JAPAN HYDROGEN FORUM

JH2F MEMBER

FY2026

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JH2F
Japan Hydrogen Forum

Industory Map

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Major Japanese Companies in the Hydrogen Supply Chain

Production

H2 Water Electrolyzer

Alkaline

Module
AsahiKASEI

Membrane
株式会社日本触媒

PEM

Module
東レ株式会社 TOYOTA NIKKISO

Catalyst
AGC 株式会社田中貴金属グループ

Membrane
AGC

MEA
AGC 東レ株式会社
TOSHIBA 株式会社田中貴金属グループ

AEM

Module
MITSUBISHI HEAVY INDUSTRIES

SOEC

Module
株式会社デンソー
MITSUBISHI HEAVY INDUSTRIES

Membrane
株式会社日本触媒

Electrode
AGC

Sealing
AGC

Hydrogen Purifier
AGC 株式会社田中貴金属グループ

Analyzer
Recherche 2000 Inc.

H2 Fossil Fuel Pyrolysis

SMR
株式会社荏原製作所　日揮ホールディングス株式会社
TOYOTA TSUSHO AMERICA, INC.　株式会社田中貴金属グループ　MITSUBISHI HEAVY INDUSTRIES

Plasma Pyrolysis
MITSUBISHI HEAVY INDUSTRIES

Catalytic Methane Decomposition
sojitz

CCS / CDR
株式会社荏原製作所　株式会社 IHI　INPEX
日揮ホールディングス株式会社
MITSUBISHI HEAVY INDUSTRIES　株式会社三井 E&S

Total Engineering and Operation

Iwatani

Carrier Conversion / Transportation / Storage

Compressed Hydrogen

Compressor
AGC 株式会社荏原製作所　株式会社加地テック
Kawasaki　MITSUBISHI HEAVY INDUSTRIES　株式会社三井 E&S

Accumulator

Tank
AGC Hexagon Purus ASA TOYOTA

Linepipe
JFEスチール株式会社

Liquid Hydrogen

Plant
Kawasaki

Tank / Operation
AGC エア・ウォーター株式会社　Kawasaki　株式会社荏原製作所　Iwatani

Pump
AGC　Kawasaki　MITSUBISHI HEAVY INDUSTRIES　NIKKISO
株式会社荏原製作所　株式会社 IHI

Liquefactin
エア・ウォーター株式会社　NIKKISO

LOHC of H2 (Organic Hydrides)

Dehydrogeneration
CHIYODA INTERNATIONAL CORPORATION

NH3 Conversion

Port System
株式会社 IHI

NH3 Infrastructure

Vessel
JFEスチール株式会社
MITSUBISHI HEAVY INDUSTRIES　NYK LINE

Plant Engineering
株式会社 IHI
日揮ホールディングス株式会社
MITSUBISHI HEAVY INDUSTRIES
つばめ BHB 株式会社

Receiving Termial
株式会社 IHI

Tank
AGC JFEスチール株式会社　株式会社 IHI

Pump
AGC 株式会社荏原製作所
MITSUBISHI HEAVY INDUSTRIES　NIKKISO

NH3 Sunthesis

Electrochemical Synthesis
株式会社 IHI

Utilization

H2 Refueling Station

Development and Manufacturing (Dispenser/Pre-Cooler/Pump/Nozzle etc.)
AGC　長州産業株式会社　株式会社荏原製作所
FirstElement Fuel Inc.　Iwatani　株式会社加地テック
TOYOTA TSUSHO AMERICA, INC.　株式会社三井 E&S　NIKKISO

Operations
長州産業株式会社　FirstElement Fuel Inc.

Fuel Cell

Passenger Vehicle
HONDA　TOYOTA

HD Vehicle
HONDA　株式会社三井 E&S
PACECO CORP.　TOYOTA　TOYOTA TSUSHO AMERICA, INC.

Membrane
東レ株式会社

FC Power Generator
長州産業株式会　HONDA　TOSHIBA　TOYOTA

H2 Generator

Turbine
株式会社加地テック
MITSUBISHI HEAVY INDUSTRIES　株式会社三井 E&S

Boiler
株式会社荏原製作所　株式会社加地テック　MIURA

NH3 Generator

Tubeline / Boiler
株式会社 IHI　Kawasaki　MITSUBISHI HEAVY INDUSTRIES

NH3 Drive / Generator

Engine (ICE)
株式会社 IHI　株式会社三井 E&S

AGC Inc.

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#1 FORBLUE™ S-SERIES

Fluorinated Ion Exchange Membrane for PEM Water Electrolyzers
(For Green hydrogen production)

#2 FORBLUE™ i-SERIES

Electrolyte Polymer Dispersions for Fuel Cells (For Fuel cell vehicle)

#3 FORBLUE SELEMION™

Hydrocarbon Ion Exchange Membrane for AEM Water Electrolyzers
(For Green hydrogen production)

#3 Fluon® ETFE Films

Semi-Fluorinated Resin (MEA Transfer Membrane with Chemical Resistance and Electrical Properties)

Achievements

AGC's water electrolysis ion-exchange membrane FORBLUE ™ S-SERIES adopted for JAXA's test model of oxygen generation system for human space activity.

