Presentation for ICEF

TOKYO GAS GROUP

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# Initiative of Tokyo Gas toward Carbon Neutrality

## Implementation of E-methane

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**Hisataka YAKABE**

**Tokyo Gas Co,. Ltd.**

# Tokyo Gas's Steps toward Achieving Carbon Neutrality by 2050



- Tokyo Gas will contribute to the carbon neutrality by 2050 through the following three perspectives and measures: (1) **GX（De-carbonization）**, (2) **Resilience of energy supply**, and (3) **Effective utilization of existing infrastructure**. **Digital technologies** are actively and effectively used in all measures.
- From the perspective of minimizing additional costs, **e-methane （synthetic methane)** is one of the most effective options.

## Perspectives & Means

### ① GX（De-carbonization） ＋

**Employment of all measures**

- **Power sector：**Expansion of RE
- **Heat utilization sector ：**Advanced Energy Usage, CCU･CCS, and employment of **e-methane** and **hydrogen**

### ② Resilience of energy ＋

**Strength toward disaster**

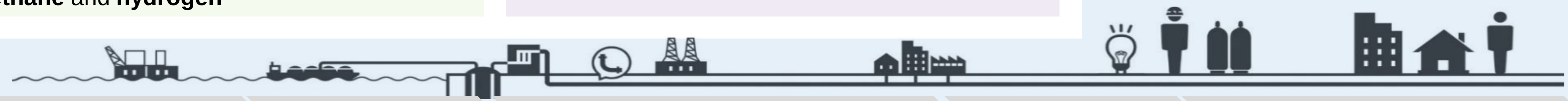
- **Diversification of energy sources**
- **Integration of supply-side and demand-side**

### ③ Utilization of existing infrastructure

**Minimizing additional social costs**

- **Maximize the effective use of existing infrastructure with e-methane**

## LNG value chain and existing infrastructure



Procurement → Transportation → Production of city gas → Distribution → Sales

**Volume of LNG procurement**

**12.6 MTPA**

- for city gas 6.9 MTPA
- for wholesale, power generation 3.8 MTPA
- for other uses 1.9 MTPA

**Owned and managed vessels**

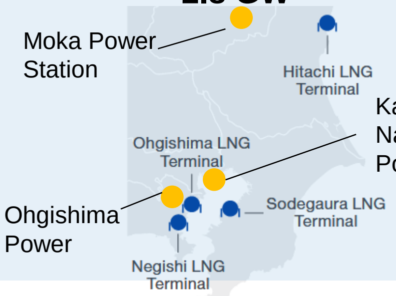
**10** ships


**LNG terminal and pipeline network**

**4** terminals & pipelines over **60,000** km

**Natural gas-fired power plant**

**2.8 GW**



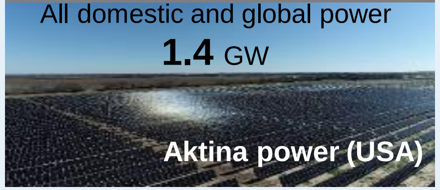

**Digital technology**

**City gas**

sales to **8.8** M and supply to **11** M customers

**renewable energy source**

All domestic and global power **1.4** GW




**Electricity**

Number of retail electricity sales **3 M** customers

さすてな電気

octopus energy



As of 2021 March（Only number of electricity customers, as of 2022 March)

