NIPPON SANSO HOLDINGS

BofA Securities Hydrogen Conference 2021 Corporate Presentation

June 23, 2021

Tokyo (Japan) with Texas (the United States)

The Gas Professionals

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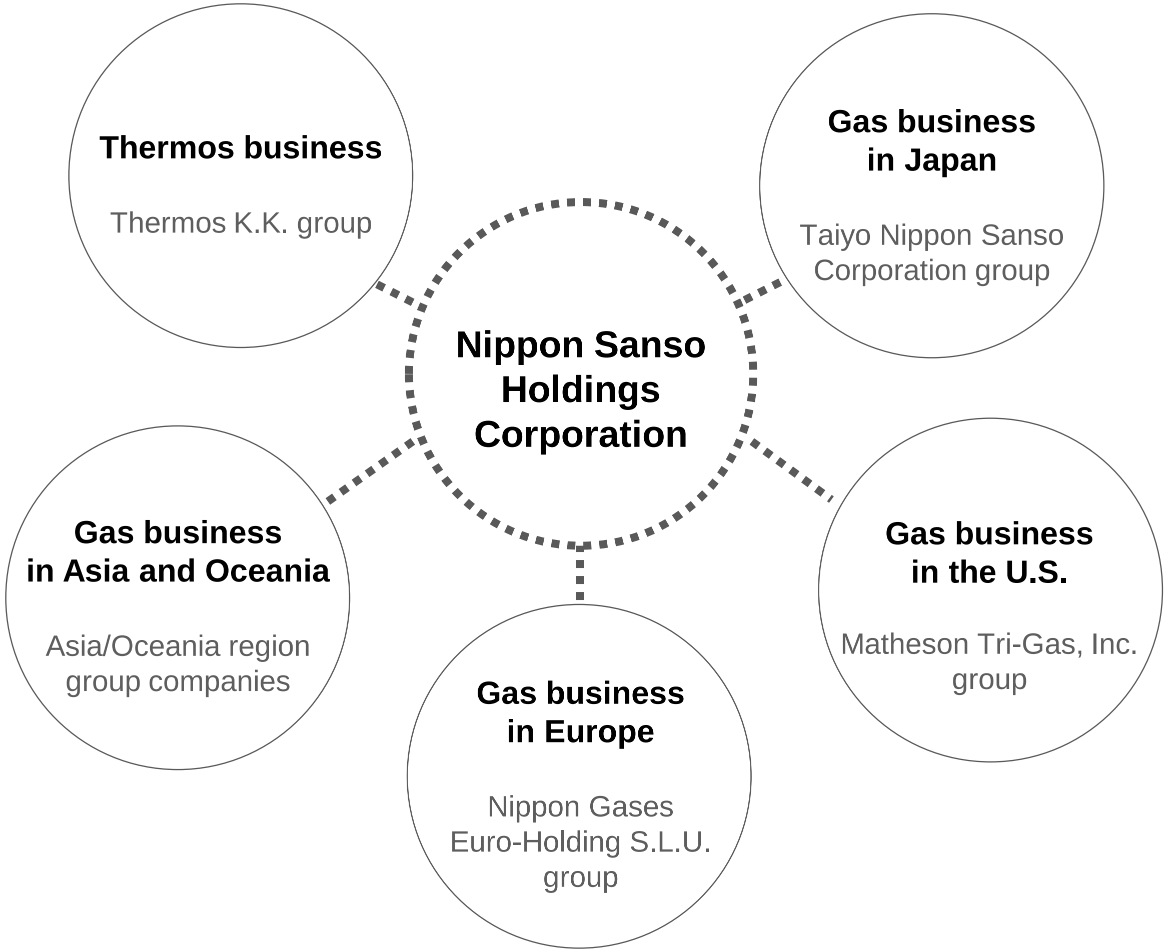
● Financial information

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%**
Contries Served	**29** Countries and Areas

