The 11th NEDO-CDTI Joint Workshop

"Technologies for Hydrogen Valley in Spain and Japan – Regional H2 Value Chain"

Development of large scale PEM type Water Electrolyzer for Power to Gas

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NEDO

GOBIERNO DE ESPAÑA
MINISTERIO DE CIENCIA E INNOVACIÓN

CDTI INNOVACIÓN

CO_2 FREE FUEL H_2YES Yamanashi Hydrogen Energy Society

AeH2 ASOCIACIÓN ESPAÑOLA DEL HIDRÓGENO

Hitachizosen Company Profile

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Head Office (Osaka, Japan)

Edward Hazlett Hunter
(*founder*)

Devoted to modernizing Japan through the fostering of industry

<Desalination>
60,000 m³/day
6 Plants

Typical example of construction in Saudi Arabia

Date of Foundation	Apr 1, 1881
Capital	359 million USD／FY 2021
Net Sales	3.3 billion USD／FY2021
Employee	11,540／FY 2021
Number of Group Companies	148 companies (68 companies abroad)

Hitachizosen Business

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Environment

- ■Waste incineration power plant
- ■Biomass System
- ■Water treatment systems, etc.

Machinery & Infrastructure

- ■Systems machinery
- ■Bridges, etc.

Decarbonization

- ■Water Electrolyzer } Power to Gas Business
- ■CO_2 Recycling }
- ■Process Equipment
- ■Wind power generation
- ■Marine engines

Our Products: Power to Gas Technology

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① Electrolysis Process

【Potential Customer】
RE Producer

【Electrolyzer】
HZC＝PEM
HZI＝AEC

HZC＝Hitachi Zosen Corp.
HZI＝Hitachi Zosen Inova (Subsidiary in Switzerland)

99% H_2

Green-H_2 & Green-NH_3 Market

FCV H_2

99% H_2

99% O_2

≥15% CO_2

≥98% CO_2

【Potential Customer】
CO_2-Emitting Industries
(Steel・Cement etc.)

【CO_2 Sep. & Rec.】
HZC＝HDS
HZI＝Amine・Membrane

② CO_2 Separation and Recovery Process

Heat Rec.

Heat

≥80% CH_4

【Catalyst】
HZC-Cat.

【Reactor】
HZC＝S&T
HZI＝Plate

【CH_4 Refiner】
HZC＝HDS
HZI＝Membrane

③ Methanation and Purification Process

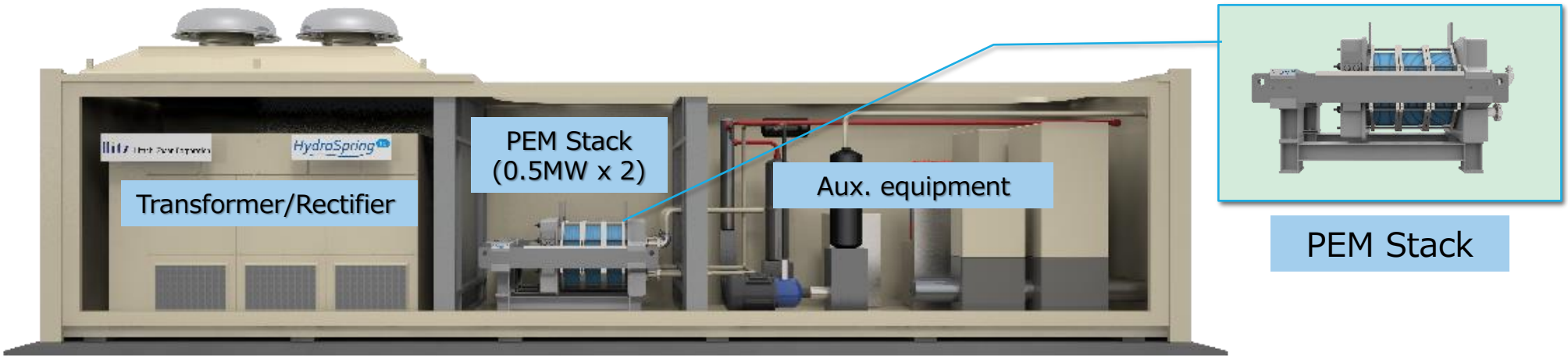
≥99% CH_4

Syn-Gas Market

CNG

Our Product: MW class PEM Electrolyzer

- ✓ MW class - packaged hydrogen generation system
  - MW class system can be installed in 20 ft containerThird level
  - It can be installed in outdoor without any additional building



Rated pressure :0.8 MPaG
Electric capacity :1 MWel
Dimension:12.2m×2.4m×2.9m

Rated hydrogen capacity：200Nm^3/h
Hydrogen purity：99.999%-dry

Challenge: Large scale PEM Water Electrolyzer

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Delivered a 1.5 MW class PEM system to the Komekurayama site in Yamanashi Pref., Japan
under the NEDO※ demonstration support program.