# $CO_2$ Recycling through the Use of E-Methane

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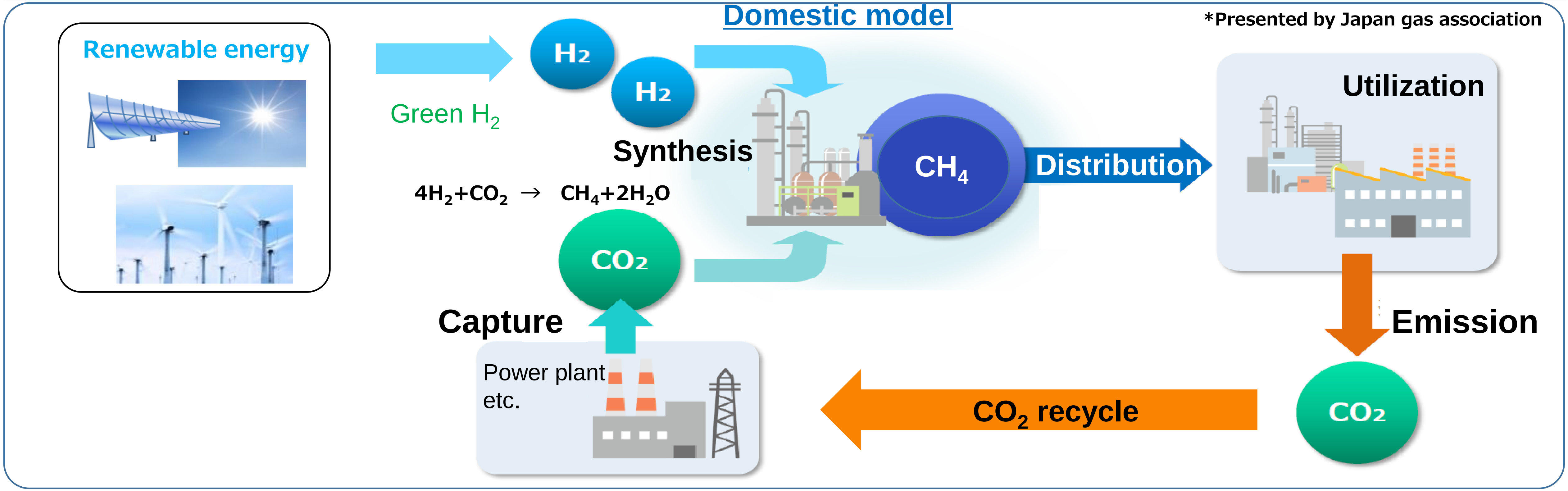
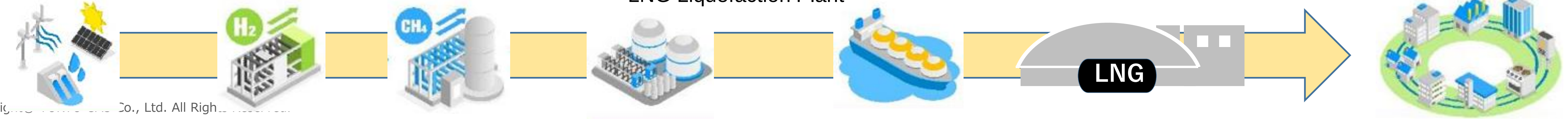
- E-methane is produced by reacting hydrogen with $CO_2$ recovered from factories or thermal power plants.
- The utilization of e-methane does not increase $CO_2$ in air overall.
- The advantage of e-methane is that existing infrastructure can be used without any further additional cost.
- E-methane is also expected to decarnbonize heat demand sectors that are difficult to electrify.




## Global supply chain of e-methnae



# Roadmap for Social Implementation of E-methane (1% Adoption by 2030)

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- To implement e-methane, we will conduct three major steps.
  **Step I** :Small scale (50 km$^3$/y) , **Step II**: Middle scale (1.6 million m$^3$/y) , **Step III**: Overseas project (80 million m$^3$/y)

Establishment of technology → scale-up → social implementation

22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33

**STEP Ⅰ**

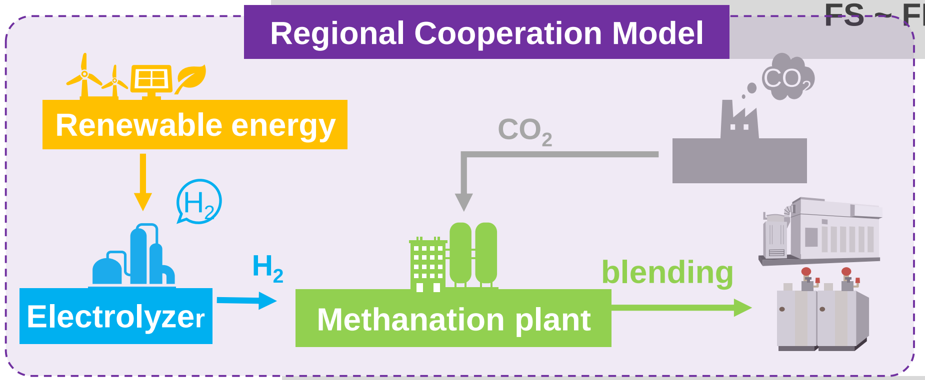
Domestic small-scale demonstration → Innovative technology demonstration

