

Jera



# KAWAGOE

## THERMAL POWER STATION

WELCOME TO KAWAGOE THERMAL POWER STATION!

Features and key points of  
the Kawagoe Thermal Power Station

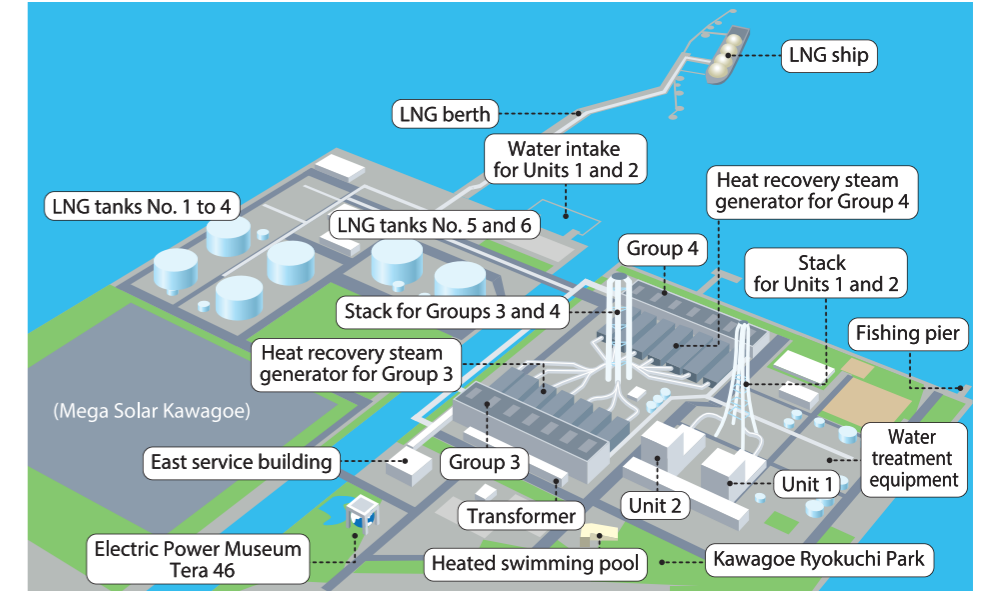
The power station generates the largest output in West Japan,  
equipped with steam units, combined-cycle units and LNG units.

# One of the largest LNG thermal power stations in the world with a total output of approximately 4,800MW

The Kawagoe Thermal Power Station is located on the coastal industrial area that faces Ise Bay. Unit 1 went into operation in 1989. With four groups operating in total, this is one of the largest thermal power stations in the world with a total output of approximately 4,800 MW. The station provides a stable supply of electricity to various areas. LNG, which is an environmentally friendly energy source, is used as fuel for power generation. Units 1 and 2 are ultra-supercritical-pressure two-stage reheat systems. This is the world's first power generation system used for large-capacity generators. It operates at the steam temperature of 566°C and main steam pressure of 31.0 MPa. Groups 3 and 4 are 1,300°C-class combined-cycle power generation systems that consist of gas turbines and steam turbines. The station also has a berth where the world's largest LNG ships can dock, six LNG tanks, and LNG vaporizers.



