Completion of Bench-Scale Test Facility for SOEC Methanation under the Green Innovation Fund Project

June 3, 2025
Osaka Gas Co., Ltd.

Osaka Gas Co., Ltd. (Representative Director and President: Masataka Fujiwara; hereinafter "Osaka Gas") is pursuing the development of SOEC[*1] methanation under the SOEC methanation technology innovation project of the Green Innovation Fund Project[*2]/Development of Technology for Producing Fuel Using CO_2, etc." of the New Energy and Industrial Technology Development Organization (hereinafter "NEDO"), which was selected in collaboration with the National Institute of Advanced Industrial Science and Technology (President and CEO: Kazuhiko Ishimura; hereinafter "AIST"). The bench-scale test facility has now been completed, and the completion ceremony was held today.

SOEC methanation, which Osaka Gas aims to implement in society, is a technology that uses renewable energy and other sources to electrolytically decompose water and CO_2 in a SOEC electrolyzer to produce hydrogen and carbon monoxide, which are then used in a methane synthesizer/reactor to synthesize e-methane through a catalytic reaction.

A key feature of this technology is that it does not require external hydrogen as a raw material and can produce e-methane directly from water and CO_2. In addition, this technology can reduce the amount of required electricity from renewable energy sources, etc. because it performs electrolysis at high temperatures (approximately 700 to 800°C). Furthermore, since the waste heat generated during methane synthesis can be effectively utilized, it has the potential to achieve an energy conversion efficiency[*3] of approximately 85 to 90%, which significantly exceeds that of conventional Sabatier reaction methanation (approximately 55 to 60%). This is expected to significantly reduce the cost of e-methane production, which relies heavily on electricity from renewable energy sources.

Osaka Gas has been conducting laboratory-scale (equivalent to two general households) testing since fiscal 2024. In the bench-scale test (equivalent to approximately 200 general households) to be conducted at this facility, the company will first combine a SOEC steam electrolyzer[*4] with a methane synthesizer filled with a catalyst developed by Osaka Gas to verify the performance of the devices and collect operational data for the entire process, thereby advancing verification to achieve high energy conversion efficiency. Subsequently, Osaka Gas will install a new SOEC co-electrolyzer,[*5] which is currently under development for further efficiency improvements, to conduct testing.

From fiscal 2028 to fiscal 2030, the company will conduct pilot-scale testing with the aim of establishing e-methane production technology that achieves world-leading energy conversion efficiency (approximately 85 to 90%) by fiscal 2030.

In the future, Osaka Gas aims to begin practical application in the late 2030s to around 2040, following a demonstration phase starting in fiscal 2031 or later.

The Daigas Group, under the "Energy Transition 2050" initiative announced this February,

remains committed to developing technologies and services that contribute to realizing a carbon neutral society and solving social issues, including climate change, in order to become a corporate group that contributes to the “further evolution” of customers’ lives and businesses.

*1: A fund totaling approximately 2.8 trillion yen that has been established to achieve carbon neutrality by 2050, with the aim of significantly accelerating efforts toward structural changes in the energy and industrial sectors and innovation through bold investment. The support will focus on priority fields for which implementation plans have been formulated within the government’s Green Growth Strategy, where policy effects are significant and long-term continuous support is required to realize implementation in society.
*2: Abbreviation for Solid Oxide Electrolysis Cell, an electrolytic cell that uses solid oxides.It electrolyzes water vapor and CO_2 at high temperatures.
*3: The ratio of fuel energy obtained to the amount of electrical energy input.
*4: High-temperature electrolyzer that generates hydrogen by electrolysis of water vapor. It is manufactured by Toshiba Energy Systems & Solutions Corporation, a subcontractor of Osaka Gas.
*5: High-temperature electrolyzer that electrolyzes CO_2 together with water vapor to produce hydrogen and CO.

