

Introduction of our energy solutions aiming to carbon neutrality achievement

25th February 2022

OSAKA GAS CO., LTD.

ASIA ENERGY BUSINESS DEPT,

ENERGY RESOURCES AND INTERNATIONAL BUSINESS UNIT

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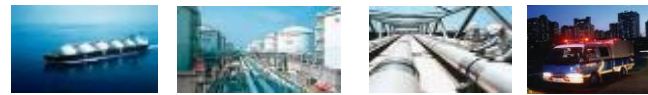
Agenda

- 1. About Osaka Gas**
- 2. Our business in India**
- 3. Our business in Southeast Asia**

1. About Osaka Gas

Outline of Osaka Gas

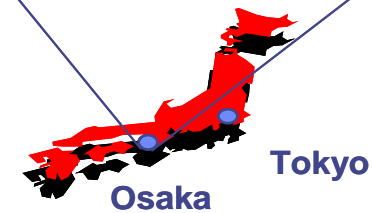
- Since founded in 1905, one of the major gas and energy service providers, with 9 million customers and 25% of gas market share in Japan.
- Actively strengthening electric power and overseas energy businesses.



Natural Gas Value Chain

LNG purchase/transport → LNG receive/City gas production → Supply of city gas → Maintenance

- Household
- Commercial
- Industrial
- Power generation
- Community air-conditioning



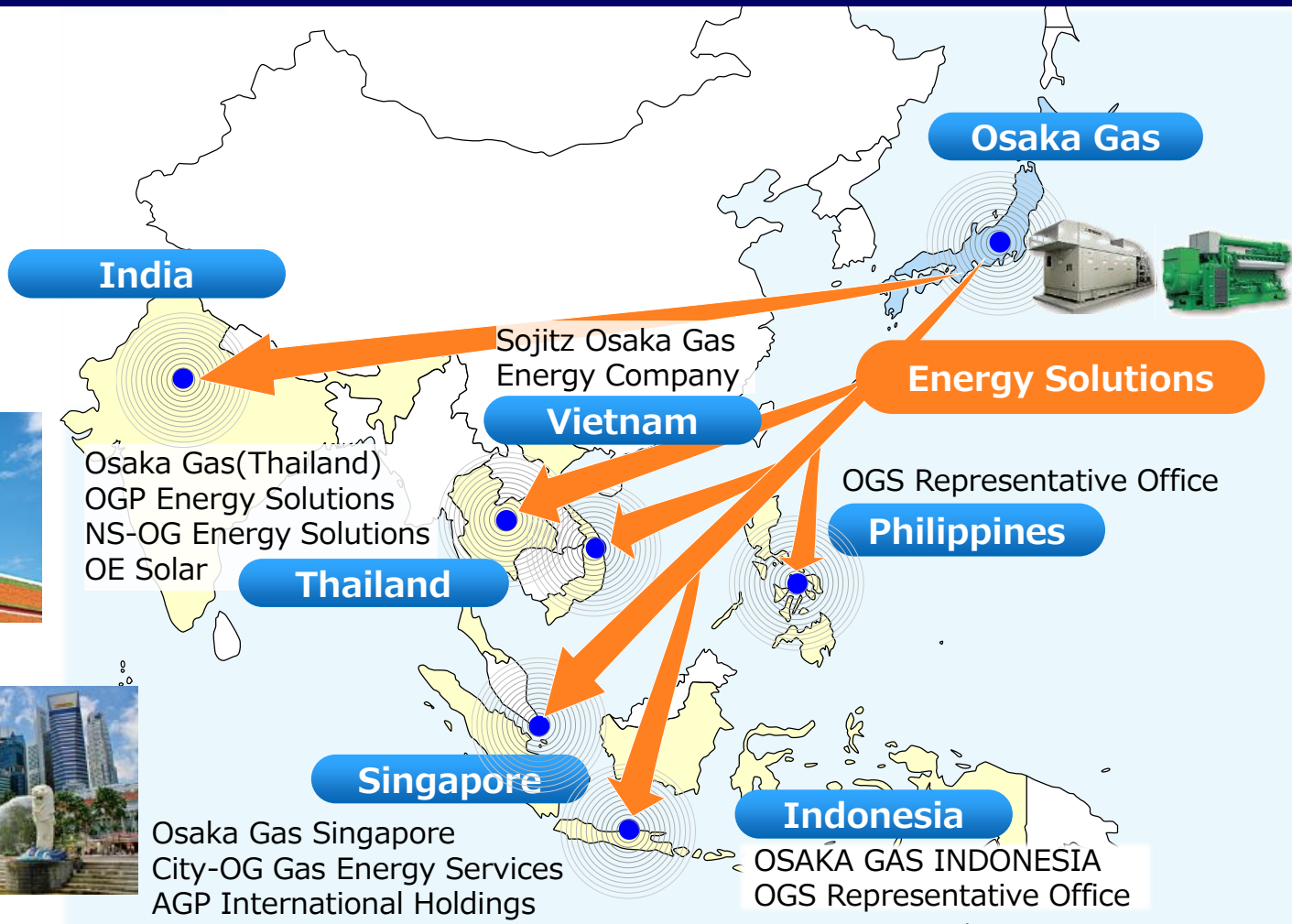
- ◆ Gas sales volume: **7.9 billion m³ (45MJ/m³)**
- ◆ LNG procurement: **9.5 million tons**
- ◆ Power generation capacity: **3.8GW in 5 countries**
- ◆ Electricity sales volume: **11.7 billion kWh**