## Overall layout of the power station

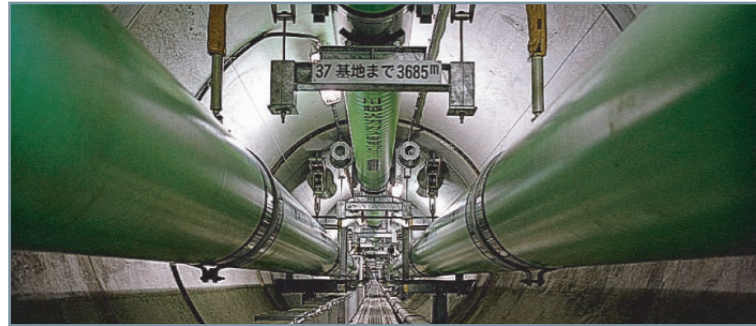


Site area: Approximately 1,240,000m<sup>2</sup>

## Outline of facilities

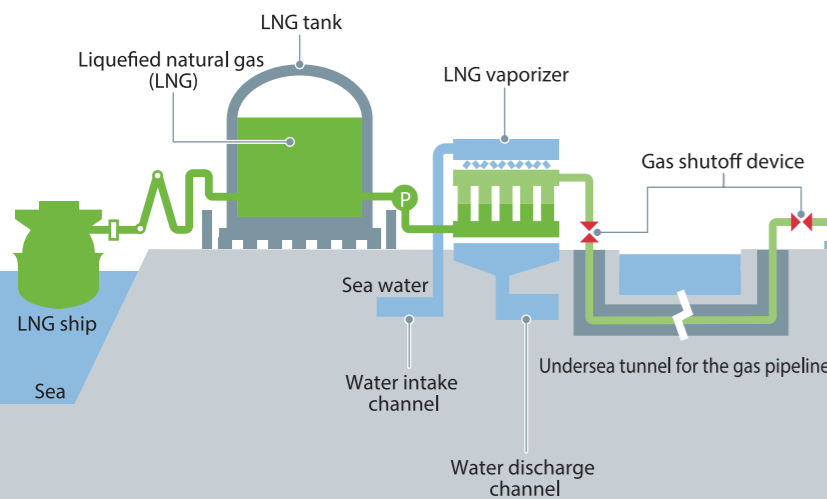
Unit No.	Output (MW)	Fuel	COD	GT combustion temperature (°C)	Power generation type	
Unit 1	700	LNG	June 1989	—	Steam	
Unit 2	700		June 1990	—		
Group 3	3-1		243	June 1996	1,300	Combined cycle
	3-2		243	August 1996	1,300	
	3-3		243	August 1996	1,300	
	3-4		243	November 1996	1,300	
	3-5		243	November 1996	1,300	
	3-6		243	December 1996	1,300	
	3-7		243	December 1996	1,300	
Group 4	4-1		243	June 1997	1,300	Combined cycle
	4-2		243	August 1997	1,300	
	4-3		243	August 1997	1,300	
	4-4		243	September 1997	1,300	
	4-5		243	September 1997	1,300	
	4-6	243	November 1997	1,300		
	4-7	243	November 1997	1,300		

