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Decarbonizing Energy with e- Methanation Technology

ENERGAS your business
PT ENERGASINDO HEKSA KARYA

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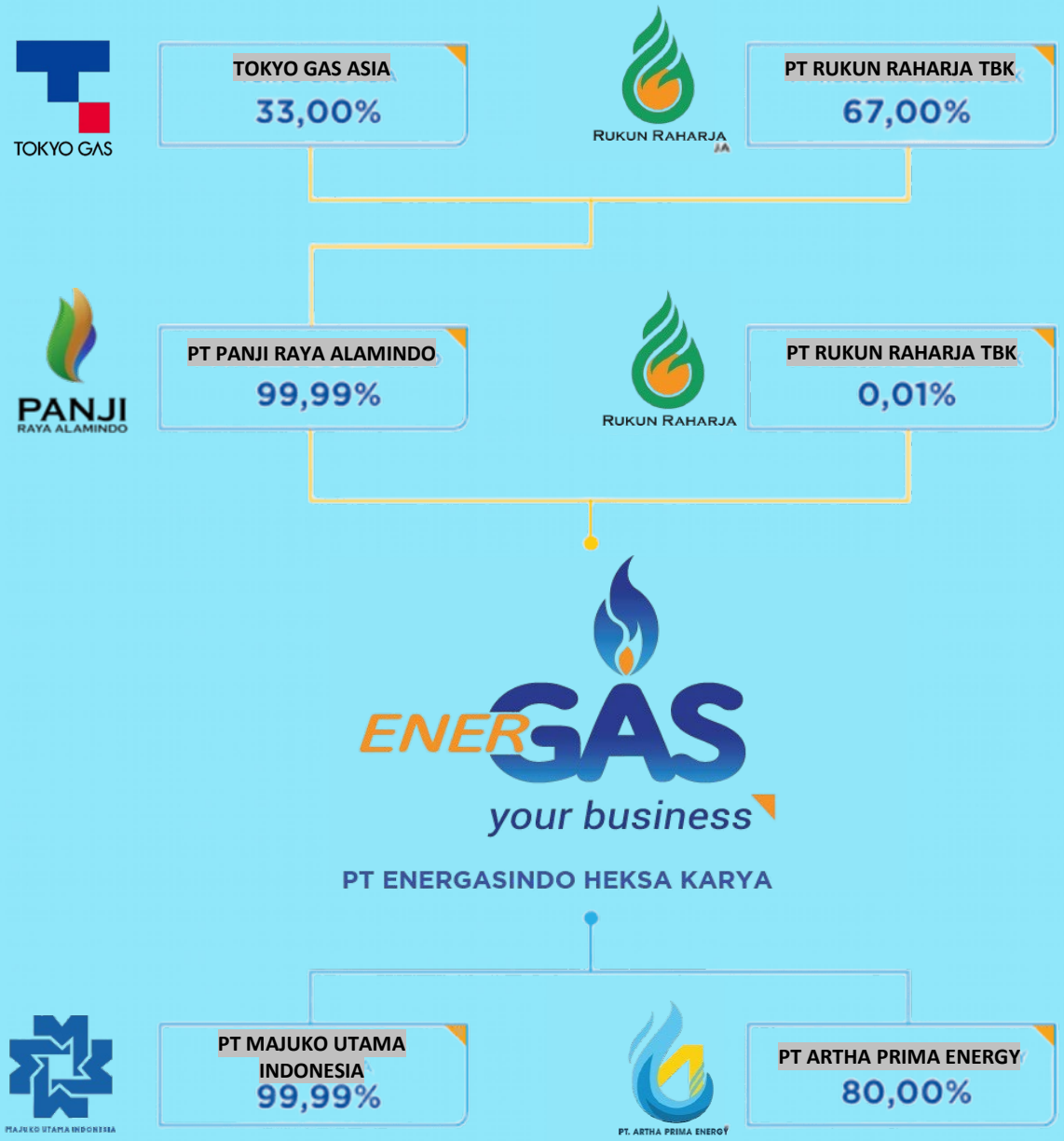
Company Group Structure



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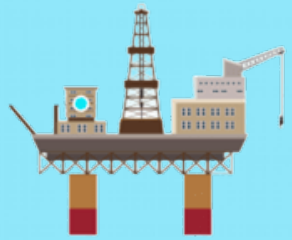
PT Energasindo Heksa Karya

- **Berdiri Tahun**
  Established in 1998
- **Pionir Perusahaan Swasta Niaga Gas**
  Pioneer of Private Gas Trading Company