- ◆ Operating revenues: **US\$ 12.3 billion**
- ◆ Total assets: **US\$ 18.2 billion**
- ◆ Market Capitalization: **US\$ 8.1 billion**
- ◆ Credit Ratings: **Moody's: Aa3, S&P: AA-**
- ◆ Net income: **US\$ 302.7 million**
- ◆ Net assets: **US\$ 9.3 billion**

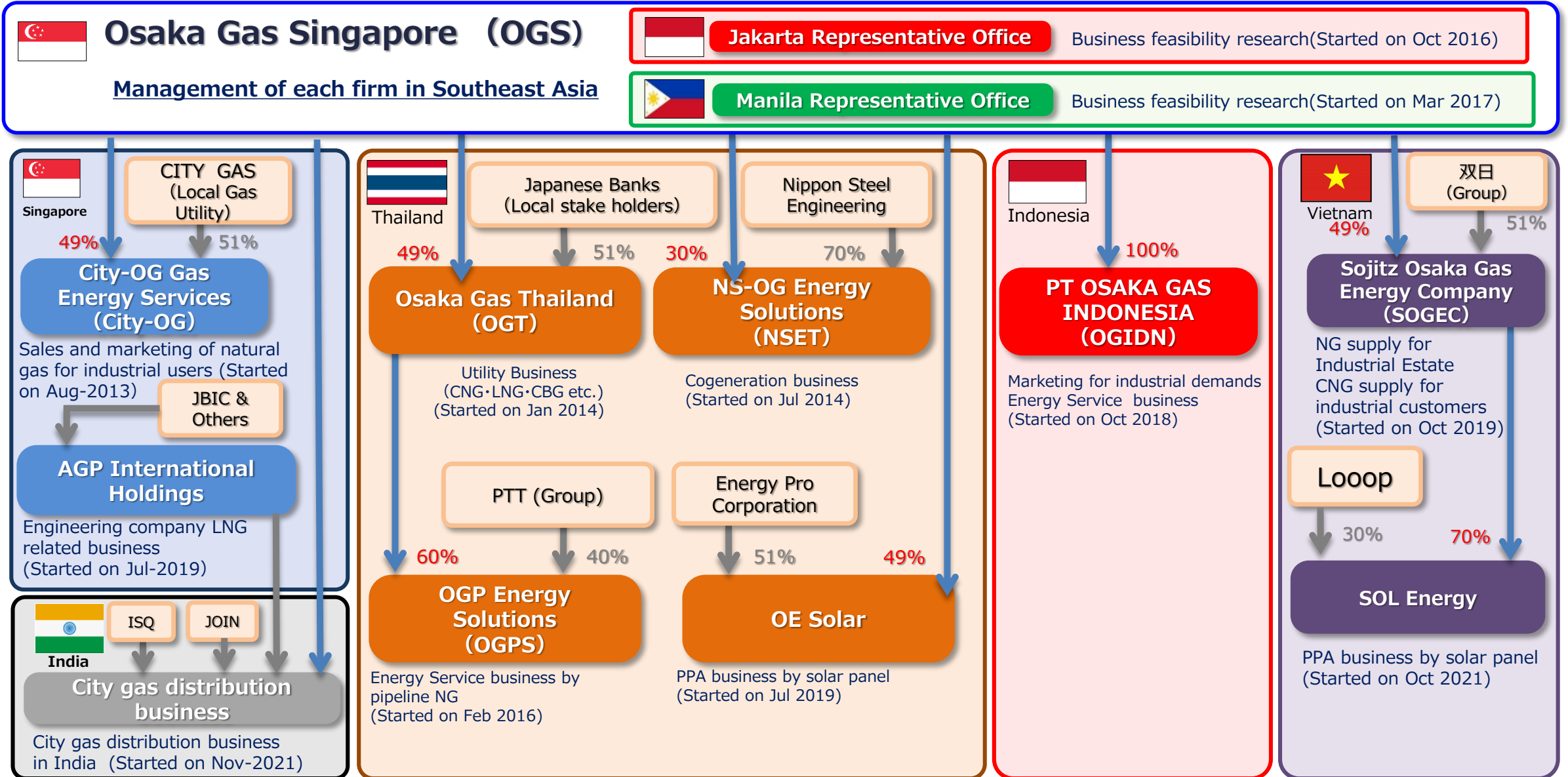
(Consolidated, ¥110.99/US\$)
(as of 29 March 2019)

Our business in Asia

➤ Osaka Gas strives to promote energy efficiency in Southeast Asia. Daigas Group has been expanding its business operation from Singapore to Thailand, Indonesia, Philippines, Vietnam and India.