Stable power

To system power

Komekurayama solar power plants

Unstable power

HydroSpring

Electrolyzer

Hydrogen Tank

Hydrogen Delivery Equipmen t

To Hydrogen users

Electrolysis of water

Source: Hitachi Zosen Corporation WEBSITE News Release
https://www.hitachizosen.co.jp/newsroom/news/release/assets/pdf/15dbc628bd4e6f3184c4ccba46f2874b_1.pdf (Speaker translation)

Source: Yamanashi Prefecture Enterprise Bureau, New Energy System Promotion Office WEBSITE
https://www.pref.yamanashi.jp/newene-sys/documents/p2g_pic_210609.jpg

Yamanashi Komekurayama Site

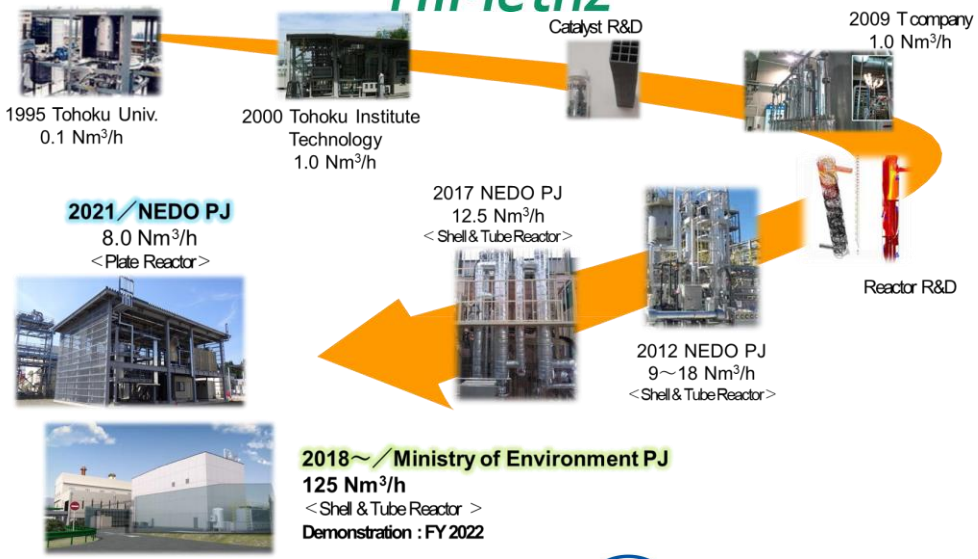
Inside the P2G Demonstration Building

Our Product: Methanation Catalyst and System

- ✓ Hydrogen carrier using conventional infrastructure (transport , storage, and utilize)
- ✓ CO_2 effective utilization for carbon recycling)

Methanation Reaction (Sabatier Reaction)

HiMethz



- ➢ High Conversion rate at low temperature and ambient pressure
- ➢ High reaction selectivity: 100%
- ➢ High Energy Conversion Efficiency
- ➢ Convert carbon monoxide into CH_4
- ➢ Long term durability

H_2 input : 50Nm^3/h
CH_4 Production
12.5Nm^3/h

Challenge: Development of Large scale technology of water electrolyzer / Large Scale Demonstration of Power (NEDO Green Innovation Fund Project)

