

JAPAN'S EFFORTS OF ENERGY INNOVATION

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Table of Contents

1. Hydrogen

2. Carbon Recycling

3. G20 Ministerial Meeting on Energy Transitions
and Global Environment for Sustainable
Growth

Hydrogen Strategy

● “Basic Hydrogen Strategy” (Prime Minister Abe’s Initiative)

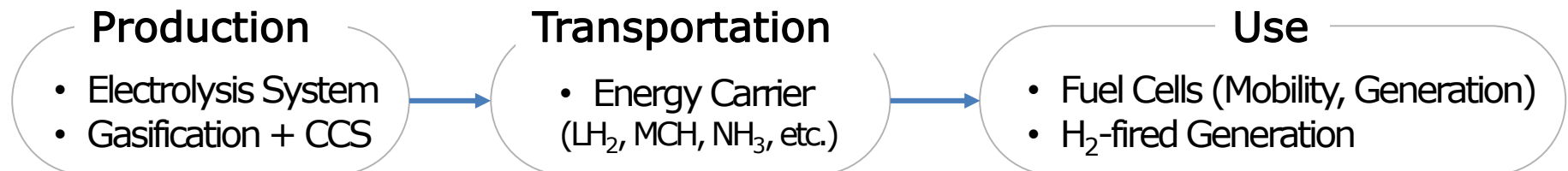
- ✓ World’s first national strategy
- ✓ 2050 Vision: position H₂ as a new energy option (following Renewables)
- ✓ Target: make H₂ affordable (\$3/kg by 2030 ⇒ \$2/kg by 2050)



3 conditions for realizing affordable hydrogen

- 【Supply】 { ⊖ **Inexpensive feedstock** (unused resources, renewables)
⊖ **Large scale H₂ supply chains**
- 【Demand】 • ⊗ **Mass usage** (**Mobility** ⇒ **Power Generation** ⇒ Industry)

● Key Technologies to be Developed



Direction of Activities to Realize a "Hydrogen Society"

Production

Domestic fossil fuels

City gas
LP gas

Reforming

Byproduct
hydrogen

Future

Overseas unused energy

Brown coal

Gasification

CCS

Byproduct
hydrogen

Overseas
renewable energy

Water
electrolysis

Renewable energy

Solar power

Water
electrolysis

Wind power

*Use hydrogen as a means of energy storage (absorb fluctuations in intermittent RES)

Transportation and supply (supply chain)

— City gas pipeline/LPG supply network —
— Liquefied hydrogen lorry —
... Hydrogen pipeline ...

- Installation of 113 stations nationwide
- Promotion of regulatory reform for cost reduction



Hydrogen station

- Demonstration of the world's first international hydrogen supply chain in 2020

Large-scale hydrogen ocean Transportation network



- Demonstration of large-scale power-to-gas @Fukushima/aiming for use in the 2020 Tokyo Olympic and Paralympic Games

Use

- 2,900 vehicles installed
- 40,000 vehicles by 2020

Fuel cell vehicles
(FCV, FC bus, etc.)



- Entered service in Tokyo in March 2017
- 100 buses by 2020

Transportation

- Over 270,000 units installed

Fuel cell cogeneration
(e.g. Ene-Farm)

Reforming



- For Business and Industry use, some models have already been launched in 2017

Future

Hydrogen power generation
(CO₂-free thermal power plants)



