INPEX
Energy for a brighter future

Government support

Kashiwazaki Hydrogen Park, an initiative aimed at commercializing low-carbon energy, is supported by NEDO and JOGMEC. The project is designed to establish low-carbon supply chains in collaboration with relevant government agencies.

NEDO New Energy and Industrial Technology Development Organization | (Subsidized project)

Demonstration of an integrated hydrogen and ammonia production system with CO_2 Recovery under the NEDO Program "Technology Development for the Utilization and Production of Ammonia as Fuel and the Production of Blue Ammonia"

JOGMEC Japan Organization for Metals and Energy Security | (Joint Research)

Evaluation and monitoring of CO_2 injection and storage technologies under the JOGMEC Program "Demonstration to Quantify CO_2 Storage Capacity at Depleted Oil Fields in Japan for the Low-Carbon Utilization of Natural Gas"

Project Period: April 2022 – End of September 2026 (scheduled to conclude)

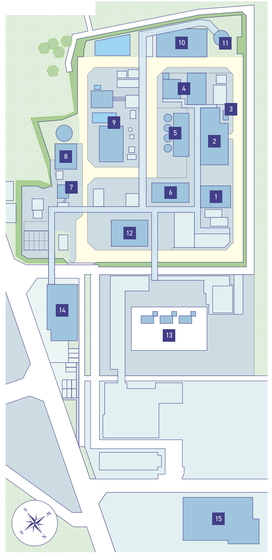
Visitor Center

The Visitor Center is designed to systematically communicate the philosophy and technologies underpinning the demonstration project. It features a theater room developed by teamLab, offering an immersive visual presentation of the processes from the production to the utilization of hydrogen and ammonia as clean energy sources that generate no CO_2 emissions at the point of use. The center also includes a presentation and information exchange room, where hydrogen and ammonia production technologies, as well as CCS technologies—including the utilization of depleted gas fields in Japan—are clearly introduced.

CCUS: Carbon dioxide capture, utilization, and storage, in which CO_2 separated and stored through CCS is put to practical use.

Image

Site Map



1 Hydrogen production facilities
Hydrogen is efficiently produced from natural gas by mixing it with steam and oxygen.

2 CO_2 recovery facilities
CO_2 generated as a by-product of hydrogen production is separated and recovered.

3 Hydrogen purification facilities
A portion of the hydrogen produced at the hydrogen production facilities is purified to more than 99.999%.

4 Ammonia production facilities
Ammonia is produced from high-purity hydrogen and nitrogen.

5 Oxygen and nitrogen storage facilities
Liquid oxygen for hydrogen production and liquid nitrogen for ammonia production are stored separately in tanks.

6 Feed gas compressor
Natural gas (methane) fed through the pipeline is compressed to 4.6 MPaG.

7 Gas supply facilities
Natural gas is safely supplied via INPEX's pipeline.

8 Fire-extinguishing installation
Fire-fighting water is supplied throughout the plant during emergencies.

9 Utility system
Utilities, such as electricity and gas, are supplied to operate the plant.

10 Hydrogen-powered generator
A hydrogen-powered gas engine generator produces electricity.

11 Flare system
Surplus flammable gas generated within the plant is safely flared.

12 CO_2 compressor
Separated and recovered CO_2 is compressed to supercritical pressure and fed to the injection well.

13 Production, CO_2 injection, observation wells
CO_2 is sequestered in the depleted gas field from which natural gas was previously produced.

14 Control building
The plant is remotely monitored and operated 24/7/365 to ensure safe and stable operation.

15 Visitor Center
The theater room provides a visual presentation of the plant.

INPEX
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KASHIWAZAKI HYDROGEN PARK

INPEX Energy for a brighter future

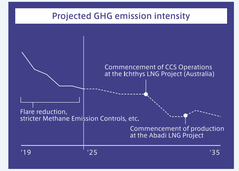
Kashiwazaki Hydrogen Park to contribute to realizing a low-carbon society

Kashiwazaki Hydrogen Park, the culmination of INPEX's long-established expertise and technological capabilities in the energy sector, is Japan's first demonstration plant for the integrated production and utilization of hydrogen and ammonia. Natural gas is sourced from INPEX's Minami-Nagaoka gas field, also located in Niigata Prefecture. Existing infrastructure and operational know-how—including the Naoetsu LNG terminal and a pipeline network of approximately 1,500 km spanning Tokyo and eight prefectures—are leveraged to produce blue hydrogen and blue ammonia. By spearheading clean hydrogen initiatives in Japan and overseas, INPEX is committed to advancing a responsible energy transition that supports stable energy supply and the realization of a low-carbon society.

