LNG Training of Tokyo Gas

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Outlook for Natural Gas Consumption

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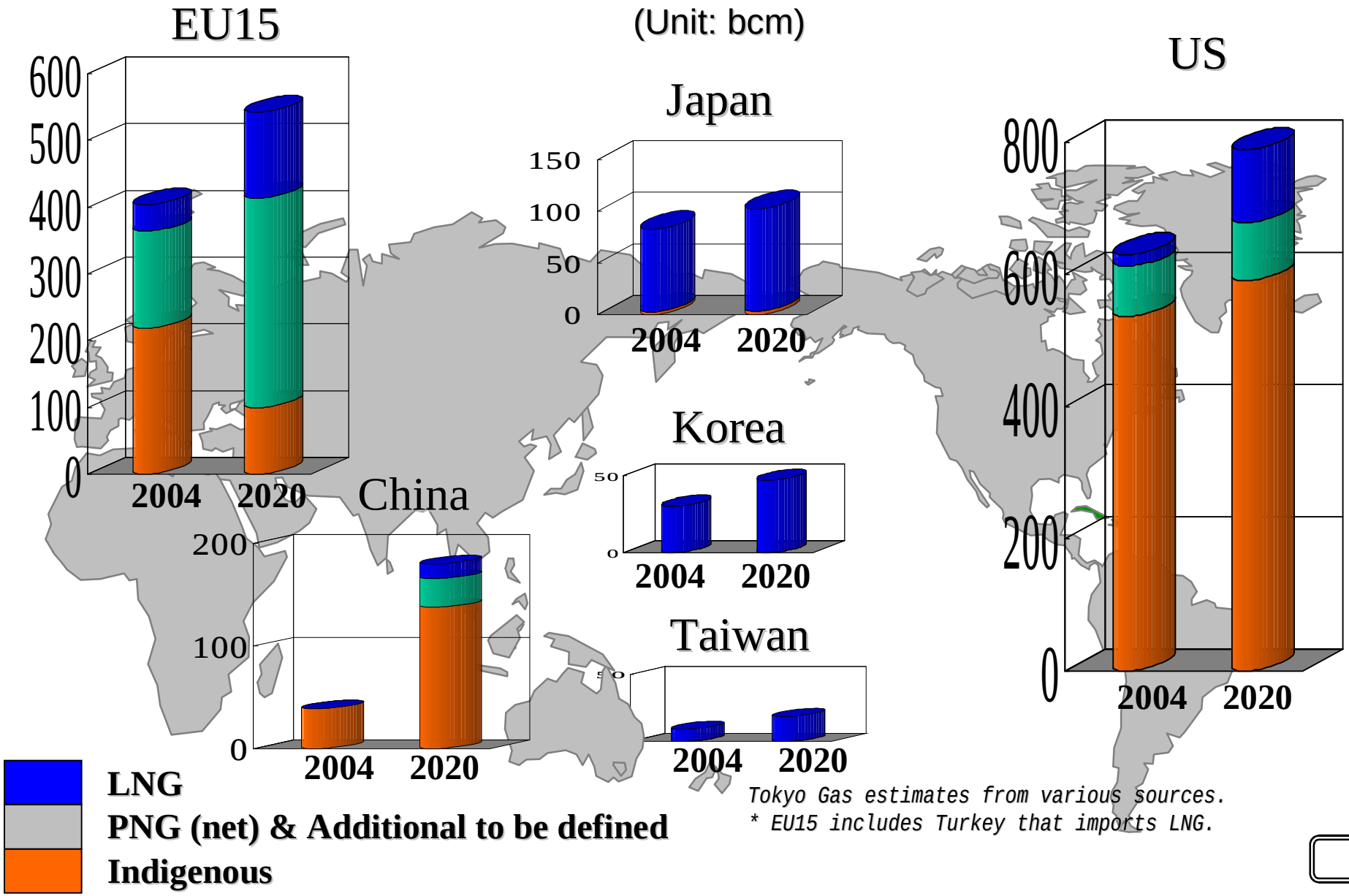

Tokyo Gas estimates from various sources.
** EU15 includes Turkey that imports LNG.*

