



NIPPON SANSO HOLDINGS

# BofA Securities ｜ 2021 Japan Conference Corporate Presentation

September 7, 2021 [JST]
Tokyo (Japan) with Texas (the United States)

The Gas Professionals

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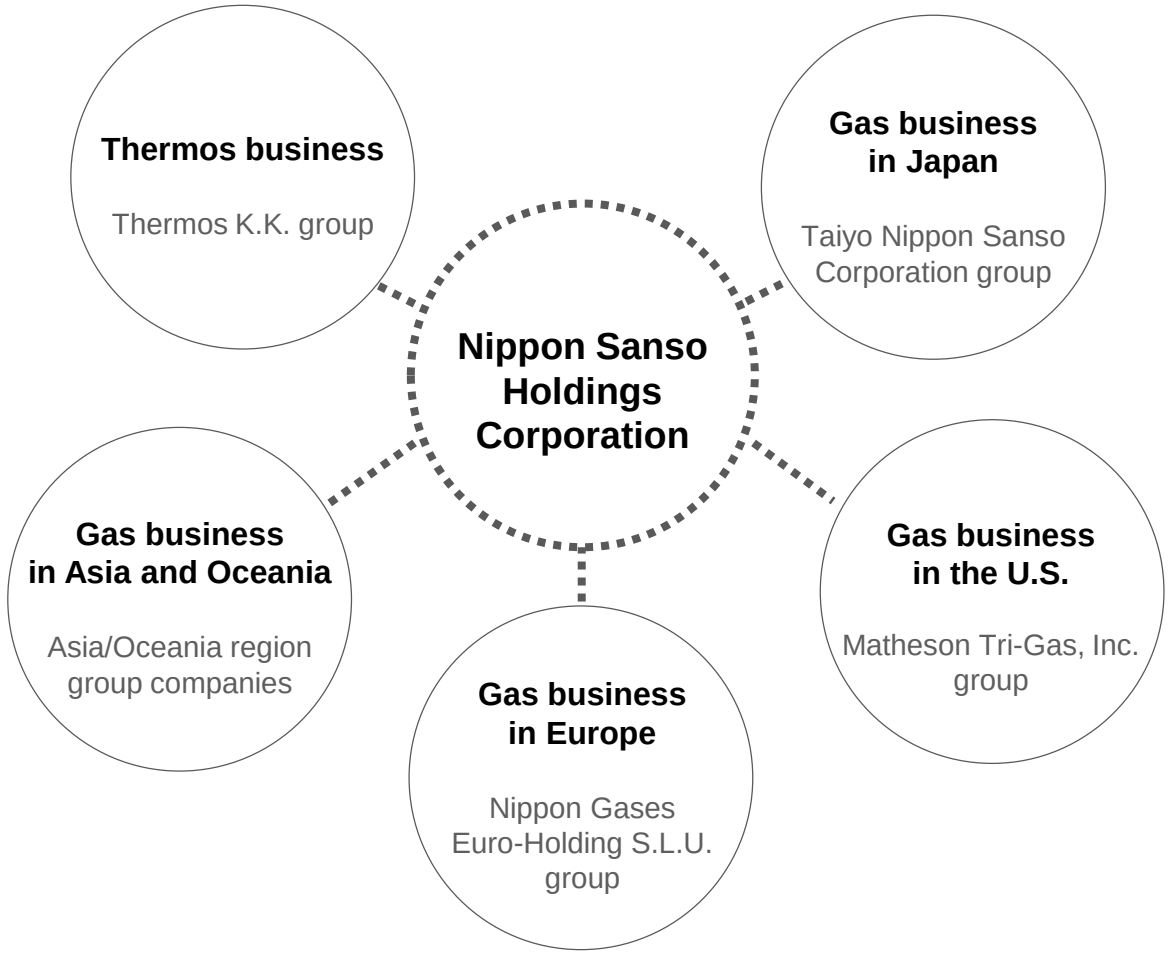
● **Financial information**

NSHD’s financial statements are prepared in accordance with international Financial Reporting Standards (“IFRS”).

# Group Overview

| | |
|---|---|
| Company name | **Nippon Sanso Holdings Corporation (NSHD)** |
| Ticker (Tokyo Stock Exchange) | **4091.T** |
| Established | **October 30, 1910** |
| Head office | 1-3-26 Koyama, Shinagawa-ku Tokyo, Japan |
| President CEO | **Toshihiko Hamada** |
| Employees [As of March 31, 2021] | **19,357** |
| Revenue (¥bn.) [FYE2021] | **818.2** |
| Operating income (¥bn.) [FYE2021] | **88.8** |
| OI margin [FYE2021] | **10.9%** |
| Countries Served | **30** Countries and Areas |

**NSHD's Group operating structure**



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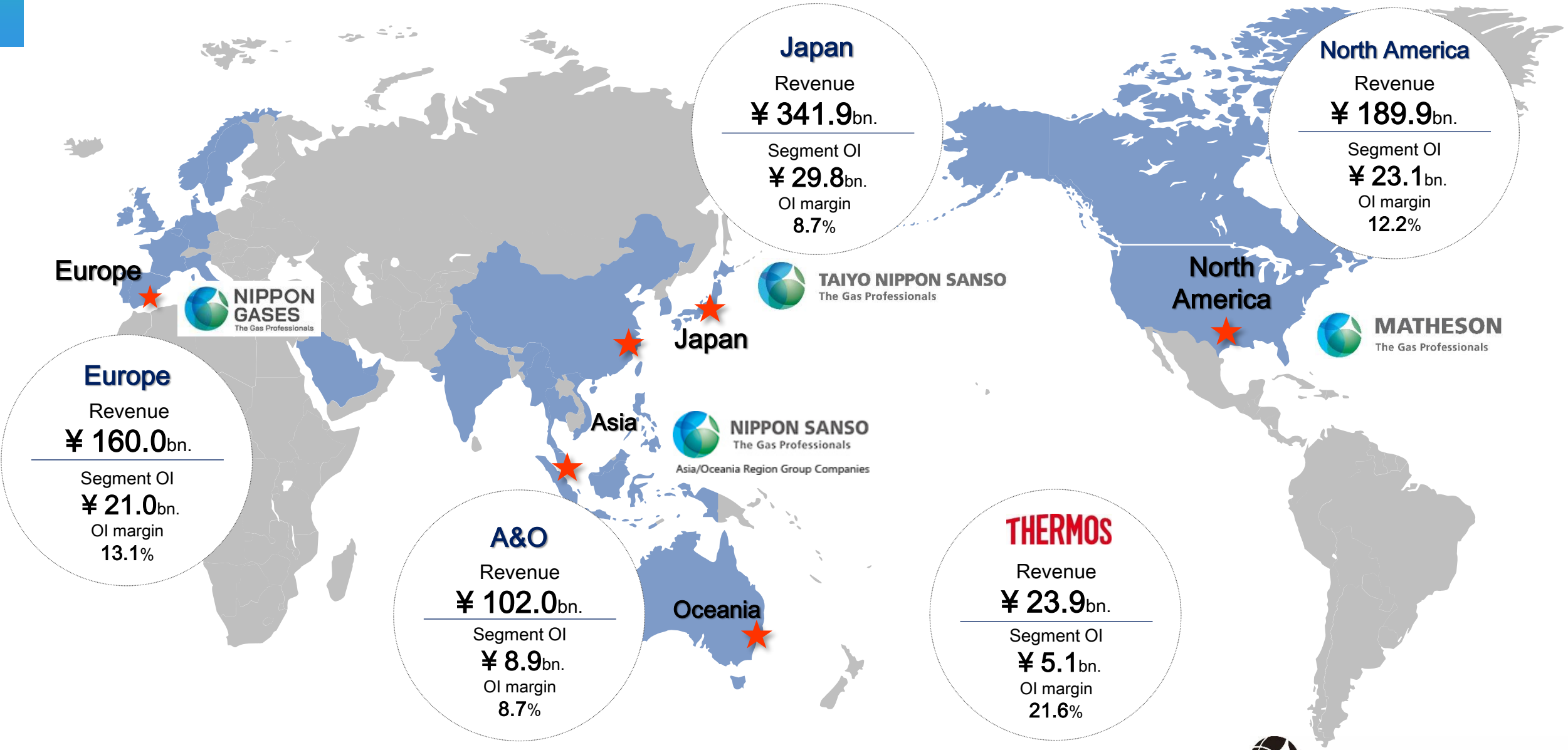
# Global business network