NSHD's Group operating structure



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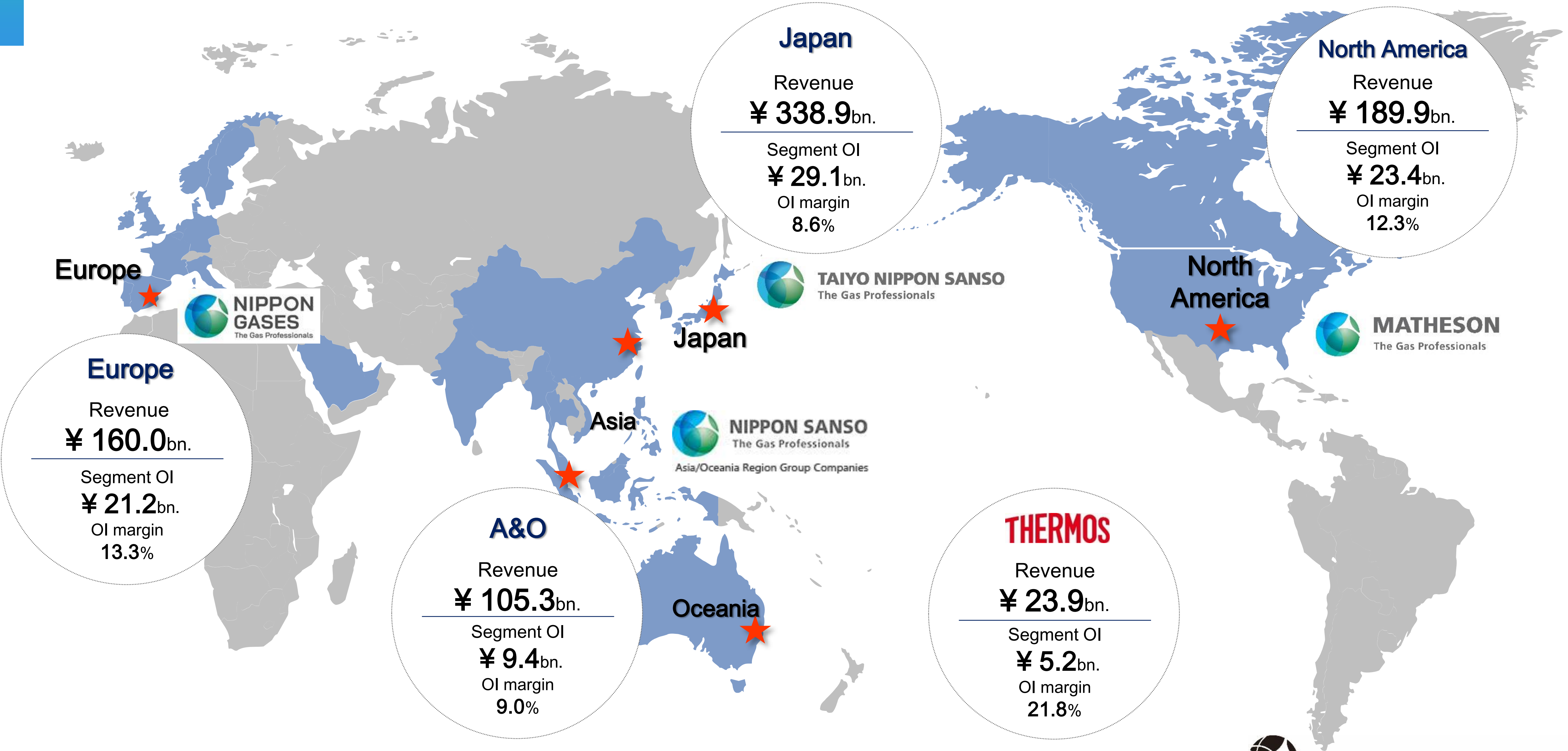
Global business network



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Our key businesses

Industrial Gases

Main Products
- Oxygen
- Nitrogen
- Argon
- Hydrogen, CO and syngas
- Carbon dioxide
- Helium