Contact: Ayumi Takahashi: ayumi.takahashi@agc.com
Shunsuke Tsukuemoto: shunsuke.tsukuemoto@agc.com

Looking for Partners:

AGC hope to collaborate with all players involved in hydrogen supply chain, including electrolyzer manufacturers and fuel cell manufacturers.

Future Timeline

Currently providing samples of each grades to customers and partners in Europe, the United States and Asia.

AGC
Your Dreams, Our Challenge

American Honda Motor Co., Inc

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#1 Fuel Cell Module
(FC Module for CR-V, Next-Generation FC Module)

- Fuel Cell Module for CR-V: Output 78kW
  Can be used as a diesel alternative for commercial vehicles, construction machinery, and generators.
- Next-Generation Fuel Cell Module: Output 150kW(Targeted) Contributes to improving Package Efficiency on the application side.

#2 Stationary Fuel Cell
(~MW level power generator)

- Container-sized stationary power source as a replacement for diesel emergency generators.
- Features a small footprint with a cooler installed on top.

Achievements

- Started research on fuel cells in the late 1980s, with extensive development experience.
- Proven track record with passenger cars and demonstration units for commercial vehicles and power sources in the US, Japan, China, and Europe.

Contact: Noritaka Masumitsu: noritaka_masumitsu@na.honda.com
Naoki Yamano:naoki _yamano@na.honda.com
Mayur Thakare: mayur_thakare@na.honda.com

Looking for Partners:

Sales channels: Customers looking to achieve CN (Carbon Neutral) applications and facing shortage of power for logistics/warehouses/EV chargers, etc.

Future Timeline

2027: Next-Generation Fuel Cell Module: Planned production begin in 2027(fiscal year ending 2028.3.31).

HONDA

Asahi Kasei

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#1 Alkaline Water Electrolyzer

- Large scale green hydrogen electrolyzer technology developed based on 50+ years of experience in electrolysis for the Chlor-alkali market.
- Over 1GW of electrolyzer manufacturing capacity in Japan with additional 2GW expansion planned for AWE.

- (Product Line-up)
  - 10MW Modules
  - 100MW Systems
  - 1MW~7.5MW containerized turn-key solution

Aqualyzer™

Looking for Partners:

- Green hydrogen project developers
- Local EPC partners
- Local balance-of-plant (BOP) suppliers

Future Timeline

- **2025:** North America product launch

Achievements

- 10MW system in operation since March 2020
- Multi-module system in operation since May 2024

Contact: Yusuke Tsukahara: tsukahara.yb@om.asahi-kasei.co.jp
Bowman Ty: ty.bowman@ak-America.com

AsahiKASEI

Chiyoda Corporation

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#1 LOHC-MCH (SPERA HydrogenTM)

A commercially proven hydrogen supply chain technology that enables large-scale, long-distance storage and international transport of hydrogen under ambient conditions by using MCH and existing tanker infrastructure.

#2 Electrolysis System Development

A high-efficiency, low-LCOH, containerized 5-MW-class water electrolysis system jointly developed by Chiyoda and **Toyota**, combining fuel-cell stack technology with large-scale plant engineering expertise.

Achievements

- **Successfully demonstrated the world's first international hydrogen supply chain using MCH, transporting hydrogen from Brunei to Japan at commercial scale.**
- **Established a strategic partnership with Toyota to jointly develop large-scale, high-efficiency water electrolysis systems for green hydrogen production.**
- **Executed an MOU with US startup to conduct a concept study on hydrogen recovery and purification processes for stimulated geologic hydrogen.**

Looking for Partners:

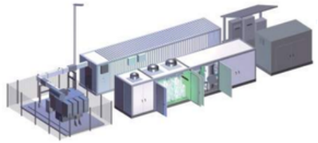
#1: **SPERA HydrogenTM**
SPERA seeks hydrogen supply companies as partners, as it licenses a fully developed technology.
#2: **Electrolysis System**
seeking hydrogen producers/users as customers for its packaged system offerings.

Future Timeline

#2: Electrolysis System Development

- **2027:** Start commercial system supply to the market
- **2029:** GW factory operation start

Contact: Shinjiro Takeshita: takeshita.shinjiro@chiyodacorp.com
Masaru Yamaguchi: yamaguchi.masaru@chiyodacorp.com



CHIYODA INTERNATIONAL CORPORATION

FUKOKU AMERICA, INC.

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#1

Manufacture and sale of rubber products, metal and synthetic resin products, ceramics and medical devices, and biotechnology and medical-related products / Material design, shape design, and processing technology focusing on rubber materials

- Development of large unique packing for hydrogen generation electrolysis cll.
- Development of peristaltic motion pump for transporting poultry manure.
- And the others.

Achievements

N/A

Looking for Partners:

We are widely exploring hydrogen-related technologies and business opportunities that we can collaborate with.

Future Timeline

N/A

Contact: Masahiro Morimoto: m_morimoto@fukoku-rubber.co.jp
Ebisawa Ryoichi: r_ebisawa@fukoku-rubber.co.jp
Yasuyuki Okamoto: y_okamoto@fukoku-rubber.co.jp

FUKOKU

Fuyo General Lease (USA) Inc.

