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Enhanced Oil Recovery

Strategy of Japan and roles of JOGMEC towards Carbon Neutrality

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Hydrogen and CCS Project Department, Energy Business Unit

Japan Organization for Metals and Energy Security

November 24, 2022

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    ・Green Growth Strategy
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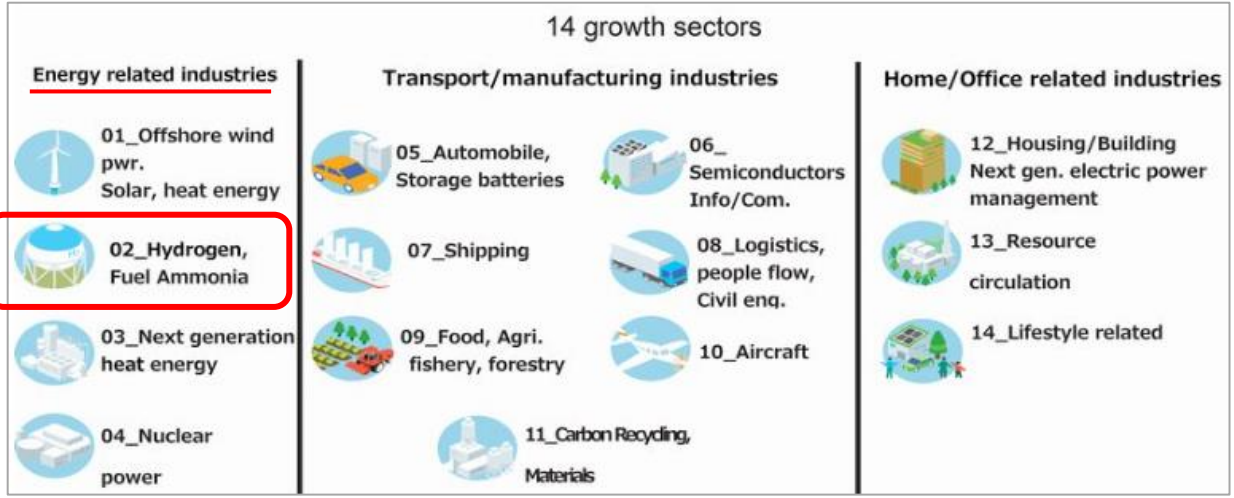
2. JOGMEC's role for achieving energy security and carbon neutrality

    ・JOGMEC's new activities – Carbon Neutral Initiatives
    ・Amended JOGMEC law has been enacted
    ・CCS, Hydrogen, and Ammonia projects
    ・JOGMEC’s CCS Guideline, GHG/CI Guideline and a new guideline related to CO2EOR storage

Japan's Policies for Carbon Neutrality -(Hydrogen/Ammonia)

・Japan declared reducing its greenhouse gas emissions **by 46% in 2030 compared to the level of 2013, and to net-zero in 2050**.

・In December 2020, METI (Ministry of Economy, Trade and Industry) formulated an industrial policy **"Green Growth Strategy Through Achieving Carbon Neutrality in 2050"** which aims to promote a positive cycle of economic growth and the environmental protection.
・The Strategy specifies 14 promising fields that expected to grow and provides them with action plans from the viewpoints of both industrial and energy policies.

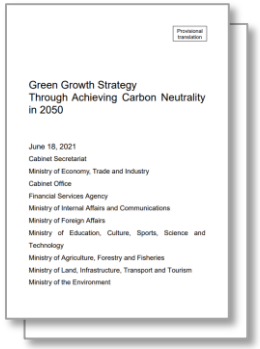


The Green Growth Strategy includes **CCS** as a measure to reduce emissions from thermal power generation and industrial production processes such as steel and cement, and it is expected to reduce emissions by 30-40% by 2050.

(Source, METI: https://www.meti.go.jp/english/policy/energy_environment/global_warming/ggs2050/index.html)

Japan's Policies for Carbon Neutrality -(Hydrogen/Ammonia)

・Under **the Green Growth Strategy**, Main future targets of Hydrogen and Fuel Ammonia are;


Provisional translation

Green Growth Strategy
Through Achieving Carbon Neutrality in 2050

June 18, 2021
Cabinet Secretariat
Ministry of Economy, Trade and Industry
Cabinet Office
Financial Services Agency
Ministry of Internal Affairs and Communications
Ministry of Foreign Affairs
Ministry of Education, Culture, Sports, Science and Technology
Ministry of Agriculture, Forestry and Fisheries
Ministry of Land, Infrastructure, Transport and Tourism
Ministry of the Environment

Hydrogen

・Domestic introduction target is **3 million tons per year (mt/y) in 2030, 20 mt/y in 2050**.
・Strengthening international competitiveness by focusing on technologies in which Japan has strength such as hydrogen power generation turbines, fuel cells, and FC trucks.

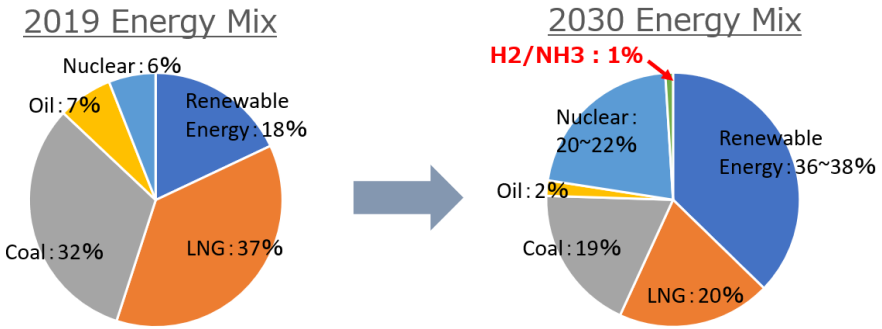
Fuel Ammonia

・Introduce the use of 20% co-firing in power generation by 2030 (short-term target).
・Increase the co-firing rate (50%) and commercialize the technology for fuel ammonia power generation by 2050 (long-term target).
・Promoting exports to the Southeast Asian market through international standardization and co-firing technology.

・In February 2021, METI drafted an interim report of **Fuel ammonia's Roadmap** and set the target for use of fuel ammonia to **3 mt/y in 2030**, and **30 mt/y in 2050** (equivalent to 5mt/y of hydrogen).

Japan's Policies for Carbon Neutrality -(Hydrogen/Ammonia)

・In October 2021, the Government of Japan formulated **the Sixth Strategic Energy Plan** to show the direction of Japan's energy policy and the Cabinet approved.

