

Methanation Technology as CCU business By Hitachi Zosen Corporation

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Hitachi Zosen Corporation

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Hitachi Zosen Corporation

- Founding 1st April 1881
- Representative Director
Chairman & President Takashi Tanisho
- Headquarters Suminoe Osaka
Shinagawa Tokyo
- No. employees 10,377 (As of 31 March 2018)
- Capital 45.4 bil.yen (As of 31 March 2018)
- Sales 3764 bil.yen (As of 31 March 2018)
- Business Field Environment・Plant, Machinery, Infrastructure



Osaka Nanko Headquarter

Philosophy

We create value useful to society with technology and sincerity to contribute to a prosperous future.



EFW



Desalination Plant



Marine engine

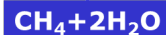


Shield Machine

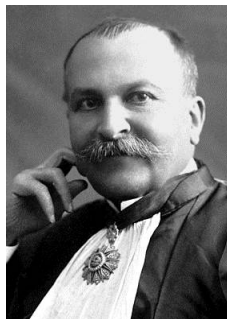


Flap gate type flood control equipment

What is Sabatier Reaction ?



Sabatier Reaction



Paul Sabatier (1854-1941)
winner of the Nobel Prize
in Chemistry in 1912

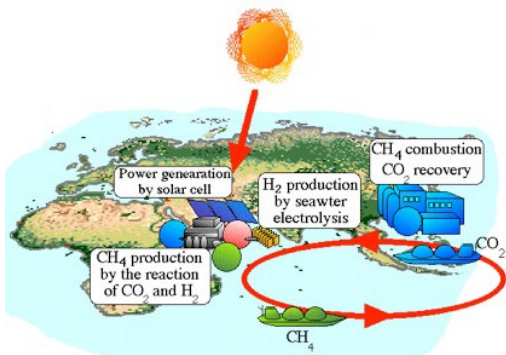
The Sabatier reaction was discovered by the French chemist Paul Sabatier in the early 1900. It involves the reaction of hydrogen with carbon dioxide at elevated temperatures (optimally 300–400 °C) and pressures in the presence of a nickel catalyst to produce methane and water.

The reaction is very simple.
Methane can be produced by just passing CO_2 and H_2 through a reaction tube packed with catalyst

History of methanation technology



Global CO₂ Recycling
Advocator
Emeritus Prof.
Koji Hashimoto
Tohoku Univ



Prof. Hashimoto proposed **Global CO₂ Recycling System 26 years ago**, Hitachi Zosen have collaborated with his group to develop new materials such as new electrodes for Alkali water electrolysis and Methanation catalysts so as to realize his idea.



•1993 :Prof. Hashimoto proposed Global CO₂ recycling system

• 1995 :0.1Nm³-CH₄/h Demonstration Plant

•2003 : 1Nm³-CH₄/h Demonstration Plant

•2010 : 6Nm³-CH₄/h Demonstration Plant (1Nm³-CH₄/h × 6)

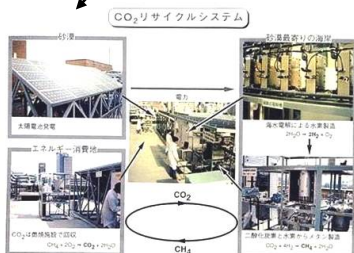
•2012 : 2Nm³-CH₄/h Integrated reactor

•2017 :
12.5 Nm³-CH₄/h
Integrated reactor

•2015 : 250 Nm³-CH₄/h Basic design

•2017 ~ :
8Nm³-CH₄/h
Plate type reactor

•2018 ~ :
Demonstration Plant commissioned by the
Ministry of the Environment



Prime Minister Abe mentioned “Methanation” at World Economic Forum

23 Jan.2019
Prime Minister Abe
Speech at World
Economic Forum



Abe's speech (extracted)

CO₂, ladies and gentlemen, could well be the best and most affordable resource for multiple uses.

There is artificial photosynthesis, for which a key discovery, one for photocatalysis, was made by Akira Fujishima, a Japanese scientist.

An old technology of **methanation** is getting attention anew to remove CO₂.

