

Naoetsu LNG Terminal

INPEX



*A New Wind
for Energy*



Welcome to Naoetsu LNG Terminal

Naoetsu LNG Terminal which commenced operations in December 2013, is an LNG receiving facility that supplies natural gas to customers in Japan.

The terminal which is owned and operated by INPEX CORPORATION, Japan's largest oil and gas exploration and production company, is located in Joetsu city, Niigata prefecture, a key point along the company's pipeline network.

With the surge in demand for natural gas in recent years due to growing public awareness of the environment and energy conservation, Naoetsu LNG Terminal is well positioned to ensure the stable and efficient supply of natural gas-based energy in line with INPEX's efforts to play an increasingly vital role in society.

Roles of Naoetsu LNG Terminal

Naoetsu LNG Terminal is core facility responsible for establishing a global gas value chain that links overseas gas supply sources with the domestic gas market.

LNG (liquefied natural gas) from INPEX overseas projects is shipped to Naoetsu LNG Terminal.

Naoetsu LNG Terminal receives LNG from INPEX -operated Ichthys LNG Project in Australia and natural gas from Minami-Nagaoka gas field in Japan.



INPEX is committed to providing a safe and reliable supply of natural gas produced in Japan and around the world.

One of INPEX's growth targets is strengthening its global gas value chain to realize the long-term stable provision of natural gas to its customers. Naoetsu plays a key role in this process by regasifying LNG, blending it with natural gas produced in Japan, adjusting the calorific value before transferring the end product to the company's pipeline network.

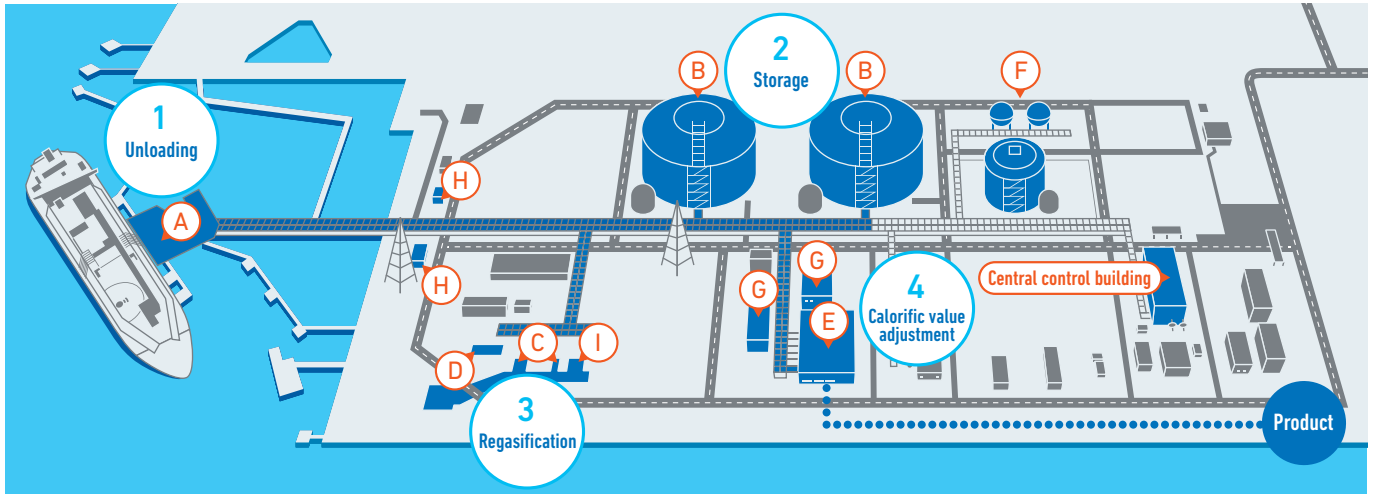
- **Pipeline network (approx. 1,500km in total length)**

INPEX's pipeline network currently extends to Tokyo and across eight prefectures of Niigata, Nagano, Gunma, Saitama, Tochigi, Yamanashi, Shizuoka, and Toyama.



Terminal Overview

LNG delivered by vessels to Naoetsu LNG Terminal undergoes regasification followed by calorific value adjustment prior to being fed to the company's pipeline network as sales gas.