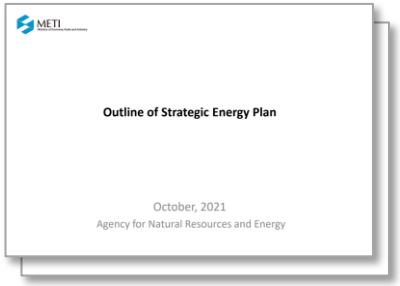


		(FY2019 ⇒ previous energy mix)	Energy mix in FY2030 (ambitious outlook)
Energy efficiency improvement		(16.55 million kl ⇒ 50.30 million kl)	**62 million kl**
Final energy consumption (without energy conservation)		(350 million kl ⇒ 377 million kl)	350 million kl
Power generation mix Electricity generated: 1,065 TWh ⇒ Approx. 934 TWh	**Renewable energy**	(18% ⇒ 22-24%)	**36-38%** ※If progress is made in utilization and implementation of R&D of renewable energy currently underway, 38% or higher will be aimed at.
	Hydrogen/Ammonia	(0% ⇒ 0%)	**1%**
	Nuclear	(6% ⇒ 20-22%)	**20-22%**
	LNG	(37% ⇒ 27%)	**20%**
	Coal	(32% ⇒ 26%)	**19%**
	Oil, etc.	(7% ⇒ 3%)	**2%**
(+ non-energy related gases/sinks)			
GHG reduction rate		(14% ⇒ 26%)	**46%** Continuing strenuous efforts in its challenge to meet the lofty goal of cutting its emission by 50%

(details of renewable)
- solar 6.7% ⇒ 7.0%
- wind 0.7% ⇒ 1.7%
- geothermal 0.3% ⇒ 1.0~1.1%
- hydropower 7.8% ⇒ 8.8~9.2%
- biomass 2.6% ⇒ 3.7~4.6%

(details of renewable)
- solar 14~16%
- wind 5%
- geothermal 1%
- hydropower 11%
- biomass 5%

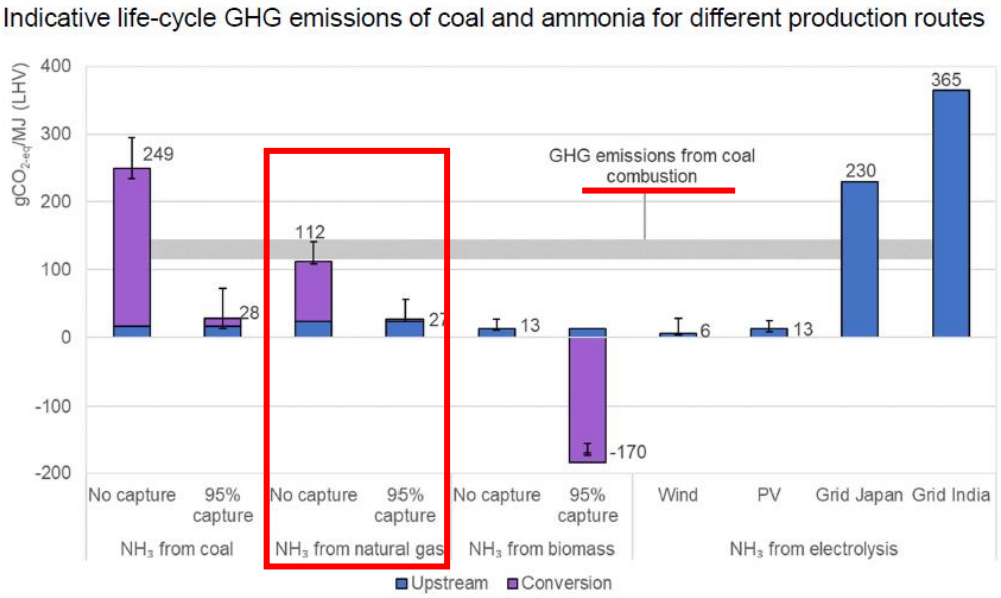
12



(Source, METI: https://www.meti.go.jp/english/press/2021/1022_002.html)

(Reference) IEA's Low-Carbon Fuels report

Using low-C fuels can lead to significant reduction in GHG emissions



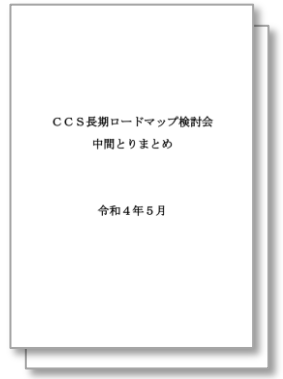
International standards are required to ensure that use of low carbon fuels lead to global emission cuts.

(Source, IEA, The Role of Low-Carbon Fuels in the Clean Energy Transitions of the Power Sector, October 2022: https://www.iea.org/reports/the-role-of-low-carbon-fuels-in-the-clean-energy-transitions-of-the-power-sector)

Japan’s Policies for Carbon Neutrality -(CCS)

・Under **the 6th Strategic Energy Plan**, CCS is expected as a reduction measure of CO2 from industries. It is said that a long-term CCS roadmap should be prepared together with stakeholders in consideration of technology development and cost reduction, development of suitable sites, and improvement of business environment.

・In January 2022, METI established the CCS Long-Term Roadmap study meeting and drafted the **interim report of the CCS Long-Term Roadmap** in May after several meetings in which wide variety of industries joined.

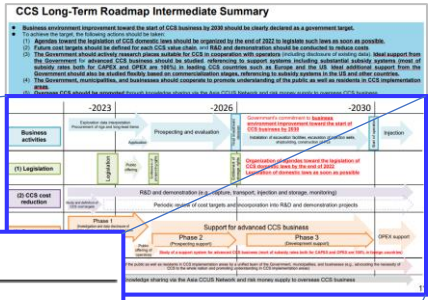


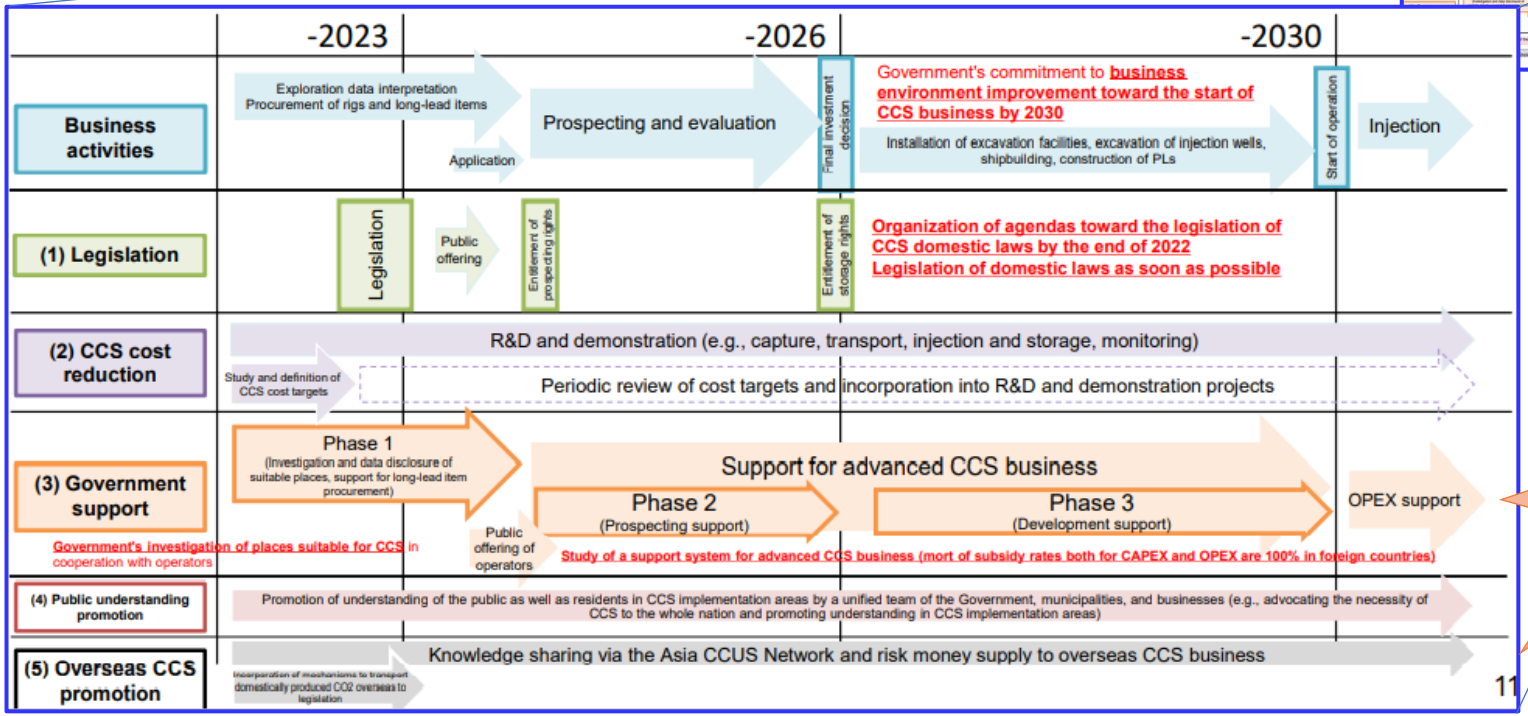
・In the interim Roadmap, METI plans to set a legal framework for CCS to enable companies to start storing CO2 underground by 2030. To start CCS project by 2030, related law and regulations must be in place by 2023 to admit trial drilling in 2024.