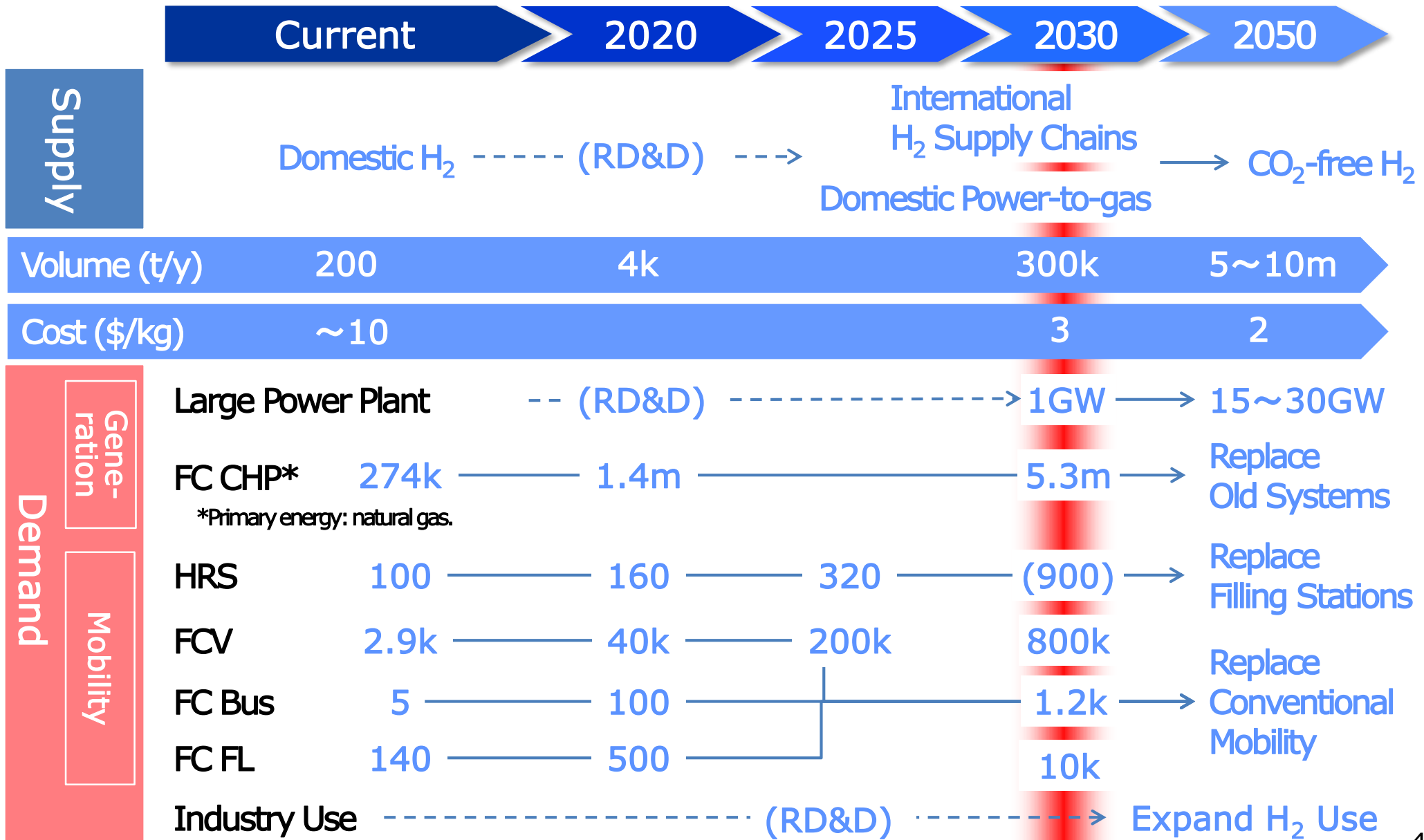
- Combined heat and power supply using hydrogen cogeneration in Kobe in early 2018

Power generation

Use in the industrial sector
(Power-to-X)

Other

Scenario



Hydrogen Energy Ministerial Meeting

- Date / Place : October 23rd, 2018 / Dai-ichi Hotel Tokyo
- Organized by : METI , New Energy and Industrial Technology Development Organization (NEDO)
- Participants : 300 people including representatives from 21 countries, regions, international organizations, etc.*

*Japan, Australia, Austria, Brunei, Canada, China, France, Germany, Italy, the Netherlands, New Zealand, Norway, Poland, Qatar, South Africa, Korea, United Arab Emirates, United Kingdom, United States, European Commission, IEA Participants :

PROGRAM

- Ministerial Session
- Industry and International Organization Session
 - Plenary Session: Potential of Hydrogen Energy for Energy Transition
 - Session 1: Expansion of Hydrogen Use - Mobility & H₂ Infrastructure -
 - Session 2: Upstream & Global Supply-chain for Global Hydrogen utilization
 - Session 3: Renewable Energy Integration & Sectoral Integration

Tokyo Statement

We share the view that hydrogen can be a key contributor to the energy transitions underway to clean energy future and an important component of a broad-based, secure, and efficient energy portfolio. Also, we confirmed the value of collaborating on the following four agendas on "Tokyo Statement" to achieve a "Hydrogen Society" .