8 **Area Operational**
Operational Areas

210 **km**
Total Panjang Pipa Total Pipelines Length



50 **BBTUD**
Alokasi Gas Gas Allocation

Konsumen Gas Pipa
Gas Pipeline Consumers
53

117 **Konsumen CNG**
CNG Consumers

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Our Group Portfolios

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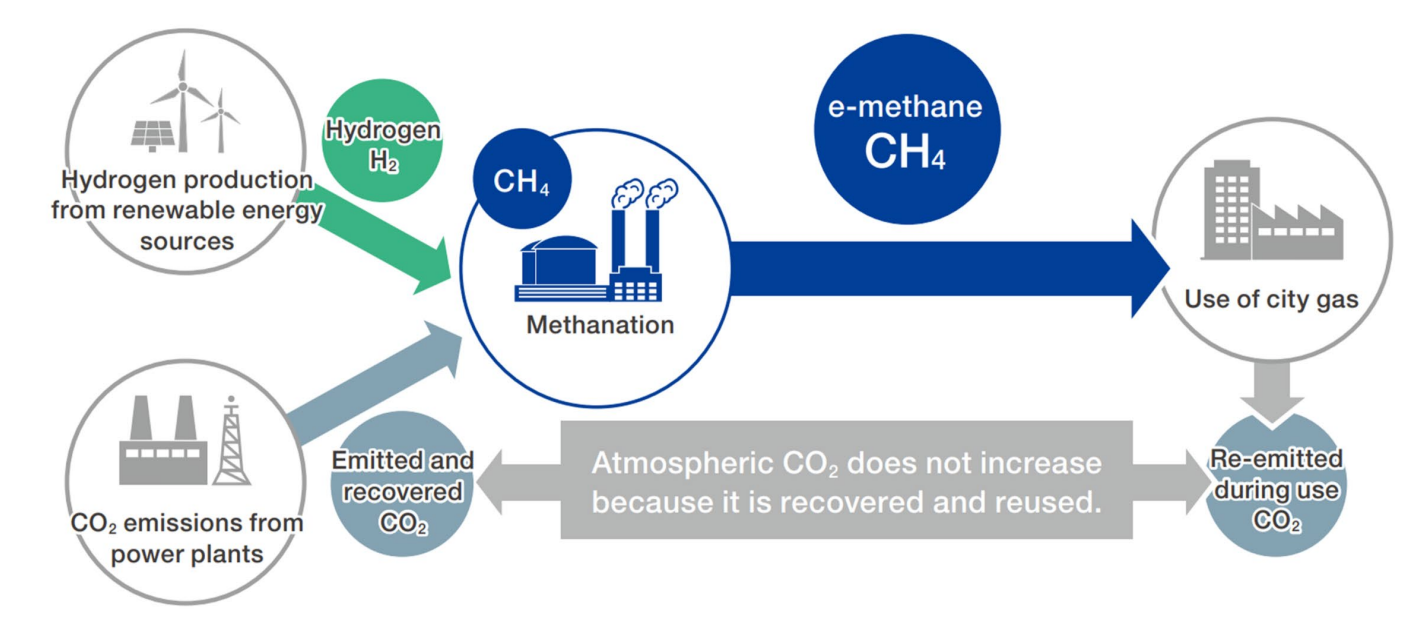
What is E-Methane ?



E-methane is methane produced through methanation, using hydrogen and CO_2 as raw materials.

E-methane is carbon neutral because the CO_2 emitted during combustion is offset by the CO_2 used during production.

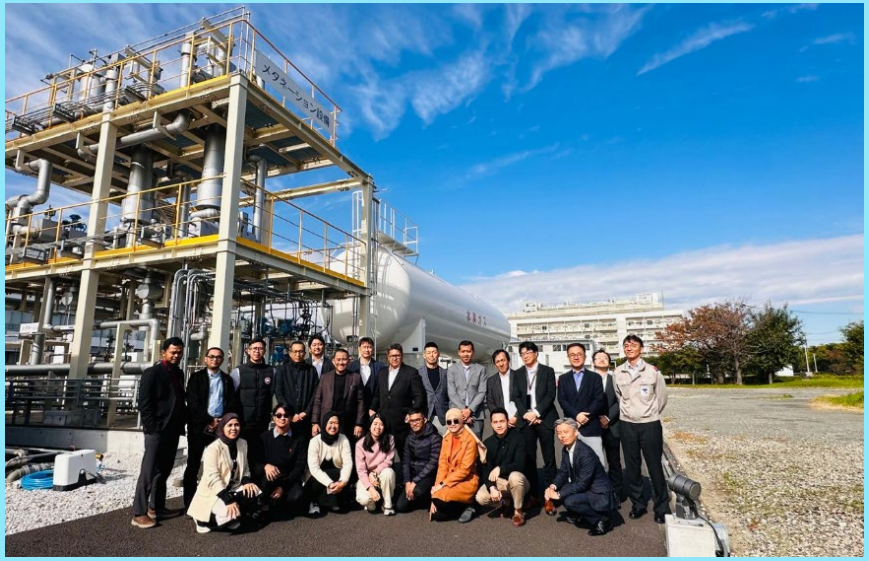
E-methane can be used with **existing infrastructure**, such as:
City gas pipelines &
Domestic gas appliances

Since it works with current systems, e-methane helps to minimize additional costs in the transition to a carbon-neutral society.