・METI estimated the **Japan’s CO2 volume need to be captured and stored would be 120~240 million tons per annum (mtpa) in 2050**. Figures are based on the IEA’s prediction of storage volume with different scenarios. It will be necessary to increase the number of wells by 12 to 24 each year until 2050.

Japan's Policies for Carbon Neutrality -(CCS)

CCS Long-Term Roadmap Intermediate Summary



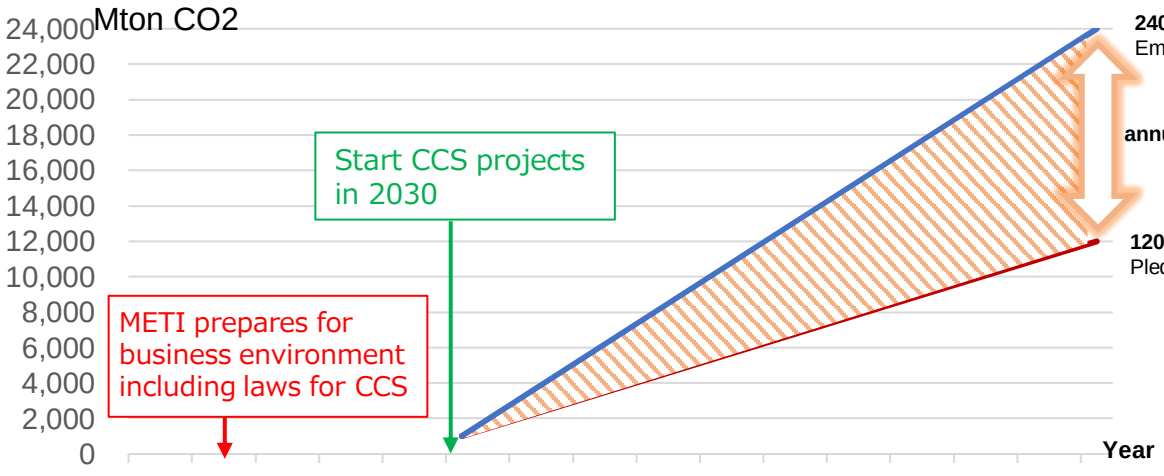


JOGMEC supports here!

(Source, METI: The second Asia CCUS Network Forum in Sept.30, 2022)

Japan's Policies for Carbon Neutrality -(CCS)

CCS plays a key role for decarbonization in Japan.



- Basic studies and demonstration projects.
(Iwanohara, Tomakomai by RITE etc.)

JOGMEC
- Technical and financial support.
- site surveys and pilot projects.
- Guideline preparation for CCS operation.

JOGMEC
Technical and Financial support for projects (capital investment & liability guarantee)

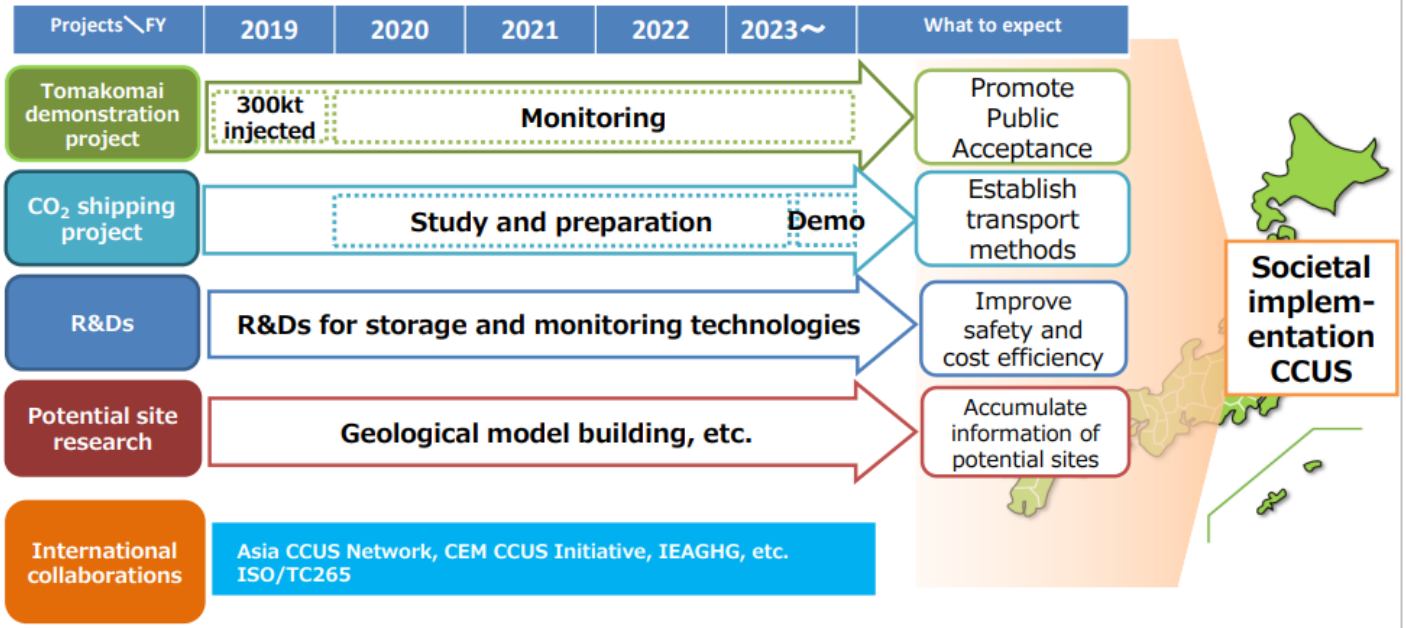
(Source, METI: https://www.meti.go.jp/shingikai/energy_environment/ccs_choki_roadmap/pdf/20220527_2.pdf)

Japan's Policies for Carbon Neutrality -(CCS)

Current CCS Projects in Japan

- Toward the start of CCS business by 2030, the followings are being carried out;

  ①Tomakomai demonstration project ②CO2 shipping project ③R&Ds for storage and monitoring technologies ⑤Investigation of Potential CO2 storage sites



(Source, METI: The second Asia CCUS Network Forum in Sept.30, 2022 The Second Asia CCUS Network Forum - Hybrid Forum — Asia CCUS Network (asiaccusnetwork-eria.org))

Who is JOGMEC?