As a result of the reclassification of segment classifications in FYE2022, figure for FYE2021 has been restated based on the new segment classifications.




**Japan**
Revenue
¥ 341.9bn.
Segment OI
¥ 29.8bn.
OI margin
8.7%

**North America**
Revenue
¥ 189.9bn.
Segment OI
¥ 23.1bn.
OI margin
12.2%

**Europe**
Revenue
¥ 160.0bn.
Segment OI
¥ 21.0bn.
OI margin
13.1%

**A&O**
Revenue
¥ 102.0bn.
Segment OI
¥ 8.9bn.
OI margin
8.7%

**THERMOS**
Revenue
¥ 23.9bn.
Segment OI
¥ 5.1bn.
OI margin
21.6%

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# Our key businesses

## Industrial Gas


Main Products
- Oxygen
- Nitrogen
- Argon
- Hydrogen, CO and syngas
- Carbon dioxide
- Helium
- Related equipment & construction

## Electronics

Main Products
- $AsH_3$
- $B_2H_6$
- $CH_3F$
- HCL
- $PH_3$
- $SiH_4$
- Related equipment & construction

## Thermos


Main Products
- Bottle
- Mug
- Tumbler
- Frying-pan
- Pan
- Dish



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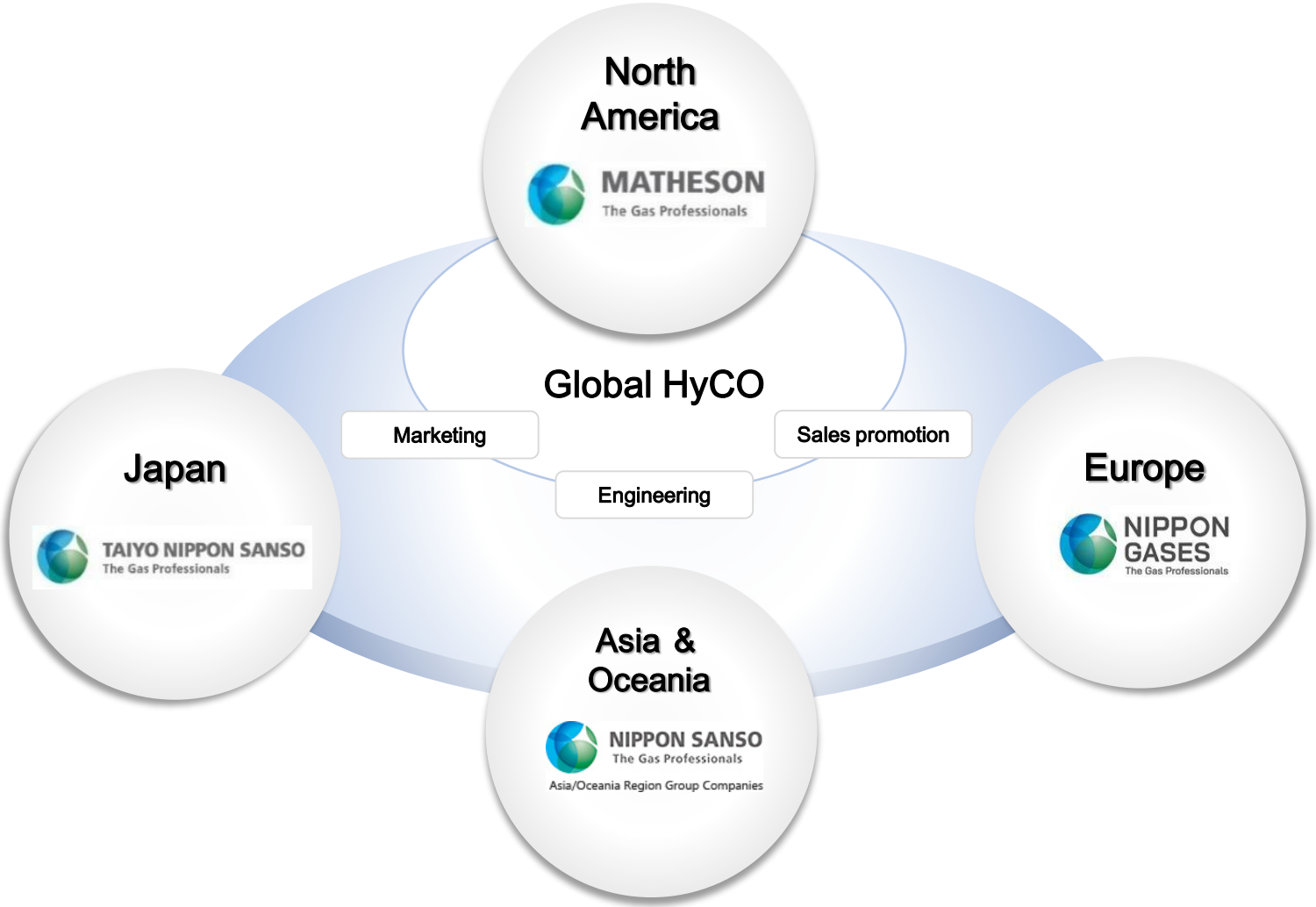
# Global HyCO




