



Hitachi Zosen Corporation

Green Hydrogen Technology of Hitachi Zosen

**Hitachi Zosen Corporation
Decarbonization Systems BU
Business Development Dept.**

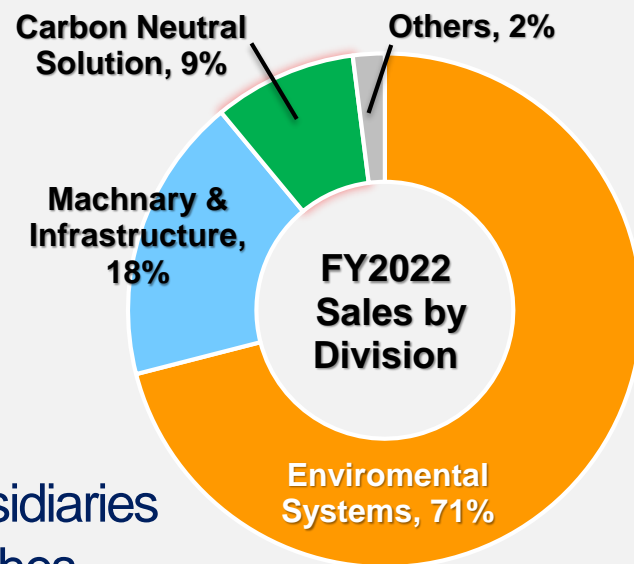
25th August 2023

1. Company Profile

Hitachi Zosen Corporation

※As of 31st March 2023 / US\$=JP¥ 140.00

◆ Date of Founded	01 st April 1881
◆ Date of Incorporated	29 th May 1934
◆ President	Mr. Sadao Mino, Representative Director and CEO
◆ Location of Head Offices	Osaka and Tokyo, Japan
◆ Capital (JP¥ 45,442 million)※	US\$ 325 million
◆ Equity (JP¥ 479,600 million)※	US\$ 3,425 million
◆ Net Sales (JP¥ 492,600 million)※	US\$ 3,518 million
◆ Employees	11,400
◆ International Operations	79 International Subsidiaries 4 International Branches
◆ ASEAN Operation	Jakarta, Bangkok, Singapore and Hanoi



2. Business Overview

Environmental Systems

- WtE (Waste to Energy) Plants
- Biomass System
- Water Treatment System, etc.



Carbon Neutral Solution

- Water Electrolyzer
 - CO₂ Recycling
 - Process Equipment
 - Wind Power Generation
 - Marine Diesel Engines
- Power to Gas Business**



CO₂ Recycling



Water Electrolyzer

Machinery & Infrastructure

- System Machinery
- Social Infrastructure



Wind Power



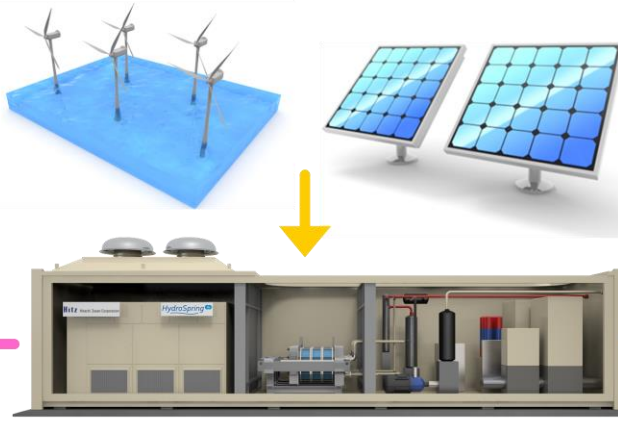
Process Equipment

3. PtG Related Technologies and Market

**METI (*1) FS for
Joint Credit Mechanism @Laos**

(*1) METI : Ministry of Economy, Trade and Industry
(*2) NEDO : New Energy and Industrial Technology Development Organization

Green Hydrogen Generator



**NEDO (*2) FS for
Demonstration Project @Laos**

Green H₂ Market

Green NH₃ Market



O₂

H₂

CO₂ Separation & Recovery

Methanation

Natural Gas Market



ca.10%
CO₂

≥98%
CO₂

CH₄

Heat



**CO₂ Emission
Industry
(Hard to Abate)**

Cement Industries / Coal-Fired Power Stations

4. Hydrogen Production Technology

Renewable Energy



Solar Power



Wind Power



Hydro Power

Electrolyzer

H₂

CO₂ Emission
3.4kg-CO₂/Kg-H₂

Fossil Fuel



Natural Gas

Coal



Reforming

H₂

CO₂ Emission
9 to 25kg-CO₂/Kg-H₂

Carbon Capture
& Storage (CCS)