Mission As agency of Japanese government (METI)

Secure the stable supply of Natural Resources for Japan

- Financial support: Support risk money with taking equity capital and liability guarantee.
- Technical support: Technical and financial support for R&D stage such as feasibility study, Pre-FEED, and FEED of the project.

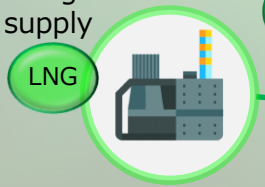
Three basic policies

JOGMEC will contribute to achieve carbon-neutral society by securing stable resource / fuel supply and strengthening initiatives that are consistent with climate change.

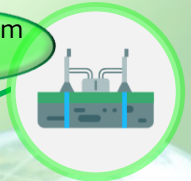
Strengthening efforts for clean resources and energy

Fossil fuel development and decarbonization

Strengthening the LNG supply chain

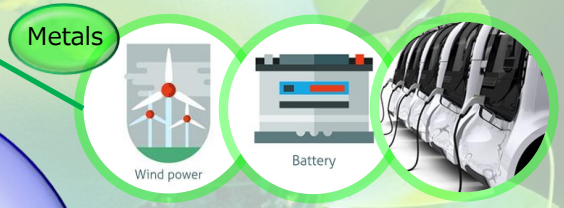


Geothermal

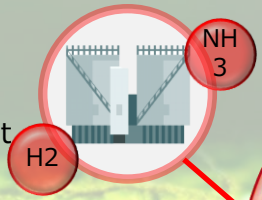


Promoting domestic and international project development of geothermal energy

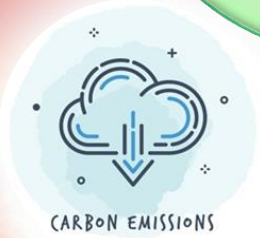
Stable metal / mineral resource supplies which support electrification



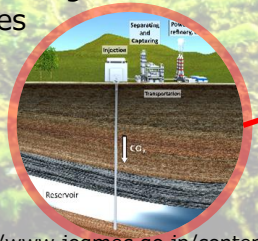
Constructing hydrogen / ammonia supply chain and market expansion



Strengthening efforts for decarbonized fuel and technology



Securing CCS-suitable sites



Development of systems necessary for decarbonization

Contributing to system developments

http://www.jogmec.go.jp/content/300372219.pdf

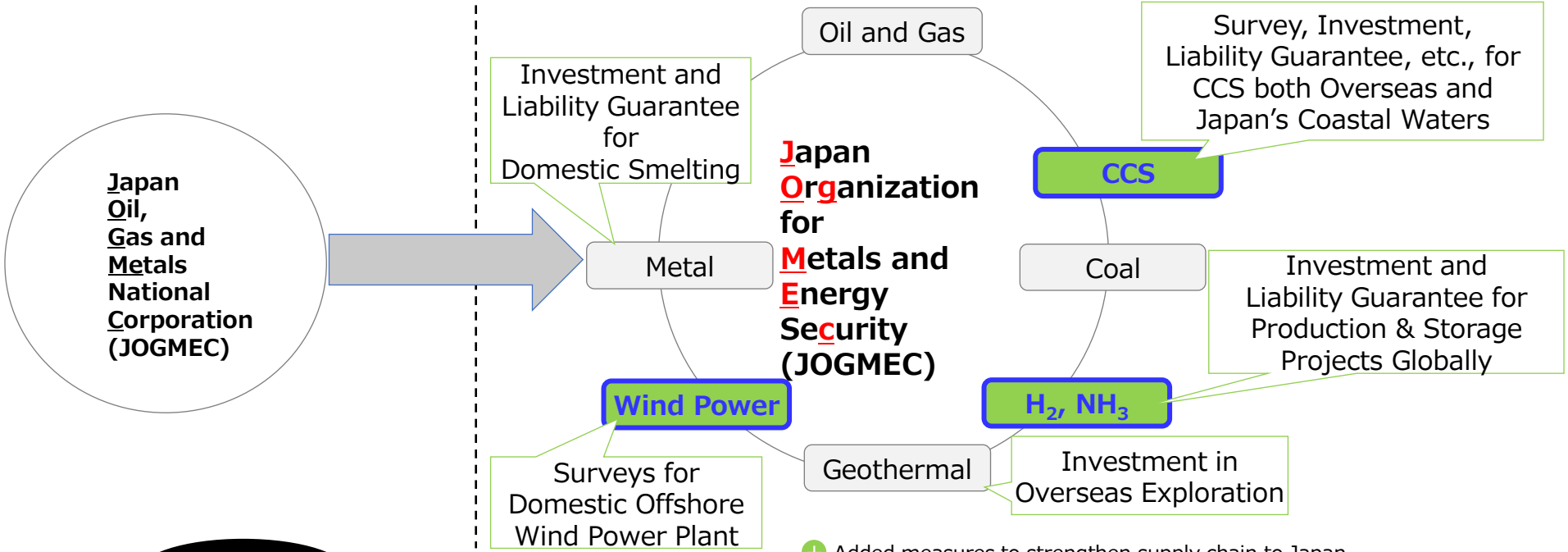
Law Amendment on JOGMEC's Activities

New JOGMEC law has been enacted on 14th November 2022

(https://www.jogmec.go.jp/english/news/release/news_10_00017.html)

Law Amendment (Promulgated on May 20th)