## Development and Value Creation

- Selective technology & EPC partnerships and alliances
- Engineering & Design Standards across Fleet
- HyCO Solutions to deliver robust value
- Best-in-class lifecycle operations
  - To-date fleet reliability > 99.5%
  - Premier safety, design, operations, and maintenance performance
  - Field and industry experts with continuous monitoring from Remote Operations Center (ROC) with steady and dynamic models developed for various plant types
  - Continuous feedback into plant design, instrumentation & controls

# HyCO/Hydrogen – “Owner-Operator” Perspective

Evolving Considerations

Evolving Technologies

Achieving Optimal Balance

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# HyCO/Hydrogen Production – Primary Technologies

Historically, there have been a large number of routes used for industrial hydrogen production

- Hydrocarbon-based Technology Options
  - Reforming Technologies – youngest of the widespread technology families
    - Steam Reforming of Hydrocarbons (1938+): Steam Methane Reforming (SMR) and Steam-Naphtha Reforming (SNR)
    - Autothermal Reforming (ATR)
    - Secondary Reforming, Pre-Reforming, Gas Heated Reforming, Combined Reforming
  - Gasification (1765/1870 +)
    - Partial Oxidation (POx) of gas feedstock
    - Heavies, waste gasification
- Electrolysis (1800/1888+)
    - Alkaline Electrolysis – classical method for hydrogen production that continues to evolve
    - Proton Exchange Membrane (PEM) based Electrolysis
    - Solid-oxide Electrolysis and other novel Electrolysis approaches
- Other categories of Hydrogen/HyCO production include
  - By-product/co-product hydrogen from various industrial processes
    - Some of these such as gas crackers and caustic chlorine can be very significant sources
  - Novel/emerging technologies
    - *Various forms of pyrolysis, dissociation and carbon-dioxide recycle and utilization based concepts/technologies*



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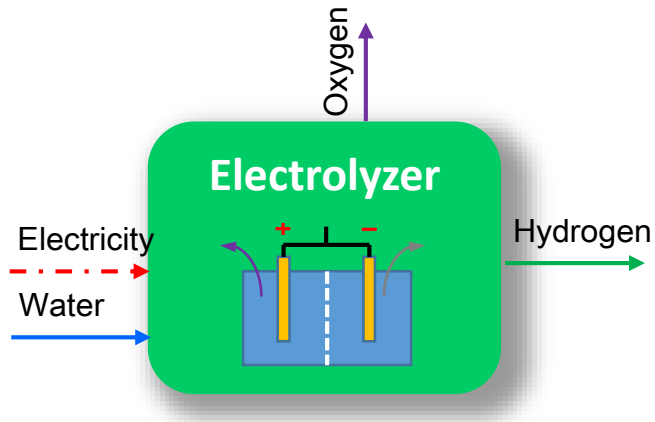
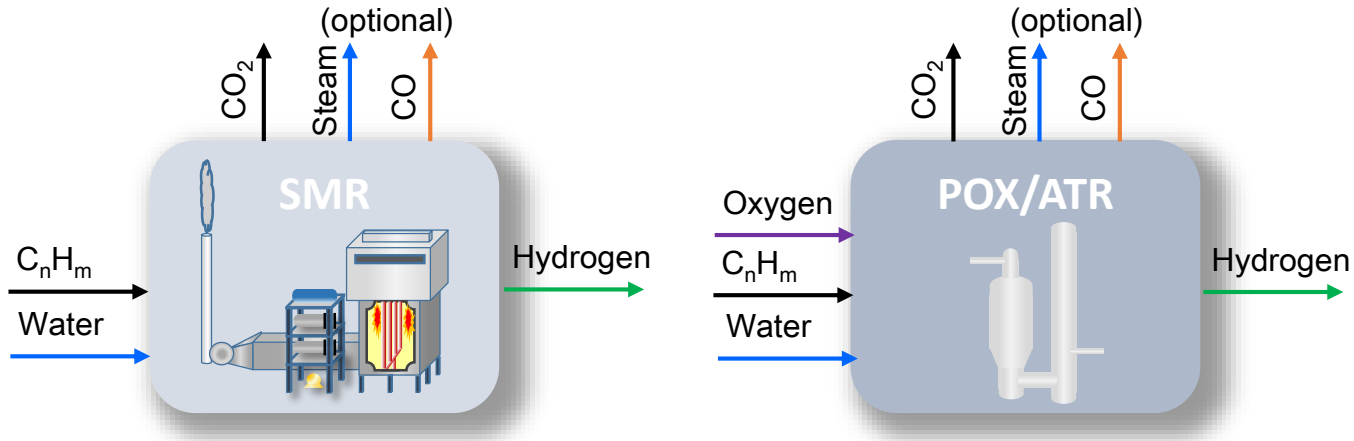
# Hydrogen Production – Electrolysis and Hydrocarbon-based

## Electrolysis Based




## Hydrocarbon Based




## Key Considerations:

- Electricity Consumption ~50-70 kWh/kg $H_2$
- Power Source (cost, carbon intensity, availability)
- Water availability
- Potential co-product utilization (Oxygen)
- Related $CO_2$ emission depends on carbon intensity of power source (from Zero to much worse than SMR when included)

- HydroCarbon Energy Consumption*
  SMR 51-60 kWh/kg $H_2$  POX/ATR 48-58 kWh/kg $H_2$
- Feed Source (cost, carbon intensity, availability) – C/H ratio in feed source is an important variable
- Oxygen Source (for POX and ATR)
- Potential co-product utilization (CO, Syngas, Steam)
- Potential $CO_2$ utilization (CCS, CCU)
- $CO_2$ emission**
  SMR 9.2-11.2 kg/kg $H_2$  POX/ATR 8.8-11 kg/kg $H_2$

* Does not include credit from steam export (5-10 kWh/kg $H_2$ reduction) – SMR coproduct steam is the most efficient steam production in chemical plants & refineries
** Does not include associated $CO_2$ from electricity consumption or avoided $CO_2$ from steam export