LNG Receiving Terminals in Japan

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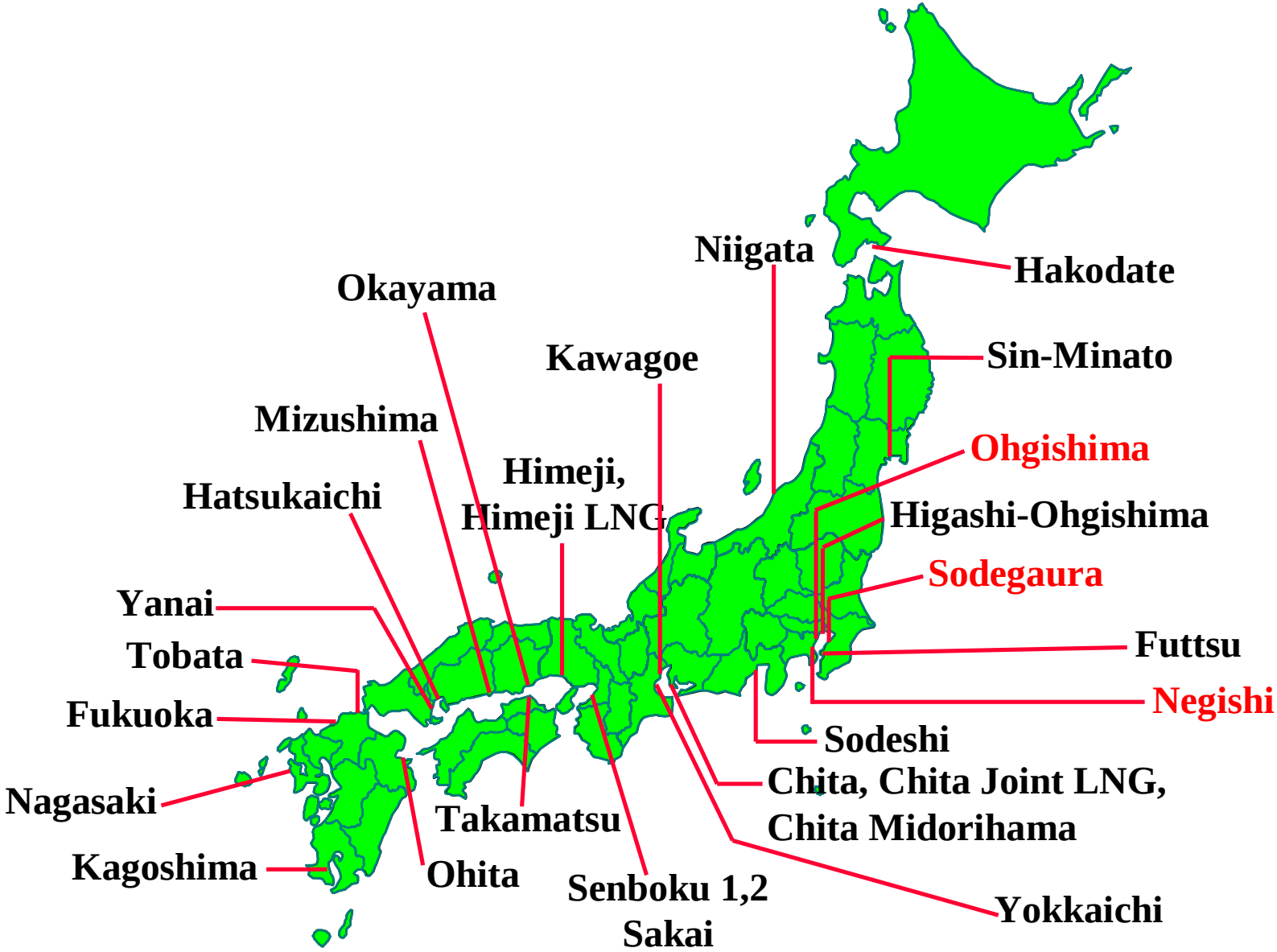

Philosophy of LNG Training

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- LNG is extreme low-temperature liquid at -162 degrees Celsius, which has unique property. Special knowledge and know-how are needed to handle LNG with safe at high level in both operation and maintenance.
- Tokyo Gas has the experience over 35 years all about LNG in operation, maintenance, and engineering with the great extent of knowledge and know-how. No serious incidents have occurred in the LNG history of Tokyo Gas with high reputation in terms of safety and security.
- The special engineers and operators have been brought up and trained with our profound education and training program.
- As many LNG terminals are being constructed in the world, to train competent LNG engineers and operators is getting more important while it is not easy task.