Amendment Act

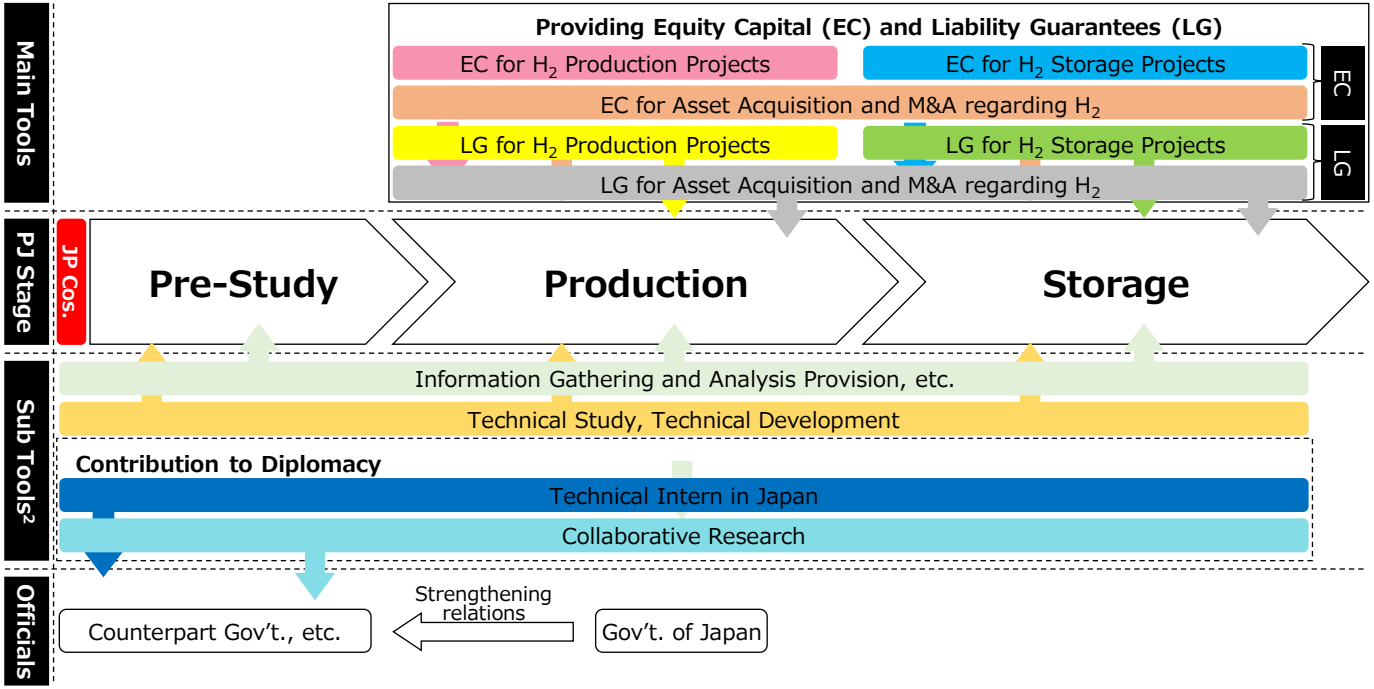


Consistent Mission

Secure a Stable and Affordable Supply of Energy and Metal Mineral Resources to Japan

JOGMEC's support for Hydrogen and Ammonia

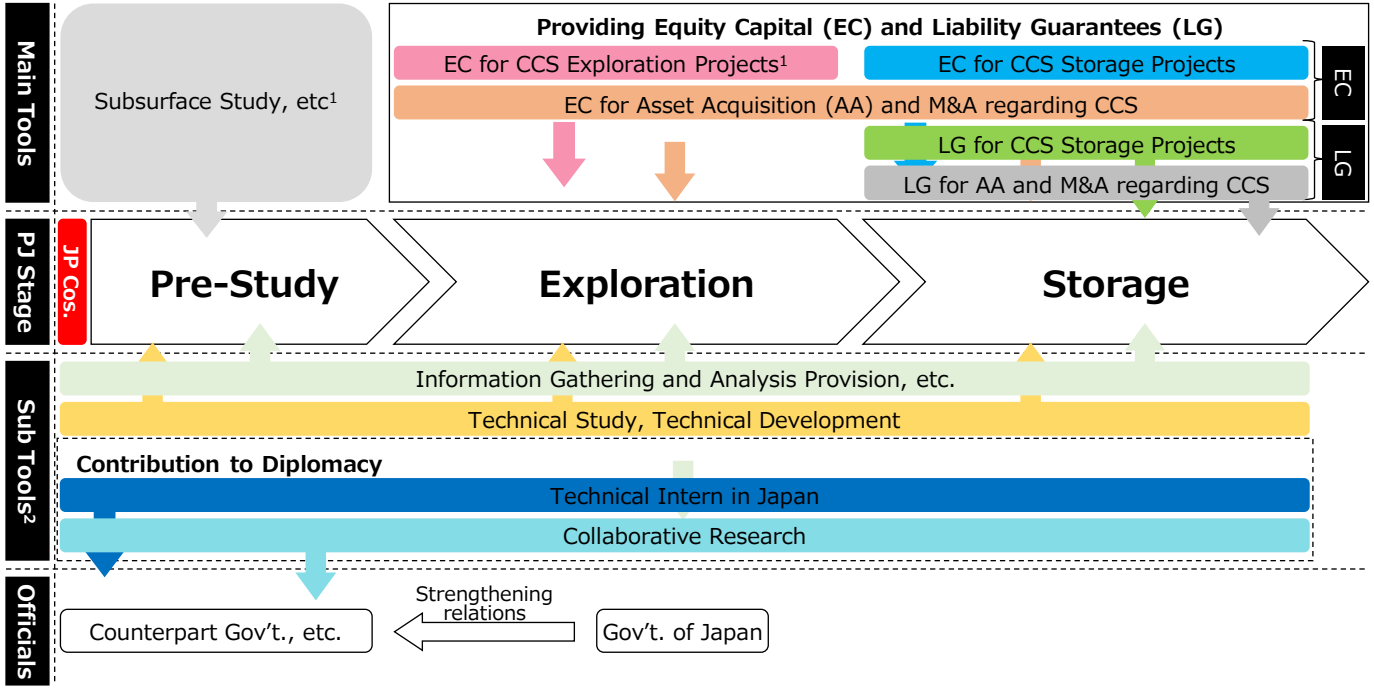
JOGMEC supports both domestic and overseas projects by Japanese companies for hydrogen[1] production and storage for the stable supply of hydrogen to Japan by providing assistance outlined below.



[1] Hydrogen of all origins is subject to JOGMEC support.
[2] Ancillary business tools to each tool categorized as Main Tools