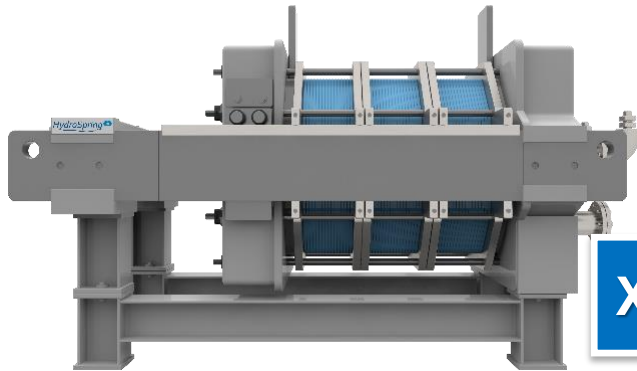
H₂

More than 30% CO₂ reduction

5-1. Superiorities of Hitachi Zosen PEM Electrolyzer

➤ Large Electrolytic Cell
H₂ Production 100Nm³/h

➤ 1MW 40ft. Container Type (2 Cell System)
H₂ Production 200Nm³/h = 18.0kg/h for 3FCVs



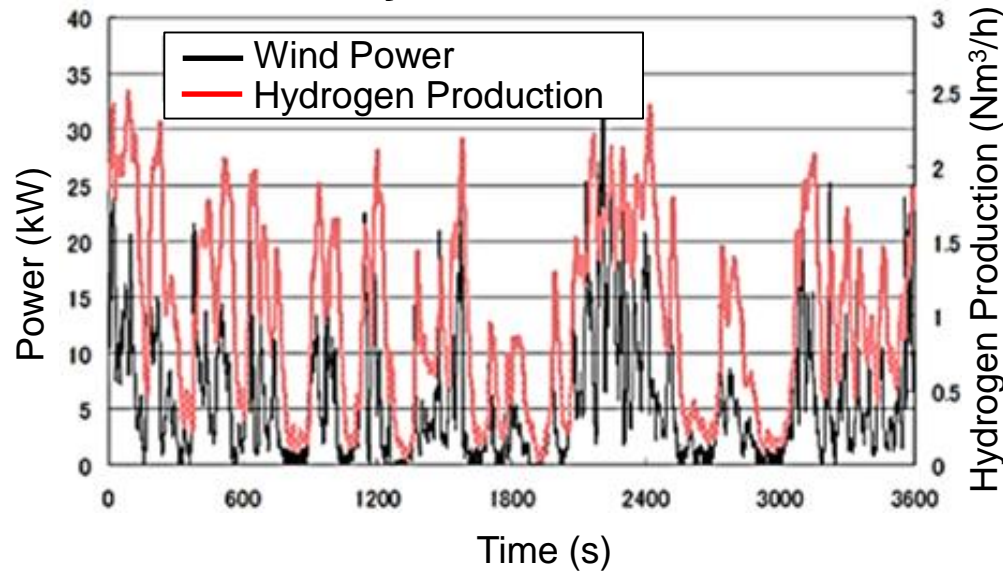
X 2 in



Production Scale	1Nm ³ /h ~	100Nm ³ /h	200Nm ³ /h
Outlet Pressure	~ 0.8MPa / Max. 0.85MPa		
Purity	99.9 ~ 99.999%		
Dew point	-15 ~ -70°C		
Power Consumption	5.0 ~ kWh/Nm ³ - H ₂		
Pure Water Consumption	1L/h ~	100L/h	200L/h
Water	<ul style="list-style-type: none"> ■ Non-chemical water for safety and 		
System	<ul style="list-style-type: none"> ■ Non-chemical water for safety and easy operation ■ Less space requirement (for 40ft.Container) ■ Less volume of local construction (40ft. Container) 		

5-2. Superiorities of Hitachi Zosen PEM Electrolyzer

➤ PEM Electrolyzer



Operation Mode

- Timely adjustment to power input
- No interruption due to power input fluctuation
- Operation range of 10% to 100%
- Frequent On/Off operation and early start-up

Connecting

In the Future

- Early prediction of future trouble
- Timely trouble investigation
- Early communication for trouble shooting