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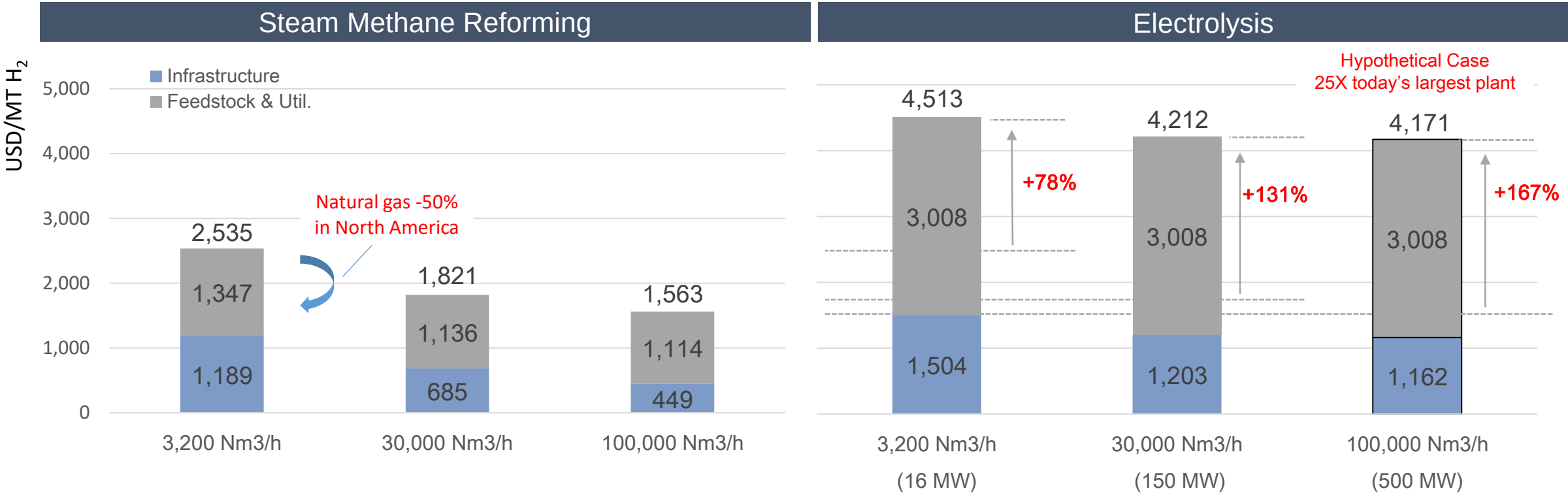
# Hydrogen Production – Key Technologies & Benchmarking




| CO2 Emissions MT $CO_2$/MT $H_2$ | 9.3 | **Break Even at >200 USD/MT "Carbon Tax"** | USA 25.0 / 16.7 Europe Grid zero if 100% renewable |
|---|---|---|---|

Nat gas: $20/MWh ($6/mmbtu), ***Power: $50 $/MWh***, Grid Carbon intensity: USA 0.45, Europe 0.30 kg $CO_2$e/kWh

***Differences in economics increase with scale; More significant for markets such as Americas, Indonesia, Russia, Iran, central Asia***



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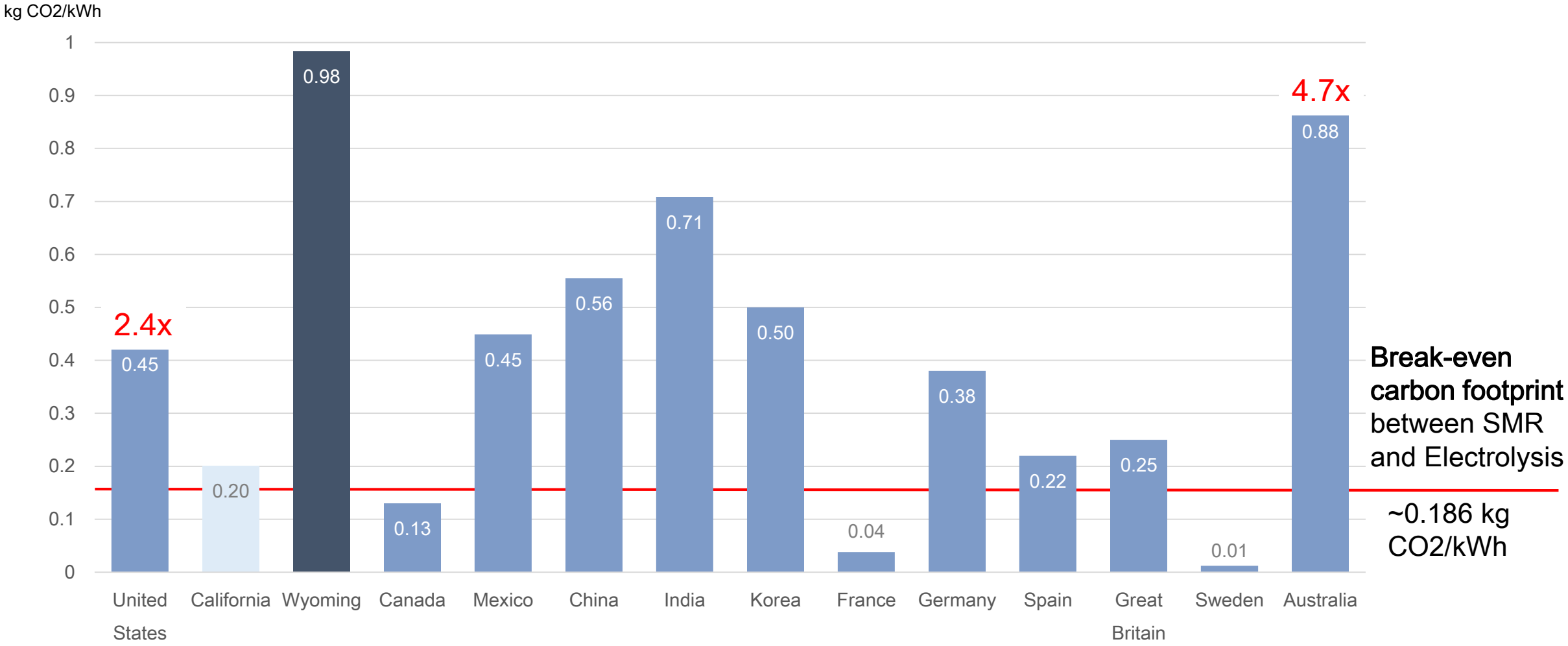
# Hydrogen Production - GHG Benchmarking Across Markets




- *Minimization of coal/heavy oil-based power and "cleaner" grids are the critical factor for HyCO production carbon footprint management and cost-effective power to the economics*