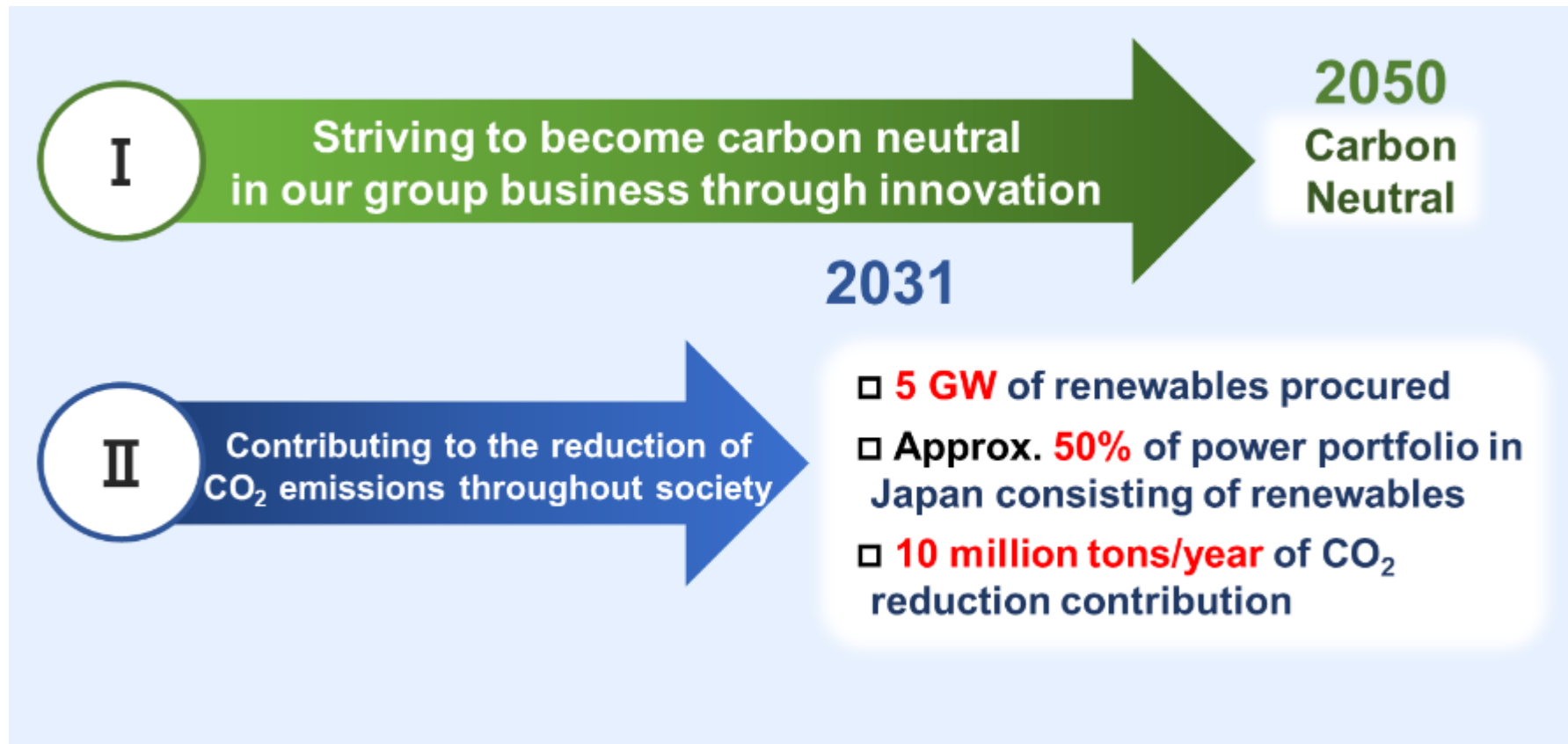


Our business structure in Asia



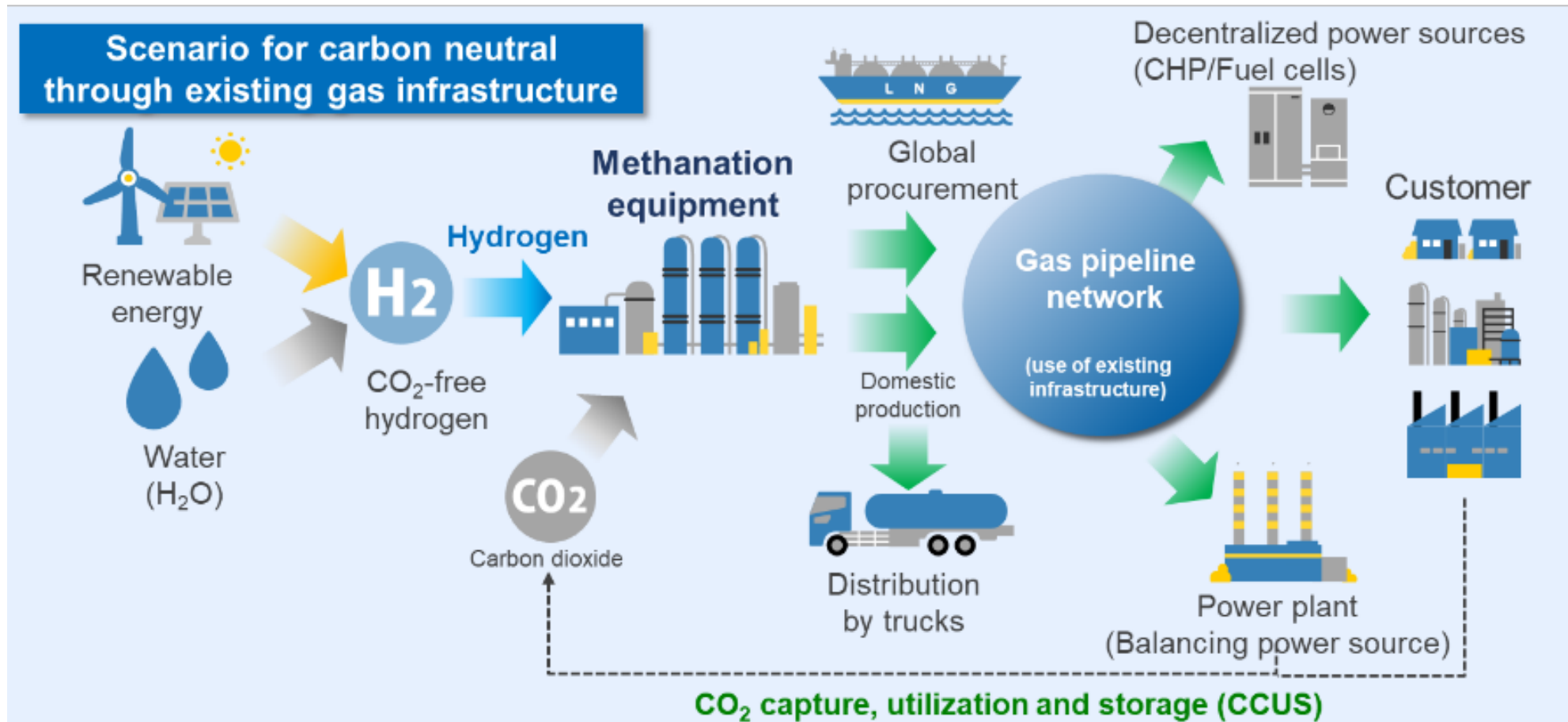
Target for Carbon Neutral

- **2050: Carbon Neutral through decarbonization of Natural Gas/Electricity realized by innovation, and provision of solutions to achieve sustainable society.**
- **2031: As a milestone, aggressive target for CO₂ reduction with extension of our strong capability. (Energy saving, Advanced utilization of Natural Gas, Renewables)**



Scenario for Carbon Neutral with Methanation

- Electricity Network with Renewable Energy requires thermal power plant.
- Decarbonized Methane generated by Methanation and supplied by existing gas facilities will be the efficient and economical solution.



2. Our business in India

Overview of the natural gas market in India

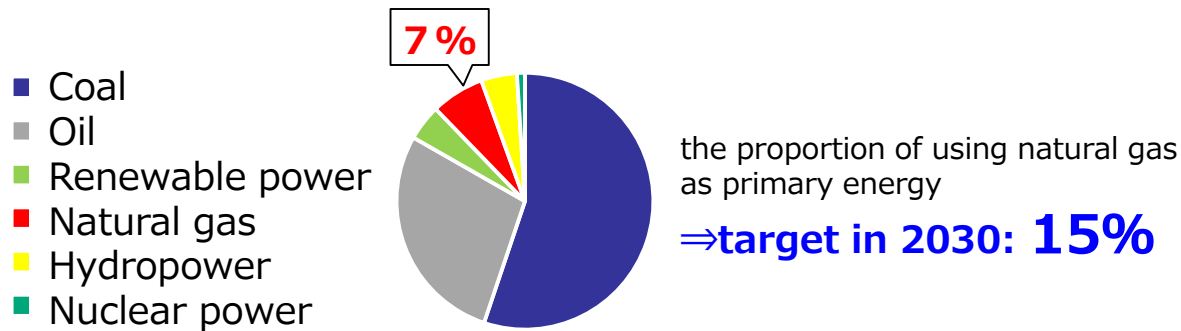
➤ The government of India push forward policies that will raise the share of the Natural Gas supply, and Compressed Natural Gas (“CNG”) vehicle to tackle with the issue of air pollution and imbalance of energy trade.

Policy for Natural Gas

Bids for the city gas development projects