- ◆ Harmonization of Regulation, Codes and Standards
- ◆ Study and Evaluate Hydrogen's Potential
- ◆ International Joint R&D emphasizing Safety
- ◆ Communication, Education and Outreach

*Hydrogen Energy Ministerial Meeting 2019 is scheduled for September 25th in Tokyo. (tentative)



Japan Promotes Carbon Recycling

Carbon Recycling

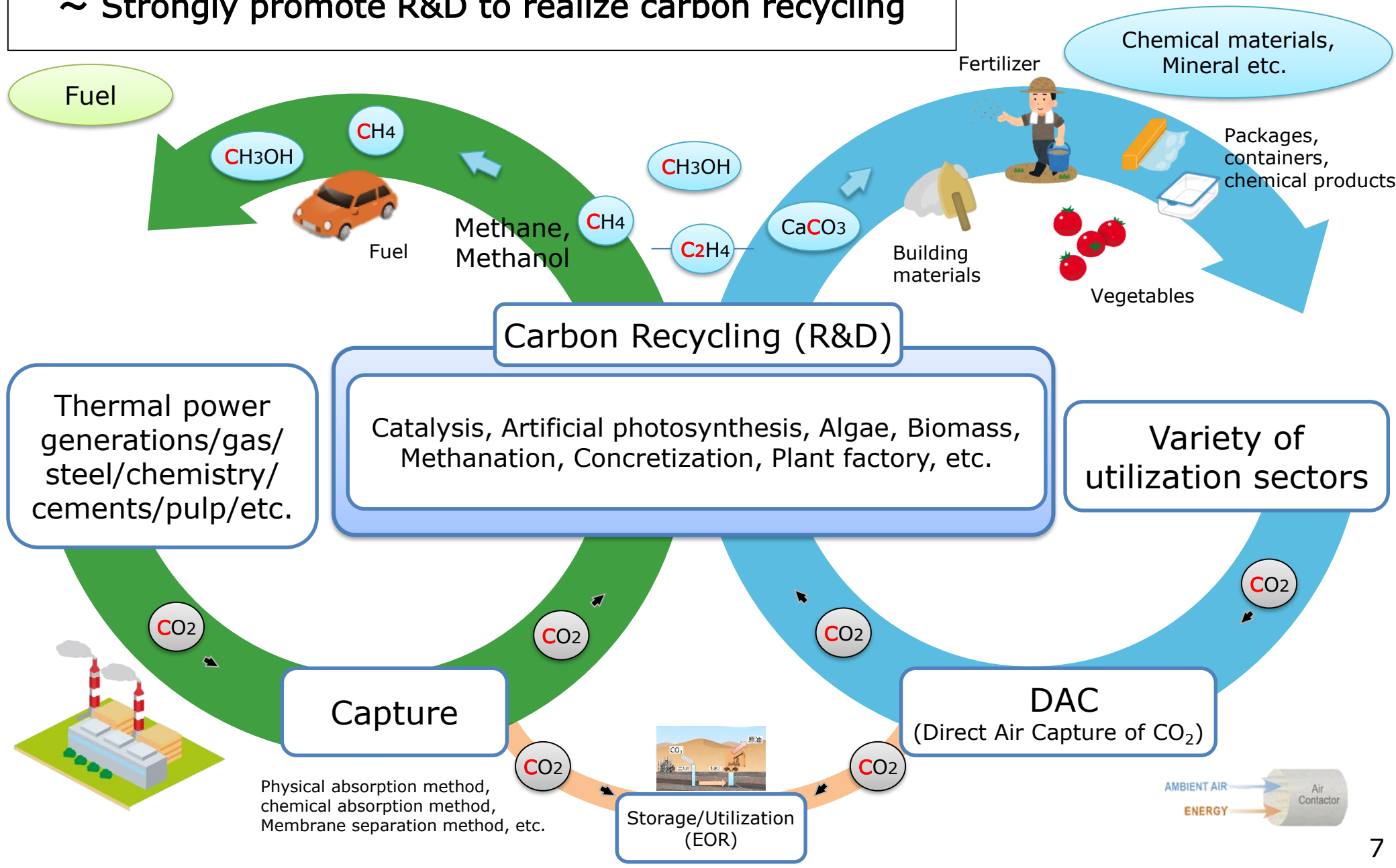
- Considering Carbon dioxide (CO₂) as source for Carbon, capture CO₂ then utilize and recycle it as Carbon compounds.
- Focusing on utilization of CO₂, in order to contribute to the energy security issues as well as climate change problems by innovative R&D with industries, academia and public from all over the world.

