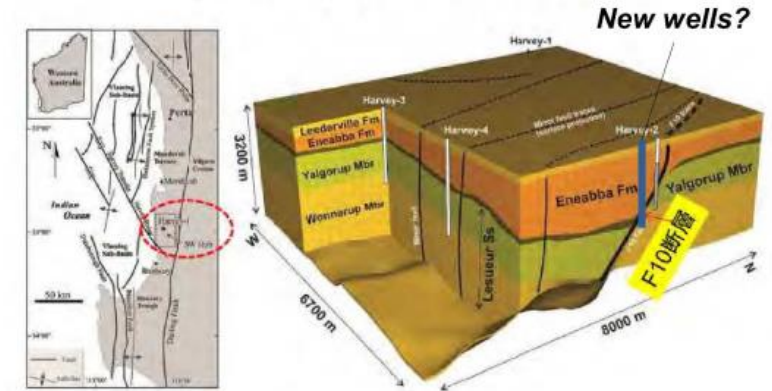
Collaborations Between RITE-CISRO & RITE-CO2CRC Fiber Optic Sensing for Fault Integrity Monitoring

Drilled and cored wells through fault
New wells?



RITE-CO2CRC @Otway

The South West Hub In-Situ Laboratory – A Facility for CO₂ Injection Testing and Monitoring in a Fault Zone



RITE-CISRO @SW Hub In-Situ Lab

3. NEDO's Effort on CCS

3.5 CO₂ Storage Guideline



 Geological Carbon Dioxide Storage
Technology Research Association



Practical Guidance for
Geological CO₂ Storage

Phase **01**

Overview of
Geological CO₂ Storage

<https://www.co2choryu-kumiai.or.jp/cms/wp-content/uploads/2021/10/practical-guidance-01-e.pdf>