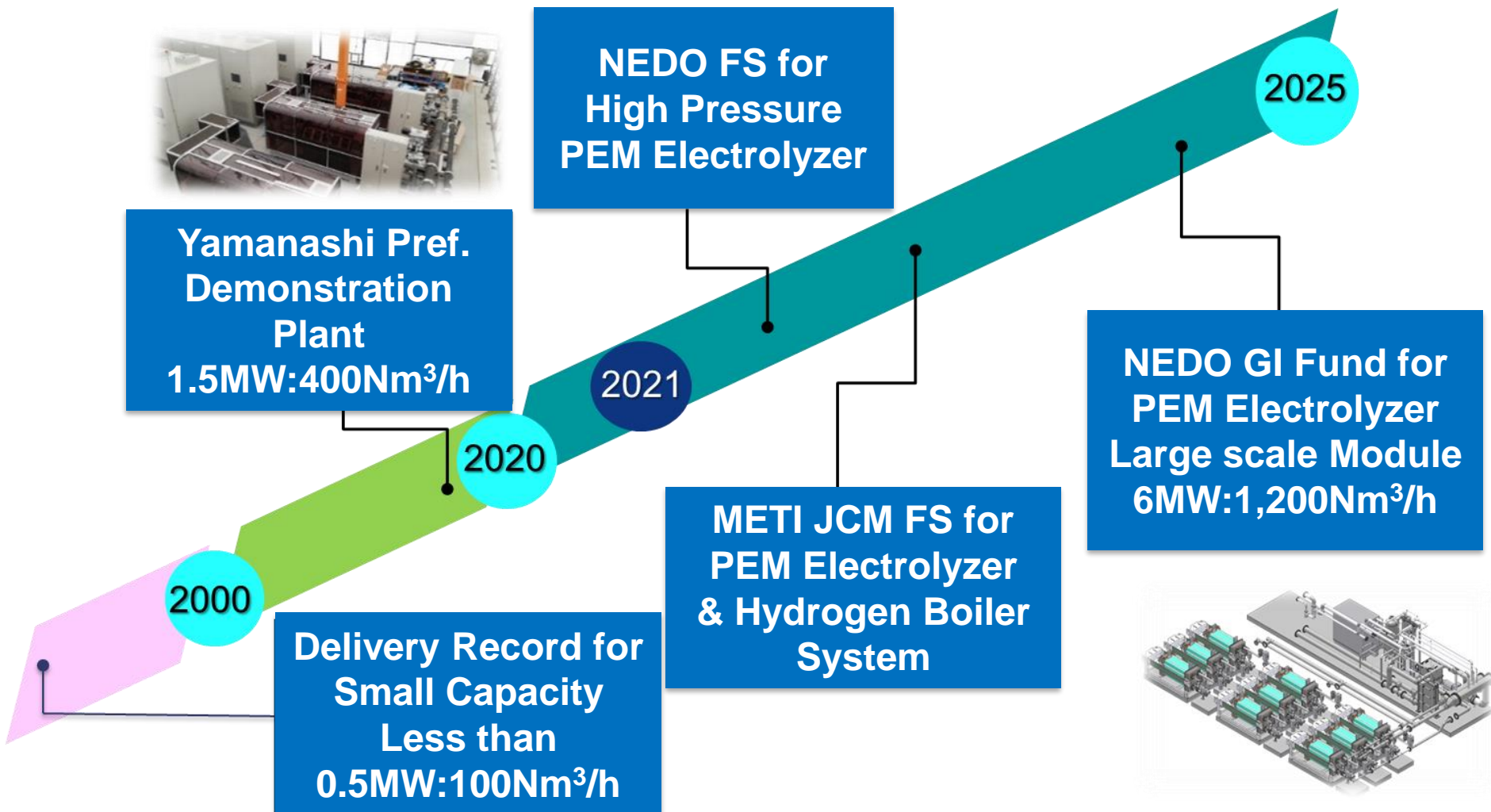
➤ Remote Monitoring



WtE (Waste to Energy) Plants remote monitoring room

6. Electrolyzer Technical Development

- 2021 R&D of Module PEM Electrolyzer (NEDO Green Innovation Fund)
- 2021 High-pressure PEM Electrolyzer (NEDO Demonstration Project @Laos)
- 2023 FS for Joint Credit Mechanism (JCM) for hydrogen boilers (METI @Laos)



7. NEDO Demonstration Project in Lao PDR

Procedure (Basic Study was completed in September 2022)

1

Basic Study

Energy market & policy
Business Environment
Business opportunities

2

Feasibility Study

Business development plan
Demonstration plan
MOU execution
Project Agreement

3

Demonstration

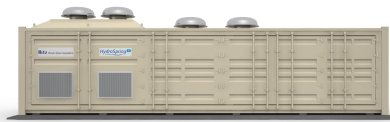
System/equipment fabrication
Pilot plant construction
Pilot plant operation