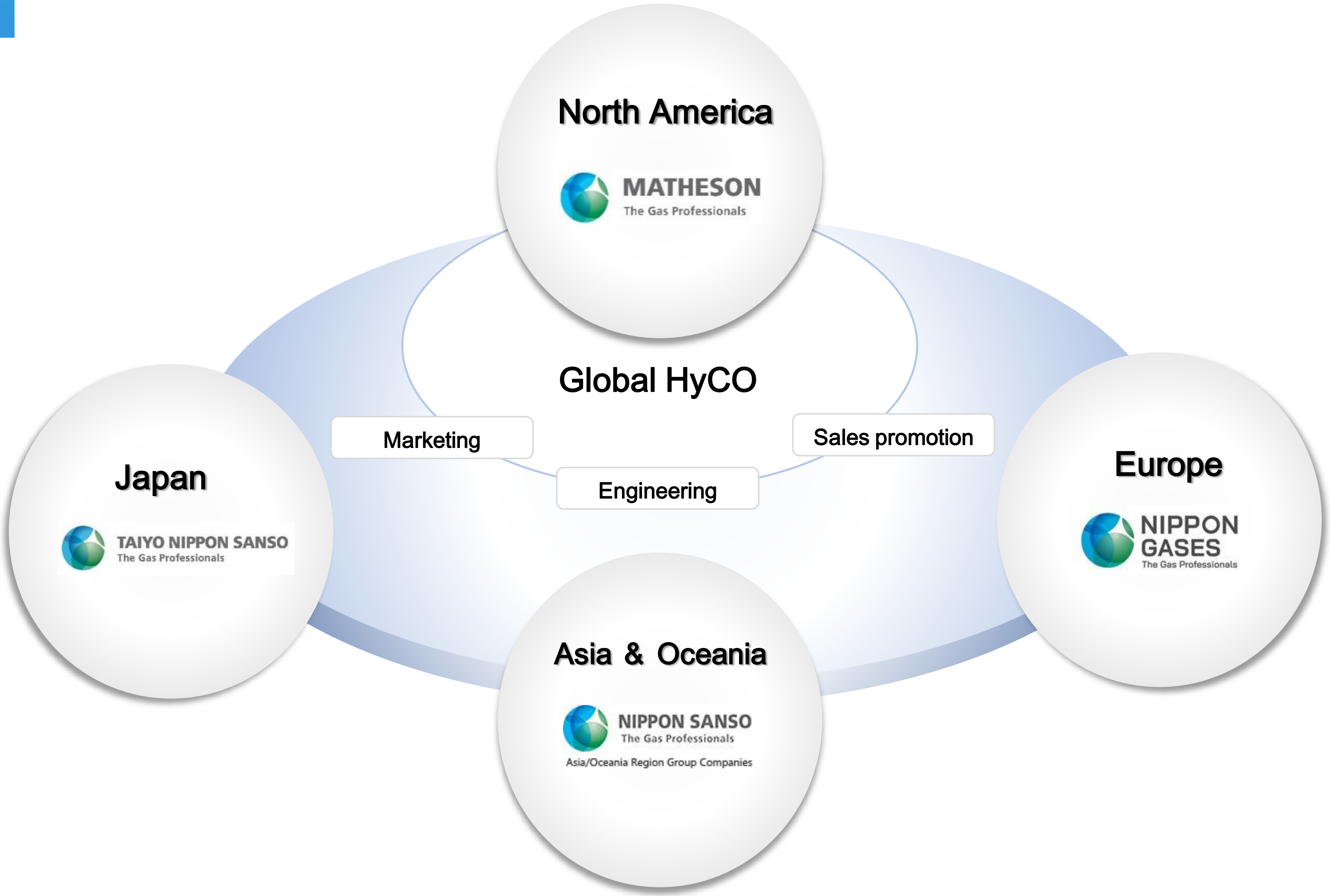
Electronics

Main Products
- AsH_3
- B_2H_6
- CH_3F
- HCL
- PH_3
- SiH_4

Thermos

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

Global HyCO



- Premier operational safety performance
- Structured leadership for global Hydrogen and Syngas (HyCO)
- Responsibilities from technology and product development through strategy and alliances to business development and operations
- Best-in-class design, operations, and HyCO supply solutions
- Leadership has over 200 years HyCO experience
- Life to date supply reliability > 99.5%
- Global heritage and experience

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
    - Steam Reforming of Hydrocarbons (1835+): 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
    - Proton Exchange Membrane (PEM) based Electrolysis
    - Solid-oxide Electrolysis
- 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 for hydrogen production including various forms of pyrolysis

HyCO/Hydrogen – An "Owner-Operator" Perspective

Evolving Considerations

Evolving Technologies

Achieving Optimal Balance

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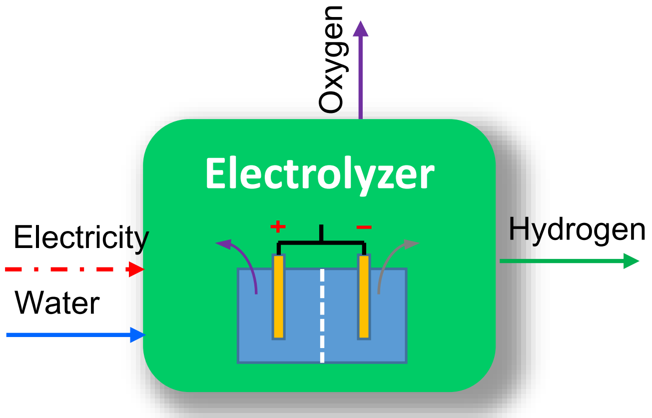
Hydrogen Production – Electrolysis and Hydrocarbon-based

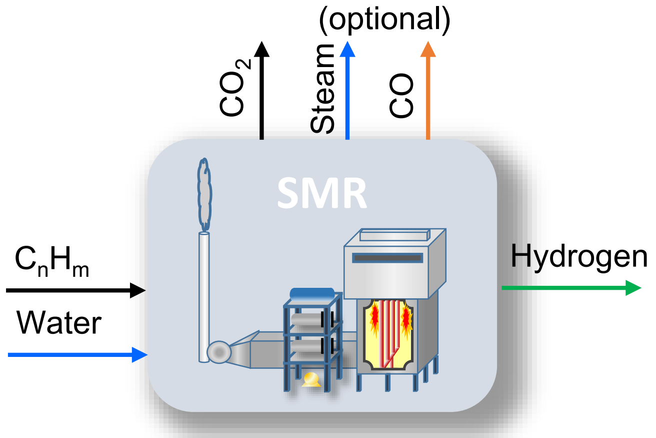
Electrolysis Based

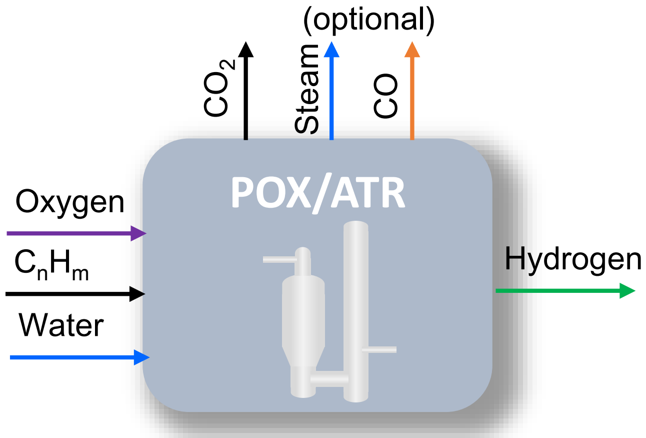


Key Considerations:

- 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 worse than SMR)

Hydrocarbon Based

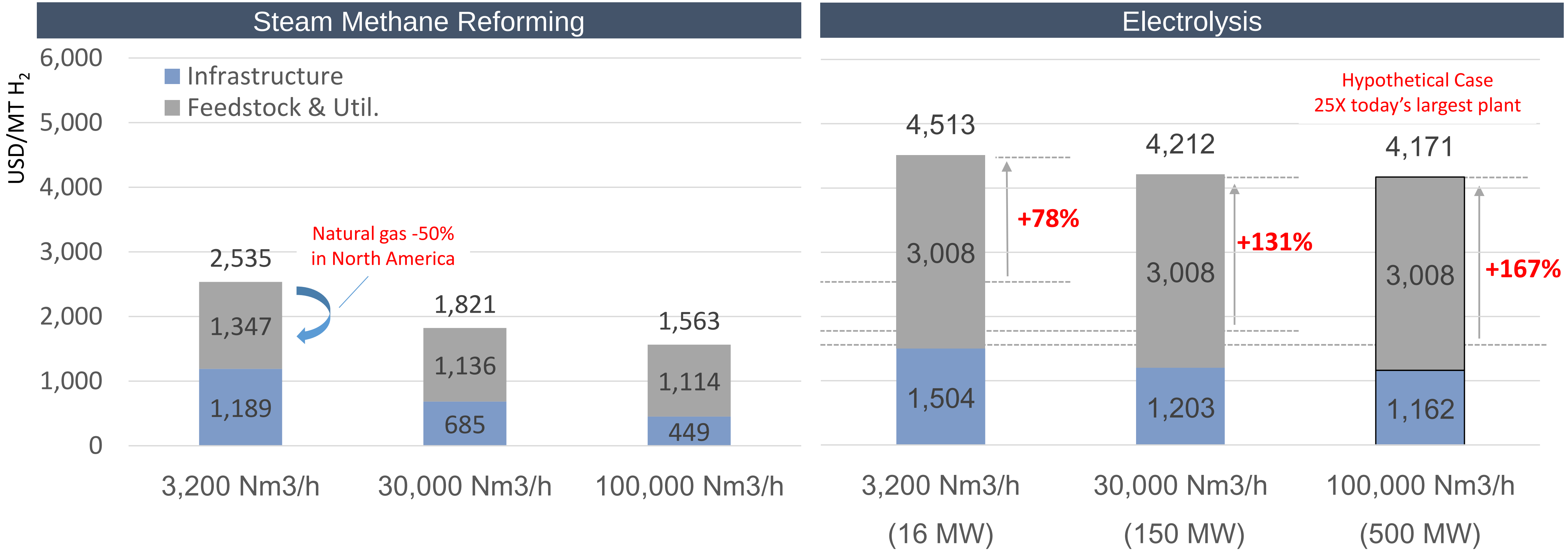




- Hydro Carbon Energy Consumption*
  SMR 51-60 kwh/kg H_2 POX/ATR 48-58 khw/kg H_2
- Feed Source (cost, carbon intensity, availability)
- Oxygen Source (for POX and ATR)
- Potential co-product utilization (CO, Syngas, Steam)
- Potential CO_2 utilization (CCS, CCU)
- CO_2 emission**
  SMR 9.2-11.2 kg/kg H_2 POX/ATR 8.8-11 kg/kg H_2

* Doesn't include credit from steam export (5-10 kwh/kg H_2 reduction)
** Doesn't include associated CO_2 from electricity consumption or avoided CO_2 from steam export