Current and future activities

- Establishment of Carbon Recycling Promotion Office in ANRE※¹/METI※² as of February 1st, 2019
 - ⊖ Drafting roadmap for carbon recycling technologies by June 2019.
 - ⊖ Spreading the importance of “Carbon Recycling” through the discussion of G20 Ministerial Meeting on Energy and Environment on June, 2019.
 - ⊗ Hosting International Conference on Carbon Recycling among industries, academia and governments on September 25th, 2019.

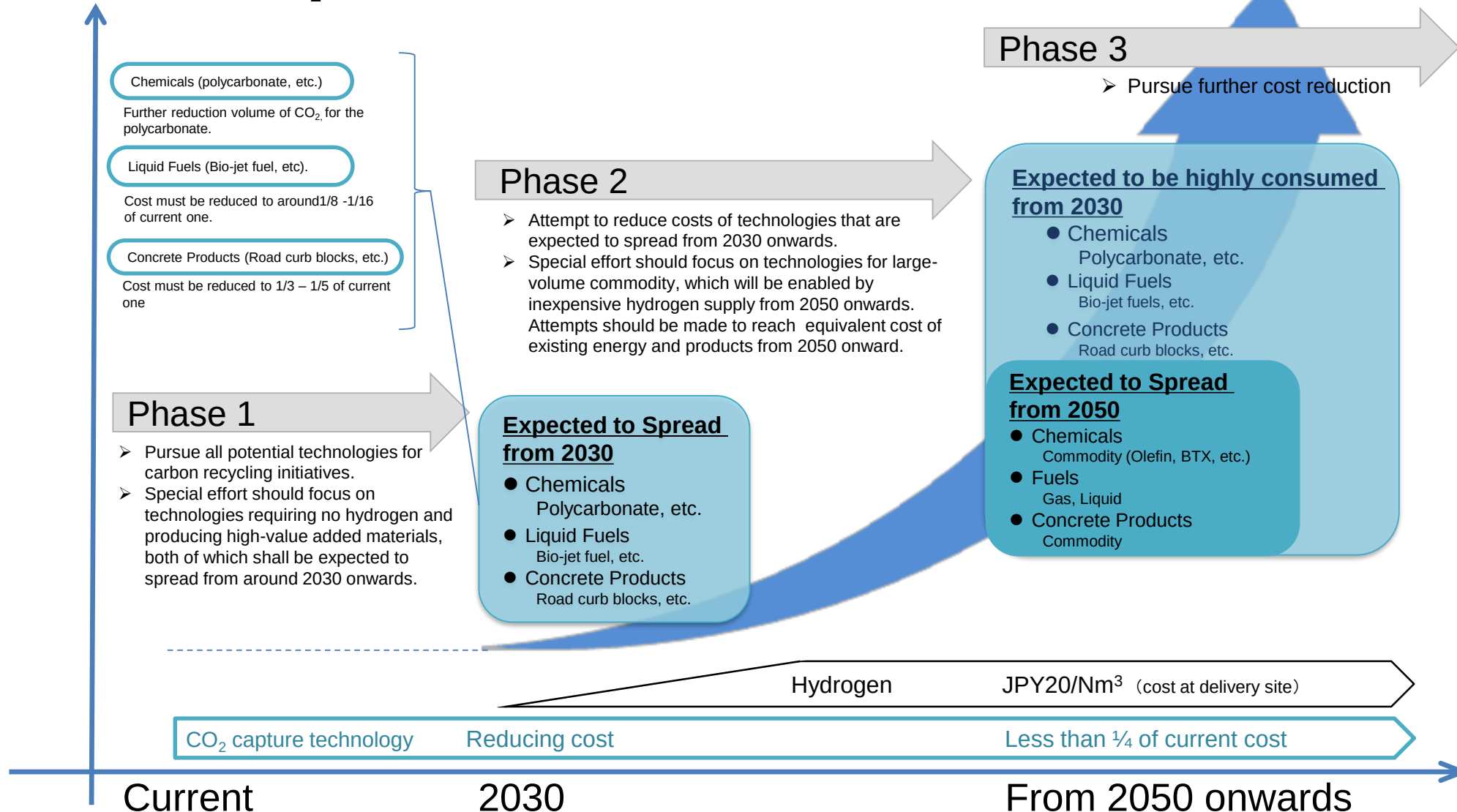
Concept of Carbon Recycling

~ Strongly promote R&D to realize carbon recycling



Roadmap for Carbon Recycling Technologies

Volume of utilized CO₂



<Review process> Be flexible in the addition of technologies based on the state of international technology development obtained through the International Conference on Carbon Recycling among Industry-Academia-Government, or proposals of new technologies. The roadmap should be reviewed in five years as needed, take into account the revision of the "Long term Strategy for Growth strategy based on the Paris Agreement (provisional translation)".

International Conference on Carbon Recycling

1. Date, Venue and Other Information

(1) Date : 13:30 – 17:00 on September 25th, 2019

Venue: International Convention Center “Tsuruno-ma”, Hotel New Otani, Tokyo

(2) Organizer : METI Co-Organizer: NEDO Sponser(P) : JOGMEC, AIST, IEA

(3) Outline and Purpose

- Japan will hold an International Conference on Carbon Recycling in order to collaborate with the industrial, academia and governmental sectors worldwide promoting the discussions for the deployment and the expansion of the concept of “Carbon Recycling”. Specifically, Japan will aim to pave the way to international collaboration towards the realization of Carbon Recycling through ⊖sharing the Roadmap for Carbon Recycling Technologies, ⊖sharing the best practice regarding Carbon Recycling of each country, ⊗deliberating on potential for international collaboration and discussing the challenges to effectively promoting innovation for Carbon Recycling.



2. Agenda (TBC)

● Agenda 13:30-17:00

13:30-14:30 Ministers Session