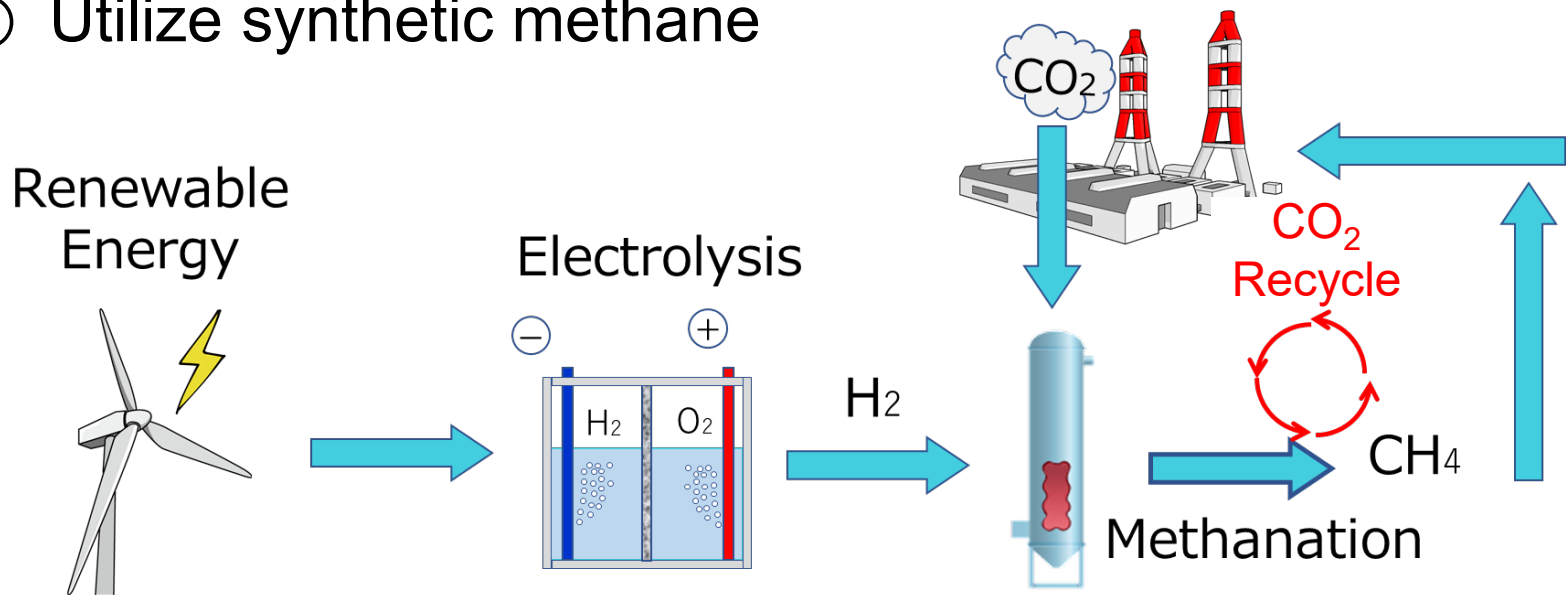
It's time now to think about **CCU, Carbon Capture AND Utilization.**

Communiqué G20 Ministerial Meeting on Energy Transitions and Global Environment for Sustainable Growth 15-16 June 2019, Karuizawa, JAPAN

“Carbon Recycling” and “Emissions to Value” → Energy Innovation

How to produce methane from CO₂

- ① Capture CO₂ from flue gas of industrial facilities
- ② Produce hydrogen with using renewable energy
- ③ Synthesize methane from Hydrogen and CO₂
- ④ Utilize synthetic methane