Shaping a sustainable, low-carbon future from Kashiwazaki

Project objectives and background　INPEX's competitive edge and vision

- As net-zero initiatives advance worldwide, INPEX Vision 2035 promotes the realization of a "responsible energy transition," with the goal of reducing greenhouse gas (GHG) emission intensity by 60% from 2019 levels by 2035.
- Kashiwazaki Hydrogen Park is Japan's first demonstration project for the integrated production and utilization of blue hydrogen and blue ammonia, enabling virtually zero CO_2 emissions. The project is designed to deliver INPEX's proprietary low-carbon solutions by leveraging CCS* and hydrogen technologies. Specifically, hydrogen, ammonia, and CCS technologies—together with operational expertise—will be mobilized to establish a hydrogen value chain and provide society with GHG emission reduction solutions.
- INPEX has continuously reduced its GHG emission intensity through ongoing efforts to review and upgrade its production processes. Over the coming decade, we are committed to achieving meaningful reductions by providing low-carbon solutions centered on CCS and hydrogen technologies, thereby contributing to the broader decarbonization of society.

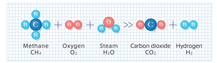


CCS: Carbon dioxide capture and storage, in which CO_2 is separated, recovered, and permanently stored underground.

A

Hydrogen Production Unit

Natural gas (methane) feedstock is mixed with steam and oxygen within the reactor to produce approximately 700 tons of hydrogen annually. The unit utilizes Air Liquide's advanced ATR (Autothermal Reforming) technology. Because the internal partial combustion reaction with oxygen eliminates the need for an external heat supply, hydrogen is produced with superior energy efficiency and a smaller physical footprint.



ATR (Autothermal Reforming) (Air Liquide)

- This process injects oxygen into the reactor, utilizing the internal heat released by partial oxidation (combustion) to drive the reforming reaction.
- Compared to conventional Steam Methane Reforming (SMR), ATR technology concentrates all CO_2 under pressure in the process gas which ensures efficient and simple CO_2 removal, and not necessary to capture CO_2 from the Flue Gas.

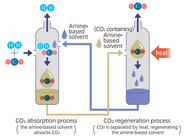
B

CO_2 recovery facilities

CO_2, a by-product of hydrogen production, is separated and recovered using HiPACT® technology, which is more efficient than conventional methods. Its key advantage lies in high-pressure CO_2 separation and recovery, reducing energy consumption by the CO_2 compressor.

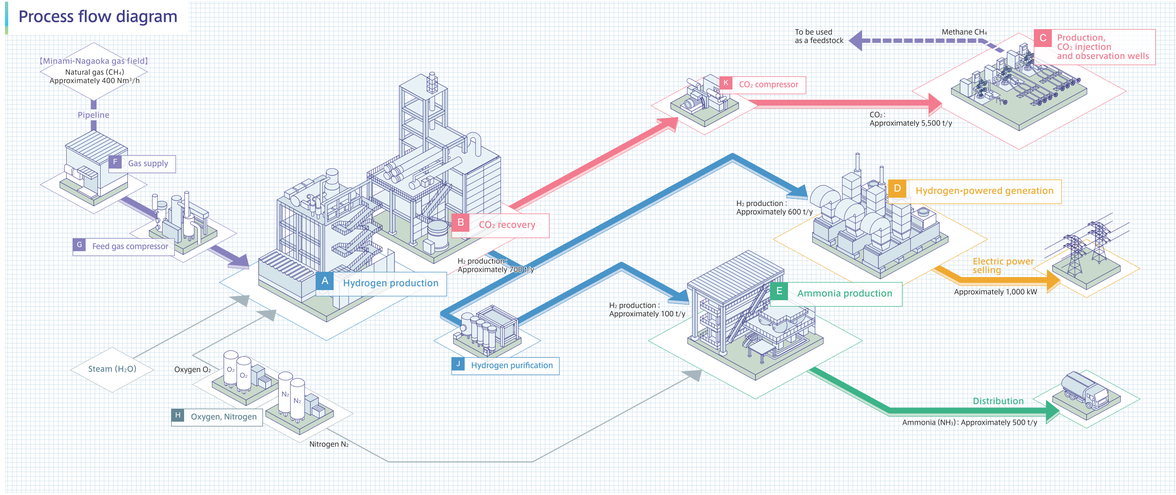
HiPACT®* (JGC Corporation/BASF)

- The system uses an amine-based solvent to separate and recover CO_2 at high pressures.
- The system reduces the energy required by the CO_2 compressor during injection.



*HiPACT: High Pressure Acid-gas Capture Technology

Process flow diagram



C

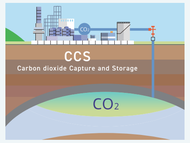
Production, CO_2 injection, observation wells

The separated and recovered CO_2 is compressed to supercritical pressure and fed into the injection well. Approximately 5,500 tons per year of CO_2 are injected and stored in the depleted gas field located about 2,600 meters underground. The injected CO_2 is monitored through the observation well, while a production well is also in place to evaluate EGR (Enhanced Gas Recovery).