Block Flow Diagram



Facilities and Equipment

A Unloading Arms

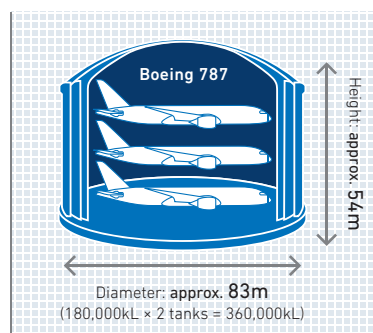


The unloading arms are used to unload LNG/LPG from the LNG/LPG carriers and transfer them to their respective storage tanks. Hydraulic quick couplers installed at the end of the arms ensures safety and accuracy of operations during coupling and decoupling from flanges on the LNG carriers.

B LNG Tanks

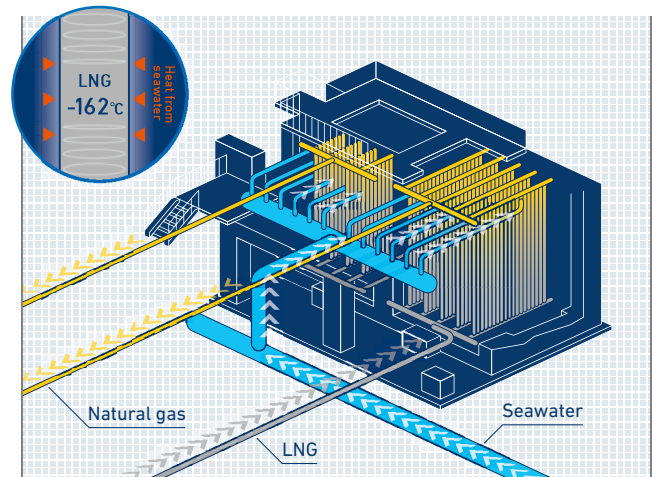
Aboveground full-containment storage tanks
Capacity: 180,000kL × 2 units

Naoetsu LNG Terminal stores LNG in two tanks with a height of approximately 54m and diameter of approximately 83m. The tanks have a total capacity 360,000kL. Each tank is large enough to hold three Boeing 787 aircrafts.



C Open Rack Vaporizer (ORV)

ORV uses seawater as heat source to regasify the LNG at -162°C as it passes through the vaporizer pipe.



D Submerged Combustion Vaporizer (SMV)



The SMV is a vaporizer operated mainly in emergencies. It burns natural gas to create high-temperature exhaust gas that heats water in a tank containing heated tubes that regasify the LNG through heat conduction.

E Calorific Value Adjustment Facility



This facility adjusts the calorific value of regasified LNG and natural gas produced in Japan by adding liquefied petroleum gas (LPG). The end product is then transferred to the pipeline network as sales gas.

F LPG Tanks



LPG is used in calorific adjustment. There are two types of LPG storage tanks; ambient temperature LPG tank and cryogenic LPG tank.



G BOG Treatment Facility



Boil off gas (BOG) is constantly produced in the LNG and cryogenic LPG tanks due to heat flux from the surroundings. There are two ways to process the LNG BOG. One is to re-liquefy the gas and transfer it back to the tank or vaporizer. The other is to compress the BOG and send it to a vaporized gas pipeline. LPG BOG is processed by re-liquefying it and sending it to either the ambient temperature LPG tank or cryogenic LPG tank.

H Return Gas Blower (RGB)



RGB is used to transfer boil off gas (BOG) to unloading LNG vessels to maintain positive pressure inside the cargo tank.