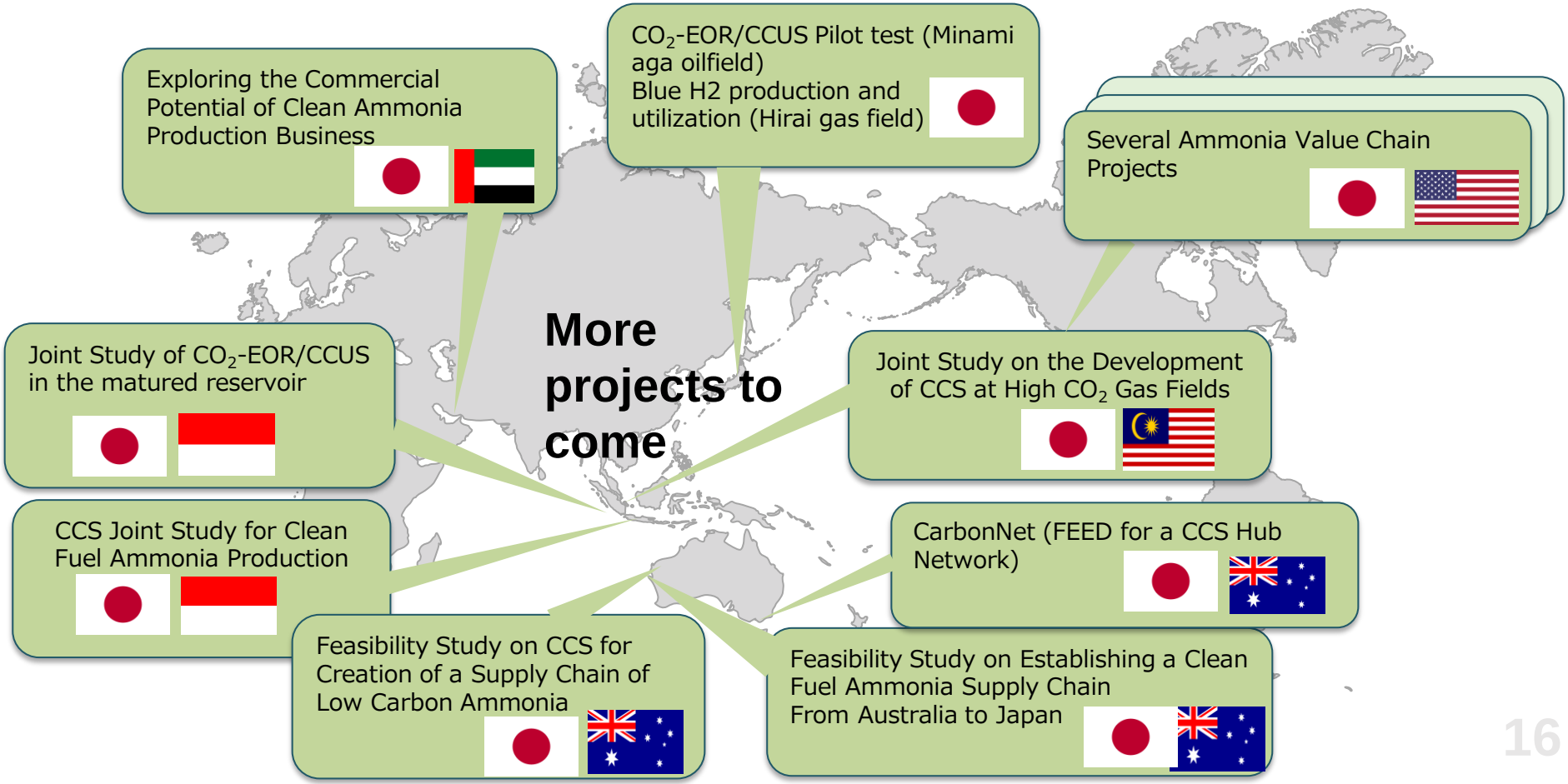
JOGMEC's support for CCS

JOGMEC promotes projects of Japanese companies both overseas and around the coastal waters of Japan securing suitable places for and implementation of CCS by providing a wide range of assistance as below.



[1] Includes lending a vessel for seismic survey for CCS
[2] Ancillary business tools to each tool categorized as Main Tools

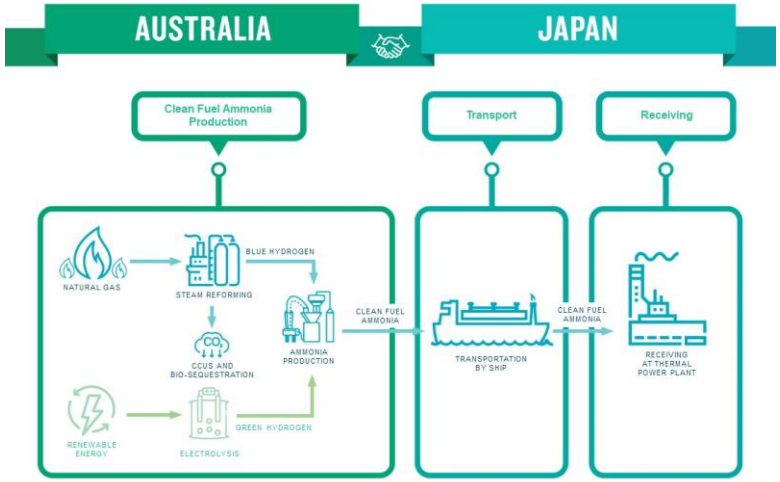
JOGMEC's Project Map of CCS and Clean Ammonia



(Reference)
Clean Fuel Ammonia Supply Chain from Australia to Japan

- Jointly with Woodside Energy Ltd., Marubeni Corporation, Hokuriku Electric Power Company, and The Kansai Electric Power Co. Inc, Tohoku Electric Power Co., Inc, and Hokkaido Electric Power Co., Inc, JOGMEC is conducting a feasibility study as phase 2 for the development of a clean fuel ammonia supply chain from Australia to Japan.

- The feasibility study includes the production of clean fuel ammonia in Australia from natural gas with CO2 abatement methods such as CCS･CCU and bio-sequestration; marine transportation to Japan; utilization of ammonia as a fuel for power generation and marine use; and financing.

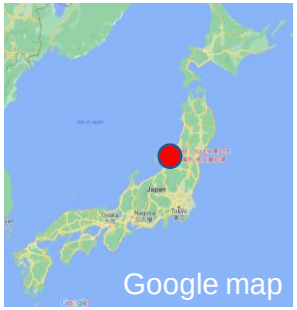


https://www.jogmec.go.jp/english/news/release/news_10_00009.html

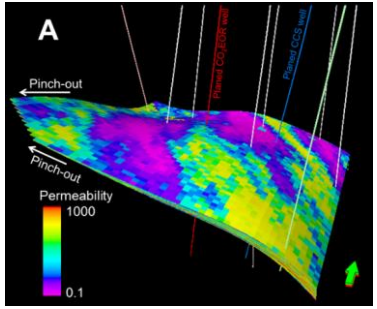
Signing of a joint research agreement for Phase 2 FS(July 2021)

(Reference) CO_2-EOR as CCUS pilots in Japan and Indonesia

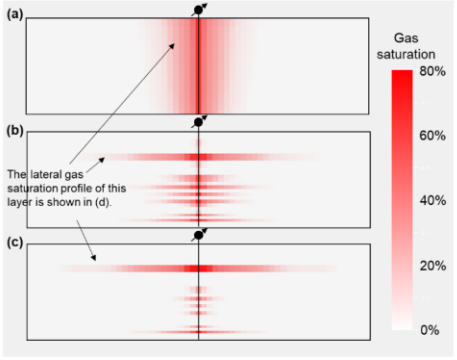
- **Minami Aga oil field, Niigata, JAPAN**
  Huff'n'Puff CO_2-EOR pilot test planned in FY2022

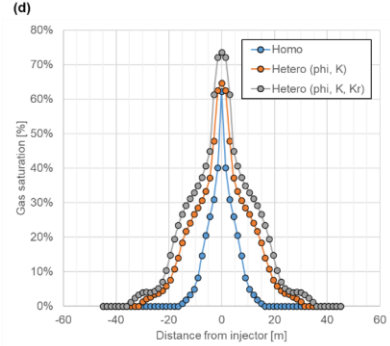


Geological model of the pilot area



Simulated CO_2 distribution around the well





JOGMEC Annual report 2022

- **Jatibarang oil field, Java island, INDONESIA**
  CO_2-EOR pilot test planned in FY2022