Target of Natural Gas supply in 2030

7% (2020) ⇒ **15% (2030)**



The rate of primary energy in India (2020)

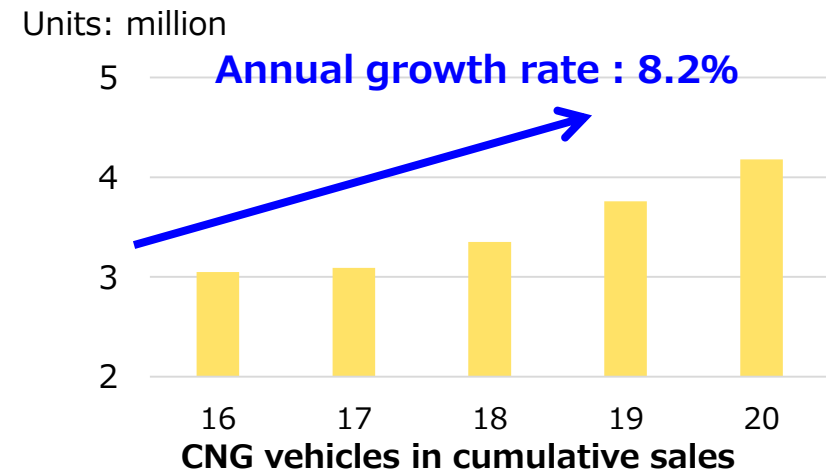
Source : BP Statistical Review of World Energy

Policy for CNG

Priority of using domestic natural gas for vehicle

Target of CNG stations in 2025

3,000 units (2020) ⇒ **10,000 units (2025)**



Source : PPAC

City Gas Distribution Business

- **Osaka Gas participated in India's City Gas Distribution ("CGD") business by investing in Singapore based AG&P CGD HoldCo SPV3*1 .**
- **We provide support to the venture for engineering solutions and commercial know-how of city gas business.**

Overview

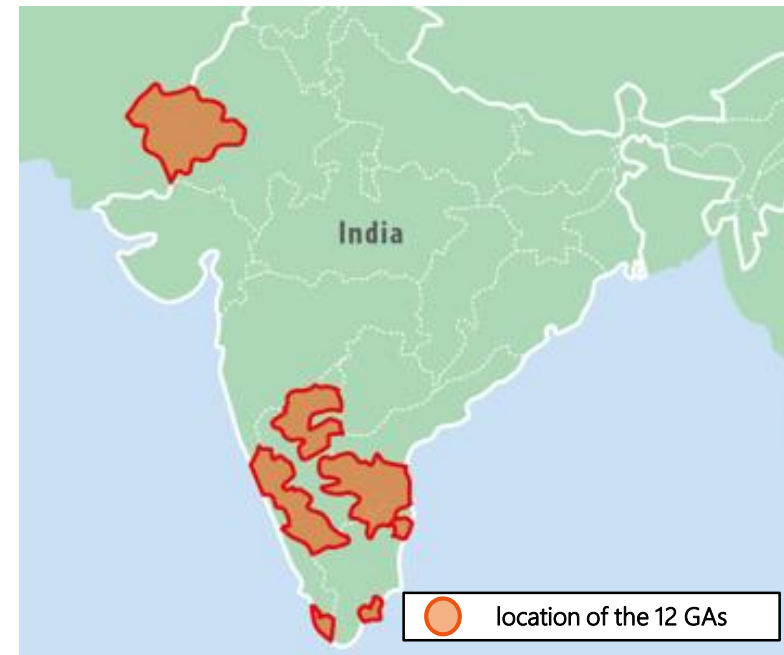
- ✓ **Exclusive city gas sales rights and infrastructure ownership rights in 12GA*2.**
- ✓ **Promoting city gas demand for CNG vehicles as well as for household, commercial, and industrial uses.**
- ✓ **Utilizing LNG lorries as one of the main gas supply system to reduce the time for development and roll-out of the city gas infrastructure.**
- ✓ **Osaka Gas shall support the venture for engineering solutions and commercial know-how of city gas business.**