Phase
01 Preliminary
plan



Phase
05 Design and
construction



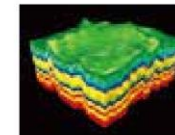
Phase
02 Site selection



Phase
06 Operation and
management



Phase
03 Site
characterization



Phase
07 Site closure



Phase
04 Implementation
plan



Phase
08 Post-closure
management



Publication Schedule

Phase 01 : Oct. 2021

Phase 02-03 : Mar. 2022

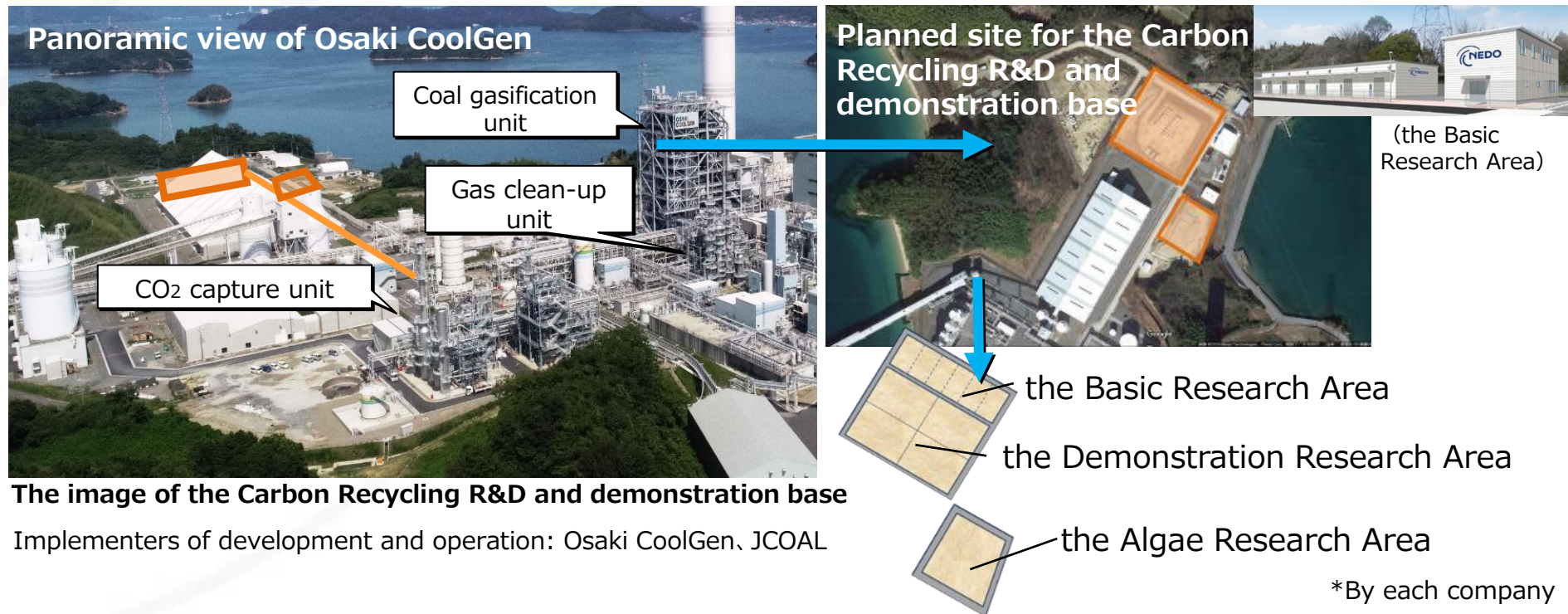
Phases 04-08: FY2023

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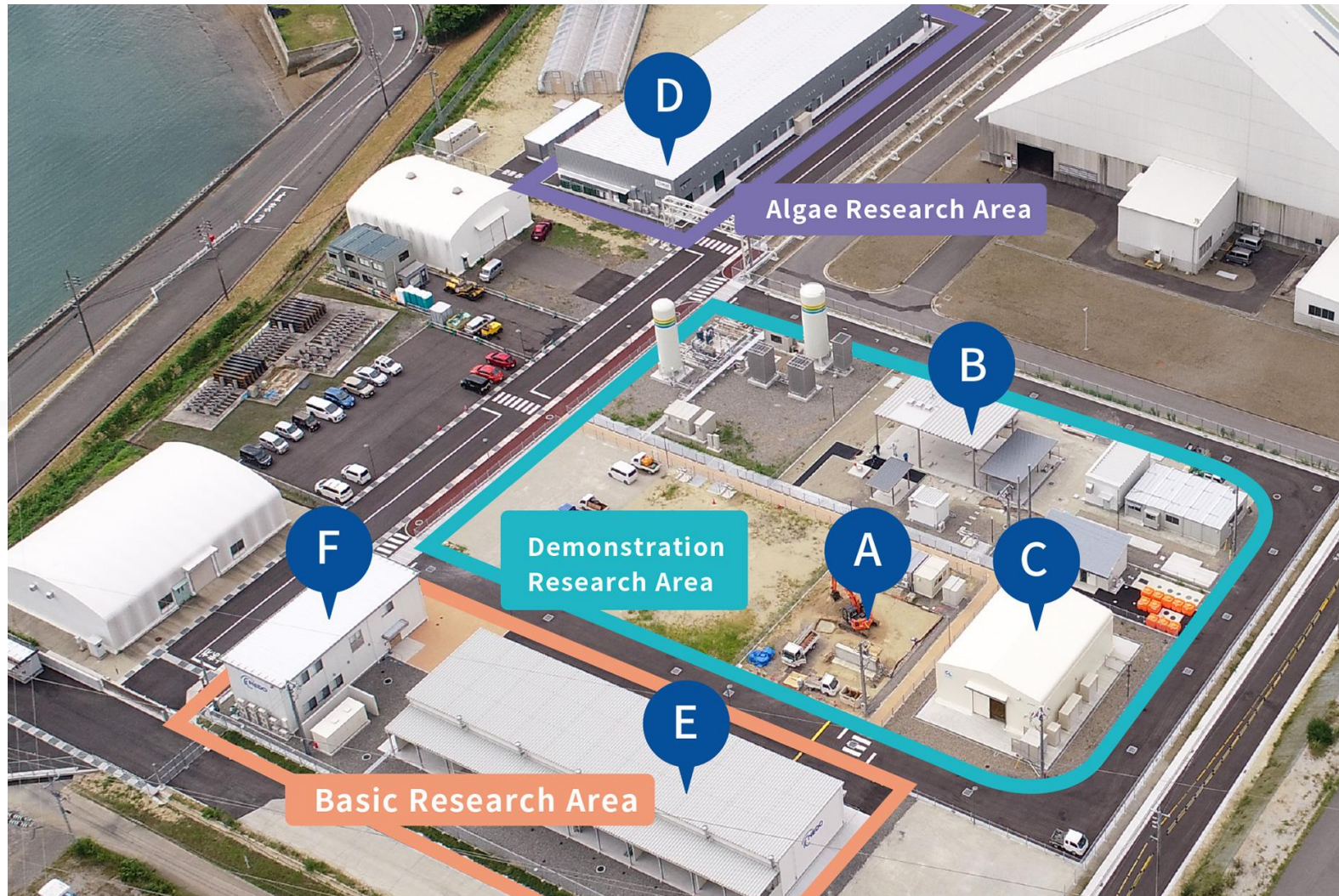
4. NEDO R&D and Demonstration Base <Carbon Recycling : Osaki CoolGen Project>



- ◆ In order to bring innovations in CR technologies, it is necessary to keep an easy access to certain amount of CO₂ as a research resource. (2022. Sept ~)
- ◆ Coordinating with other NEDO project; Osaki Cool Gen (IGCC demonstration plant), captured CO₂ has been supplied to CR research and demonstration facilities via pipeline.