Hydrogen Production – Key Technologies & Benchmarking



CO2 Emissions
MT CO_2/MT H_2

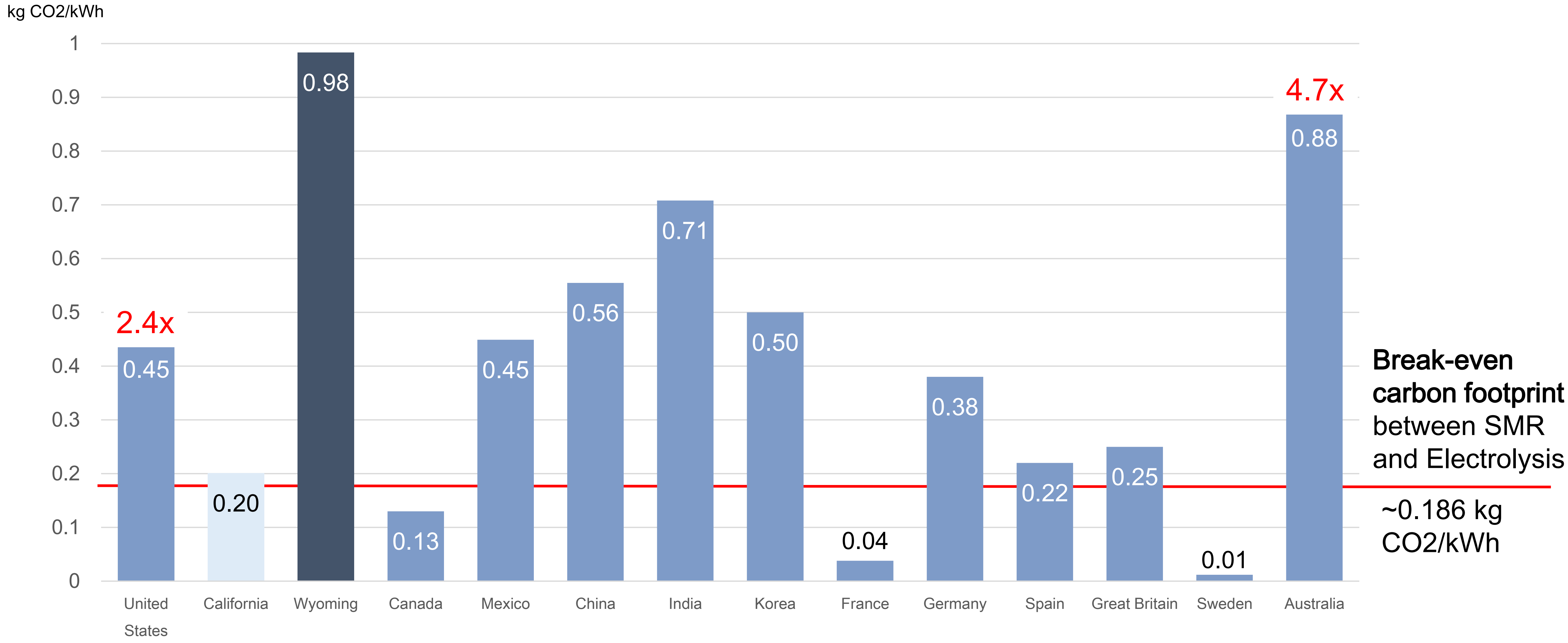
9.3

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_2e/kWh

Hydrogen Production Benchmarking– Key Considerations (Contd.)



- ***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

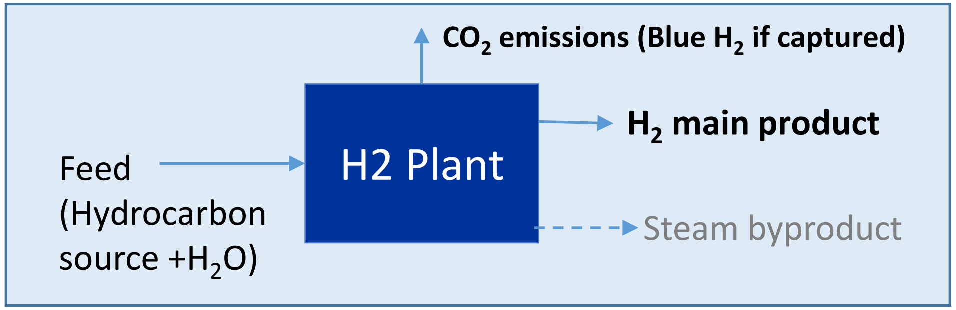
HyCO/Hydrogen Production Integrated with Utilization

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

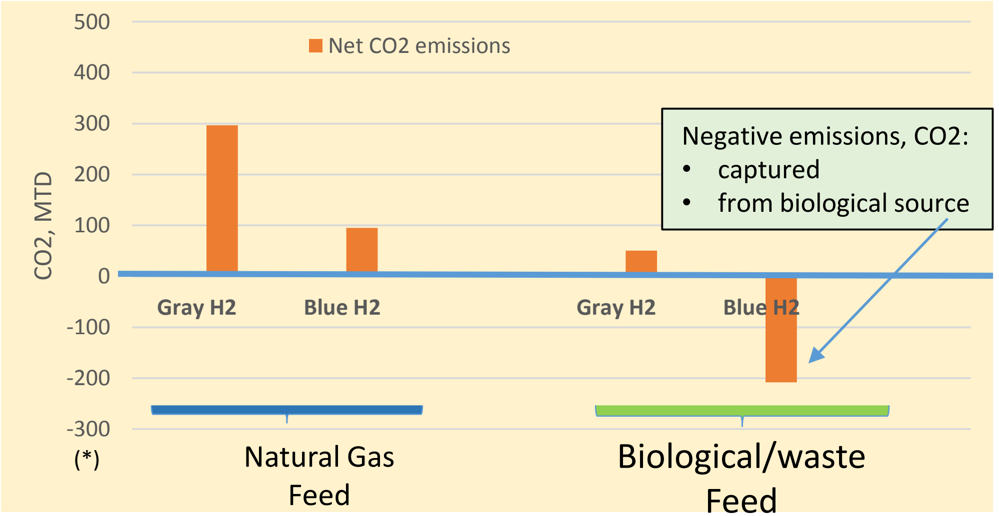
- HyCO/H2 Production with CO2 Recovery/Use: “Blue” H2
- HyCO Production integrated with Petrochemicals
- Hydrogen Production integrated with Biofuel Manufacture
- HyCO integrated with Steel and other downstream

"Blue" Hydrogen Production with Carbon-Dioxide Recovery

- **Blue H2**: bridge between (low cost, high emissions) gray H2 and (high cost, scale limited, zero emissions) green H2.
- CO2 can be recovered and reused, e.g., Enhanced Oil Recovery (EOR), use to make chemicals; or permanently sequestered (geological or deep sea).
- Blue H2 production entails higher capex and variable costs for CO2, 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 CO2 sequestration sites and processing costs are essential for commercially viable deployment of blue H2 and governments and collaborative efforts have a critical role.