I Open Rack Type LPG Heater



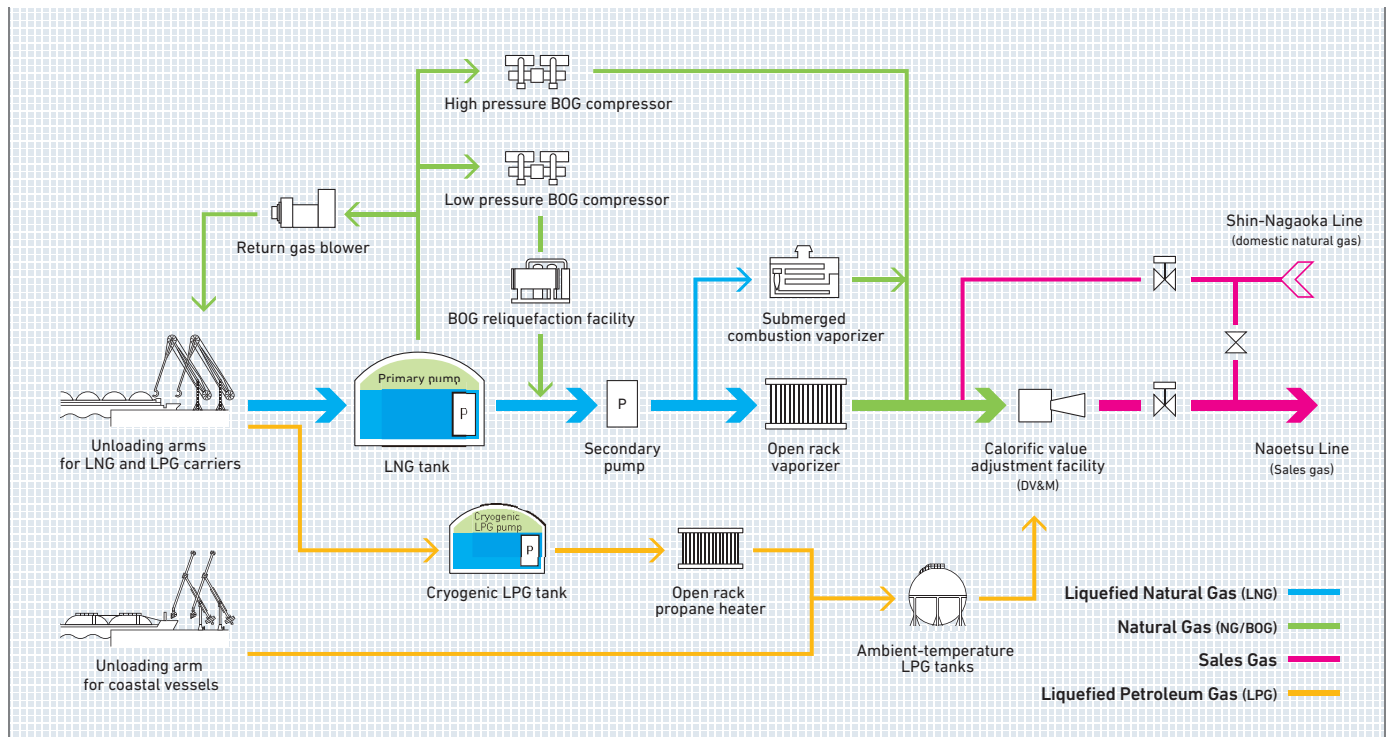
ORH uses seawater as heat source to heat the cryogenic LPG at -43°C to ambient temperature.

Central Control Building (Central Control Room)

The central control room monitors and controls all the operations at the terminal. It features redundant safety measures to ensure the terminal's operational continuity in the event of equipment malfunctions.



Process Flow Diagram



Specifications of Main Equipment

Equipment	Specifications
LNG tanks	Aboveground full-containment storage tanks 180,000kL × 2 units
Ambient-temperature LPG tanks	Spherical LPG tank 1,100t × 2 units
Cryogenic LPG tank	Aboveground full-containment storage tank 43,000kL × 1 unit
LNG BOG treatment facility	High pressure BOG compressor (Reciprocating) 8t/h × 2 units Low pressure BOG compressor (Reciprocating) 8t/h × 1 unit BOG re-liquefaction facility 8t/h × 1 unit
Cryogenic LPG BOG treatment facility	BOG compressor (Reciprocating) 4.3t/h × 2 units BOG re-liquefaction facility 8t/h × 1 unit
LNG feed pumps	Primary pump 120t/h × 6 units Secondary pump 85t/h × 4 units 40t/h × 2 units
LNG regasification facility	Open rack type vaporizer 80t/h × 3 units Submerged combustion type vaporizer 130t/h × 1 unit
Calorific value adjustment facility	Liquid/Gas calorific value adjustment (DV&M system) 400t/h

Disaster Preparedness and Environment Sustainability Measures

Safety

Water Curtain



In the event of a fire during unloading operations, a water curtain over 20min height is deployed to prevent radiant heat from affecting vessels and adjacent facilities at the terminal. Vaporized gas will also be diffused upward to quickly lower the density of gas at ground level.