Demonstration Scheme

Renewable Energy
(Hydro Power)



Electrolyzer
(PEM Type)



Air Separator

H₂

N₂

Ammonia
Converter

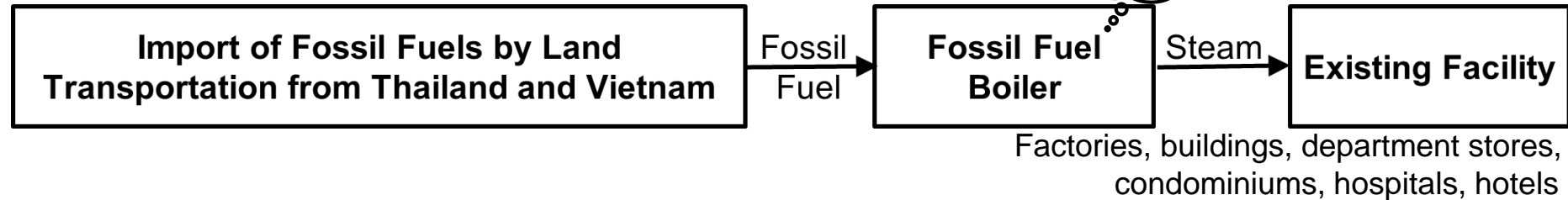
NH₃

CO₂ emission reduction effect = 1.6-4.0 ton-CO₂ reduction per ton of ammonia

(Reference: The Future of Hydrogen / 2019, IEA)

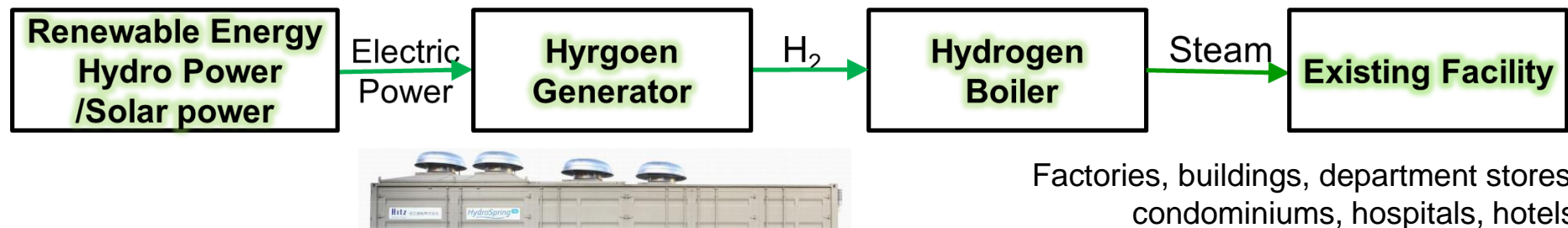
8. METI Feasibility Study for JCM in Lao PDR

[Conventional Boiler Firing]



- 
- CO₂ Emission Reduction
 - Alleviating Foreign Fossil Fuel Dependence
 - Effective Utilization of Domestic Resources (Renewable Energy)

[Hydrogen Fired Boiler]



9. Summary and Conclusion

Renewable Energy



Solar Power



Wind Power

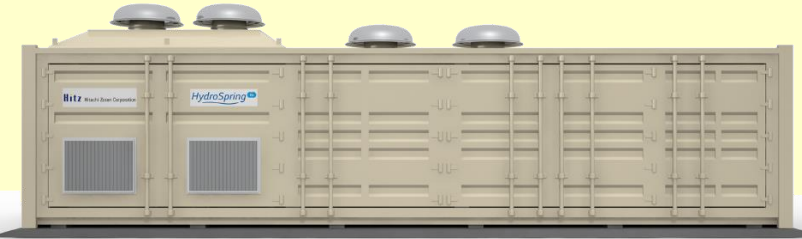


Hydro Power

Electrolyzer

Hitachi Zosen with

- ◆ long history of R&Ds from 1970s
- ◆ MW-class system delivery record
- ◆ operational solution
- ◆ well adjusted to renewable energy
- ◆ large scale R&Ds activities



H₂

&

GHG Net Zero

For the future communication

**Carbon Neutral Solution Business HQ
Decarbonization Systems BU
Business Development Depart.**

Attention: Minoru Hayasaki

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Technology for People, the Earth, and the Future

Hitachi Zosen creates links between mother nature and our future