*1 AG&P CGD HoldCo SPV3 is developing twelve CGD networks, or concessions, in South India and Rajasthan under the brand name AG&P Pratham.

*2:GA stands for Geographical Area and is the unit by which CGD business rights were assigned.

Project area

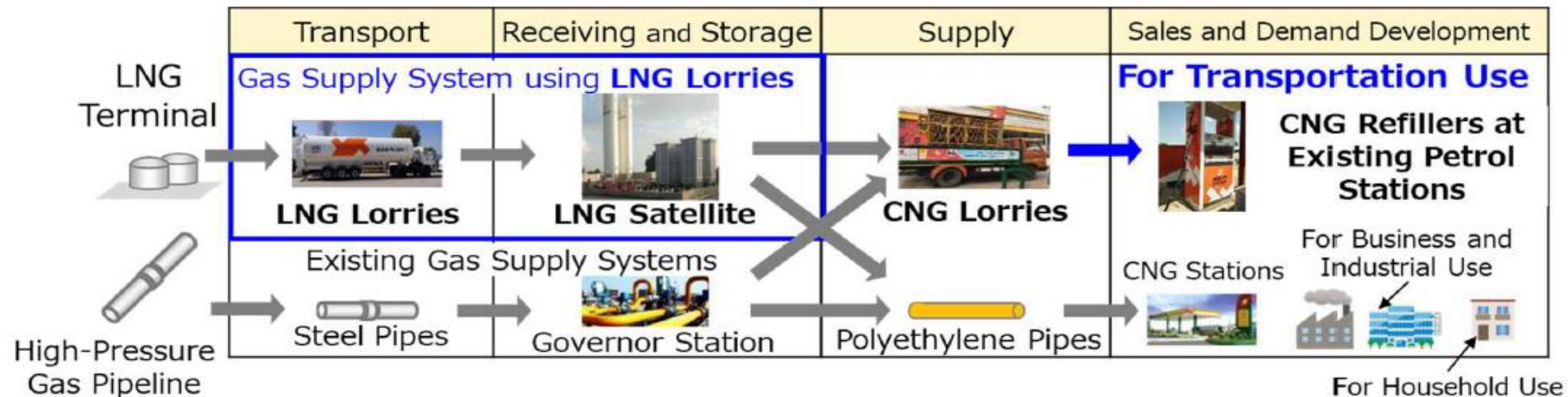
The vast swath of southern India.
(roughly equivalent to 3/4 the area of Japan)



Overview of gas supply systems

- Utilizing LNG lorries as one of the main gas supply system to reduce the time for the development and roll-out of the city gas infrastructure.
- Osaka Gas will contribute to carbon emissions reduction and stable energy supply in India.

Gas supply systems



Contribution to India

Approximately 29 million t-CO₂ of carbon reduction can be archived in 12 GA by converting the conventional fuel (petrol, diesel oil, etc.) to Natural Gas in transportation and energy sector.

3. Our business in Southeast Asia

Steps for energy transition

➤ Practical and sustainable steps to energy transition are essential in Asia.

Three steps for energy transition

① Fuel conversion

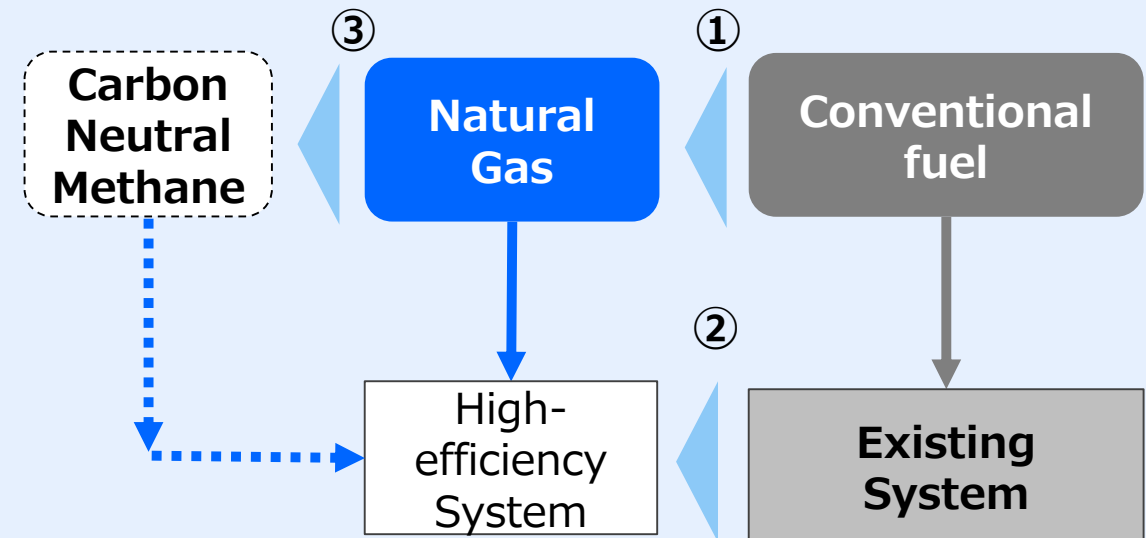
Switching from conventional fuel (coal, fuel oil, diesel oil, etc.) to Natural Gas can drastically reduce carbon emissions.