## Units 1 and 2 Ultra-supercritical-pressure two-stage reheat power generation



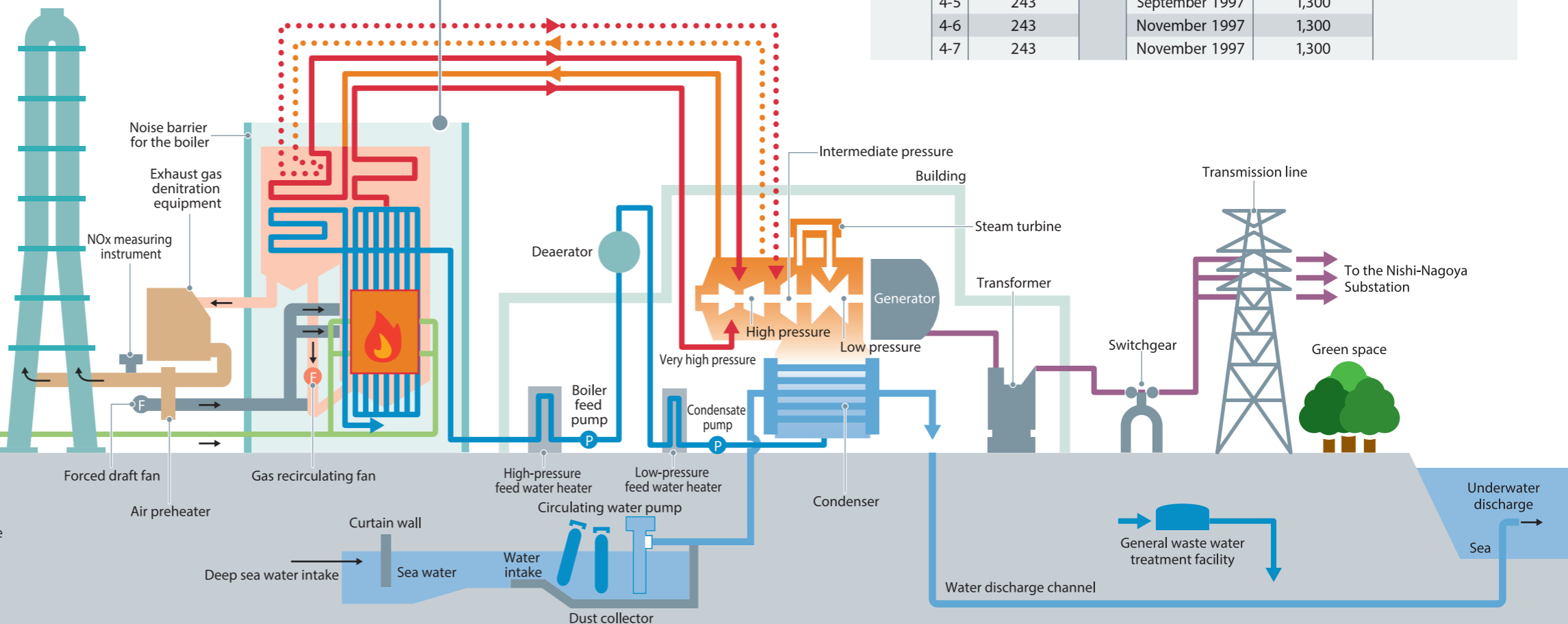
## Fuel

Liquefied natural gas (LNG) transported by LNG ships from overseas is stored at the Yokkaichi LNG Center (in Yokkaichi City). LNG is then gasified and sent to the Kawagoe Thermal Power Station through a gas pipeline (laid in the undersea tunnel) and used as fuel for Units 1 and 2.



## Boiler

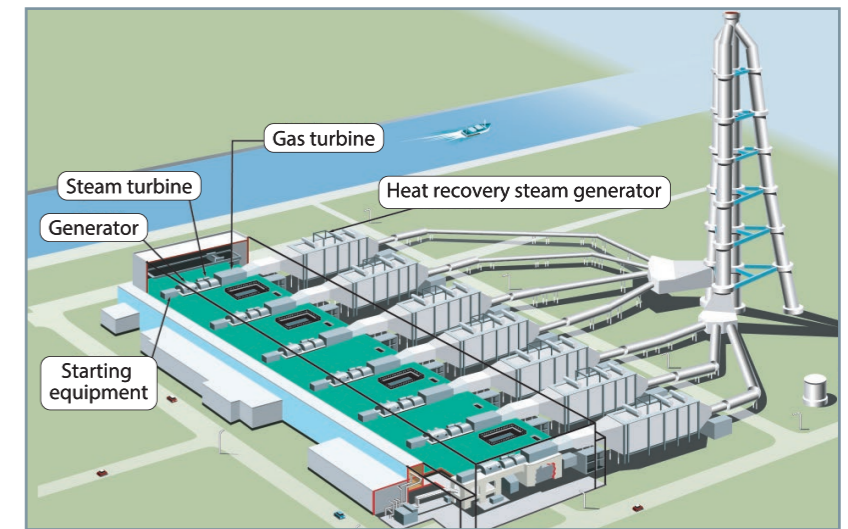
The fuel gas sent from the Yokkaichi LNG Center is burned in a boiler. The heat generated in the boiler turns the boiler water into high-temperature, high-pressure steam, which is then sent to a steam turbine.



# Groups 3 and 4 Highly efficient combined-cycle power generation

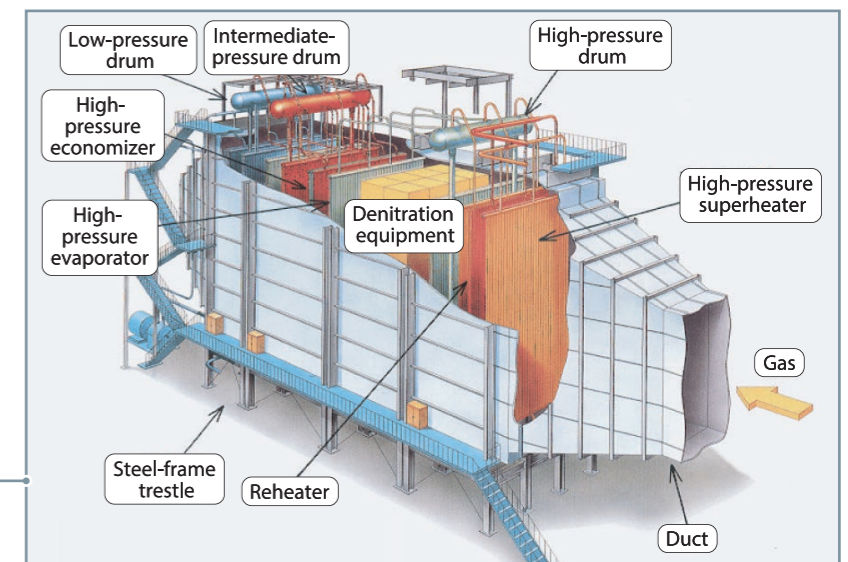
## Gas turbines and steam turbines

Fuel is burned in compressed air, and the high-temperature combustion gas (approx.1,300°C) rotates gas turbine. The exhaust gas of approx.600°C is sent to a heat recovery steam generator to form steam and drive a steam turbine. Each group consists of seven generators, which are stopped one by one when the electricity consumption is small to keep the thermal efficiency of operation high. Electricity of 3,402 MW in total is generated by 14 gas and steam turbines (243 MW each).