*Grid data source: carbonfootprint.com*



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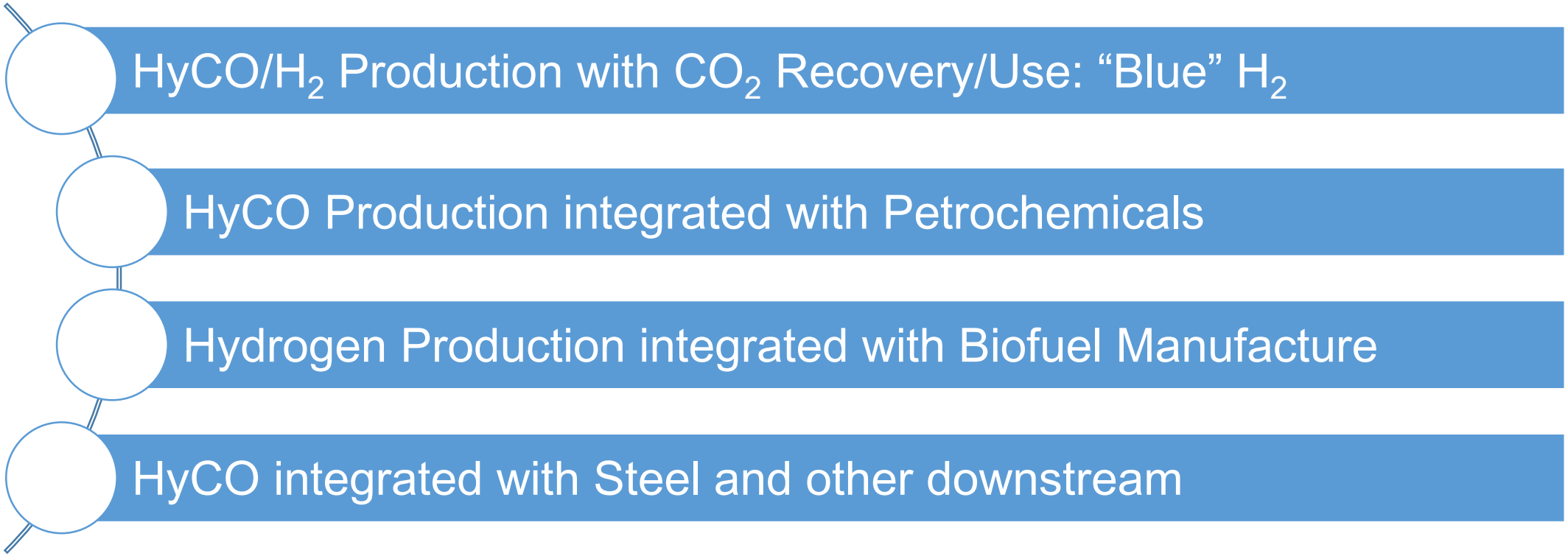
# HyCO/Hydrogen Integrated with Utilization for GHG Management

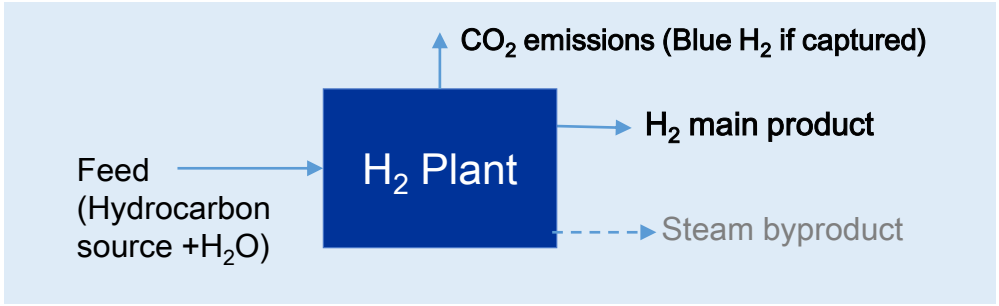
- Traditional, highly-proven HyCO production technologies can be integrated with downstream to substantially reduce GHG




- Variations often referenced in “Circular Economy” concepts

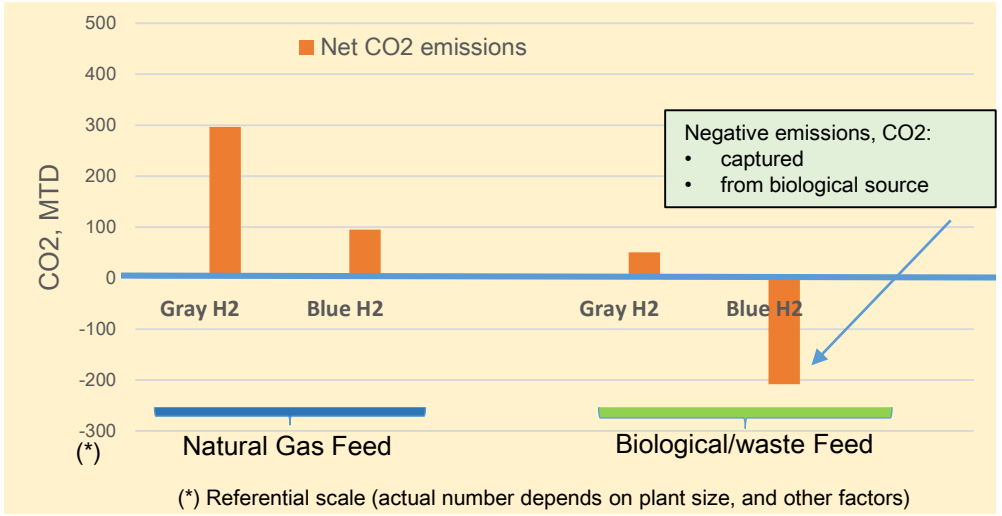
# “Blue” Hydrogen Production with Carbon-Dioxide Recovery

- Blue $H_2$: bridge between (low cost, high emissions), gray $H_2$ and (high cost, scale limited, zero emissions) green $H_2$.
- $CO_2$ can be recovered and reused, e.g., Enhanced Oil Recovery (EOR), use to make chemicals; or permanently sequestered (geological or deep sea).
- Blue $H_2$ production entails higher capex and variable costs for $CO_2$, capture, compression, storage, transportation and sequestration, although this can, for many cases represent the most balanced solution for the medium and even long term
- Carbon credits, availability of $CO_2$ sequestration sites and processing costs are essential for commercially viable deployment of blue $H_2$ and governments and collaborative efforts have a critical role.