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#1 Solution-oriented finance leases, operating leases, loans, and investments in renewable energy projects

We provide financial solutions such as cost control, financing, and capital efficiency optimization to support our clients in overcoming management challenges, with a primary focus on Japanese companies.

Achievements

Finance leases for hydrogen stations (sale and leaseback), term loans, investments in solar power generation, and more.

Looking for Partners:

Please feel free to contact us if your company is considering the introduction or provision of various hydrogen-related facilities and equipment, such as hydrogen production, supply, and transportation.

Future Timeline

We are constantly considering the needs of various companies across industries, including support for the introduction of hydrogen-related products and sales promotion.

Contact: Jun Fukuda(President & Chief Operating Officer): j-fukuda@fgl-usa.com
Daisuke Morooka(Vice President): d-morooka@fgl-usa.com

FUYO LEASE GROUP

HORIBA Instruments Inc.

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#1 CCM/MEA Catalyst Coating Monitor XV-100

- In-line, non-destructive, and non-contact measurement applied in roll-to-roll process is useful to determine the amount of a precious metal such as Pt and Ir used as a catalyst in PEM Fuel Cell and Electrolyzer.
- Continuous measurement with a response time as short as 10ms, as the fastest in the world.
- Customized engineering services such as in-process traversing and data management.

#2 Fuel Cell/Electrolyzer Test Station Evaluator Series

Consists of various gas control devices (control devices of flow, humidity, temperature and back pressure) for Fuel Cell and Electrolyzer evaluation, along with electronic loads, cooling water control, and electrical measurement devices. Our product line enables performance evaluation of PEM Fuel Cells, SOEC, and PEM & AEM Electrolyzer from single cells to stacks.

Achievements

- HORIBA integrates “Global Network” x “Measurement Technology” x “Engineering” to provide comprehensive solutions including Fuel Cell/Water Electrolysis Evaluation, Material Analysis, and Gas Analysis & Measurement.
- Our goal is to support the adoption and optimization of sustainable energy solutions, contributing to the realization of a carbon-neutral society

Contact: Teruhiko Ikeda
(Chief Manager Energy & Environment Strategy Office)
teruhiko.ikeda@horiba.com

Looking for Partners:

Customer : Fuel Cell/Electrolyzer cells and stacks, as well as their material manufacturers, fuel cell systems and mobility

Future Timeline

As the production of fuel cell and electrolyzer stacks advances, we will support quality assurance and final inspection by developing and supplying advanced evaluation systems and real-time monitoring solutions for both materials and completed stacks

HORIBA

INPEX USA Inc.

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#1 Port of Houston, Texas Blue Ammonia Business

- Our company, Air Liquide, and LSB Industries are jointly developing a blue hydrogen and ammonia production business at the Port of Houston, Texas, U.S.A.
- The project is expected to utilize the existing ammonia terminal site owned by Vopak Exolum Houston at the Port of Houston, and the conceptual design (Pre-FEED) was completed in September 2024.
- The Port of Houston is one of the largest industrial areas in the United States, and its infrastructure, including pipelines for natural gas, hydrogen, and CO2, is well established in the vicinity of this project site. In addition, the Port of Houston is one of the most accessible major ports on the Gulf Coast of the United States, and efficient transportation operations can be expected.
- The project aims to produce 1.1 million tons of blue ammonia commercially annually, and discussions are underway with potential customers in East Asia, including Europe and Japan, for supply.
- Reference Links; Port of Houston, Texas Blue Ammonia Project | INPEX

Achievements

- Various projects including oil and natural gas are listed here.
- Project | INPEX

Looking for Partners:

Seeking the company, who is interested in the offtake of Ammonia from us

Future Timeline

Proceed the project preparation to aim starting the commercial production of Ammonia in 2030

Contact: Shunsuke Mizuta: shunsuke.mizuta@inpex.co.jp

INPEX

ITOCHU International Inc.

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#1 Investment in Raven SR Inc.

- Raven aims to produce hydrogen by gasifying municipal solid waste, primarily focusing on green waste and food waste.
  - Location: Richmond, CA
  - Feedstock: Green Waste
  - Capacity: 6.5 ton/day (transportation grade)
- After completion of the first plant, we plan to expand hydrogen production plants to other regions as well as to utilize syngas for production of SAF etc.

Looking for Partners:

Entities with
- Hydrogen Demand
- Hydrogen Logistics

Future Timeline

- Upon obtaining the necessary permits, the project is expected to be completed within approx. 12 months.

Achievements

Raven is aiming to construct the first commercial-scale hydrogen production plant, which will be our first achievement.

Contact: Susumu Kamibeppu: Susumu.Kamibeppu@itochu.com
Kohei Otsuka: Kohei.Otsuka@itochu.com

ITOCHU

Iwatani Corporation of America

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#1 Hydrogen station business

Operating hydrogen stations (Outsourcing from own and other companies)

#2 Hydrogen delivery business

Hydrogen is transported from production plants to our company and other companies.

#3 Build Low-CI Hydrogen supply chain

Plan to manufacture Low-CI hydrogen

Achievements

In 2019, the company purchased 4 stations from Messer and began operating them. Since 2022, 7 new facilities have been constructed and 12 facilities have received subsidies from CEC.