Source : www.tokyo-gas.co.jp

What is Methanation?

Methanation is a technology for synthesizing e-methane from hydrogen and CO_2. It is required to develop efficient, large-scale methanation facilities to replace conventional natural gas with e-methane.



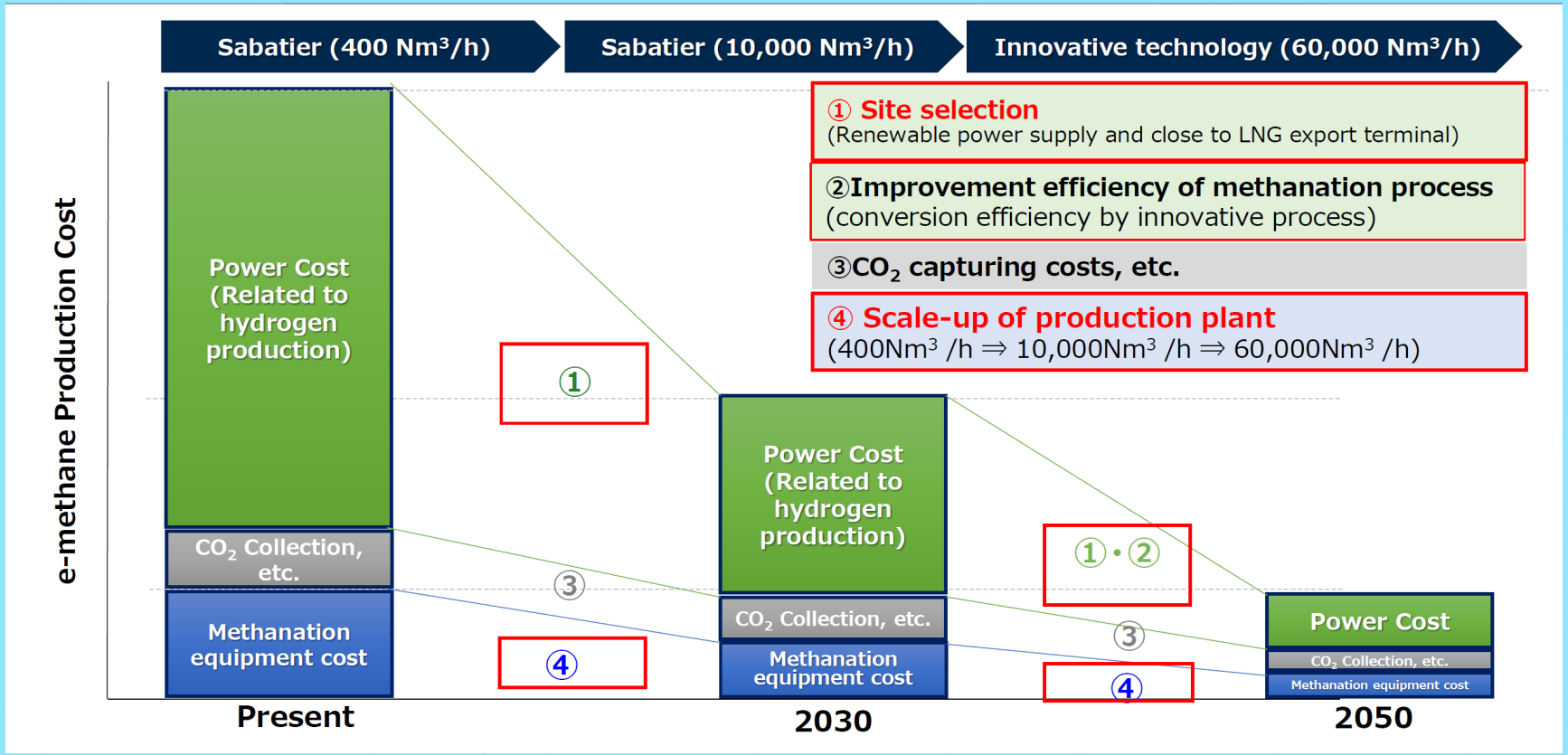
Example undertaking small-scale methanation pilot projects.

They are also working on e-methane manufacturing projects overseas and estabslishing an international supply chain.