Training Curriculum for Tokyo Gas

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- Based on our experience for over 35 years, the competency to operate and maintain LNG terminal is established in Tokyo Gas.
- To meet the competency, training curriculum was established and classified in some levels and subjects.
  - Basic, Advanced, and Senior courses
  - Operation, Mechanical, Electricity, and Instrumentation
- Our engineers learn all the courses in their first year and operators learn them within three years.
- We usually share the Basic course with other companies.

	Operation	Maintenance		
		Mechanical	Electricity	Instrumentation
Basic	Training curriculum for the other companies			
Advanced				
Senior				

Training Curriculum for Other Companies

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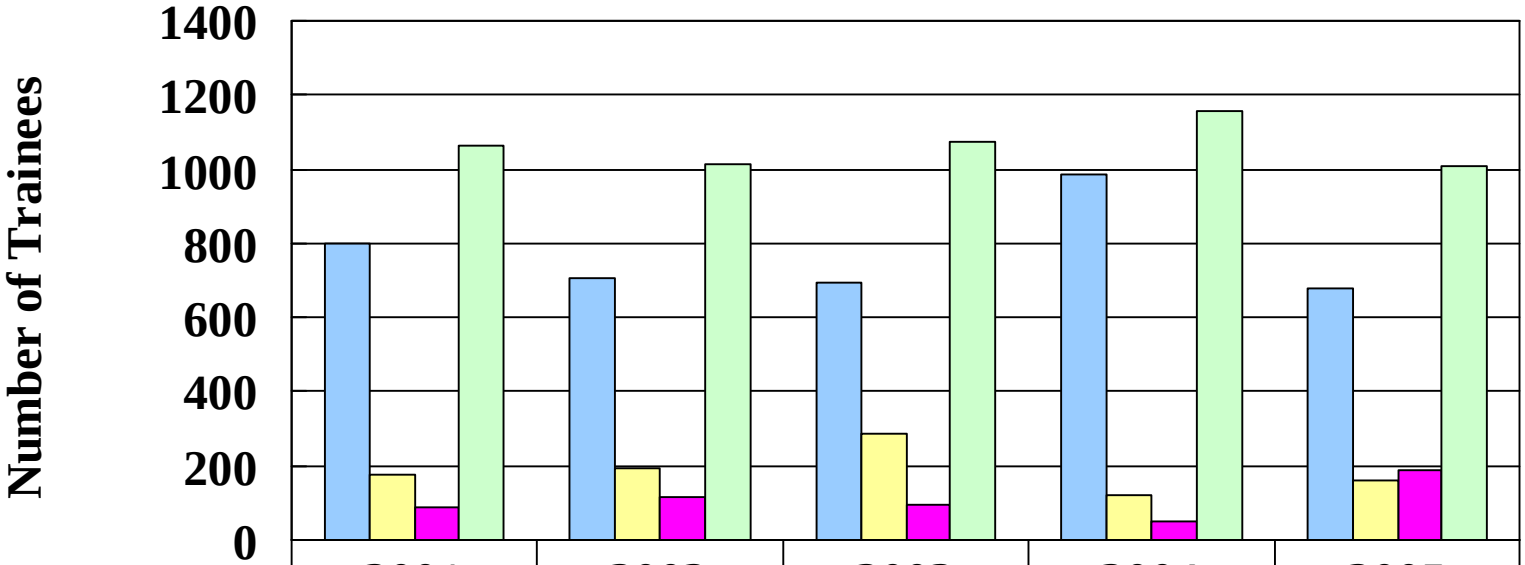
- We normally provide two week course as a general training course. However, the curriculum can be customized. Trainers can go to trainees' site and give the training there as well.
- To deepen their understanding, detailed lecture is provided first. It covers characteristic of LNG, LNG storage tanks, in-tank pumps, vaporizers, BOG compressors, piping and valves, welding and corrosion, receiving terminal operation, procedure of LNG receiving, roll-over prevention, quality control, measurement, and safety and security.
- Photographs and videos help them to understand the tips of operation and maintenance.