4. NEDO R&D and Demonstration Base <Carbon Recycling : Osaki CoolGen Project>



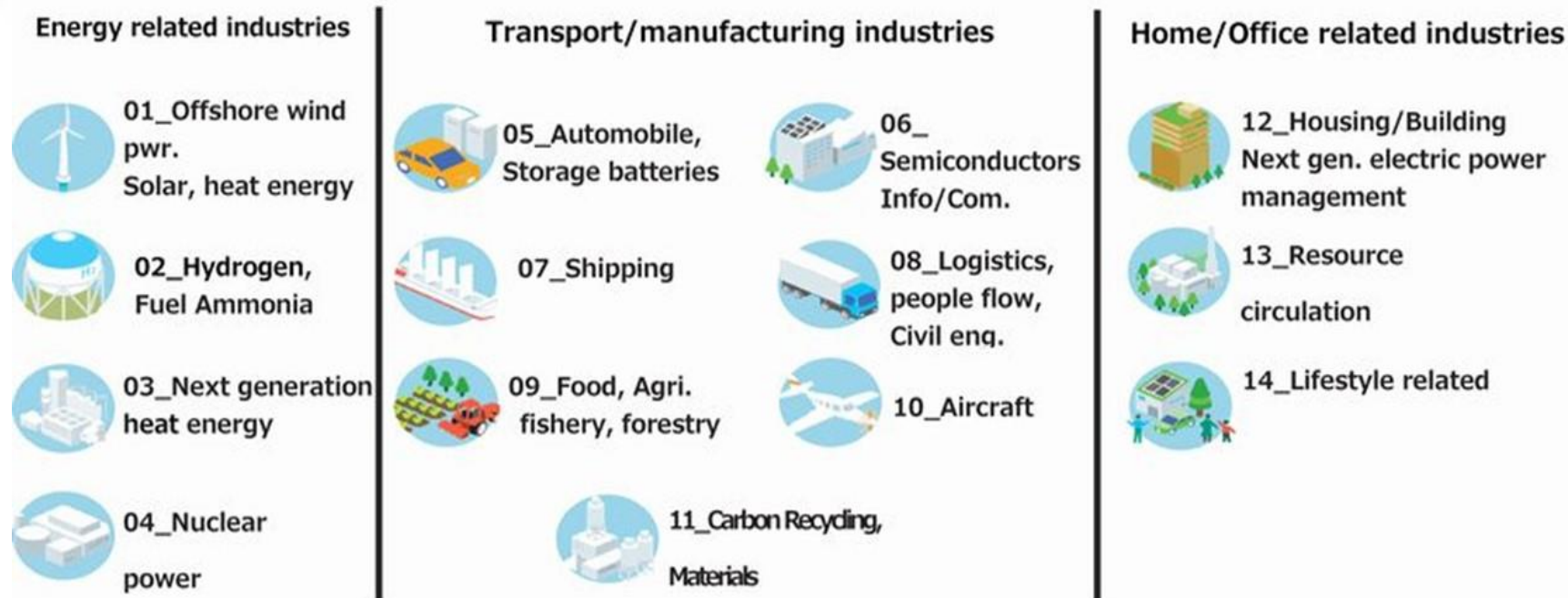
- A** Carbon recycling technology demonstration and R&D with co-production of multiple valuable commodities by using seawater
- B** Research of Selective Synthesis Technology of Chemical Products for Carbon Recycling
- C** Development of Gas-to-Lipids Bioprocess
- D** Establishing a Research Base and Developing Technologies that Lead to Increased CO₂ Utilization Rate for the Production of Microalgae-Derived SAF
- E** Research Building
- F** Common Use Building

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- In October 2020, the Government of Japan declared that it aims to **achieve carbon neutrality by 2050**.
- The Ministry of Economy, Trade and Industry in collaboration with other ministries and agencies, **formulated the "Green Growth Strategy through Achieving Carbon Neutrality in 2050"**.
- This strategy specifies 14 promising fields that are expected to grow and provides action plans for them from the viewpoints of both industrial and energy policies.

14 growth sectors



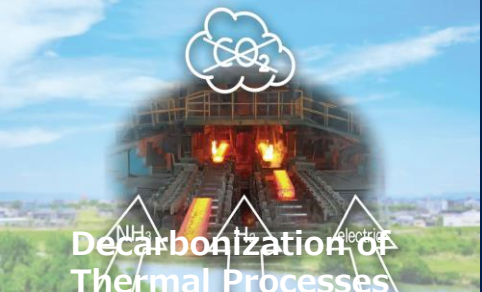
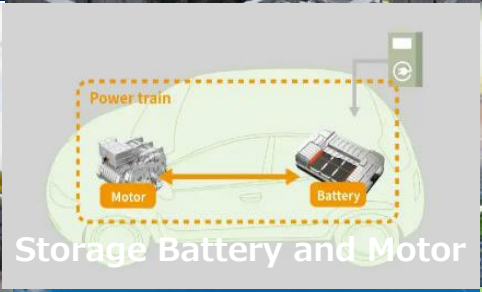
“The Green Innovation Fund ”

Creation of 2.8 trillion yen

**Continuous
Support for
Up to 10 years**

**From
Ambitious R&D
to social
implementation**

**Management
Commitment**



Already formulated 19 Projects



Thank you for your attention.