Plant scale 12.5 Nm$^3$／h

**STEP Ⅱ**

FS ~ FEED ~ FID → Domestic middle-scale demonstration

Plant scale ～500 Nm$^3$／h




1% ⇒ Implementation

**STEP Ⅲ**

FS ~ FEED ~ FID → Large-scale overseas supply chain establishment


Plant scale ～20,000 Nm$^3$／h
(Equivalent to 1-2 GW power)

Domestic

Overseas

# Social Implementation Initiatives of E-Methane

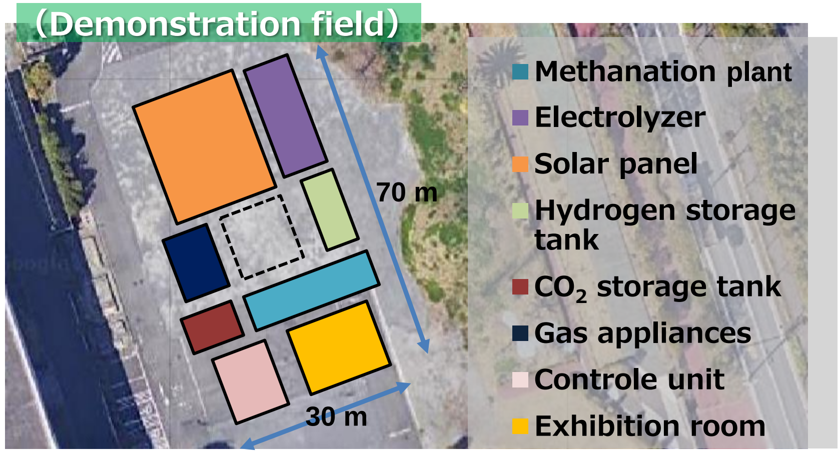
- **Small-scale demonstration : We have started a small-scale demonstration experiments of technology and collaboration for regional carbon-neutrality, and will acquire the skill and know-how for scaling up to mid-scale.**
- **Mid-scale demonstration : We will promote social implementation through conduit injection of the produced e-methane, on-site utilization, and regional cooperation toward large-scale production overseas.**

## Small — Demonstration at Tokyo Gas's facilities (12.5 Nm³/h) and regional collaboration

✓ **Period** : Since March 2022 small-scale demonstration in **Yokohama** has started.
・Regional collaboration with Yokohama City facilities, etc. is undergoing

✓ **Feature** :
・Electricity: Optimization of renewable energy and grid power
・$CO_2$: Receive and utilize $CO_2$ from neighboring facilities.
・Others: Linkage of **recycled water**, **biogas** (digestion gas), **$CO_2$**, etc. with surrounding facilities of **Yokohama city.**

✓ **R&D:** Existing technologies (**Sabatier**) will be tested and innovative technologies will be also developed.