Education and Training Record



	2001	2002	2003	2004	2005
Production Dept.	799	706	692	986	676
Other Dept.	177	192	289	124	162
Other Companies	90	117	95	48	189
Total	1066	1015	1076	1158	1007

Mechanical Engineering

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Course	Principal coverage
Machine Specialist - Basic Course	- What is equipment management? - Measuring instruments - taking measurements with calipers and micrometers - Valve structures and features - ordinary valve disassembly / assembly / maintenance / leakage testing - What is non-destructive testing? (solvent-removable penetrant testing, magnetic particle testing) - Piping materials - Machine drawings, piping drawings - how to draw piping isometrics - Outline of welding and welding management - Lubricant management - Work management

Electrical Engineering

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Course	Principal coverage
Electrical Specialist - Basic courses	- Basics of electricity measurement and circuit theory - Knowledge of safe handling of electricity - Plant safety knowledge - Knowledge concerning power costs - Basic knowledge of sequence control - Practical learning using sequence boards - Basic knowledge of protective power supplies - Basics of motors

Instrumentation Engineering

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Course	Principal coverage
Instrumentation Specialist - Basic course	- General instrumentation, Equipment management - Systems of units, Instrumentation terminology - Reading drawings, basic analog/digital loop configuration and sequences - Automatic control - Flow, pressure, temperature measurement principles and adjustment - Control valve principles and adjustment - Rack and panel instruments - Positioner principles and adjustment - Tools and measuring instruments - Materials and inspection

Operation Engineering

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Course	Principal coverage
Manufacturing - Basics Course	- Basic knowledge [basic properties of gases, physical properties and handling of city gas and LNG, operation of LNG plants, utility equipment] - Learn about gas quality control and operation work-study [Experience operation using a training simulator] - Operation work-study [ORV start-up and shut-down, calorific value adjustment plant]

Bowing

Liquid Seal

Terminal Tours

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- Terminal tours to Negishi, Sodegaura and Ohgishima terminals give trainees real experience in actual situation of LNG terminal.
- Observation of LNG vessel berthing and unloading are scheduled as well.
- Trainees walk throughout our receiving terminals and observe actual equipments and dismounted equipments for the maintenance if available.
- Trainees get a practical explanation of operation in detail.

Negishi Terminal

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First LNG terminal in Asia

- **Storage capacity: 1.2mkl**
- **Start of operation: 1966**
- **Cryogenic power generation**

(Image view)

LNG Cryogenic Power Generation

(Image view)

Cold Warehouse by LNG Cryogenic Energy

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Dry Ice Production by LNG Cryogenic Energy