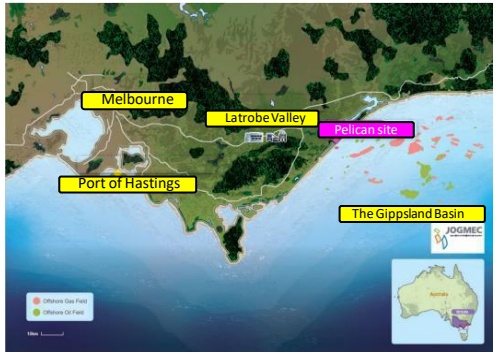
Signing agreement in Bali, August 2022

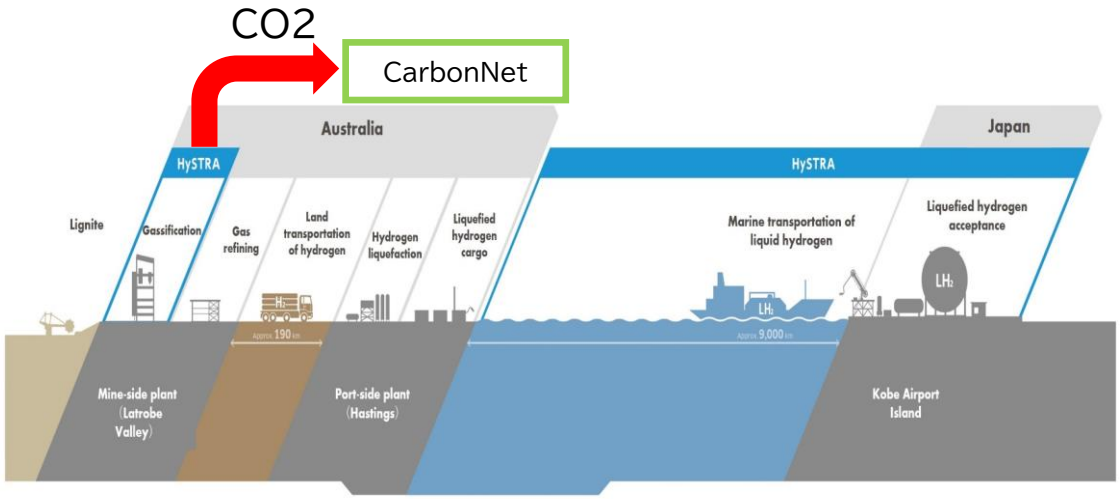
(Reference) CCS for clean hydrogen in Australia

-JOGMEC will contribute to the Front End Engineering and Design (FEED) of the CarbonNet CCS project-

- JOGMEC signed an agreement with the State of Victorian Government on January 20, 2022
- The CarbonNet is a project to conduct CCS into the Pelican site of the offshore Gippsland Basin, Australia.
- The project is
  - ✓ to store 5 million tons of CO2 per year for 25 years.
  - ✓ the world's first international blue hydrogen value chain derived from lignite coal.
  - ✓ attained jointly by Japan and Australia for the first time in the world.

Location of the CarbonNet project in the Gippsland Basin, Victoria





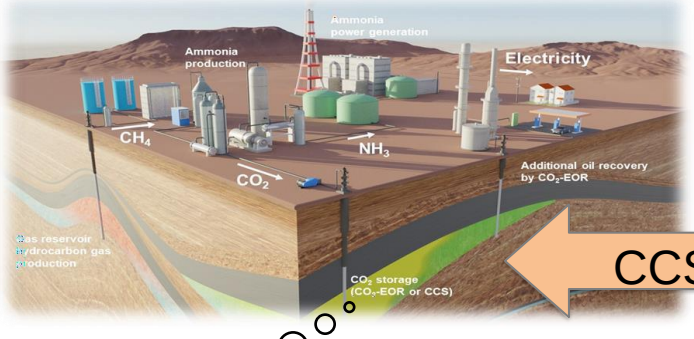
Concept of the clean hydrogen Value Chain

https://www.jogmec.go.jp/english/news/release/news_01_00002.html

JOGMEC's CCS and Carbon Intensity Guidelines

- Re-organize, edit, and explain existing CCS and Carbon Intensity accounting guidelines/standards for industries to promote CCS business and emphasize JOGMEC view

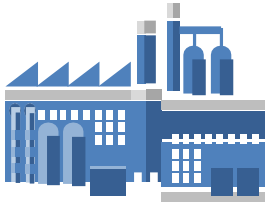
CO_2 Geological Storage Capacity



How to select the storage site and evaluate reduced amount of CO_2?

CCS

Exploration & Production



GHG emissions

Carbon Intensity (CI)

LNG
Ammonia
Hydrogen

How to calculate CI?

Recommended guidelines for implementation of CCS projects (CCS Guidelines)

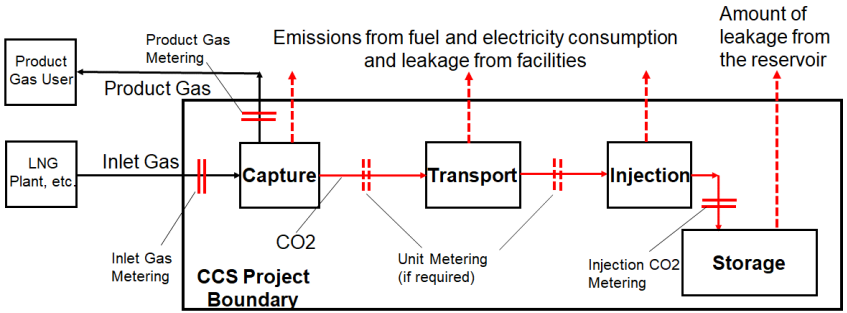
Recommended guideline for calculating GHG emissions and carbon intensity of LNG, hydrogen, and ammonia (GHG and CI Guidelines)

JOGMEC's CCS and Carbon Intensity Guidelines

Recommended guideline for the implementation of carbon dioxide capture and storage projects(CCS guideline)

- Specialized in technical recommendations and GHG calculation methodologies to evaluate GHG reduction amount for CCS projects.
- Present a method to determine CO2 storage resources with referring to SRMS (*) as an example which provides internationally comparable classification of storage resources.
- Provides a guideline from project planning until closure, including the evaluation of CO2 storage resources and GHG reduction amount.

(*) CO2 Storage Resources Management System, provided by the Society of

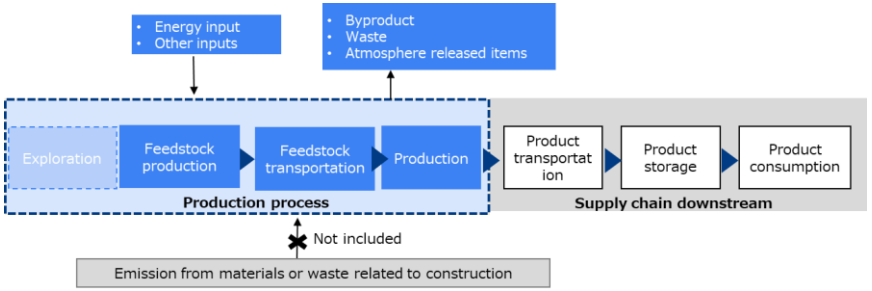


$$CO2/GHG\ emission\ reduction\ amount = (Captured\ CO2) - (Emission\ from\ fuel/electricity\ consumption) - (Fugitive\ emission)$$

Recommended guideline for greenhouse gas and carbon intensity accounting framework for LNG/Hydrogen/Ammonia project (GHG/CI guideline)

- Provides a recommended guideline to calculate GHG emission and product carbon intensity for LNG/Hydrogen/Ammonia projects.
- Includes countermeasures for methane emission, which is under international discussion, and recommends calculation methods (*) according to the emission source.
- Proposed method will be reviewed and verified through the application at actual projects.