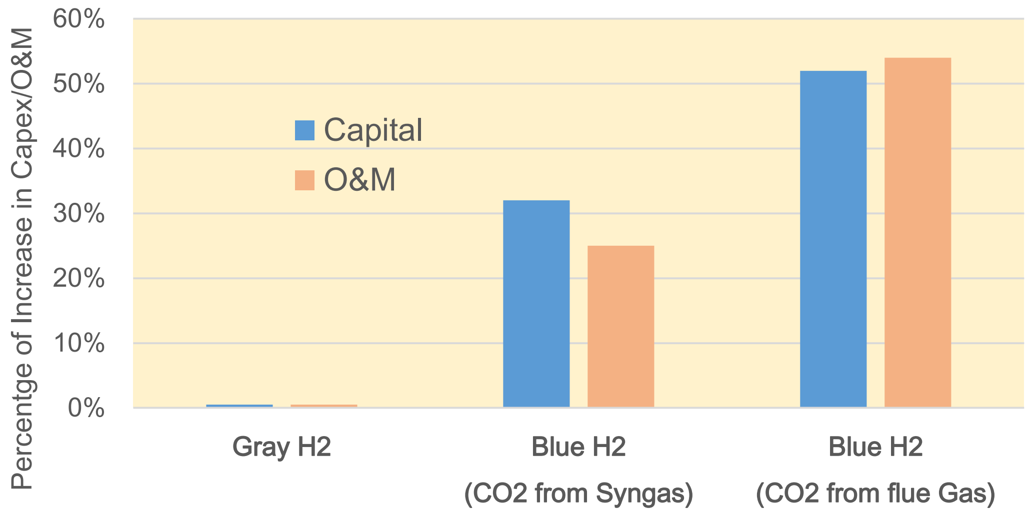
Gray H2	Blue H2	Green H2
- From fossil fuels	+/- Fossil fuel w CO2 capture/sequestered	+ Renewable source
+ Limitless production	+ Limitless production	- Limited production
+ Low Cost	+/- Moderate cost	- Expensive
- Emissions	+ less emissions	+ No/little emissions
		- 24/7 limitations
		- Credits dependent

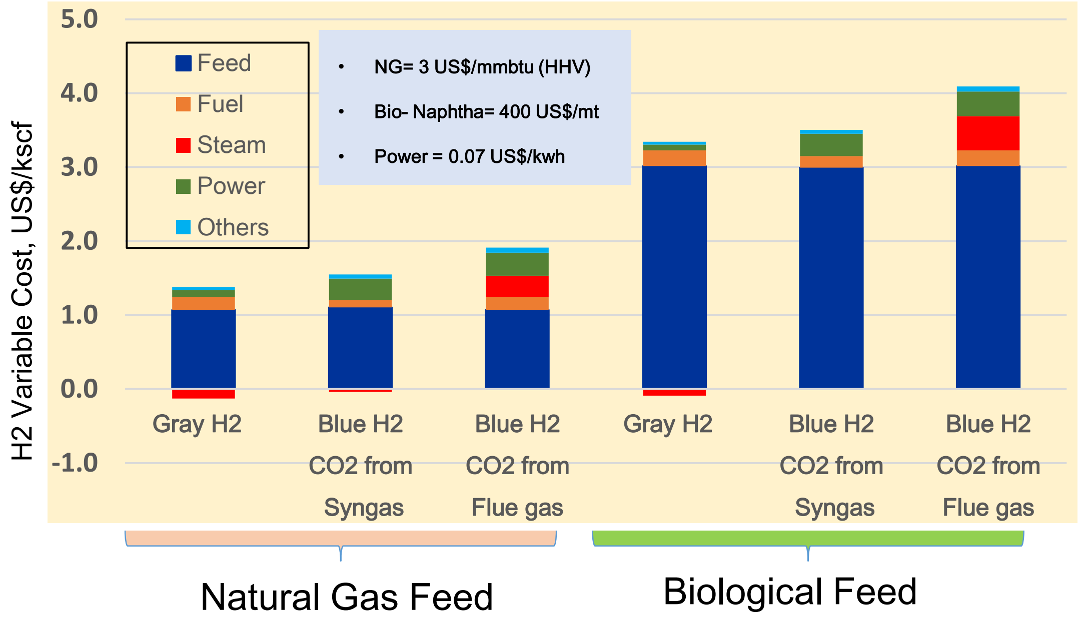


(*) Referential scale (actual number depends on plant size, and other factors)