Contact: James kast(Executive Director):jkast@iwatani.com

Looking for Partners:

Hydrogen compression equipment (gas and liquid), hydrogen production technology (Gasification, etc.)

Future Timeline

- Construction of ST for heavy-duty vehicles (2-5 year span)
- Construction of low-carbon hydrogen production plant (3-5 year span)

Iwatani

Marubeni America Corporation

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#1 Establishing a hydrogen supply chain for local production and consumption

Aiming to establish an integrated hydrogen commercial flow in the United States, starting with hydrogen sales for transportation and power generation.

#2 Blue Ammonia Export Business

Manufacture of blue ammonia in North America with the aim of exporting it mainly to Japan, South Korea and Europe

Achievements

N/A

Looking for Partners:

- Parties who use fossil fuels like natural gas or diesel for their power, transportation and/or industry in the U.S., and have interests to replace with hydrogen
- Parties who are interested in procuring blue ammonia in/outside of the U.S.

Future Timeline

- Local hydrogen business: N/A
- Blue ammonia export business: Aim to make FID within 2025 and achieve COD by 2029, subject to required conditions.

Contact: Yoshida: Yoshida-J@marubeni.com

Marubeni

Mitsubishi Corporation (Americas)

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#1 Hydrogen-related Corporate Venture Capital

In 2018, MC invested in the hydrogen-related UK venture capital firm AP Ventures as a limited partner. Through AP Ventures, we are identifying promising technologies that will be needed to develop the hydrogen society, and are directly investing in startups that we expect to have business opportunities in the future. So far, we invested in Hydrogenious, a German company with hydrogen storage and transportation technology, hystar, a Norwegian company with water electrolysis technology which is essential for green hydrogen production, and Amogy, a US company with ammonia cracking technology. We will continuously strive to utilize new technologies to further create business opportunities going forward.

#2 Clean Ammonia Supply Chain Project

Ammonia is currently mainly used as a basic material for fertilizers and chemical products. But in recent years, its use as a fuel source and hydrogen carrier in the field of energy has been attracting attention. Expectations for ammonia are rising as a next-generation fuel that does not emit CO2 when burned, and the Japanese government assumes that annual domestic demand will reach 3 million tons by 2030, and 30 million tons by 2050. In order to meet such demand, we are leveraging our accumulated experience in constructing energy supply chains and its knowledge of ammonia to develop ammonia fuel businesses around the world.

#3 International Hydrogen Supply Chain Development Project

Hydrogen supply chain business for Singapore

In 2021, we signed a memorandum of understanding regarding a strategic alliance with Chiyoda Corporation and Sembcorp Industries, one of Singapore's leading renewable energy operators, to realize a hydrogen economy in the Republic of Singapore, which is considering introducing hydrogen as the center of its energy policy. Further, in 2022, we made a new agreement with Chiyoda Corporation and Sembcorp Industries to proceed with both technical and commercial development in detail.

Hydrogen supply chain business for Europe

In Europe, a continent that is leading decarbonization policy-making efforts, we signed a memorandum of understanding in 2021 with the Port of Rotterdam Authority in the Netherlands, Koole Terminals, and Chiyoda Corporation, and conducted a joint study on the construction of an international supply chain involving the import of hydrogen to the Port of Rotterdam. Currently, based on the study outcomes, the parties are now proceeding with specific discussions and development towards realizing the project together with related companies.

Contact: Nobukazu Shimada: nobukazu.shimada@mitsubishicorp.com
Yuta Sato: yuta.a.sato@mitsubishicorp.com

Mitsubishi Corporation (Americas)

Mitsubishi HC Capital

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#1 **Actively engaging in discussions with multiple VC firms and considering financing for hydrogen-powered transportation equipment (USA)**

#2 **Japan's first resource-recycling, third-party on-site hydrogen supply model. Initiation of a study on cooperation for a green hydrogen production demonstration project on Miyakojima Island (Japan).**

#3 **Investment in European Energy, which develops hydrogen generation technology using electricity from renewable energy sources (Europe)**

Achievements

Financing of transportation equipment using hydrogen (US)

Contact: Izaki: aizaki@mhccna.com
Hara: thara@mhccna.com

Looking for Partners:

- Investment and loans for sales financing of hydrogen-related equipment and capital investment (U.S.)
- For equipment and projects related to hydrogen production, it is possible to participate from the initial stage by holding assets from the PoC stage. (Japan)

Future Timeline

- Investment and loans for sales financing of hydrogen-related equipment and capital investment (U.S.)
- For equipment and projects related to hydrogen production, it is possible to participate from the initial stage by holding assets from the PoC stage. (Japan)

MITSUBISHI HC CAPITAL AMERICA

Mitsubishi Heavy Industries, Mitsubishi Power

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#1

Hydrogen gas turbine, hydrogen engine, hydrogen iron making, hydrogen pump, various hydrogen production technologies

(AEM electrolysis, SOEC, turquoise hydrogen)

In order to connect the hydrogen value chain in a wide range, our company is working on building the entire value chain of production, transportation and use, including partnerships. Please refer to the slide for details.