② Installing High-efficiency System

Converting to natural gas can open the door to select highly efficient systems and replacing the existing system can significantly reduce energy consumption.

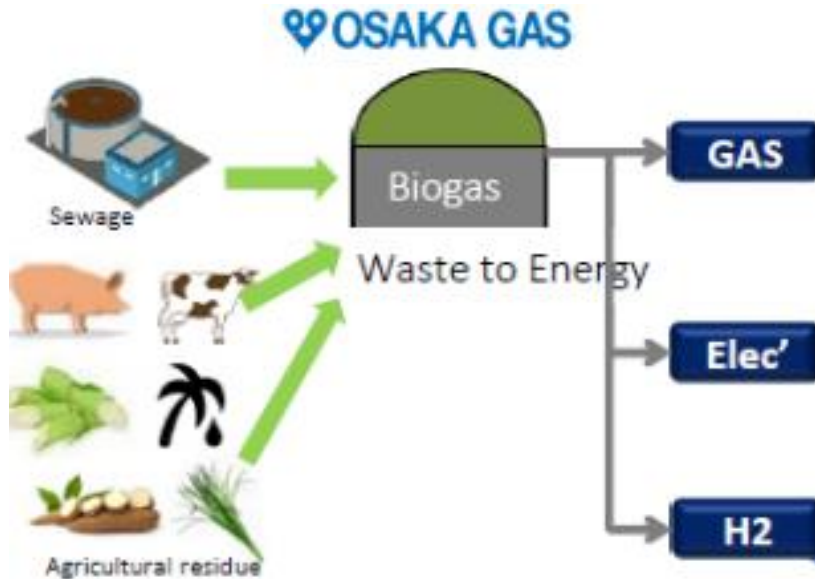
③ Switching to Carbon Neutral Methane

In the future, there might be an option to switch the Natural Gas to Carbon Neutral Methane for further carbon reduction.



Technologies of Biogas Utilization in Osaka Gas

Biogas utilization



Biogas to H₂

- ◆ We can convert biogas to H₂.



H₂ production equipment(30m³/h) in Motomachi factory of Toyota, Japan

Biogas to City Gas

- ◆ Refining biogas with the purity of 99% can be utilized as city gas.
- ◆ Injection into gas pipelines is expected to expand the utilization of biogas.



Purification Facilities(biogas 160m³/h) and NGV station at the ABC palm mil in Nakhon Si Thammarat



Biogas injection to pipelines in Kobe, Japan

Biogas to Electricity

- ◆ We generate power from biogas in the sewage-treatment plants
- ◆ We implement on-site cogeneration business, utilizing IoT (ex. Failure prediction) for reliable energy supply.



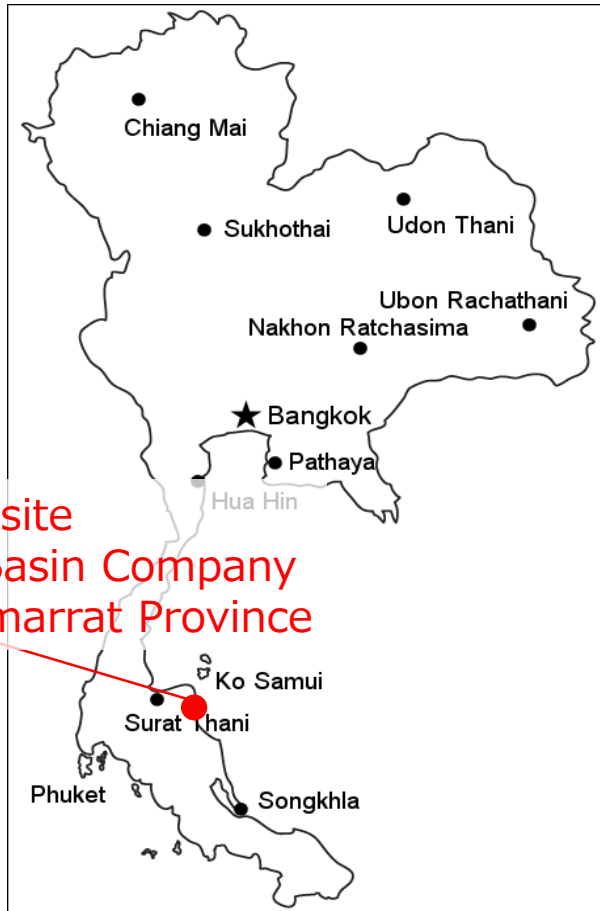
Power generator(0.4MW) from biogas in the sewage-treatment plants of Osaka City



On-site cogeneration(7MW) plant in Thailand

Our First Commercial Biogas project in Thailand

- The project is located at the Palm Oil Mill in southern Thailand.
- Biogas Processing System developed by Daigas Group is introduced.
- Biogas extracted from POME is purified (99% methane) by our system and supplied to NGVs so that Natural Gas consumption is decreased.