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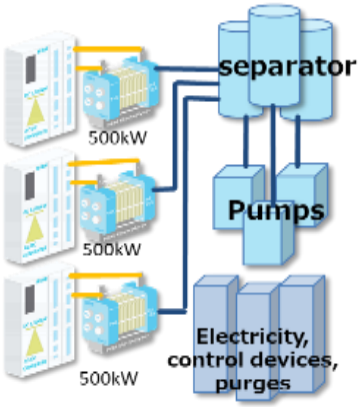
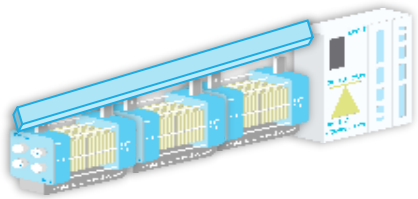
- ✓ Scope
  - By establish a H2 production platform using surplus renewable energy, aims to entering advanced overseas market.
  - Cost down target for 2030 is set at 65kJPY/kW ($485/kW). To achieve CD target, modular PEM system is developed and demonstrate using a large-scale system adjacent to consumer site.
- ✓ Project Outline
  - Total fund amount : 14BJ¥ (Subsidy: 10BJ¥)
  - Project period : 2021-2025 (5 years)
  - Demonstration location : Suntory HD Hakushu Factory(Yamanashi Pref.)



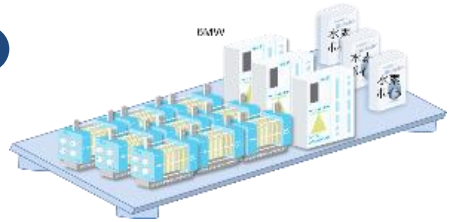
Existing system(1.5MW)

Scope of HZC in GI project

Development of MW Module



Demonstration of Multi-Module system



100MW system (2030)

Challenge: Development of Large scale technology of water electrolyzer / Large Scale Demonstration of Power (NEDO Green Innovation Fund Project)

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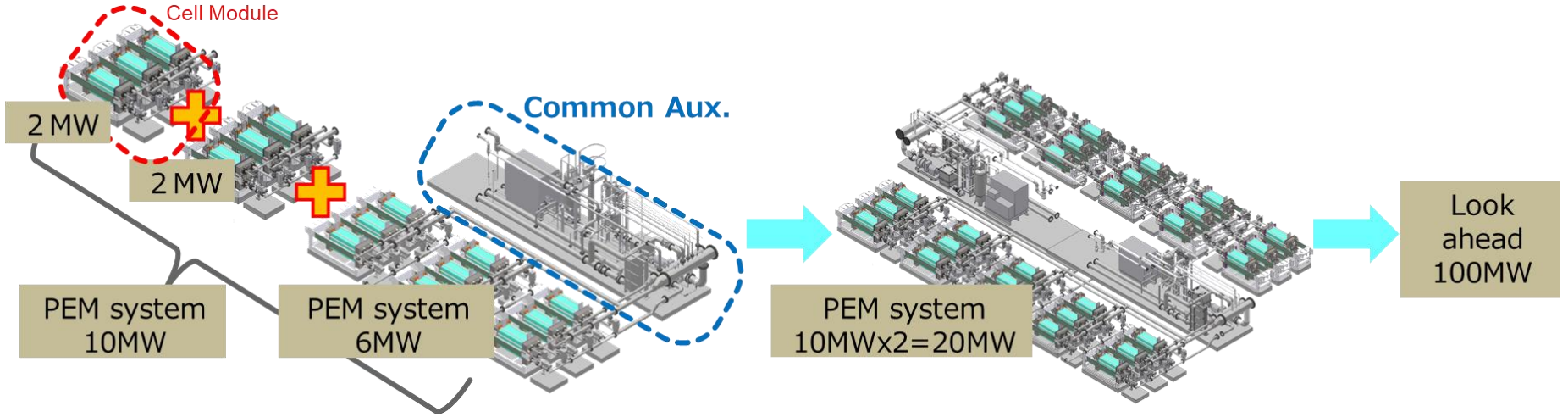
- ✓ Our Project KPI
  - Cost Down: CAPEX :250kJPY/kW@2025 →Forecast :65kJPY/kW@2030
  - Efficiency System Efficiency 77%@2025年、→Forecast :80%/kW@2030
  - Upscaling: 6MW class Electrolyzer demonstration →100MW system@2030



- ✓ Modular unit of 3 stacks as 2MW. 3 streams are installed to consist for 6MW plant.
- ✓ Common auxiliary equipment and it will be same configuration and space up to 10MW.