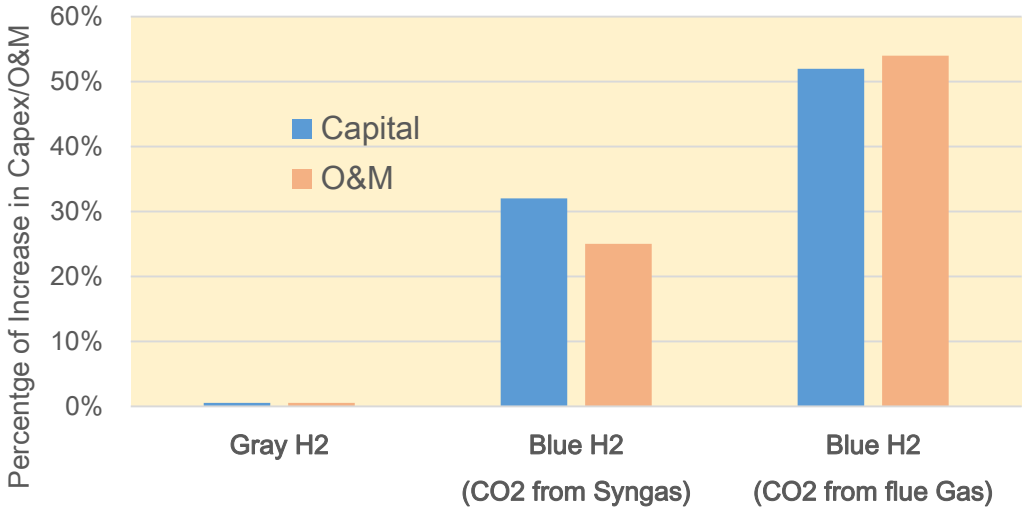


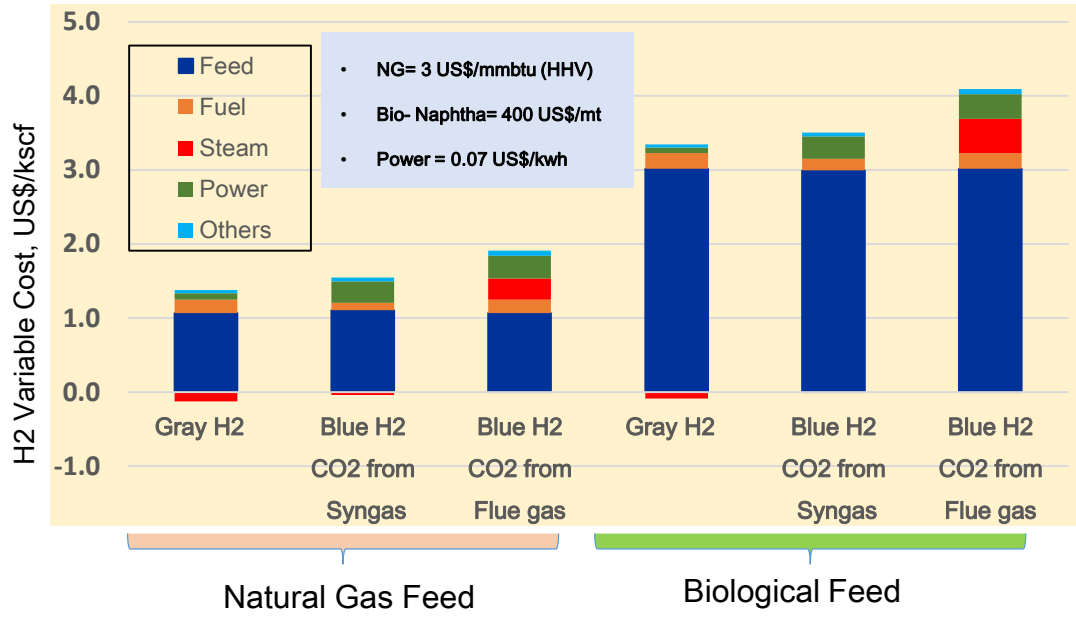
| Gray $H_2$ | Blue $H_2$ | Green $H_2$ |
|---|---|---|
| - From fossil fuels | +/- Fossil fuel w CO2 capture/sequestered | + Renewable source |
| + Limitless production | + Limitless roduction | - Limited production |
| + Low Cost | +/- Moderate cost | - Expensive |
| - Emissions | + less emissions | + No/little emissions |
| | | - 24/7 limitations |
| | | - Credits dependent |



# “Blue” Hydrogen Production – Illustrative Economic Impacts

- Green diesel production of 150-180 Million Gallons/yr
- Mid-sized $H_2$ plant (25-30 mmscfd/26.5-33 $kNm^3/hr$))
- Evaluation of “gray” $H_2$ vs (two options) “blue” $H_2$
- Higher capex and opex (equipment, chemicals, labor, etc.)
- Variable cost difference (“blue” vs “gray” $H_2$): ~ 0.25 to 0.65 US$/kscf $H_2$ higher cost for blue $H_2$ (15% to 40%)
- Costs for $CO_2$ handling after recovery excluded from the economics (compression, storage, transportation, sequestration) and WILL increase the premium without CCU/EOR credits
- Carbon credits (typically >50 $/tm $CO_2$) required to makeup the price difference (depend on multiple factors, e.g., feedstock & utility costs, $CO_2$ sink source, geopolitics, etc.); EOR with ultimate sequestration can have major benefits as applicable