Demonstration site
Agriculture of Basin Company
Nakhon Si Thamarrat Province



Biogas
250 Nm³/h

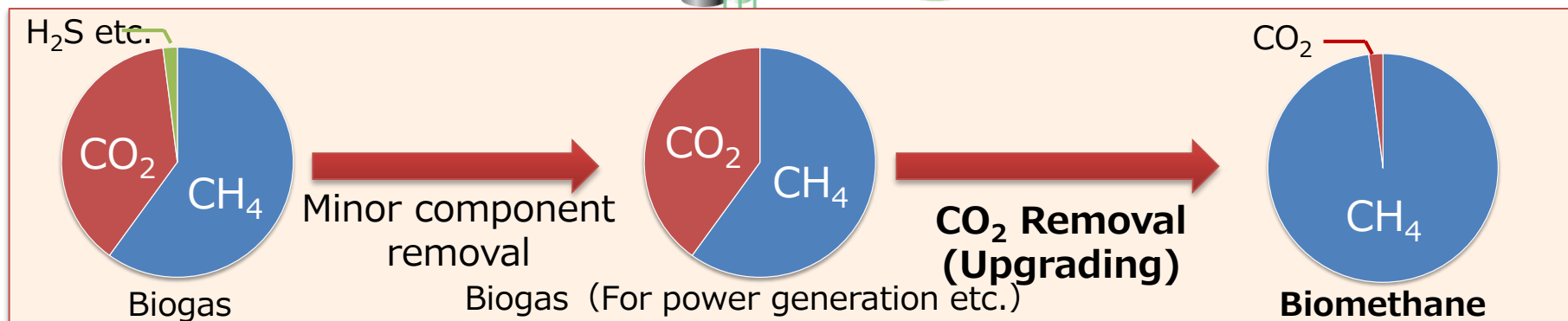
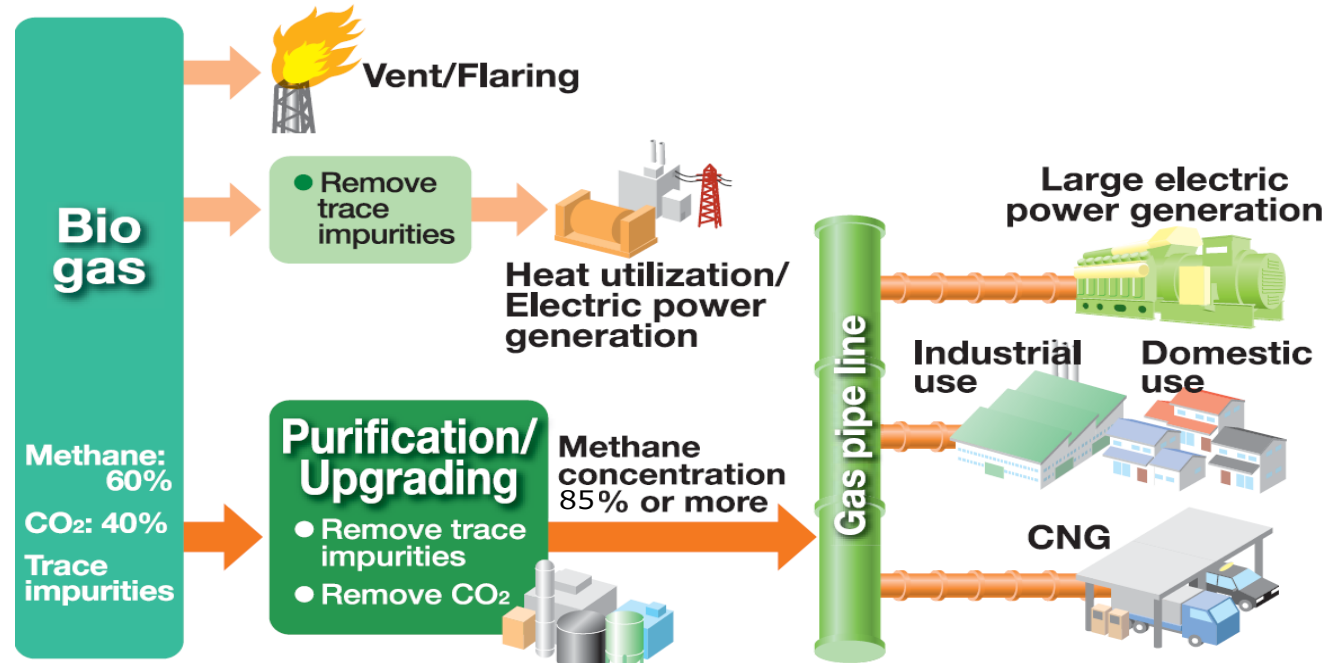