1. SOEC methanation bench-scale test system

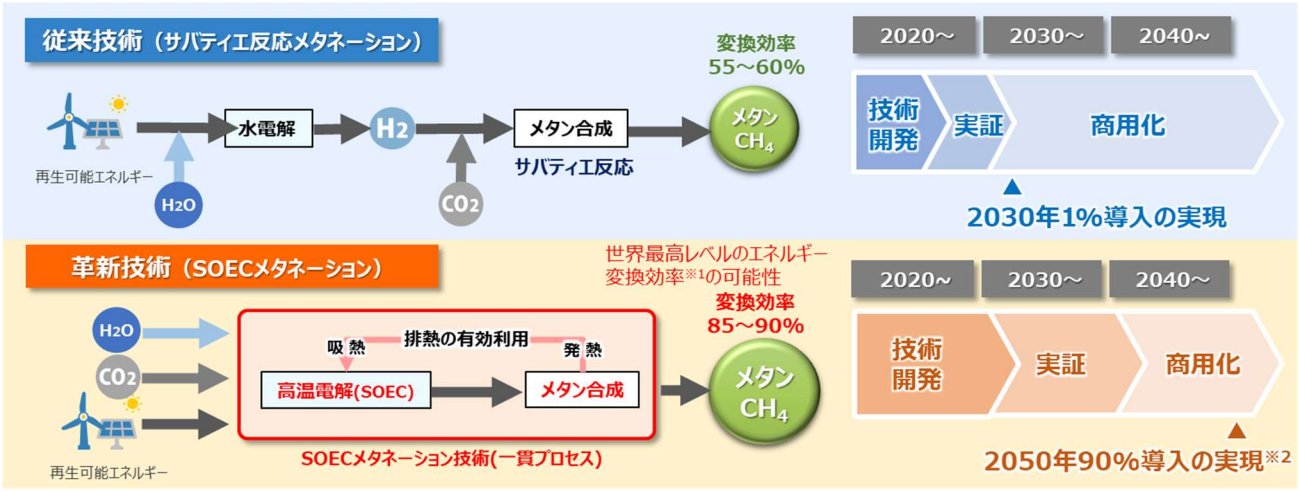
<SOEC electrolyzer>

<Methane synthesizer/reactor>

<Completion ceremony>

<Overview of SOEC methanation technology>

(1) Overview of conventional technology (Sabatier reaction methanation) and SOEC methanation

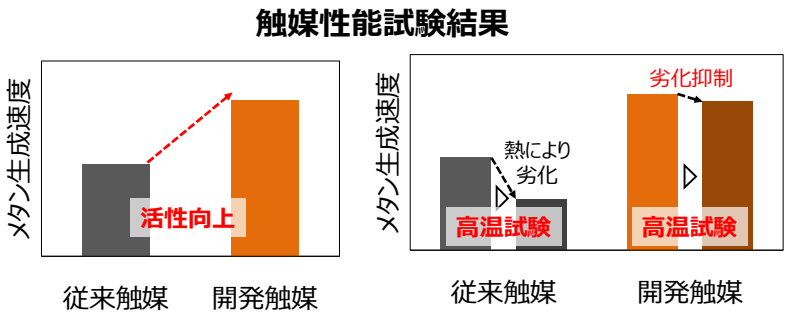


※1 投入した電力エネルギー量に対し得られる燃料のエネルギー量の割合 ※2 出典：日本ガス協会「カーボンニュートラルチャレンジ2050アクションプラン」

(2) Characteristics of the methanation catalyst

Osaka Gas possesses high-performance methanation catalyst technology that utilizes catalyst technology cultivated through past efforts in alternative natural gas production and fuel cells. Osaka Gas will install its proprietary methanation catalyst in the bench-scale test system for this project. This catalyst stabilizes active metals* in a highly dispersed state and is characterized by high activity while being resistant to degradation even at high temperatures. Since these characteristics lead to smaller reactors and more efficient processes, using this catalyst is expected to further reduce the cost of e-methane.

*: Metals that actually exhibit catalytic action in catalytic reactions



2. Overview of the project selected by the Green Innovation Fund

Project name	SOEC methanation technology innovation project
Project scheme	○ Commissioned by NEDO: Osaka Gas Co., Ltd. (manager) National Institute of Advanced Industrial Science and Technology (joint executor) ○ Commissioned by Osaka Gas: Toshiba Energy Systems & Solutions Corporation (partially responsible for the development of SOEC electrolyzer) ○ Commissioned by AIST: Kyoto University, Gunma University, Kwansei Gakuin University, and National Institute of Technology, Nagaoka College
Project period	FY2022 to FY2030 (nine years)
Project description	(1) Development of innovative elemental technology ① Development of SOEC high-temperature electrolysis cell stack and electrolyzer ② Development of gas synthesis reaction control technology ③ Development of system configuration optimization and heat utilization technology (2) System technology development and verification (small-scale testing of SOEC methanation technology) ① FY2022 to FY2024: Laboratory scale **② FY2025 to FY2027: Bench scale** ③ FY2028 to FY2030: Pilot scale

<Description and schedule of the Green Innovation Fund Project, and conceptual drawing of demonstration and social implementation in FY2031 and beyond>