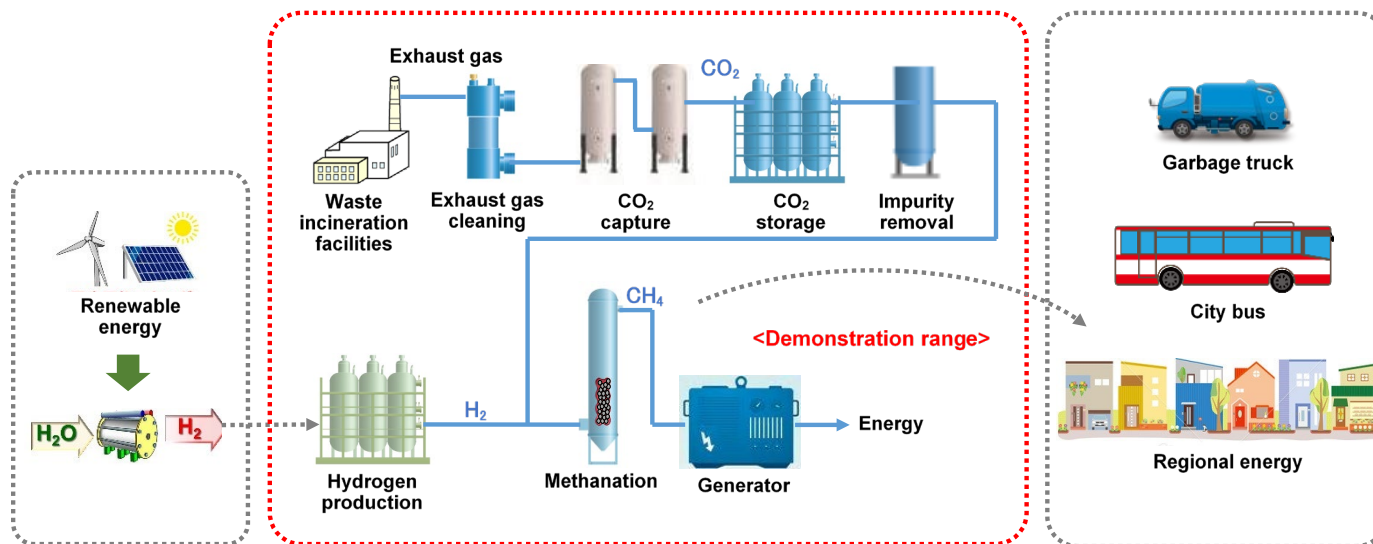
Promotion of CO₂ circulation society

Demonstration Plant commissioned by the Ministry of the Environment

Representative: Hitachi Zosen Corporation


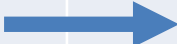
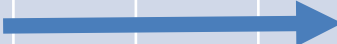
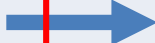

Period: FY2018~FY2022

➡ Methane production by hydrogen and CO₂ in the exhaust gas from waste incineration facilities.

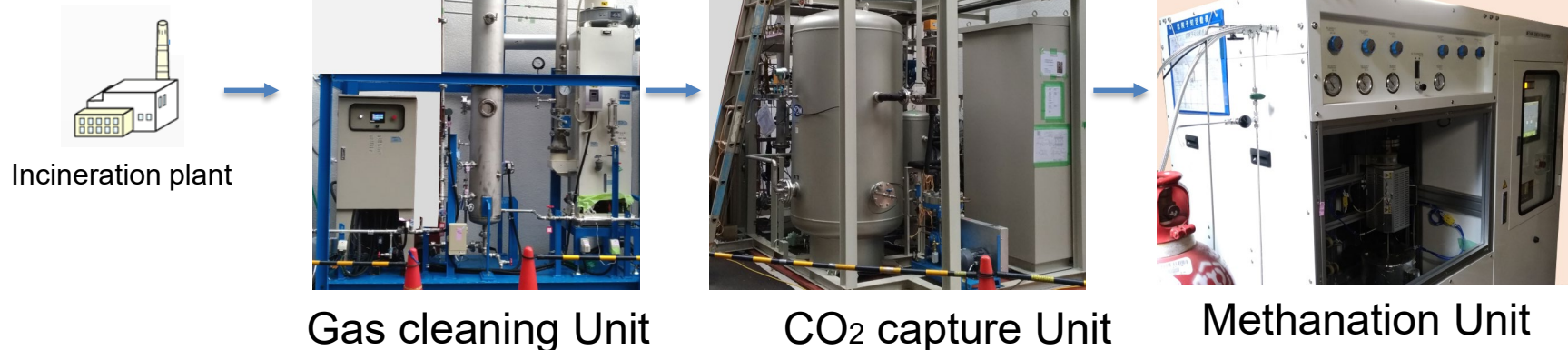


Demonstration Plant Schedule

Aim to establish commercial scale CCU technology by 2023

	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022
Bench Scale Test for Design Data					
Design					
Construction					
Demonstration					
Demolition. Removal and Recovery					

Bench Scale Test for obtaining design data



Integration bench scale test flow

Table1 Gas Composition

			Output of Incineration plant	Output of Methanation Unit
Gas Composition	CH ₄	%	<0.1	79
	CO ₂	%	8.6	0.5
	H ₂	%	<0.1	2.6