Site suitability for CCS

Depleted gas fields, from which natural gas has previously been produced, offer the following advantages for implementing CCS:

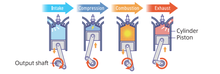
- The reduced underground pressure lowers the energy required for CO_2 injection.
- Leveraging the extensive underground data accumulated from past production enables more accurate predictions of injected CO_2 behavior, based on reliable scientific evidence.
- The underground structure that has stored natural gas for extended periods is capable of safely storing CO_2.
- The nearby INPEX natural gas pipeline ensures a stable supply of natural gas, a raw material for blue hydrogen.



D

Hydrogen-powered generator

A hydrogen-powered generator uses hydrogen as its fuel. Because hydrogen combustion produces no CO_2, it helps minimize environmental impact. The three hydrogen-powered generators have a combined output of approximately 1,000 kW of electricity, which is supplied to Niigata Prefecture.



Hydrogen gas engine mechanisms

A hydrogen gas engine operates similarly to a gasoline engine, featuring a reciprocating internal combustion system in which four cycles—intake, compression, combustion (expansion), and exhaust—are repeated. The high-temperature, high-pressure gas generated during combustion drives the pistons, converting chemical energy into mechanical power. However, because hydrogen has a small molecular weight and burns rapidly, the fuel delivery and intake systems must be modified to mitigate the inherent risks associated with hydrogen.

F

Gas supply facilities

Natural gas (methane), a feedstock for hydrogen production, is safely supplied to the plant via INPEX's pipeline and then delivered to the feed gas compressor.

G

Feed gas compressor

Natural gas supplied to the plant via the gas supply facilities is compressed to 4.6 MPaG (megapascal gauge) in the feed gas compressor and then delivered under pressure to the hydrogen production facilities.

H

Oxygen and nitrogen storage facilities

Oxygen for hydrogen production and nitrogen for ammonia production are stored in liquid form and vaporized as needed. The facilities comprise four dedicated storage tanks, with two allocated to oxygen and two to nitrogen. Liquid oxygen and nitrogen are delivered by lorry from external suppliers.

J

Hydrogen purification facilities

Part of the hydrogen gas from which CO_2 has been removed is further purified using pressure swing adsorption (PSA) technology to remove impurities, achieving a purity of more than 99.999%. The purified hydrogen is then used as a feedstock for ammonia production.

K

CO_2 compressor

CO_2 separated and recovered at the CO_2 recovery facilities is compressed to a supercritical pressure and injected into the injection well.

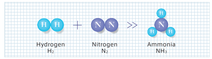
Fire-extinguishing installation

In the event of a fire, water is supplied throughout the plant from the water tank via the pumps (shown in red), which are powered by diesel engines in the event of a power outage. The water tank has a capacity of 580 kL.

E

Ammonia Production System

Ammonia is synthesized from high-purity hydrogen and nitrogen using an electride catalyst, which enables production at reduced temperatures and pressures. The resulting ammonia is liquefied via refrigeration and stored in the two tanks under pressurized conditions and ambient temperature, before being loaded onto lorries for delivery to distributors within Niigata Prefecture.

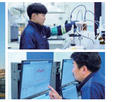


Proprietary ammonia synthesis process (Tsubame BHB Co., Ltd.)

- Ammonia is synthesized using a proprietary catalyst under low-temperature and low-pressure conditions.
- Reducing the energy required to increase material pressure enhances process safety.

Control building

The plant is remotely monitored and operated 24/7 from the control room to ensure safe and stable operations, while measurements and analyses are conducted in the analysis room. Operators, analysts, office staff, and the plant manager are stationed in these rooms.



Main facility specifications

ATR reactor	Fireproof materials	T.-T.L 6,280 mm I.D 1,240 mm	1 unit
HiPACT absorption tower	—	T.-T.L 19,220 mm I.D 700/350/190.9 mm	1 unit
HiPACT diffusion tower (regeneration tower)	—	T.-T.L 18,650 mm I.D 1,000/450 mm	1 unit
Hydrogen-powered generator	Reciprocating Internal combustion system	360 kW	3 units
Ammonia storage tank	Horizontal	T.-T.L 6,000 mm I.D 2,200 mm 25.6 m³	2 units
Ammonia feeding pump	Vertical canned pump	20 m³/h	1 unit
Feed gas compressor	Reciprocating	417 Nm³/h Outlet pressure: 4.6 MPaG	2 units
CO_2 compressor	Reciprocating	434–453 Nm³/h Outlet pressure: 13 MPaG	1 unit
Oxygen facilities	Vertical	30 m³	2 units
Nitrogen facilities	Vertical	20 m³	2 units