Sprinkler



A sprinkler system is installed on LNG, cryogenic LPG and ambient LPG tanks. In the event of a fire, the system will spray water to cool the tanks protecting them from the radiant heat. The equipment will also prevent the fire from deforming structures and spreading to adjacent facilities.

ERS (Emergency Release System)



If emergencies including earthquake-triggered tsunami and fires as well as adverse weather and maritime phenomena occur during an LNG unloading operation, the Emergency Release System (ERS) will quickly decouple the arms from vessels without discharging liquid.

Training for Emergencies



To deal with unexpected disasters, training exercises are held regularly. These include comprehensive drills such as firefighting, rescue operations and information exchange, joint vessel-terminal drills and unilateral/coordinated drills.

Backup system

Emergency Diesel Generator and Gas Turbine Generator



The terminal has generators to cope with power outages. The diesel generator is a backup source of power to keep the terminal safe. If a power outage persists, the gas turbine generator is activated to sustain terminal operations.

Renewable energy

Photovoltaic Power Generation



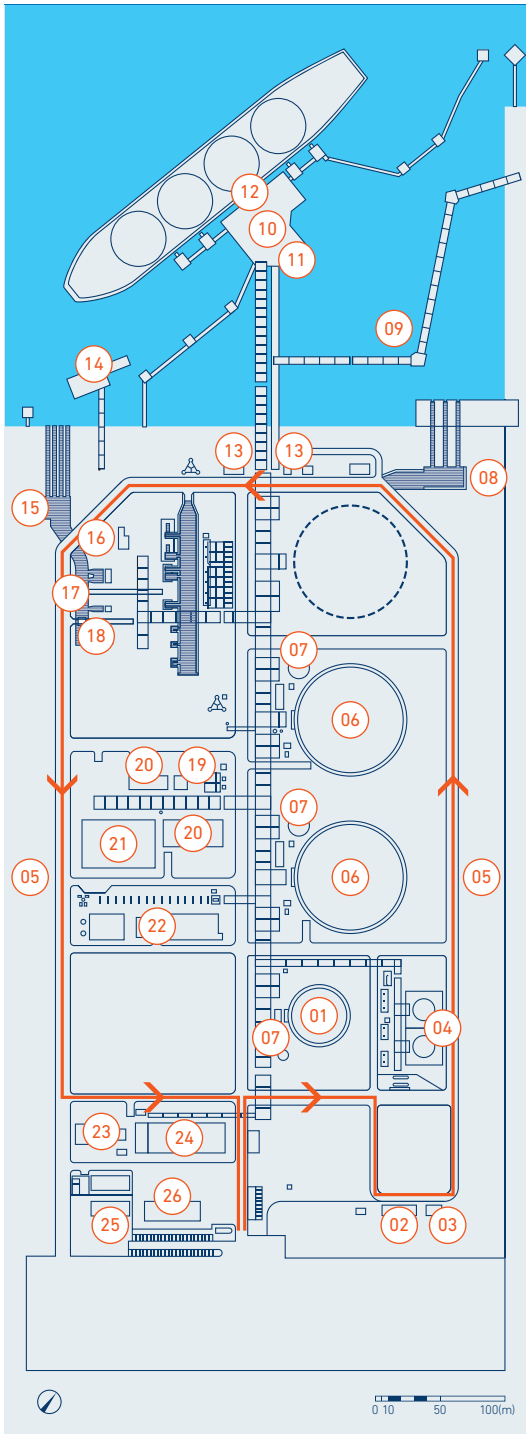
High-efficiency polycrystalline solar panels are installed on the south-east walls and roofs of the administration building and pipeline operations center. The panels which also function in snowy conditions, produce electricity that partially powers the buildings.

Environment

Tree Planting



In accordance with associated laws, 25% of the terminal's area (6.25ha) is covered with greenery and locally grown trees that have been planted to preserve the environment. The terminal's tree-planting initiative takes into account the effects of strong winds and sea salt.