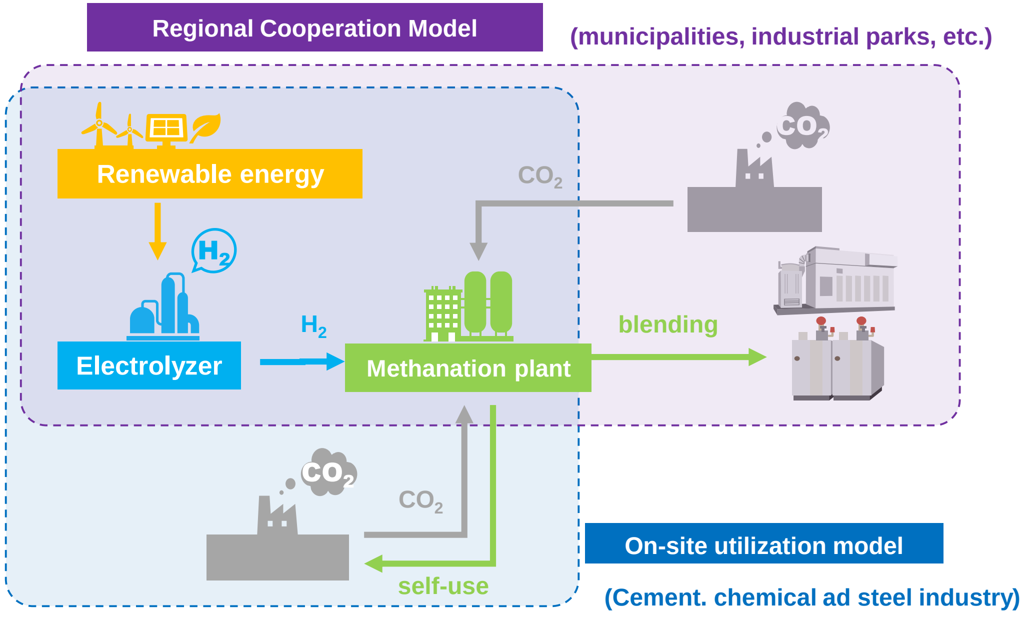


## Middle — Domestic regional cooperation and on-site use (100 Nm³/h scale)

✓ **Period** : Middle-scale demonstration + regional collaboration and on-site use
✓ demonstration planned from mid-20s.

✓ **Feature** : Production and utilization, and pipeline injection are planned for optimal utilization of resources in industrial areas, large consumers and specific regions in Japan.

✓ **Examples** : Employment of e-methane in cement, chemical and steel plants.

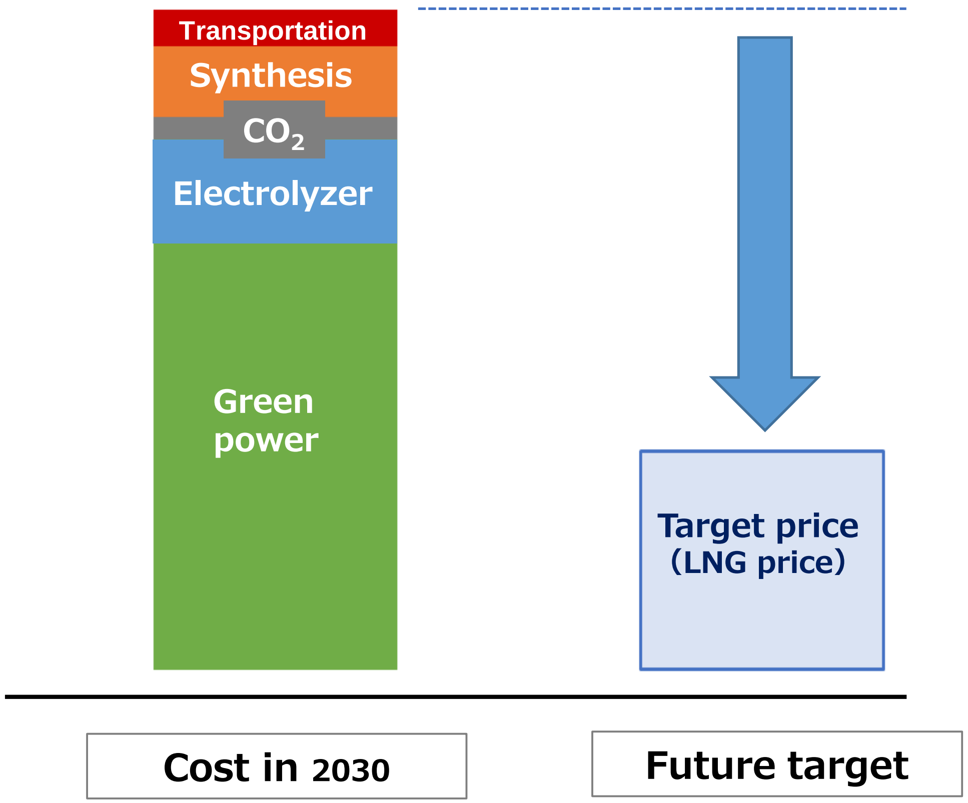


# Cost Image of E-methane and Challenges and Actions for Social Implementation



- **The cost of e-methane in 2030 is estimated still much higher than the target price (equivalent to LNG price), even assuming lower the cost of electrolyzer and the securing of inexpensive renewable power from overseas.**
- **To expand the introduction of e-methane, it is necessary to reduce costs through innovation and to bridge the price gap between e-methane and LNG through multiple measures.**