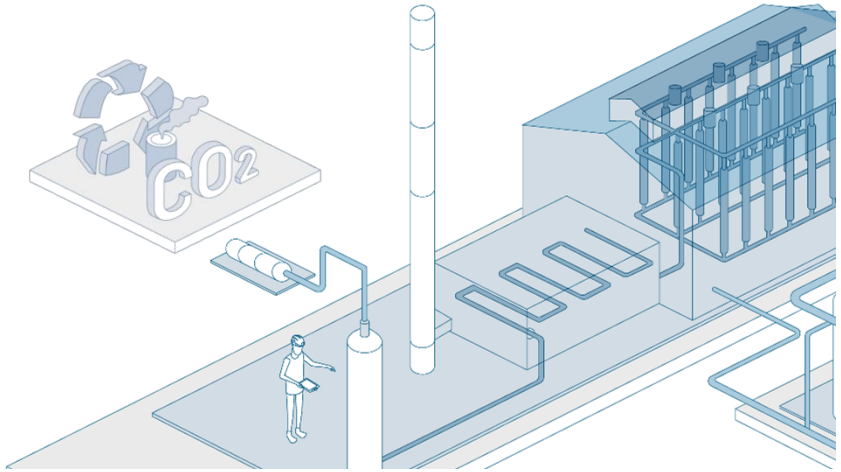


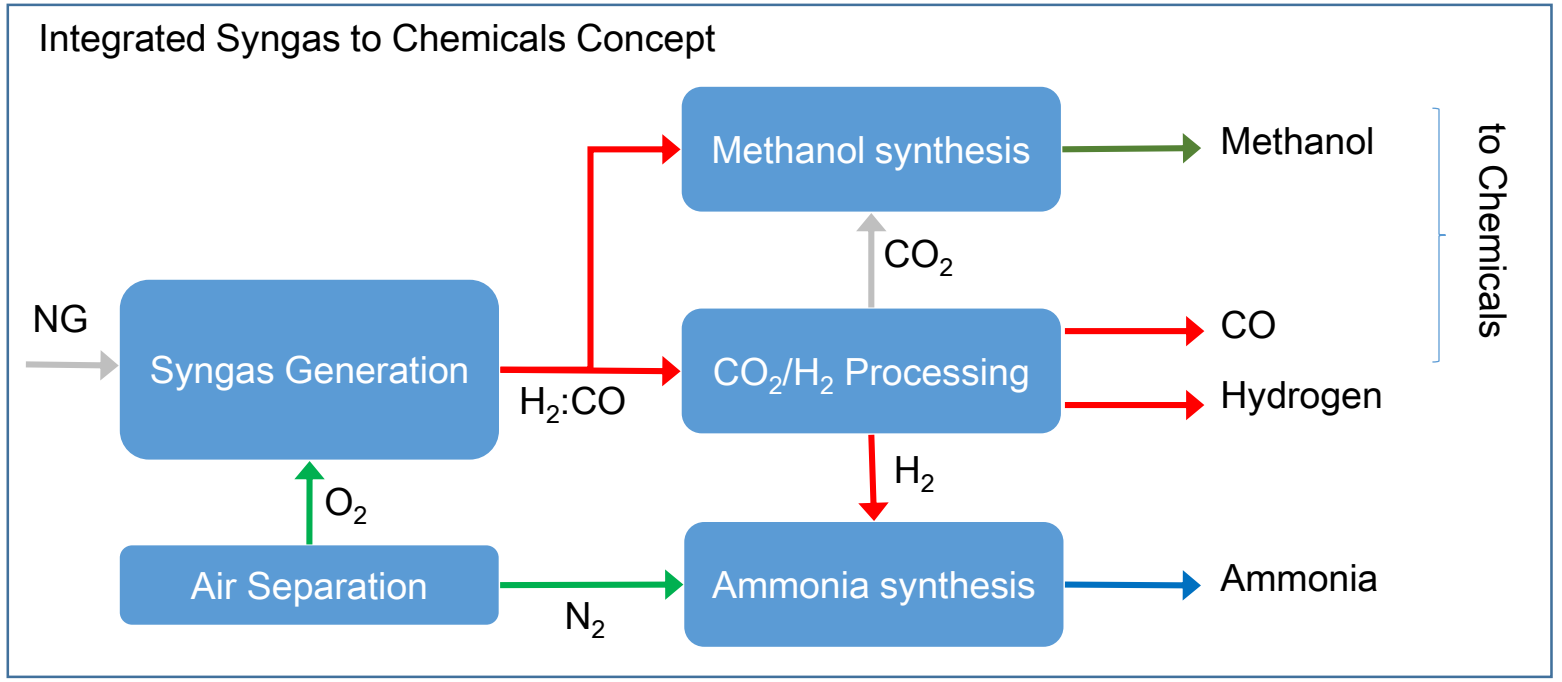



# HyCO/Hydrogen Production Integrated with Petrochemicals

Integrated HyCO facilities provide opportunities for decarbonization in the chemicals sector:

- Product balance and integration to maximize economies of scale, synergies and carbon sinks (e.g. Methanol, Acetic Acid, Formaldehyde, Oxo-alcohols & derivatives)
- $CO_2$ Capture and recycling via dry reforming, $CO_2$ electrolysis and other technologies
- NSHD capabilities very well suited to integrate across industries, products and technologies



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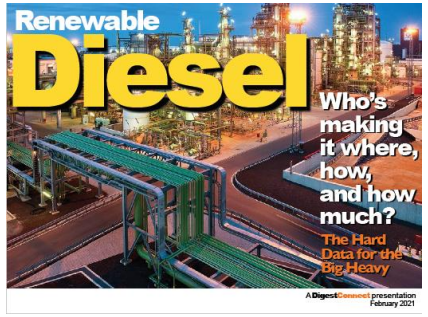
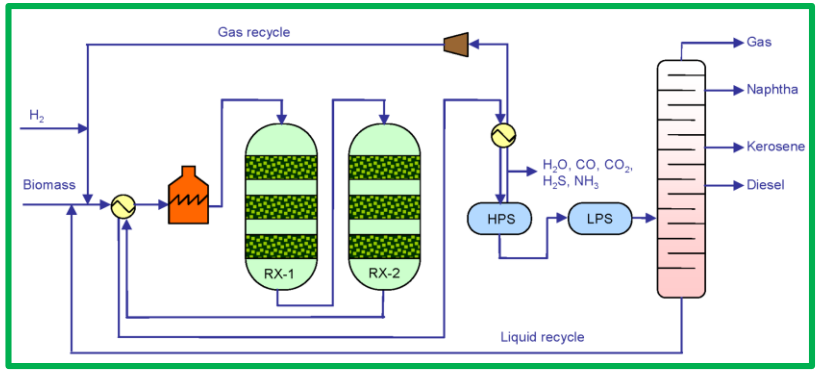
# Hydrogen Production Integrated with Biofuels

**FATS, OILS, GREASES, BIOWASTE CONVERTED TO RENEWABLE DIESEL, NAPHTHA, JET FUELS**

- >50 green diesel/jet fuel projects developed/planned (operating, expansion, in planning, announced, under construction)… and more are announced almost daily
- Lucrative business - monetization of very low cost feed
- Nearly 10 billion gallons/yr of green fuels; with full market allocation
- $H_2$ need: ~1 to 2 billion scf/day (1.1-2.2 million $Nm^3/hr$)
- $H_2$ plants are typically 10-50 mmscfd (11-56 $KNm^3/hr$)
- Renewable fuel byproducts can be smartly integrated with traditional hydrogen plants to substantially reduce overall carbon emission and economics.
  - Matheson/NSHD have developed conceptual designs and completed, firm lifecycle costs for multiple cases
  - Unlike many others, option can be economic with limited subsidies
- Matheson/NSHD working on case in the US
- $CO_2$ recovery options (syngas, flue gas) can be additionally incorporated depending on site conditions, economics.