"Blue" Hydrogen Production – Illustrative Economic Impacts

- Green diesel production of 150-180 Million Gallons/yr
- Mid-sized H2 plant (25-30 mmscfd)
- Evaluation of "gray" H2 vs (two options) "blue" H2
- Higher capex and opex (equipment, chemicals, labor, etc.)
- Variable cost difference ("blue" vs "gray" H2): ~ 0.25 to 0.65 US$/kscf H2 higher cost for blue H2
- CO2 handling after recovery excluded from the economics (compression, storage, transportation, sequestration)
- Carbon credits (typically >50 $/tm CO2) required to makeup the price difference (depend on multiple factors, e.g., feedstock & utility costs, CO2 sink source, geopolitics, etc.); EOR with ultimate sequestration can have major benefits as applicable

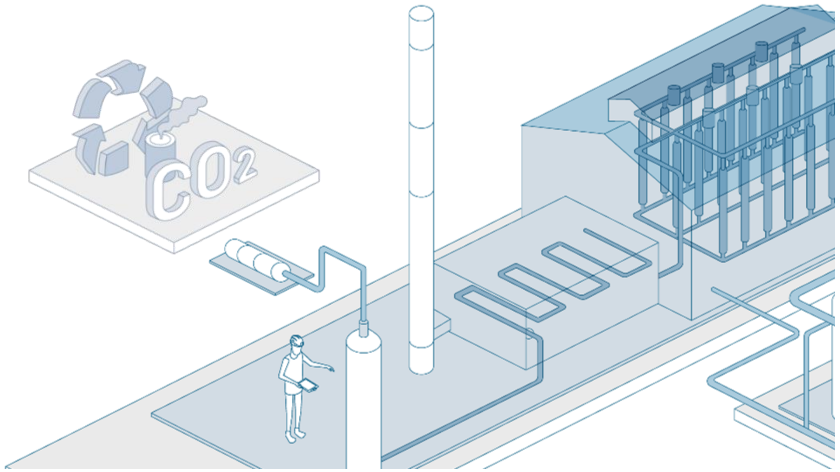


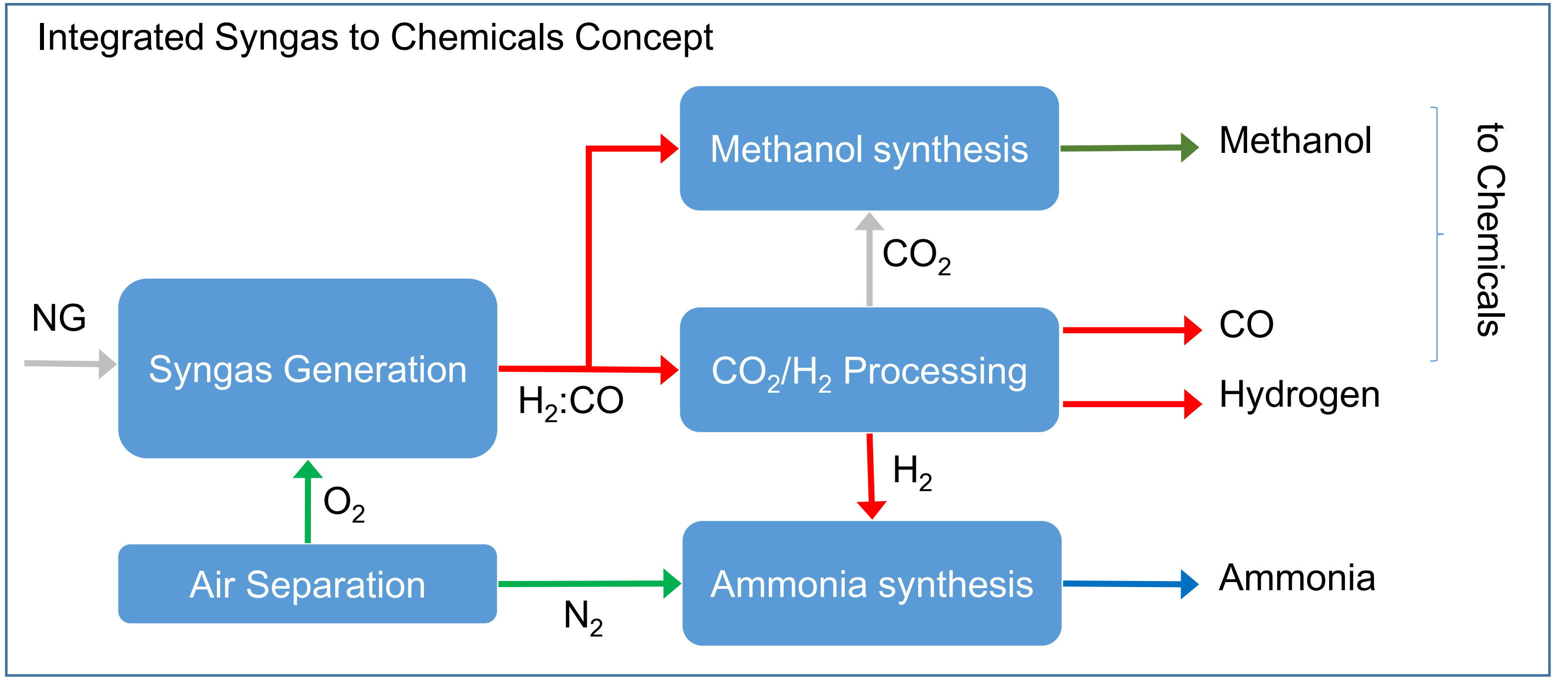


HyCO/Hydrogen Production Integrated with Petrochemicals

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)
- CO2 Capture and recycling via dry reforming, CO_2 electrolysis and other technologies