Biomethane
160 Nm³/h

18,000 vehicles
CO₂ reduction 2,500ton

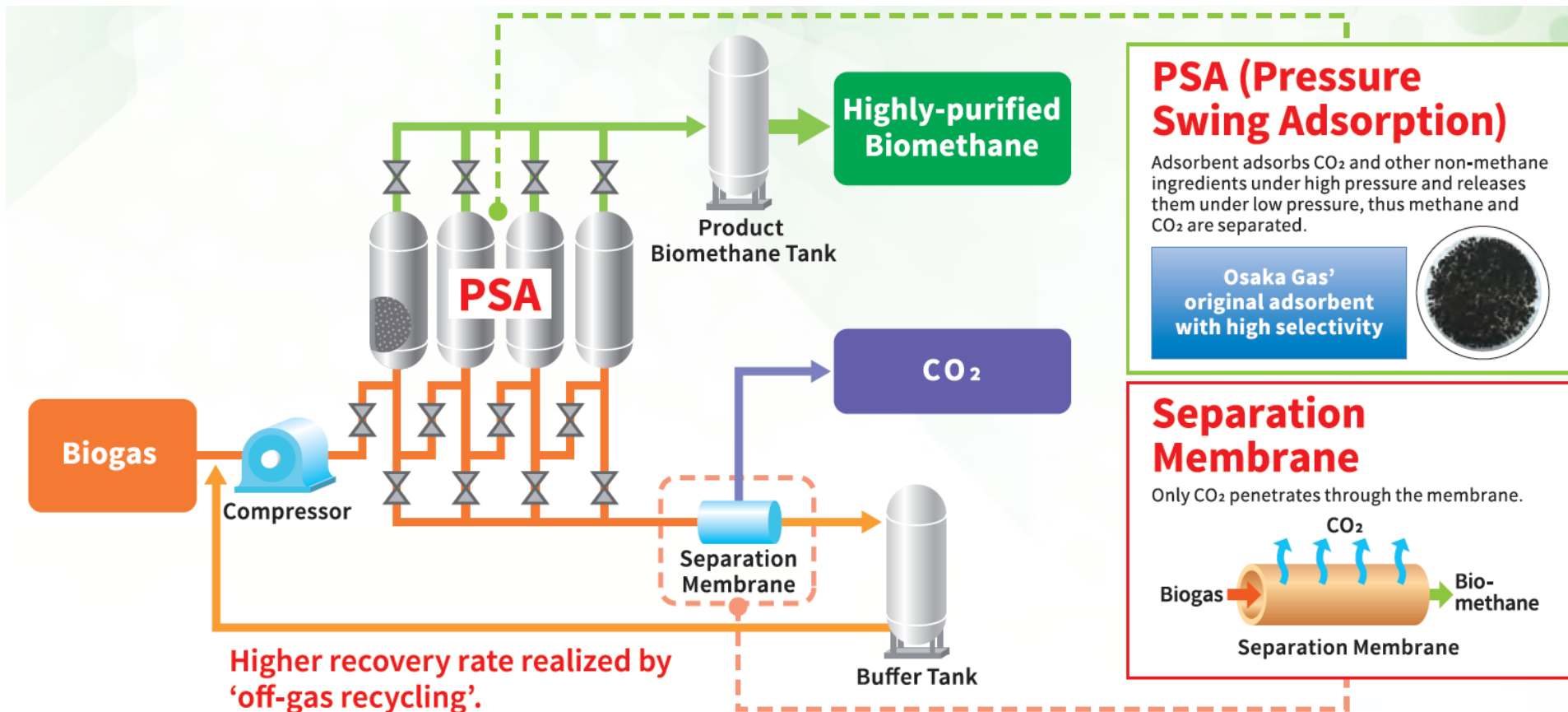
Utilization of Biogas

➤ To utilize biogas as a Natural gas alternative for city gas or fuel for vehicles, Osaka Gas has the technology of biogas purification and upgrading.



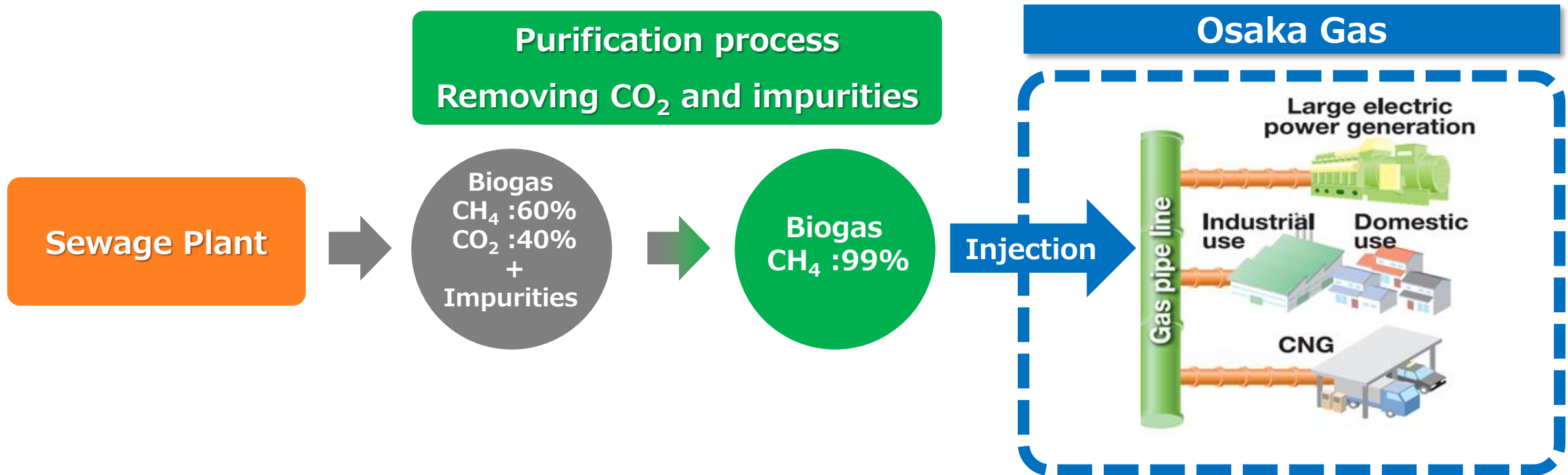
PSA/Membrane Hybrid System

- PSA is used for removing CO₂ from the feed gas, which has advantage on yielding high purity CH₄ at lower cost.
- The disadvantage of PSA, low recovery rate of CH₄, is made up for by purifying and recycling the off gas emitted from PSA using membrane technology.



Biogas introduced to gas utility pipeline

- It was the first attempt in Japan to feed biogas to the gas utility pipeline.
- Supplying biogas along with utility gas is a solution for the effective use of renewable energy resources, and it can contribute to further decarbonization.



Thank you.