Source : www.tokyo-gas.co.jp

Image of production cost structure and critical factors for cost reduction

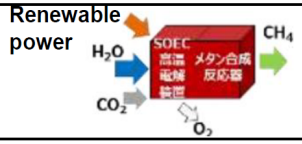
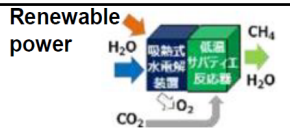
- The cost structure of e-methane is estimated to be much dependent on hydrogen production.
- Procurement of stable and inexpensive renewable power is the key. Production site selection is the most important.
- Followed by technological factors such as large-scale production and advanced higher efficient process.



Source : Japanese gas association

Innovation technologies challenged for efficiency improvement

- Major gas companies are challenging innovation technologies to improve production efficiency for cost reduction supported by “Green Innovation Funding Program” by the government.
- There are SOEC and hybrid processes that include Sabatier reaction, featured by direct use of water without hydrogen production process. Target efficiency is excess 70 to 90%, commercialization is expected in the 2040s.

	Existing Technology	Innovative Technology		
	Reference	Osaka Gas	Tokyo Gas	
Process	Sabatier Reaction (Conventional)	SOEC	Water Electrolysis	PEM
Conceptual image				
Feedstock (molecule)	Hydrogen and CO_2	Water and CO_2	Water and CO_2	Water and CO_2
Reaction formula	$4H_2+CO_2 \rightarrow CH_4+2H_2O$	$3H_2O+CO_2 \rightarrow CO+3H_2+2CO_2$ $CO+3H_2 \rightarrow CH_4+H_2O$	$CO_2+4H_2O \rightarrow CH_4+2H_2O+2O_2$	$CO_2+4H_2O \rightarrow CH_4+2H_2O+2O_2$
Reaction method	Chemical Reaction	Electrochemical Reaction	Electrochemical Reaction	Electrochemical Reaction
Temperature	up to 500℃	up to 800℃ (high temperature)	up to 220℃ (low temperature)	up to 80℃ (low temperature)
Merit	Existing technology	- No need to procure hydrogen - High efficiency by use of effective use of waste heat	- No need to procure hydrogen - High efficiency by use of effective use of waste heat	- No need to procure hydrogen - One-step methane synthesis - Low temperature process
Efficiency (targeted)	55-60%	**85-90% (Future Target)**	**Over 80% (Future Target)**	**Over 70% (Future Target)**
Challenges	- Improvement of overall efficiency - Management of thermal reactions	- Cell development for high temperature thermal electrolysis - Catalyst durability etc.	- Cell development for water electrolysis - Catalyst durability etc.	- Durability of methane synthesis catalysts

Source : Japanese gas association

Various efforts by leading Japanese Companies

Japanese major gas companies are leading field tests.
Various efforts are now underway to scale-up production, demonstrations and feasibility studies of International projects

Large scale (1000-100000 Nm³/h)

Project site	Business entities, partners	Capacity	Feedstocks	Schedule
Cameron	Mitsubishi Corporation Tokyo Gas, Osaka Gas, Toho Gas, Sempra Infrastructures Partners LP	130,000 ton-CH_4/y	Green H_2, recycled CO_2, etc.	FY2023 FS FY2025 FID FY2030- Start production
Midwest	Osaka Gas, Tallgrass, Green Plains	Max 200,000 ton-CH_4/y	Blue H_2, biogenic CO_2	

FSs in other potential regions (Australia, Middle East, South-East Asia, South America, etc.) for commercial production plants

ENEOS / OSAKA GAS Daigas Group
- Joint study on large-scale domestic production of e-methane
- Study on production scale : 10,000 Nm³/h (or 250,000 ordinary households) in Osaka port area.

Middle scale (100 – 1000 Nm³/h)

TOKYO GAS
- In May 2024, start studying domestic e-methane production at Oji Paper's Mill in Tomakomai City, Hookaido.
- Start of demonstration of e-methane production by 2030 , expand to several thousand Nm³/h beyond 2030

INPEX / OSAKA GAS Daigas Group
- Main construction of the methanation test plant started in Nagaoka City in October 2023.
- Approximately 400Nm³/h production and injection into gas pipelines will start from FY2025.

JFE IHI
JFE Steel and IHI signed contract in Dec 2022 to build 500Nm³/h e-methane production plant by FY2024.

Hitz Hitachi Zosen
Hitachi Zosen tested 125Nm³/h e-methane production in 2022 with Odawara municipal government

Small scale (- 100 Nm³/h)

SAIBU GAS HOLDINGS / KITAGAS / IHI
- Joint e-methane production demonstration with Hokkaido Gas / Hiroshima Gas / Nihon Gas, etc.
- 12.5 Nm³/h of e-methane to be produced at Kitakyushu LNG terminal by the end of FY2025.

TOKYO GAS
2022- 12.5Nm³/h production
2023- CO_2 from incineration plant

OSAKA GAS Daigas Group
2022- 5 Nm³/h biomethanation in Konohana area

TOHO GAS
2024- 5Nm³/h in Chita with municipal government

Source : Japanese gas association

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