## Cost Image of e-methane




| Issues | Measure |
| --- | --- |
| Technologies that contribute to improve energy conversion efficiency and lower equipment costs. | 1, 2 |
| Technologies to produce hydrogen from green electricity at higher efficiency and lower cost. | 1, 2 |
| Procurement of inexpensive renewable electricity for green hydrogen production. | 2 |
| Public support to bridge the gap between e-methane and current LNG price. | 3 |
| Return of the environmental value of the produced e-methane to user. | 3 |

## Measure

### 1 Innovative R&D

- ✓ **Low-cost hydrogen production technology**
- ✓ **Innovative methanation technology**
- ✓ Other technologies related to e-methane value chain

### 2 Partnership

- ✓ **Collaboration across and beyond the gas industry**
- ✓ Collaboration with research institutions and start-ups
- ✓ Customers, trading companies, engine manufacturers, different industries, local governments, etc.

### 3 Institutional design and support

- ✓ **Institutional Design** for Establishing the Environmental Value of e-methane
- ✓ **Public support** for social implementation

# Global De-carbonization Activities (e.g. E-methane / Hydrogen / RNG)



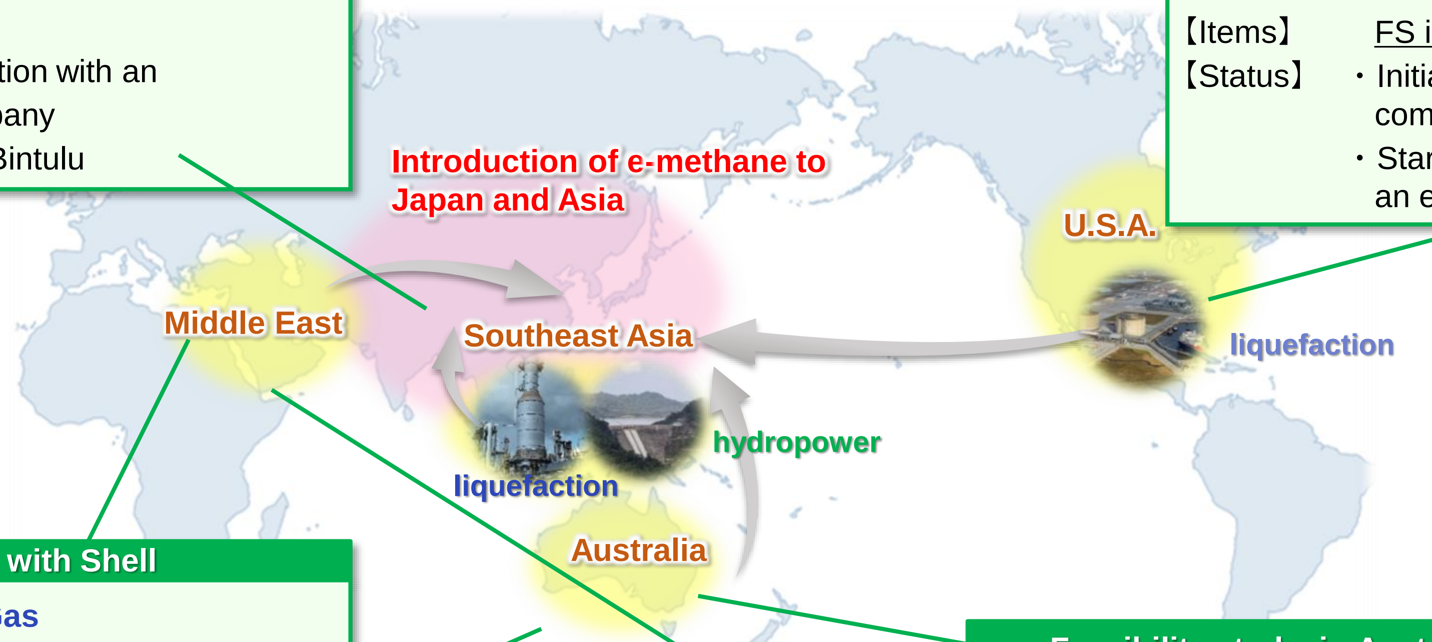
- We are currently working with trading companies and global energy companies on **feasibility studies** for **supply chains of energy carriers** in **North America, Malaysia, Australia** and **other regions**.
- Collaboratively working with **Shell** on hydrogen, biogas, e-methane, ammonia, and CCS.