Achievements

Developed (Advanced Clean Energy Storage Project — ACES) a 220 MW green hydrogen production, storage and supply project in Utah. 2022FID is scheduled to start operation in the middle of 2025.
The hydrogen will be used to generate electricity at a hydrogen co-firing gas turbine delivered by Intermountain Power, a company adjacent to the project, in our company.
In addition, various technologies such as electrolysis equipment, SOEC and turquoise hydrogen production are under development. We are also investing in and collaborating with many hydrogen-related startups.

Contact: Sakai Ricky:Ryosuke.Sakai@mhia.com
Masumoto Ryan:ryoji.masumoto@mhia.com

Looking for Partners:

Exploring a wide range of hydrogen-related technologies and business opportunities for collaboration with our company

Future Timeline

The above-mentioned ACES project is scheduled to start operation in the middle of 2025

MITSUBISHI HEAVY INDUSTRIES
MITSUBISHI POWER

Mitsui Corporation / Hexagon Purus

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#1

High-pressure gas storage tank manufacturing business Design, develop and manufacture type 4 tanks/solutions

High-pressure Type4 lightweight composite gas storage tanks with multiple pressure bands such as 250Bar, 350Bar, 500Bar, 700Bar and 950Bar are manufactured globally.
Solution includes, hydrogen transporter/container systems as well.

#2

Hydrogen storage system / vehicle integration business Design, develop and assembly fuel systems for mobility market

On-board hydrogen fuel storage/systems for hydrogen cars, trucks/buses, trains, ships, aviations,speciality equipments, and space program. Also, capable of vehicle integration/assembly for hydrogen trucks.

Achievements

Has benn a leader for supplying hydrogen tank systems for H2 buses and commercial trucks, ships as well as trains in the market. Also a prime supplier for H2 tanks for space program and new applications like heavy machienary and hydrogen stations.

Contact: David Yanagisawa: D.Yanagisawa@mitsui.com

Looking for Partners:

- Collaboration with technology companies related to hydrogen supply, such as mobile hydrogen filling and compression/decompression systems.
- Partnership with FC power generator, packaging hydrogen storage system.

Future Timeline

New product development for hydrogen refueling solutions with technology partners, mainly targeting at commercial demonstration of H2 trucks and distributed power generation.

MITSUI&CO.

HEXAGON PURUS

Miura America

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#1 Steam Boiler

A steam boiler compatible with hydrogen blending and 100% hydrogen firing.

Achievements

Proven performance in hydrogen co-firing and 100% hydrogen operation.
Standard models support hydrogen blending up to 20% (by volume).

Looking for Partners:

- Hydrogen compression equipment (for both gas and liquid hydrogen)
- Hydrogen production technologies (e.g., gasification and other methods)

Future Timeline

Order Ready Now

Contact: Kiyotaka Sato: sato.kiyotaka@miuraz.com
Hiromu Tsutsui: htsutsui@cleaverbrooks.com

MIURA

MOL (Americas) LLC / MOL Switch

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#1 Startup investment through MOL Switch (CVC/Palo Alto, owned 100% by Mitsui O.S.K. Lines)

- MOL Switch's hydrogen-related investments
- Calicat (Development of non-Ir catalyst for PEM type water electrolyzer)
- Twelve (Production of synthetic fuel from hydrogen)
- Power to Hydrogen (Development of AEM Water Electrolyzer)
- Amogy (development of hydrogen fuel cells combined with ammonia crackers)
- Koloma (Exploration and Development of Natural Hydrogen)

Achievements

Investment track record of around $40mil in startups including above (since 2023)

Contact: MORISHITA, Mitsutoshi: mitsutoshi.morishita@molgroup.com
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Ensz Jim: Jim.Ensz@molgroup.com

Looking for Partners:

We are looking for innovative technologies in the areas of methane synthesis, methane pyrolysis and ammonia synthesis.

Future Timeline

Consider projects according to the technological development progress of each startup company

MOL
Mitsui O.S.K. Lines

MOL Switch

Nikkiso Co., Ltd.

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#1 Liquid Hydrogen and Ammonia Pumps

- High-pressure reciprocating pump
- Large flow submerged motor pump
- Compact sealless centrifugal pump

#2 Heat Exchanger & Vaporizer

Various products available for heating and/or vaporizing hydrogen and ammonia

#3 Hydrogen Refueling Station

Turnkey hydrogen refueling stations utilizing Nikkiso products

#4 Hydrogen and Ammonia Transfer Systems

- Fuel gas injection systems (FGSS)
- Trailer loading & offloading facilities
- Bunkering systems etc.