## Plant configuration

The powertrain of the power generation system consists of one starting equipment, one generator, one steam turbine, one gas turbine, and one heat recovery steam generator. Groups 3 and 4 each have seven power generation systems.



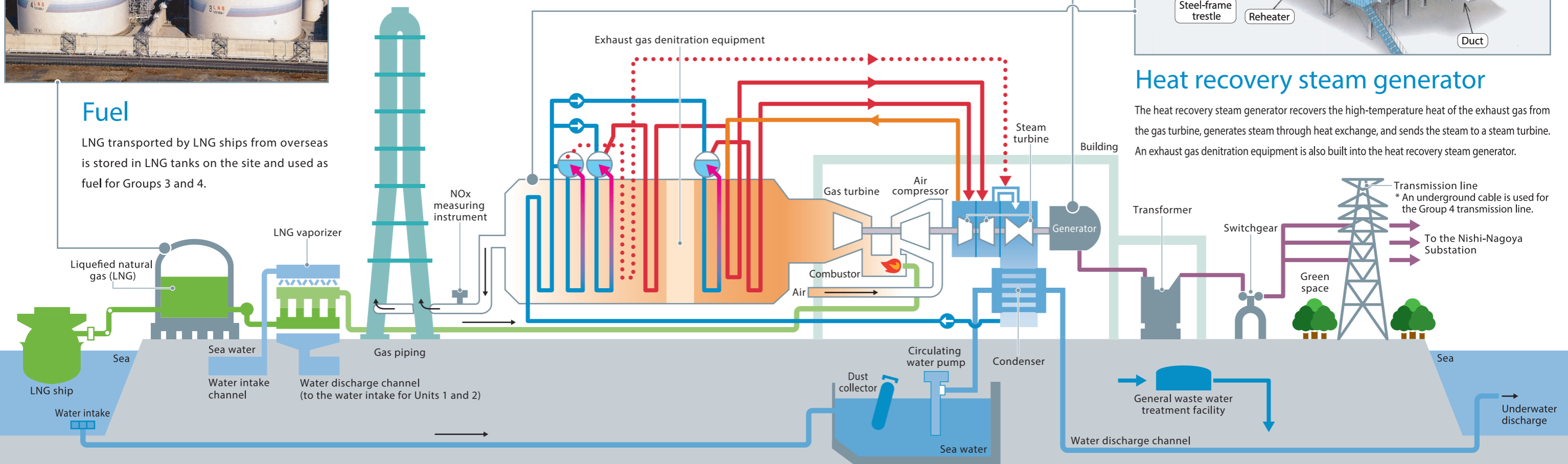
## Heat recovery steam generator

The heat recovery steam generator recovers the high-temperature heat of the exhaust gas from the gas turbine, generates steam through heat exchange, and sends the steam to a steam turbine. An exhaust gas denitration equipment is also built into the heat recovery steam generator.



## Fuel

LNG transported by LNG ships from overseas is stored in LNG tanks on the site and used as fuel for Groups 3 and 4.



# LNG equipment

- Receiving berth
- Storage tank
- Vaporizers



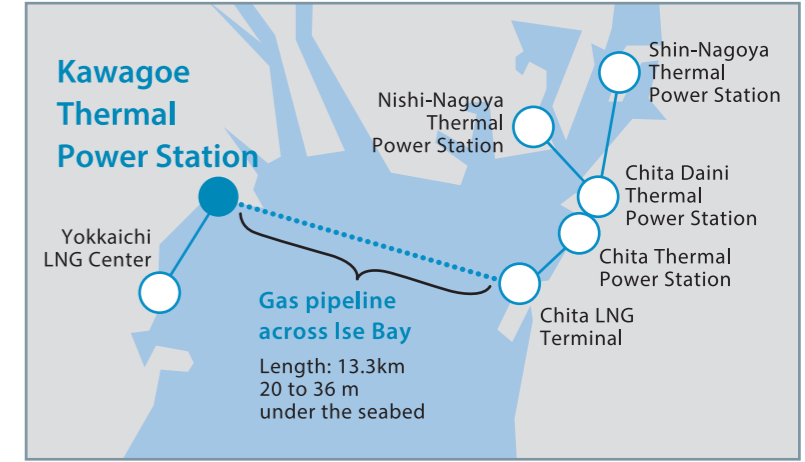
## LNG is a liquid of very low temperature.