Our Challenge: Demonstration carbon cycle model by recycling carbon dioxide recovered from waste incinerator (Ministry of Environment Project)

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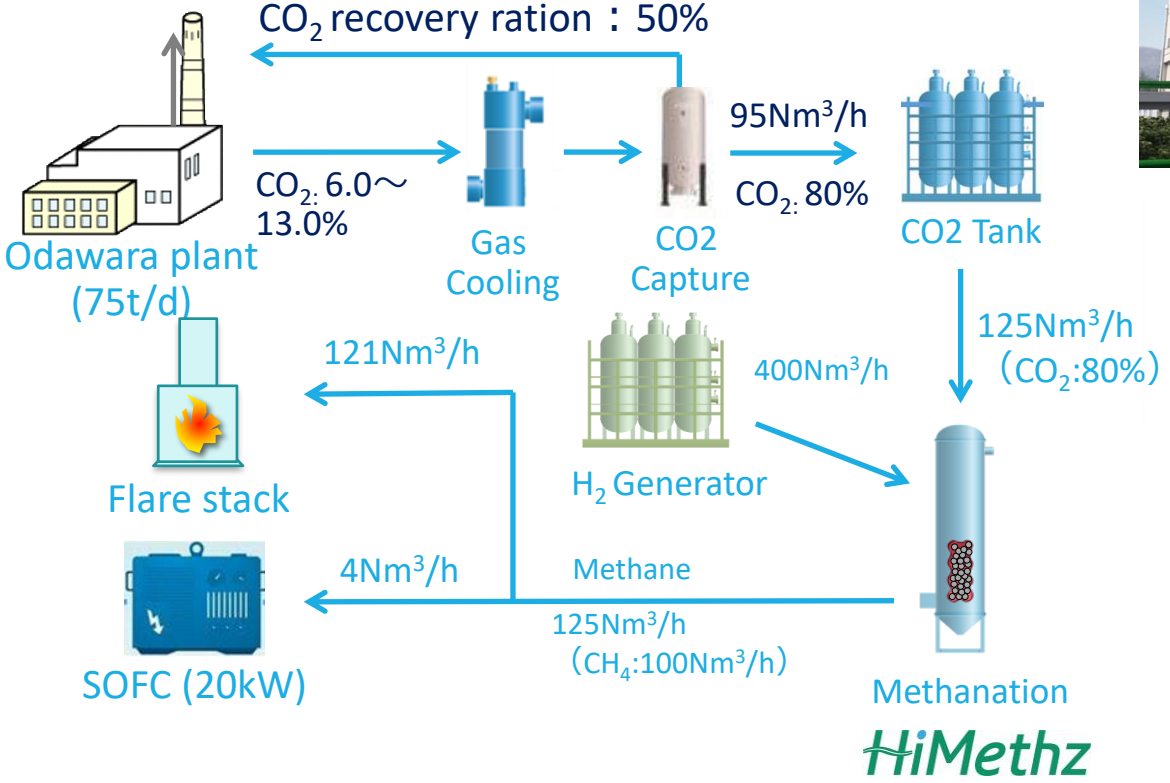
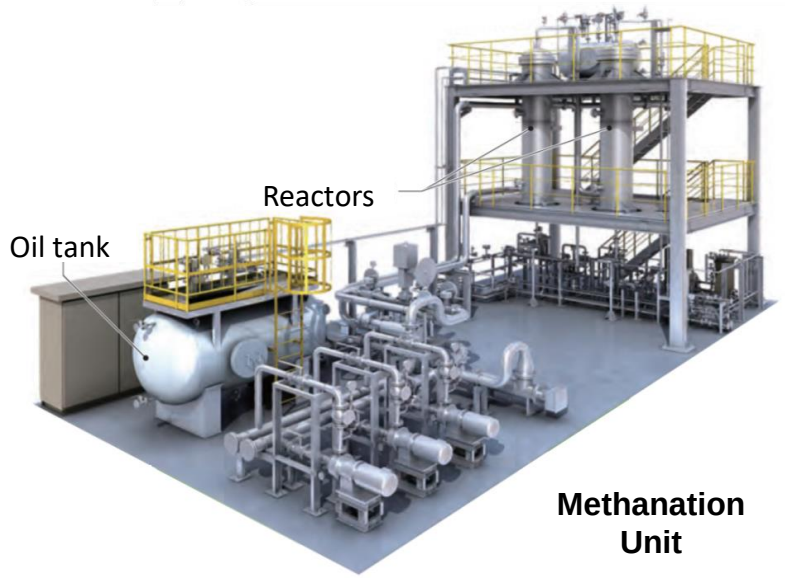
- ✓ Demonstration of 125Nm^3/h methanation of recovered CO_2 from flue gas of waste incinerator
- ✓ LCA of carbon cycle model





Ideas for a Japan – Spain collaboration

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