#5 Hydrogen Liquefier

Hydrogen liquefiers from 5 to 30 TPD capacity

#6 FEED Studies and EPCM

FEED studies and EPCM services for hydrogen and ammonia projects

Achievements

- Delivered more than 400 liquid hydrogen pumps
- Built 17 hydrogen refueling stations (LH2 storage design); 5 stations currently under construction
- Delivered liquid hydrogen bunkering skid for world's first liquid hydrogen carrier vessel
- Succeeded in world's first performance test of a high-speed centrifugal pump fully submerged in liquid hydrogen for a hydrogen aircraft development project (NEDO program)

Contact: Yuma Taniguchi: yuma.taniguchi@nikkisoceig.com
Henry Hui: hhui@nikkisoceig.com

Looking for Partners:

- Companies engaged in hydrogen and ammonia supply chain projects
- Fleet owners and operators of hydrogen vehicles

Future Timeline

- Next-generation hydrogen refueling station designs including large capacity, near-zero loss, and subcooled LH2 dispensing, to be released in 2025
- Ammonia submerged motor pump (large flow and leak-free design) to be released in 2025
- PEM electrolyzers (2.5MW to 10MW capacity per package) in pre-release / quoting stage

NIKKISO

NYK Line

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#1 Research and Development of Ammonia-Fueled Vessels

Conducting the research and development project of ammonia-fueled vessels in cooperation with Japanese shipyard, engine manufacturers, and classification sociey, supported by the Japanese Government(Green Innovation Fund).

Achievements

2024 August: The world's first Commercial-Use Ammonia-Fueled vessel(Tugboat) was delivered.

Looking for Partners:

N/A

Future Timeline

FY2026: : Ammonia-fueled Medium Gas Carrier to be delivered

Contact: NYK Line / Next-Generation Fuel Business Group:
NYKJP.Next.Generation-G.Value.Chain-T@nykgroup.com

NYK LINE
NIPPON YUSEN KAISHA

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#1

Practical application of hydrogen supply chain using organic chemical hydride process

In the organic chemical hydride process, hydrogen, which is a light gas, is chemically added to TOL by the hydrogenation reaction of TOL. It is converted into MCH, which is a liquid chemical at normal temperature and pressure, and stored and transported. Hydrogen is extracted and used by the dehydrogenation reaction at the place where hydrogen is needed. The generated TOL is recovered and reused as a hydrogen carrier.

Achievements

2020: MCH produced at a hydrogenation plant constructed in Brunei is certified under ISO It was transported by sea in a tank container and arrived at Kawasaki. Hydrogen produced at a dehydrogenation plant in Kawasaki and successfully used
2022: AHEAD participated in the demonstration promoted by ENEOS, and MCH was converted to a chemical Successful demonstration of sea transport from Brunei to Kawasaki by tanker

Contact: NYK Line / Green Business Group:
NYKJP.Green.Business-G.No3.Green.Business-T@nykgroup.com

Looking for Partners:

N/A

Future Timeline

2024: Since the hydrogen supply chain demonstration has been completed, the dehydrogenation plant in Kawasaki has finished its role and the removal work has been completed. Currently, the hydrogenation plant in Brunei is being removed.

NYK LINE
NIPPON YUSEN KAISHA

NYK Line / Japan Suiso Energy(JSE)

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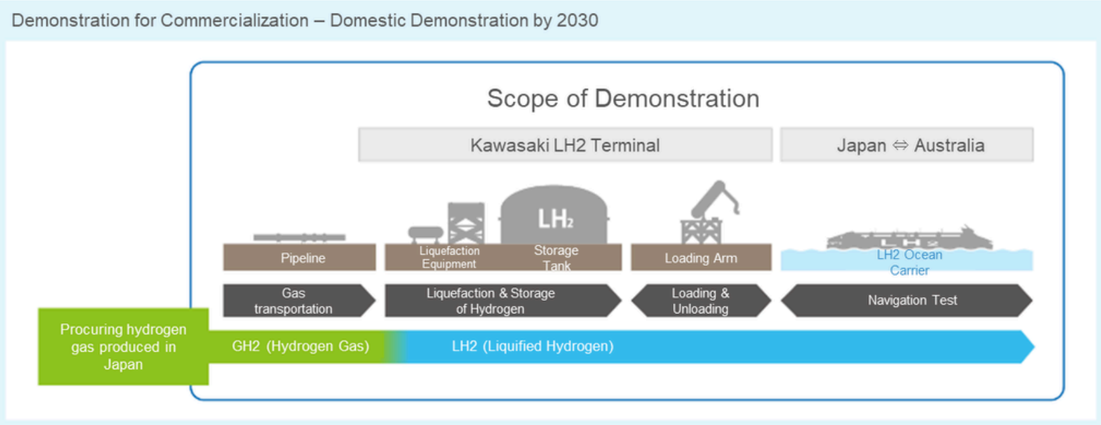
#1 Japan Suiso Energy(JSE)

- June 2021: International Supply Chain for Liquefied Hydrogen Established mainly for research, planning, management and investment. Shareholder composition: Kawasaki Heavy Industries Co., Ltd. 66.6% Iwatani Co., Ltd. 33.4%
- August 2021: Green Innovation Fund project adopted
- September 2023: 3 Japanese ships (Kawasaki Kisen Kaisha, Ltd.
- (MITSUI, Nippon Yusen Corporation) to participate in JSE Ocean Co., Ltd., a subsidiary of JSE, and start cooperation.