LNG stands for Liquefied Natural Gas (predominantly methane), that has been cooled down to around -162°C to be liquefied. Cooling and liquefaction reduces the volume of the natural gas to approximately 1/600th. It makes possible to transport in large quantities. When natural gas is liquefied at the production site, dust and sulfur contained in the gas are removed. So LNG is a clean fuel when it is burned.

## Storage tank

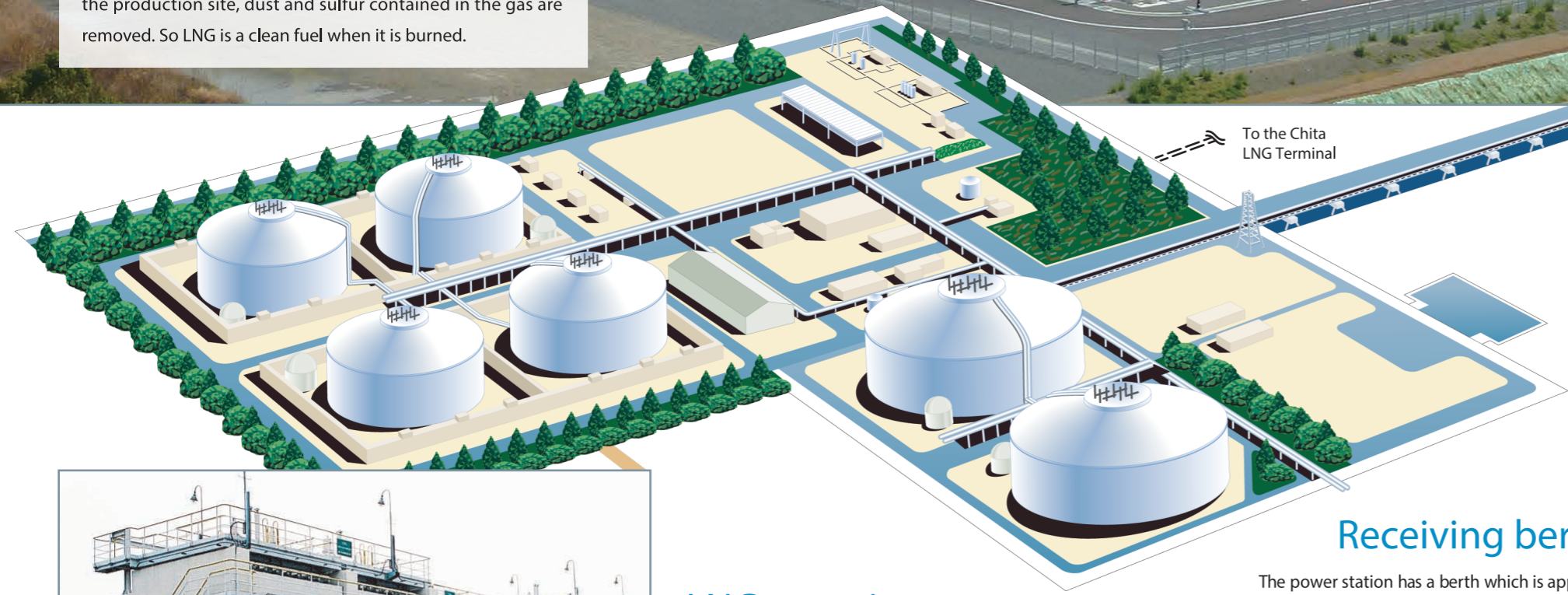
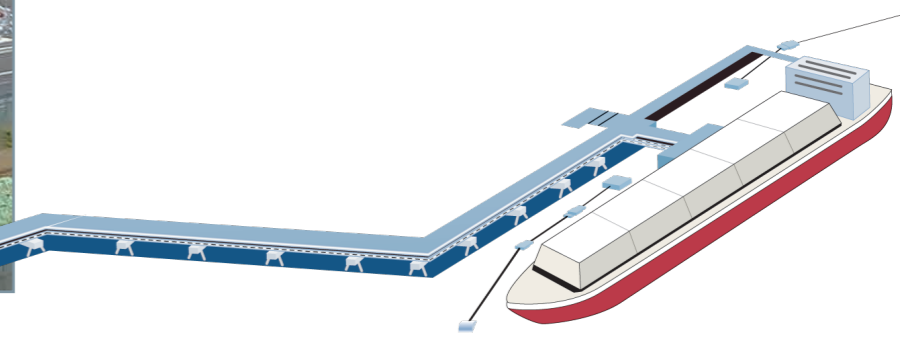
Around -162°C LNG is unloaded from LNG ships and stored in 6 tanks.