(*) Example; Recommendation for direct measurement, especially for main emission sources.



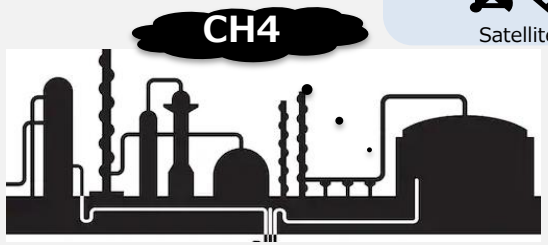
$$Carbon\ Intensity(CI) = \frac{(Product\ GHG\ emission - Emission\ deduction)}{Product\ energy\ content\ or\ weight}$$

https://www.jogmec.go.jp/english/news/release/news_10_00005.html

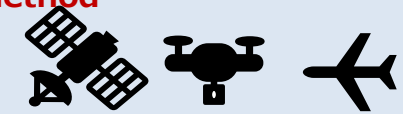
Methane emissions measurement

Top-Down

Monitoring unexpected Methane leaks by measuring the entire plant area from the outside



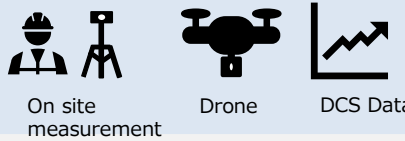
method

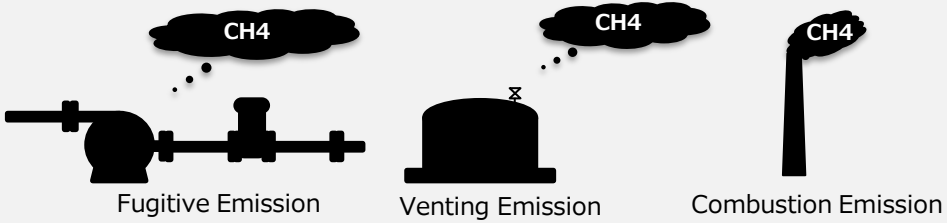


Bottom-Up

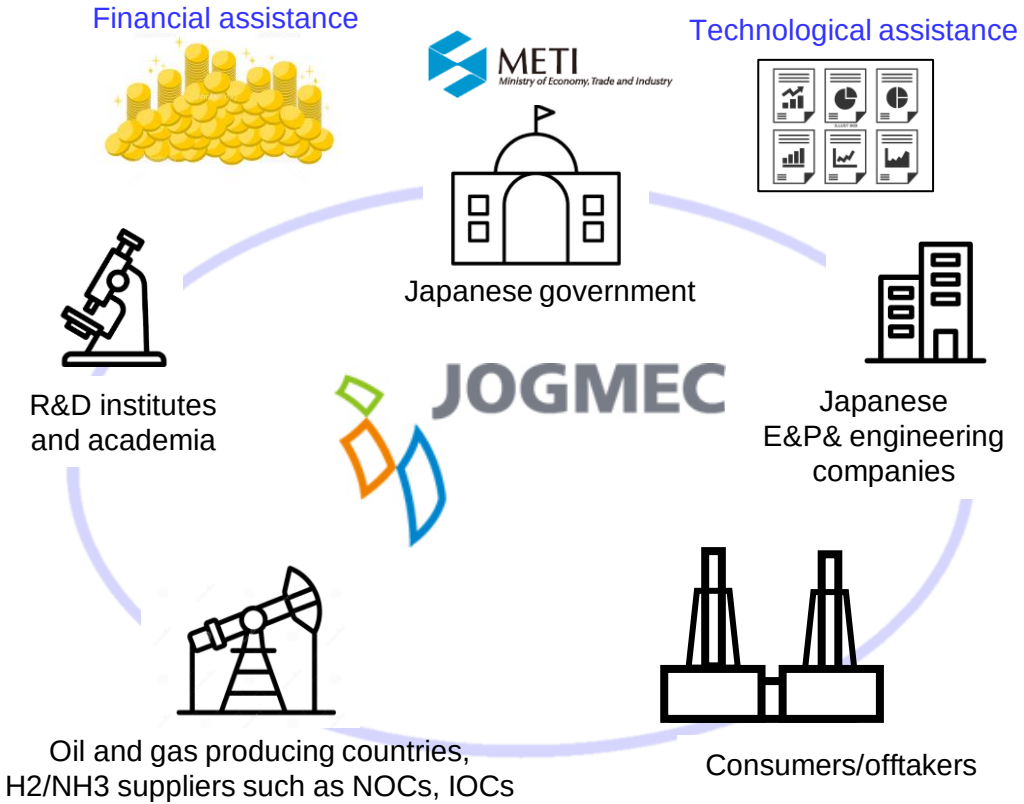
Measure Methane emissions by focusing on plant components and equipment

method





Summary



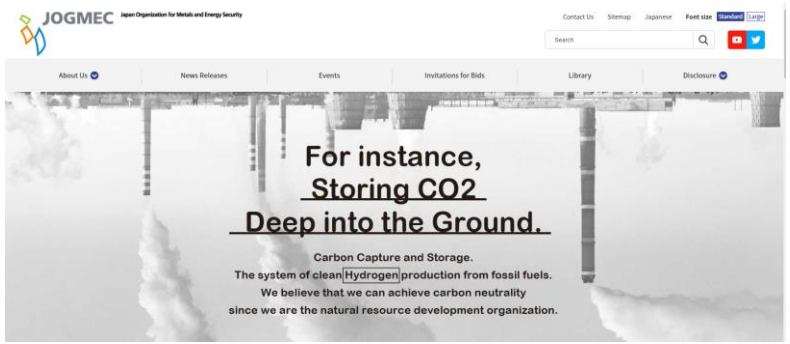
・Under METI's policies and strategies for Carbon Neutrality, JOGMEC will continues to pursue;
 - securing stable and affordable energy supply for Japan
 - energy's decarbonization toward carbon neutrality by 2050

・To achieve these important missions, we utilize our financial and technical capabilities at most and promote wide range of collaboration with stakeholders in Japan and overseas.

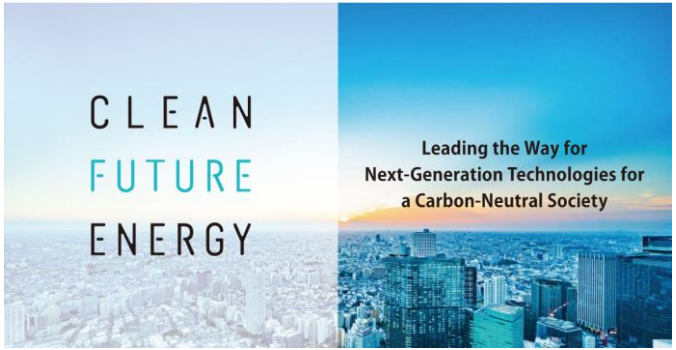
Thank you!

If you have any question, please contact to takanashi-masumi@jogmec.go.jp.

please visit our website!



https://www.jogmec.go.jp/english/index.html



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¡THANKS!
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