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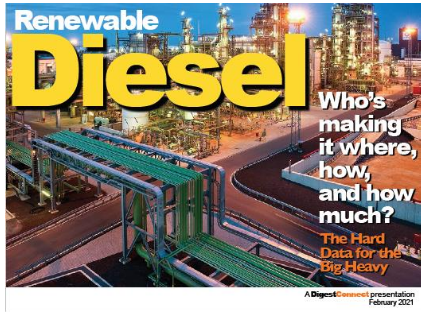
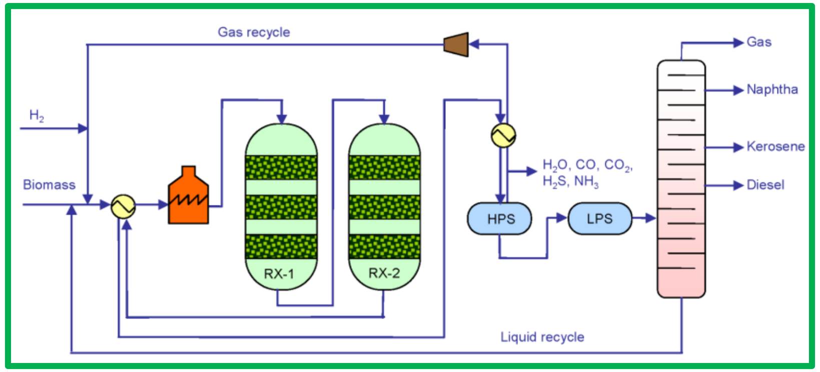
Hydrogen Production Integrated with Biofuels

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
- H2 need: ~1 to 2 billion scf/day (1.1-2.2 million Nm3/hr)
- H2 plants are typically 10-50 mmscfd (11-56 KNm3/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
- CO2 recovery options (syngas, flue gas) can be additionally incorporated depending on site conditions, economics.

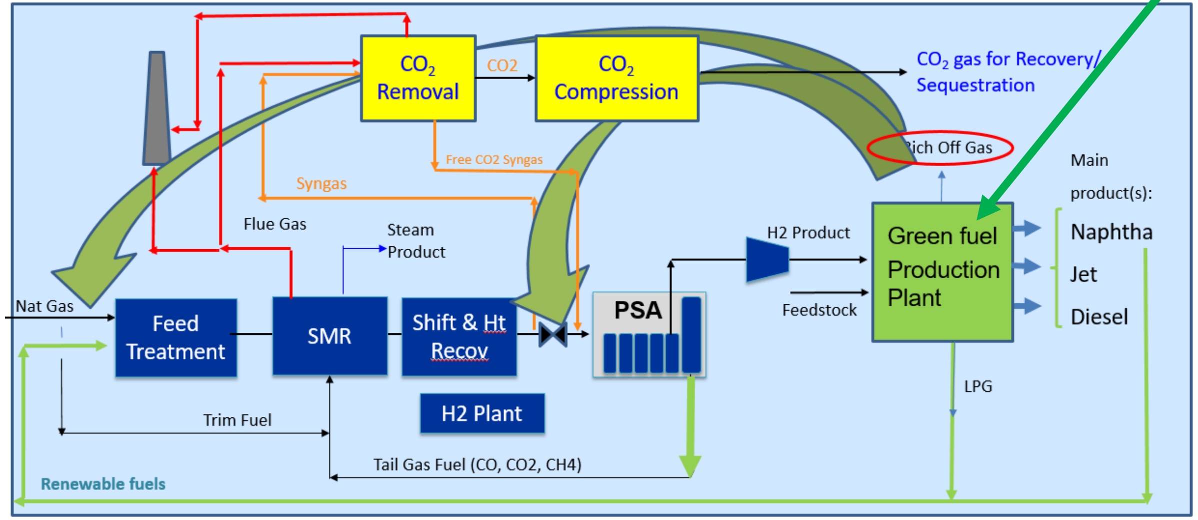


Source: **DigestConnect** presentation February 2021



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 needs are accelerated by the combination of strong environmental (GHG) drivers and increasing economic pressures
  - 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-sized and large hydrogen/HyCO needs
  - Comparisons of alternate options must consider feedstock source(power, hydrocarbons) GHG to avoid environmental degradation and economic impact caused by premature commercialization
  - Minimization of coal/heavies based power generation, or carbon capture from the same, is necessary to obtain widespread environmental benefits from power dependent HyCO production
  - Integration across processes can enable economically effective carbon-mitigated solutions

- 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

For further information, please contact:

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Upcoming IR events

Q1 FYE2022 Earnings Call	July 30, 2021

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

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