**Feasibility study in Malaysia**

| | |
|---|---|
| 【Players】 | **Petronas, Sumitomo Corporation,** and **Tokyo Gas** |
| 【Items】 | FS in **Malaysia** |
| 【Status】 | ・Initial cost estimation with an engineering company<br>・Candidate site：Bintulu |

**Feasibility study in United States**

| | |
|---|---|
| 【Players】 | **Mitsubishi Corporation, Tokyo Gas, Osaka Gas, Toho Gas,** |
| 【Items】 | FS in **United States** |
| 【Status】 | ・Initial cost estimates have been completed<br>・Start of detailed examination using an engineering company |




**Collaborative work with Shell**

| | |
|---|---|
| 【Players】 | **Shell and Tokyo Gas** |
| 【Topics】 | **Hydrogen, RNG, e-methane, ammonia, and CCS.** |
| 【Status】 | Under discussion |

**Feasibility study in Australia and Middle East**

| | |
|---|---|
| 【Players】 | **Mitsubishi Corporation and Tokyo Gas** |
| 【Items】 | FS in **Australia** and **Middle East** |
| 【Status】 | Initial cost estimation will begin. |

# Summary

- **In order to carry through responsible transitions toward a carbon neutral society, Tokyo Gas is going to promote the decarbonization of both gas and electricity.**
- **While selecting appropriate carriers considering the time frame and technology maturity, we will specially focus on the introduction of e-methane (synthetic methane).**
- **In the future, we will contribute to local and global carbon neutralization as a decarbonizing energy player in the thermal demand sector, and create new decarbonization model originating from Japan.**

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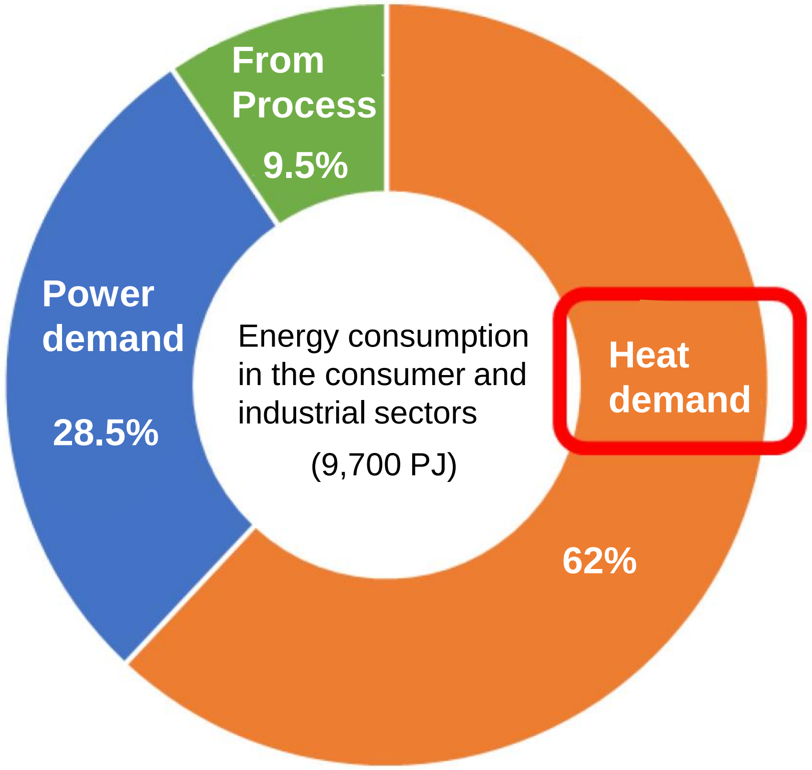
# Heat demand and the importance of its decarbonization