Looking for Partners:

- Sold to (off-takers) by JSE Select candidate companies
- NYK, like MOL and Kline, Mainly supporting technical studies in
- Cooperation for transport of transport vessels shown in the lower left of the figure below

Future Timeline

- **FY2028:** Completion of construction of liquefied hydrogen receiving terminal
- **FY2029:** Liquefied Hydrogen Carrier Arrives in Port
- **FY2030:** Completion of this demonstration
- **FY 2031 and later:** As the social implementation phase, Promoting commercialization of liquefied hydrogen supply chain

Contact: NYK Line / Next-Generation Fuel Business Group:
NYKJP.Next.Generation-G.Value.Chain-T@nykgroup.com

NYK LINE
NIPPON YUSEN KAISHA

Tsubame BHB Co., Ltd.

JH2F
Japan Hydrogen Forum

#1 Catalyst &Ammonia Synthesis Process

- Product/Supply of ammonia synthesis catalyst and compact distributed ammonia production unit
- Technology/R&D of ammonia synthesis catalyst, development of ammonia synthesis process, and entire design of ammonia synthesis unit
- Project: Distributed low-carbon nitrogen fertilizer project

Looking for Partners:

- Water Electrolyser having affinity with ammonia synthesis unit. Sold to:
- Focus on overseas, especially in Brazil

Achievements

- Ordered from INPEX for Blue Ammonia Demonstration
- Ordered from domestic Company C

Future Timeline

- **2025/08:** Start production for INPEX
- **2026/1Q:** Start production for Domestic Company C

Contact: NYK Line / Green Technology Team, Engineering Development Group:
NYKJP.Engineering.Development-G.Green.Technology-T@nykgroup.com

NYK LINE
NIPPON YUSEN KAISHA

TSUBAME BHB

PACECO CORP.

JH2F
Japan Hydrogen Forum

#1 H2-ZE RTG Transtainer Cranes

Delivered the worlds first hydrogen fuel cell powered Rubber-Tired Gantry (RTG) Crane to Yusen Terminals at the Port of Los Angeles and put into operation May 15, 2024 as part of a four year demonstration.

Looking for Partners:

Paceco is interested in new and exciting technologies in the hydrogen fuel cell space that could further improve our H2-ZE RTG and if government subsidies are available, suppliers that meet the grant conditions.

Achievements

Paceco is known for new product achievement

- First ship-to-shore crane launching the container shipping industry
- Launched the first hydrogen FC powered Zero-Emission RTG crane in a commercial container yard environment in the world.

Future Timeline

- Completion of the 4 year demonstration
- Expanding manufacturing capacity to for the hydrogen RTG product line including the ability to meet Build America Buy America and other requirements as part of grant programs.

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PACECO® CORP.

SEKISUI CHEMICAL CO.,LTD.

JH2F
Japan Hydrogen Forum

#1 Green Chemistry Project
(CCUS : CO2+H2→CO conversion technology)

- We have developed a technology that converts CO2 (carbon dioxide) and H2 into CO (carbon monoxide) with a reaction yield of over 90%, and are currently considering commercialization.
- We provide value by contributing to decarbonization for users who directly utilize CO or use it as a raw material for synthesizing valuable materials.
- The unique technology of “chemical looping reaction” can achieve the above results with a small excess of H2, and can also be used for large-scale emission sources.
- Joint demonstration with a major steel company (ArcelorMittal), the technology has been proven to be durable for more than 6 months using blast furnace exhaust gas, and we plan to expand the technology to a wide range of CO2 emission sources, mainly by providing technology licenses.

Achievements

- SEKISUI CHEMICAL begins survey on scale-up of chemical looping technology for CO₂ to CO conversion and the suitability of demonstration requirements for application to CCU | SEKISUI CHEMICAL CO.,LTD
- SEKISUI CHEMICAL begins survey on scale-up of chemical looping technology for CO₂ to CO conversion and the suitability of demonstration requirements for application to CCU | SEKISUI CHEMICAL CO.,LTD
- Funding Selections: FY23 Industrial Efficiency and Decarbonization Multi-Topic FOA | Department of Energy

Contact: Corporate Strategy Department : Taku Sasaki (taku.sasaki@sekisui.com)
Corporate R&D Institute : Keisuke Iijima (keisuke.iijima@sekisui.com)

Looking for Partners:

【Hydrogen supply player】 Although a small amount of in-house use during the R&D, we are currently searching for collaborative players who can make set proposals to the industry during the actual business stage. In addition, we are looking for end users who can utilize CO, obtained through the CO2 → CO reaction, as a raw material for synthesizing valuable materials.

Future Timeline

- We are currently developing the technology and aims to negotiate a license for commercialization after 2028.
- Aim to start operation at a scale of 100 to 1,000 tons of CO2 conversion per day by 2030

SEKISUI

Sojitz Corporation of America

JH2F
Japan Hydrogen Forum

#1 Clean H2 Supply and Sales Business

Sojitz is developing a business to supply and sell clean hydrogen produced by Sojitz to environment-friendly customers in the U.S. Through these activities, Sojitz will contribute to the decarbonization of the transportation and industrial sectors.

#2 Clean Ammonia Supply Chain Project

Sojitz aims to build an international clean ammonia supply chain. We will develop competitive projects in each region and propose optimal solutions to customers around the world.

#3 Turquoise Hydrogen Development

Sojitz supports turquoise hydrogen production technology development with investment in Hycamite TCD Technologies in Finland and start industrial-scale plant operations in 2025.