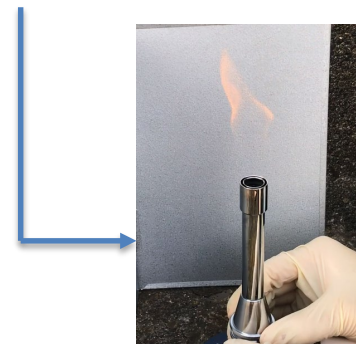
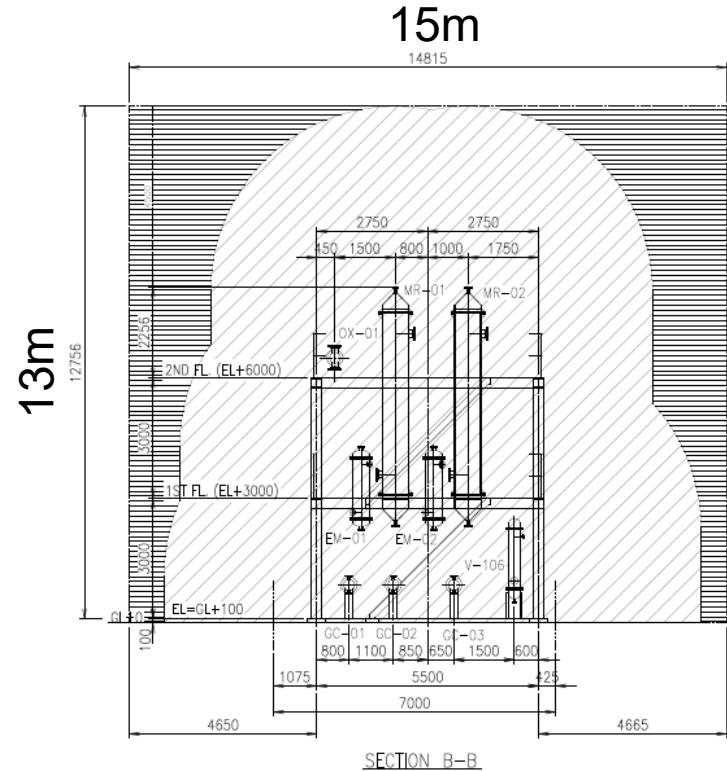
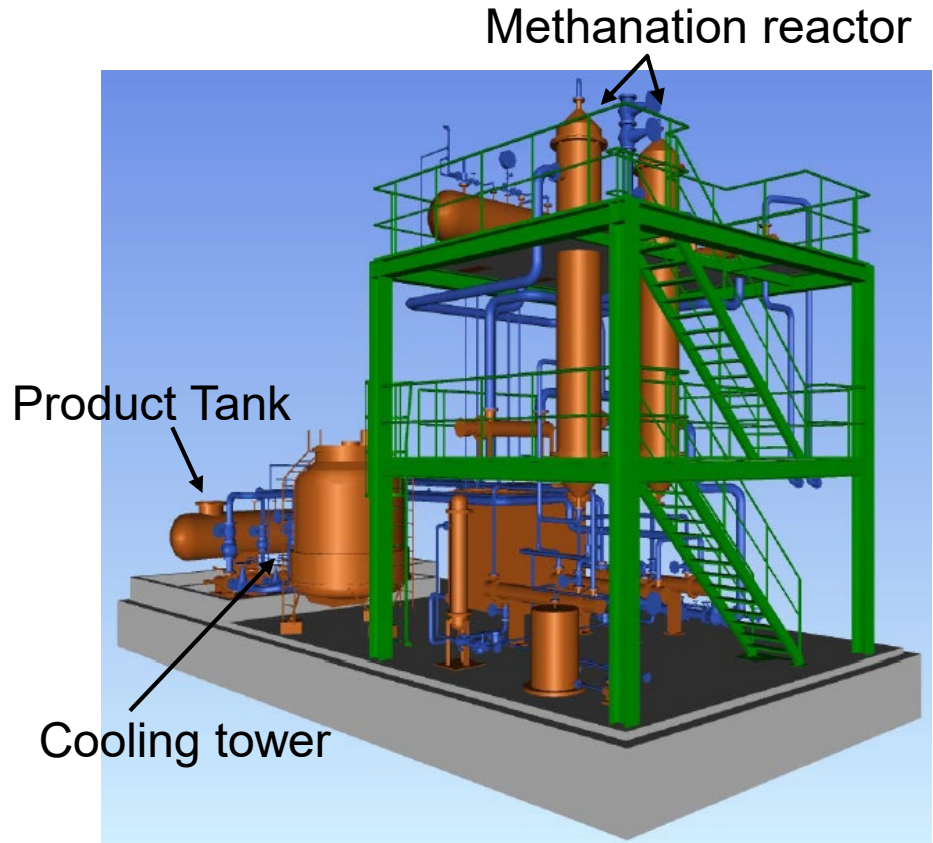
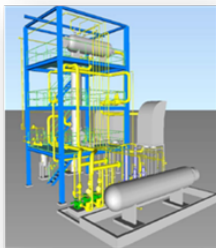