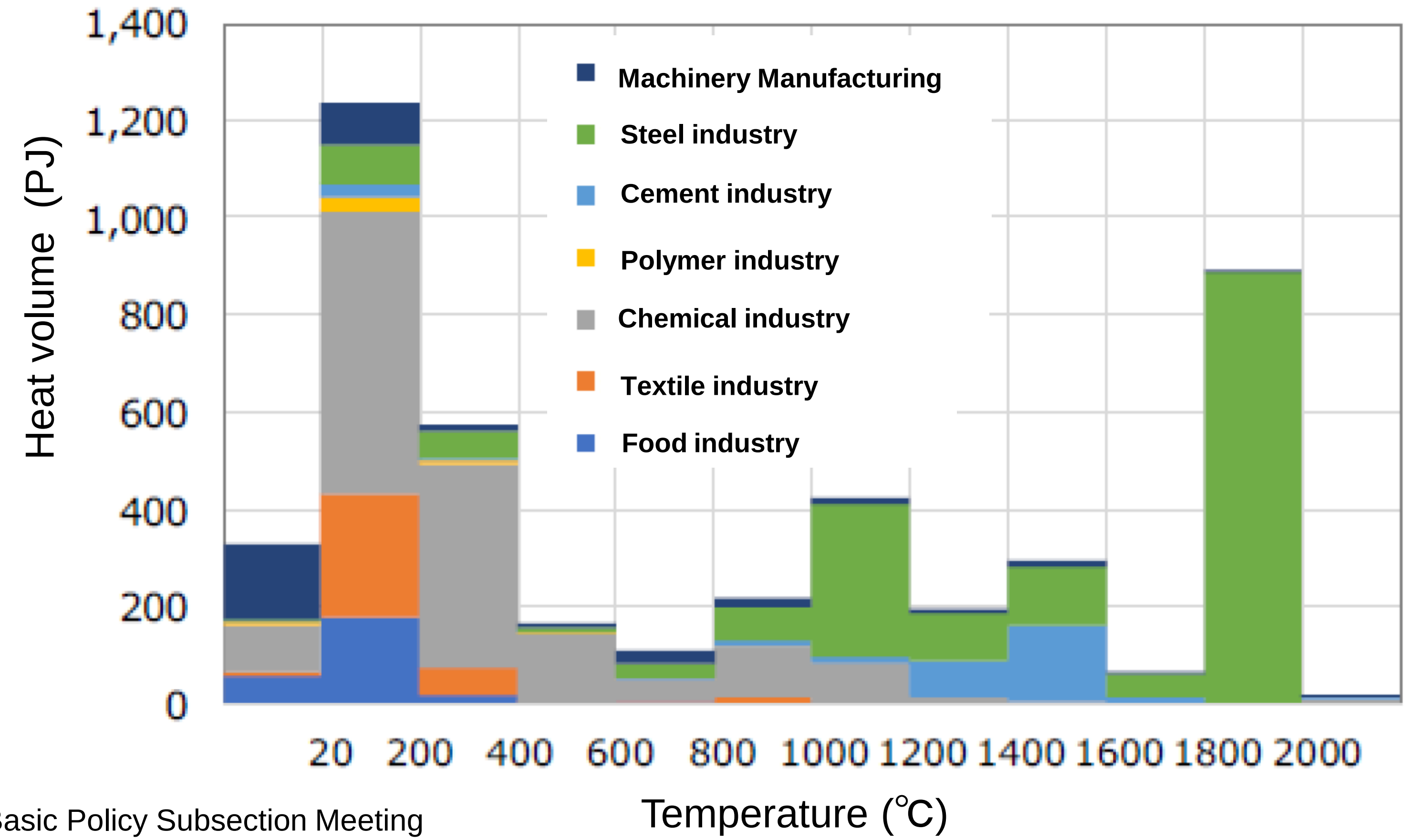


- Heat demand accounts for 60% of Japan's energy consumption in the commercial and industrial sectors. It is difficult to meet the high-temperature heat demand of the industrial sector by only electrification.
- To achieve carbon neutrality by 2050, decarbonization of the heat demand sector is important, and decarbonization of gas, which supplies heat energy to the demand side, will play a major role.

## Energy Consumption by Use in the Commercial and Industrial Sectors




## Heat demand in the industrial sector by temperature range




*presented by METI at Basic Policy Subsection Meeting