Achievements

- Sojitz has strengths in solving social challenges through business, and we will work to find a solution to the challenge of achieving a decarbonized society.
- We propose a decarbonized solution to all customers, communities and markets, and contribute to the realization of a decarbonized society.

Looking for Partners:

- Hydrogen offtakers in the United States
- Carbon capture technology providers
- CCS partners

Future Timeline

- **2027:** Commence of Clean H2 production
- **2029:** Launch of clean ammonia portfolio

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Hirofumi Matsui: matsui.hirofumi@sojitz.com

sojitz

Toshiba America Energy Systems

JH2F
Japan Hydrogen Forum

#1 Pure Hydrogen fuel Cell H2Rex

It is a pure hydrogen fuel cell system with high efficiency power generation, flexible operation, high durability (design life of 80,000 hour operation), and various control functions.

#2 Membrane Electrode Assembly for PEM Water Electrolysis Equipment

Background: The PEM water electrolysis system, which uses PEM (Polymer Electrolyte Membrane) with high durability and adaptability to fluctuations in renewable energy power, uses iridium, the rarest of the precious metals, as the catalyst for the electrodes. One of the issues for practical application is to reduce the amount of iridium used.
Technical description: The company developed its own iridium oxide nanosheet multilayer catalyst and succeeded in reducing the conventional use of iridium to 1/10 in 2017. The company also developed a technology that can film up to 5m2 of this catalyst at a time, and established a large-scale manufacturing technology for electrodes.

#3 CO2 Electrolyzer C2One™

Based on the electrolysis technology which can convert carbon dioxide (CO2) to carbon monoxide (CO) with high efficiency, CO2 electrolysis equipment C2One which produces CO of about 150 t/year is being developed with the aim of practical application in fiscal 2026. CO produced by CO2 electrolysis is assumed to be utilized as raw material for chemical products, sustainable aviation fuel (SAF), synthetic fuel, etc., and green hydrogen is assumed to be utilized in the process.

Achievements

More than 120 H2Rex units have been delivered to customers in various industries

Contact: [First Contact] Ardian Nurfalaq: ardian.nurfalaq@toshiba.com
[Second Contact] Jeffry Simmons: Jeffry.Simmons@toshiba.com

Looking for Partners:

- Pure hydrogen fuel cell H2Rex P: stationary fuel cell users, industries, data centers, engineering companies, ports, etc.
- Membrane electrode assembly for PEM type water electrolysis equipment /: PEM electrolysis equipment manufacturer, OEM
- CO2 Electrolyzer (C2One™): Petrochemical, carbon recycling, alternative fuels, SAF-related businesses, etc.

Future Timeline

- **FY2025:** 2025 Delivery of 500 kW H2 Rex Scheduled project to be completed

TOSHIBA

TOYOBO CO., LTD.

JH2F
Japan Hydrogen Forum

#1 Heat-resistant polyester film Teonex® PEN film

- It has been used for many years as a component material for PEM fuel cells and electrolyzers.
- Applications: sub-gasket, frame material

Achievements

Adopted mobility, backup power supply and boats, etc

Looking for Partners:

- Start-up companies for PEM fuel cells and electrolyzers
- Discuss the possibility of collaborating with players in the hydrogen supply chain

Future Timeline

- Already adopted mateirla for customers in Europe, North America, and Asia
- Provide commercialized film products according to customer needs and business plans.

Contact: Overseas Film Sales Department HORIMOTO
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TOYOBO
Beyond Horizons

Toyota

JH2F
Japan Hydrogen Forum

#1 Fuel Cell System
(3rd Gen FC System)

The all-new 3rd Gen FC System is designed to meet the Stationery of the commercial sector with the same durability as conventional diesel-powered engines. Additionally, the new system features significant improvements in performance, including fuel efficiency and a significant reduction in costs compared to the prior version.

Looking for Partners:

- Application OEM
- Hydrogen supply
- Electrolyzer

Future Timeline

In addition to passenger vehicles, the 3rd Gen FC System will be expanded for use in heavy-duty commercial vehicles, and is planned for introduction in markets mainly in Japan, Europe, North America, and China after 2026 at the earliest.

Achievements

- Light Duty Passenger Vehucle Development
- Heavy-duty Commercial Vehicles Development
- Stationary Power
- Port Applications

Contact: Sakuma Emori: sakuma.emori@toyota.com

TOYOTA

Toyota Tsusho America

JH2F
Japan Hydrogen Forum

#1 Port of Los Angeles/Long Beach decarbonization using FC/H2 technology

We plan to use FC technology to convert port cargo handling equipment, which is difficult to convert to ZEV by battery and electrification, and drayage trucks entering and leaving the port. In addition, we will develop in-house hydrogen supply facilities that meet customer operations and provide a set of hydrogen and FC equipment to customers.

Achievements

Including two Port of Los Angeles terminal operators and drayage trucks Implementation of FC for cargo handling equipment and demonstration of mobile high-pressure hydrogen charging

Looking for Partners:

- High-flow hydrogen supply solution

Future Timeline

- TBA

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TOYOTA TSUSHO AMERICA, INC.