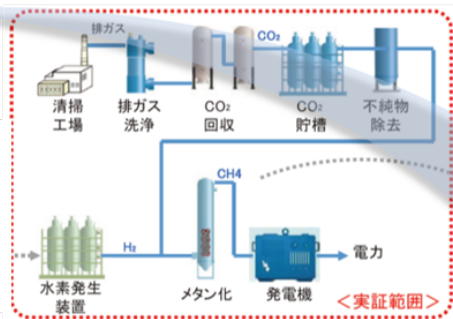
Image of Methanation Unit (Demonstration scale :125 Nm³/h)



Expected effects and future image of social implementation of this technology



Construction of methanation equipment in this demonstration project



Construction of a carbon cycle society model

- Contribute to the reduction of carbon dioxide emission through implementation of carbon dioxide-derived methane fuel.
- Break away the image of annoying waste facilities by converting to energy supply plant.

A general Image towards a Circulating and Ecological Economy



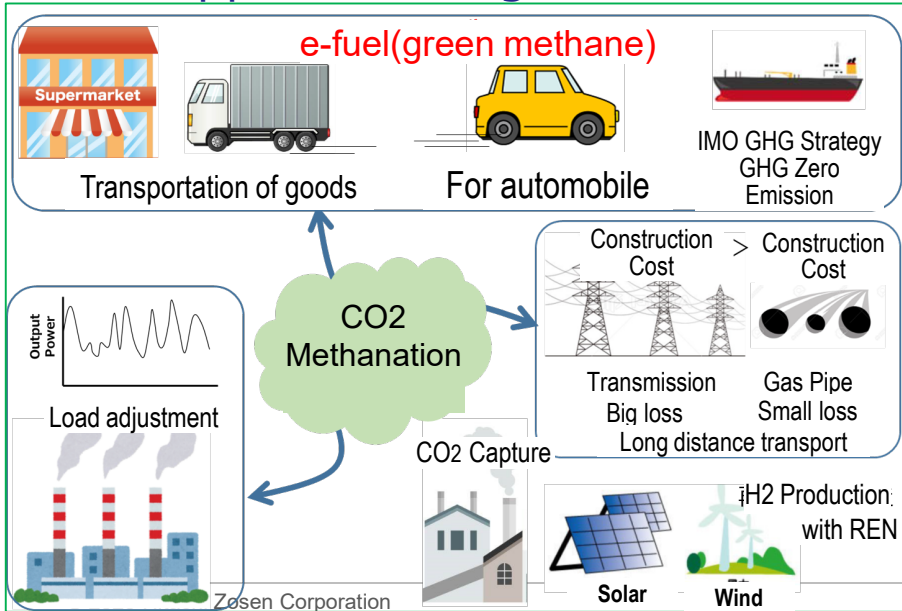
Circulating and Ecological Economy

Expectations of CO₂ reduction from industry

2016 Established CCR (Carbon Capture & Reuse) Study Group with high expectations from industry for carbon dioxide recycling. "Towards the realization of a carbon cycle society" is slogan of the group



Multi application of green methane



Hitz Hitachi Zosen 日立造船株式会社	JGC JGC株式会社	INPEX 国際石油開発帝石株式会社	EX 株式会社エックス都市研究所
Make Next. 九電工 株式会社九電工	LNG ひびきエル・エヌ・シー株式会社	三井化学 三井化学株式会社	住友商事 住友商事株式会社
IR 電力中央研究所 一般財団法人電力中央研究所	日本ガス協会 一般社団法人日本ガス協会	大阪ガス 大阪ガス株式会社	TOKYO GAS エネルギー・フロンティア 東京ガス株式会社
TEPCO 東京電力ホールディングス 東京電力ホールディングス株式会社	TOYO ENGINEERING 東洋エンジニアリング株式会社	西部ガス 西部ガス株式会社	東邦ガス 東邦ガス株式会社
MHPS 三菱日立パワーシステムズ株式会社	AsahiKASEI 旭化成株式会社	ITOCHU 伊藤忠商事 伊藤忠商事	NIPPON STEEL & SUMITOMO METAL 新日鐵住金 新日鐵住金
NGK NTK スパークプラグ ニューセラミック 日本特殊陶業 日本特殊陶業	MOL 商船三井 JMU	ClassNK 丸紅株式会社	UYENO Uyeno Group
JFE スチール 株式会社 JFE			

Special members

Kyushu Univ
Prof.Kobayashi

Tohoku Univ.
Prof.Hashimoto
Prof.Aliyama

Nagoya Univ.
Prof. Norinaga

AIST
Dr. Hayami
Dr. Takagi
Dr. Mochizuki

29 members
Incl. 2 company undisclosed

Thank you for your attention

Technology for the
People, and the Earth
and, the Future



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