- 120,000 m<sup>3</sup> (75 m in diameter, 45 m high): 4 tanks
- 180,000 m<sup>3</sup> (85 m in diameter, 60 m high): 2 tanks



## Gas pipeline across Ise Bay

The Kawagoe Thermal Power Station is connected to the Chita LNG Terminal via a pipeline to provide a backup system between LNG terminals, achieve flexible and efficient operation, and improve the reliability of fuel supply to the power station.



## LNG vaporizer

LNG stored in a tank is pumped to a vaporizer and is warmed by the sea water for evaporation. The evaporated gas is sent to the gas turbines of Groups 3 and 4 and the gas pipeline across Ise Bay.



## Receiving berth

The power station has a berth which is approximately 500 m long where the world's largest LNG ships can dock, each with the capacity of 260,000 m<sup>3</sup> (approximately 350 m long and 55 m wide). The pipe of a docked LNG ship is connected to a shore pipe using a loading arm, then the ship's pump is used to unload LNG to an LNG tank on the shore.



# Environmental Initiatives

## Preventing air pollution

The power station is fueled with LNG and therefore does not discharge the sulfur oxides which are the cause of particulate matter and acid rain. The use of low-NOx burners and exhaust gas denitration equipment has also reduced the discharge of nitrogen oxides. The white smoke rising from the plant stacks on cool days is steam.

## Keeping the oceans clean

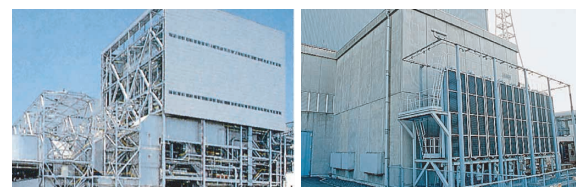
The equipment cleaning water and general waste water generated at the power station undergoes pre-processing such as oil separation and neutralization. It is then purified by means of condensation, sedimentation, filtration and neutralization, and the water quality is checked before it is discharged.

## Protecting the global environment

Since power stations make use of the earth's enriched resources, it is important to achieve high level of thermal efficiency when generating electricity due to preservation of the global environment. In addition, greater generating efficiency means that less carbon dioxide, which causes global warming, is produced. We are committed to conserve the earth's finite resources and curb global warming by leveraging the technical capabilities we have accumulated over the years and by introducing highly efficient power generating equipment.

## Installation of an exhaust gas denitration equipment

Exhaust gas denitration equipment that uses the dry ammonia catalytic reduction method is installed to reduce nitrogen oxides in the exhaust gas. It adds ammonia gas to the exhaust gas to turn the nitrogen oxides into harmless nitrogen and water.



## Prevention of noise

To minimize noise, the turbines and generators are located indoors, noise barriers are installed around transformers, the safety valve at the top of each boiler is fitted with a silencer to reduce the steam exhaust noise, and noise barriers are installed around the boilers.

# Facilities to ensure harmony with the local community

## Kawagoe Electric Power Museum Tera 46

**This pavilion is designed like a theme park. Visitors can learn how energy is used in daily life through experience while having fun.**

Open: 9:00 to 16:00 (closed at 16:30)

Closed: Mondays (on the following day if Monday falls on national holiday and substitute holiday), third Friday of every month, New Year holidays

\* For details, visit the website.

<http://www.jera.co.jp/kawagoe-pr/>

Admission: free Tel: +81-59-363-6565



## Kawagoe Thermal Power Station heated swimming pool

**Enjoy swimming in any season or weather.**

Open: 12:00 to 20:00 on weekdays (Tuesday to Friday) 10:00 to 18:00 on Saturdays, Sundays, and national holidays

Closed: Mondays (on the following day if Monday falls on national holiday and substitute holiday), New Year holidays, during periodic inspections

Admission Fee: 400 yen for adults, 150 yen for children (junior high school student or younger) Tel: +81-59-366-0066



## Kawagoe Green Park

**This long and narrow park runs from east to west. It features a flower bed, lawn square, and promenade.**

Admission: free



## Fishing pier

**The 65-m fishing pier at the mouth of the Asake River is open 24 hours.**

Admission Fee: free

The pier may be closed when a weather advisory or warning is issued.