- ⊖Opening Remarks *METI Minister Seko*
- ⊖Keynote Address *Ministers (from worldwide)*
- ⊗Photo Session *Minister Seko and Ministers*

14:30-17:00 Industry-Academia-Government Session

- ⊖Roadmap for Carbon Recycling Technologies *METI*
- ⊖Carbon Recycling R&D for future *Industry, Academia*
- ⊗Networking Coffee Break
- ④Panel Discussion
 - Efforts addressing challenges for creating Eco System-
 - Industry, Academia and*

Governments

- ⑤Chairman's Summary
 - Towards paving the way for international collaboration-

3. Participants (TBC)

Governments

Japan : METI Minister Seko
+ 4~5 Ministers

Industry

Oil, Gas, Coal, Iron, Chemical,
Material, Electric Power,
Auto Mobile, Heavy Industry,
Agriculture, etc.

Academia (Area)

Catalysts, Artificial Photosynthesis,
Utilize Algae, Methanation,
Manufacturing Concrete, Chemical,
Biological Conversion Technologies,
etc.

International Organization

IEA, GCCSI, ICEF, CSLF etc

-Focus on the importance of a virtuous cycle of environment and growth, that achieves “3E+S” (Energy security, Economic efficiency, Environment and Safety)

●Outcomes :

- 1 Communiqué
- 2 Innovation Action Plan

●Presidency Deliverables prepared by the IEA :

- 1 Innovation Gaps 2.0
- 2 Hydrogen Report
- 3 How to secure low carbon investment”
- 4 Update on progress in the reform of “IFFS”

●Main Discussion

1. Innovation

- Collecting wisdom from around the world including the annual conference of RD 20 (Research and Development 20).
- Mobilizing finance and investment and Improving business environments to encourage innovation

2. Energy Transitions

- Strengthening international cooperation on innovation such as hydrogen, CCUS including Carbon Recycling, nuclear, digitalization, biofuels, heat pumps and sector coupling.
- Further promotion of energy efficiency including well-to-wheel analysis in transport
- The investment in low-carbon power sources, system integration of renewable energy, decommissioning and final disposal of radioactive waste regarding nuclear, cleaner use of fossil fuels, transparency and flexibility of the international market for natural gas including LNG and improvement of energy access.