- 01 Cryogenic LPG Tank**
Tank storing cryogenic LPG delivered by carriers.
• Height: approx. 38m • Diameter: approx. 47m
• Capacity: 43,000kL × 1 unit

- 02 Industrial Water Pumping Facility***
Water storage pit and pumps for industrial water used at the terminal.

- 03 High-Voltage Power Receiving Facility***
Receives high voltage power (66,000V × 2) used to power the terminal.

- 04 Ambient-Temperature LPG Tanks**
Tanks storing ambient-temperature LPG delivered to the terminal by coastal LPG tankers and tank trucks.

- 05 Embankment Vegetation**
Embankments over 6.5m tall covered in vegetation and local trees.

- 06 LNG Tanks**
Tanks storing LNG.
• Height: approx. 54m • Diameter: approx. 83m
• Capacity: 180,000kL × 2 units

- 07 Breathing Tanks**
Tanks storing nitrogen used in LNG and cryogenic LPG tanks pressure adjustment.

- 08 Seawater Intake Pit**
Pit slowing seawater intake and filtering solids.

- 09 Interconnection Pipe**
Pipe connecting the terminal and the adjacent thermal power plant enabling LNG exchange.

- 10 International LNG/LPG Jetty**
Mooring facility to unload LNG and cryogenic LPG from international LNG/LPG carriers.

- 11 Jetty Operation Building**
Operating and monitoring center for unloading operations at the international jetty.

- 12 Unloading Arms**
Piping system consisting of flanges, ERS, pipes, etc. linking carriers and onshore equipment.

- 13 Return Gas Blower***
Equipment transferring boil off gas (BOG) to unloading LNG carriers to sustain cargo tank pressure.

- 14 Coastal LPG Carrier Jetty**
Mooring facility to unload ambient-temperature LPG delivered by coastal LPG carriers.

- 15 Seawater Drain Pit**
Pit blocking the release of bubbles into the sea.

- 16 Submerged Combustion Vaporizer (SMV)**
Vaporizer regasifying LNG through heat conduction from heated water.

- 17 Open Rack Vaporizer (ORV)**
Facility used to regasify LNG through heat exchange with seawater.

- 18 Open Rack LPG Heater (ORH)**
Facility that uses seawater as heat source to heat cryogenic LPG to ambient temperature.

- 19 BOG Re-liquefaction Facility**
Facility used to re-liquefy BOG for transfer to LNG or LPG tanks or vaporizers.

- 20 BOG Compressor Facility***
Compressor for pressurizing BOG for re-liquefaction and or transfer to pipeline.

- 21 Calorific Value Adjustment Facility***
Equipment that adds LPG to vaporized gas to increase the calorific value before transfer to pipeline as sales gas.

- 22 Utility Facilities**
Equipment for cooling water, nitrogen, instrumentation air and heating water required within the process facilities.

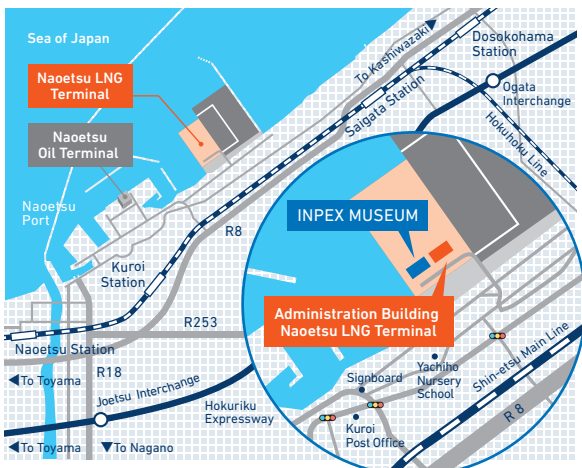
- 23 Emergency Power Generators***
Generators capable of producing sufficient electricity to ensure operational continuity during power outages.

- 24 Central Control Building**
Facility to monitor and control all terminal equipment.

- 25 Pipeline Operation Center**
Facility to monitor and operate pipeline network; also houses INPEX MUSEUM.

- 26 Administration Building**
Contains a presentation room, meeting rooms and offices for units under Domestic Energy Supply & Marketing Division.

* Equipment are stored inside buildings



INPEX
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