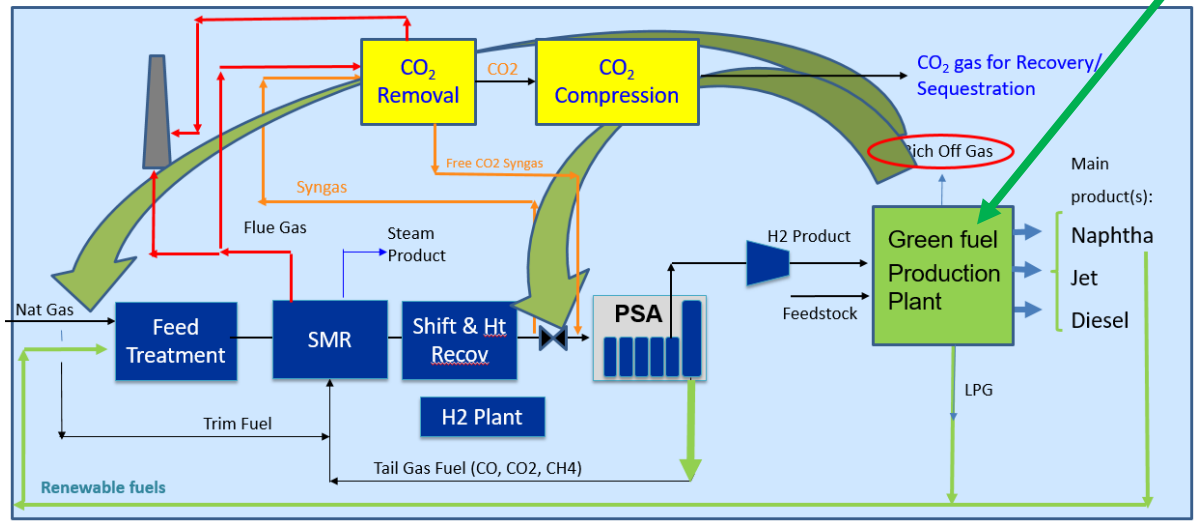



Source: **DigestConnect** presentation February 2021




**Green Fuel Production Plant**

## Hydrogen is needed to make green fuels



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# Summary

- Production and utilization of Hydrogen and co-products is a rapidly evolving arena
  - Technology and process optimization required to manage GHG-minimization and economic tradeoffs
  - Traditional production options are continuously evolving and new/ novel technologies are emerging and necessary

- Optimal solutions will continue to vary on a case-by-case basis, especially for medium/large HyCO
  - Comparisons of alternate options must consider feedstock source(power, hydrocarbons) GHG to avoid environmental degradation and economic impact
    - R&D to further improve renewable and greener technologies is necessary
  - Minimization of coal/heavies based power generation, or carbon capture from the same, is necessary to obtain widespread environmental benefits from ANY power-intensive HyCO production
    - Scope/capex due to green power (solar/wind/tidal) variability must be included in economic impact
  - Integration across processes can enable economically effective carbon-mitigated solutions for many cases

- Significant evolution across the renewables supply chain (power, bio-feedstock etc), pragmatic governmental support, and fundamental advances in blue/green hydrogen technologies are required to help moderate economic impacts & harness environmental benefits in the HyCO production arena versus the utilization of approaches that involve widespread commercial implementation of inefficient technologies and process schemes



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## For further information, please contact:


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**Upcoming IR events**

Q2 FYE2022 Earnings Call November 1, 2021

*www.nipponsanso-hd.co.jp/en/*


**NIPPON SANSO Holdings Corporation (Ticker:4091.T)**
Headquarters：1-3-26 Koyama Shinagawa-ku, Tokyo 142-0062, Japan

# NIPPON SANSO Holdings Group Summary

https://www.nipponsanso-hd.co.jp/en/ir/

Published on July 1, 2021

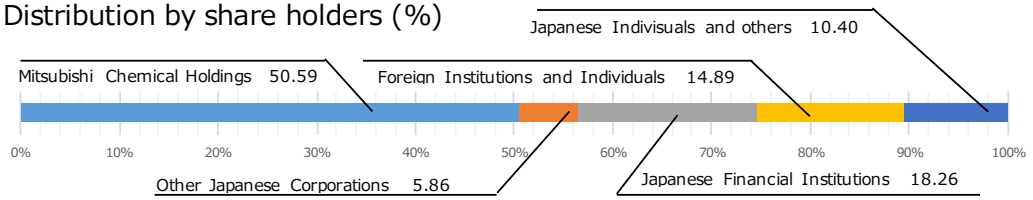
## Corporate Information (As of March 31. 2021)

| | |
|---|---|
| Company Name | Nippon Sanso Holdings Corporation |
| Founded | October 30, 1910 |
| Headquarters | 1-3-26 Koyama Shinagawa-ku, Tokyo 142-0062, Japan |
| TEL | 81-3-5788-8500 |
| Representative | Representative Director, President CEO<br>Toshihiko Hamada |
| Common stock | 37.3 billion yen |

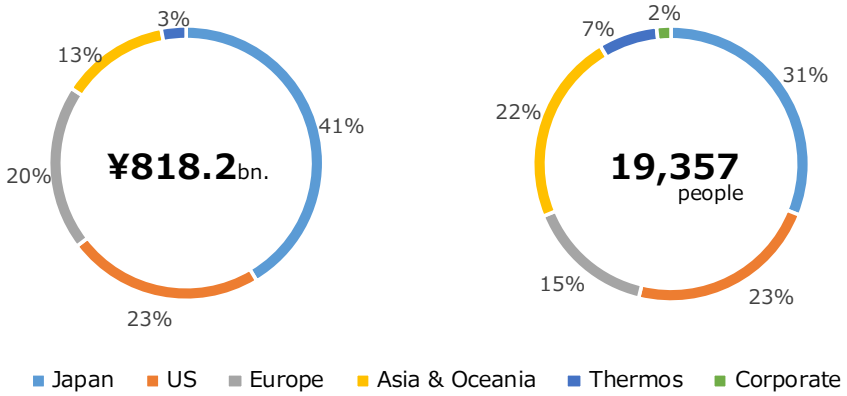
## Stock information (As of March 31. 2021)

| | |
|---|---|
| Number of shares | 433,092,837 |
| Number of shareholders | 16,205 |
| Listed stock exchanges | Tokyo Stock Exchange First section |
| Ticker | 4091.T |

Distribution by share holders (%)




## Revenue / Employee personnel by Segment (As of Match 31, 2021)




## Corporate Philosophy

# The Gas Professionals

### Group Philosophy

Proactive. Innovative. Collaborative.

Making life better through gas technology.

### Group Vision

We aim to create social value through innovative gas solutions that increase industrial productivity, enhance human well-being and contribute to a more sustainable future.

## Main Core business

### Industrial Gas business

### Electronics business

### Thermos business

## FYE2022 Financial Forecast (IFRS)

| | | | |
|---|---|---|---|
| Revenue | ¥865.0 bn. | Net income attributable to owners of the parent | ¥58.2 bn. |
| Operating income | ¥96.5 bn. | EPS | ¥134.49 |

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