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Sodegaura Terminal

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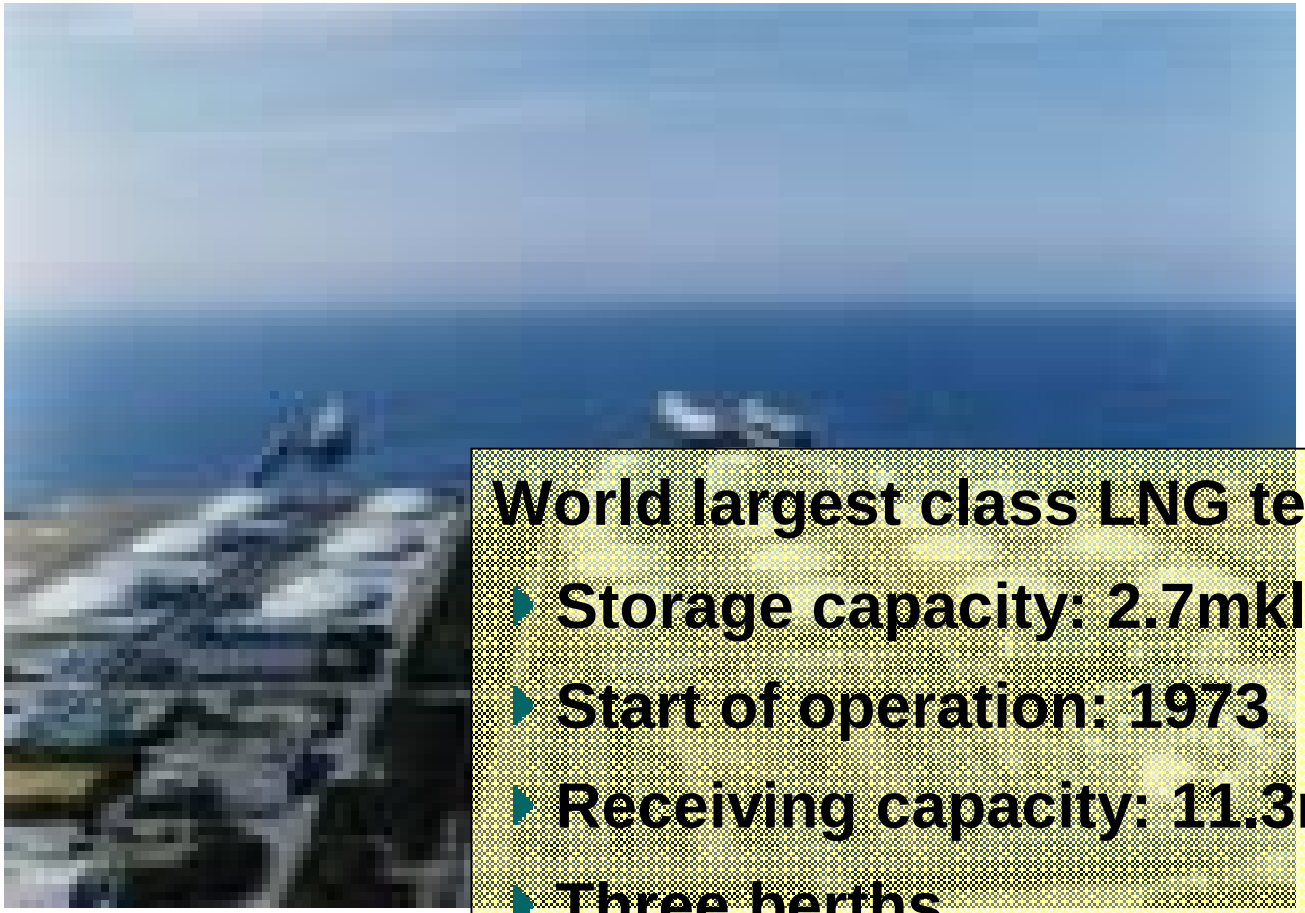

(Image view)

World largest class LNG terminal

- Storage capacity: 2.7mkl
- Start of operation: 1973
- Receiving capacity: 11.3mtpa
- Three berths

Tokyo Gas Bay Power

(Image view)

Power generation at LNG terminal

- **Specification　　：1shaft GTCC**
- **Output　　：102.89MW（11℃)**
- **Efficiency：45%（HHV)**

Lorry and Satellite Terminal

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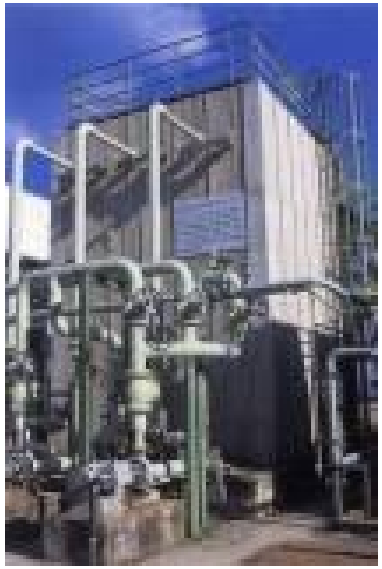
LNG tank

LNG lorry

(Image view)

Air-fin type vaporizer



Open rack type vaporizer

Small scale LNG terminal for detached inland supply area

- **7,700 cargos in 2004**

Ohgishima Terminal

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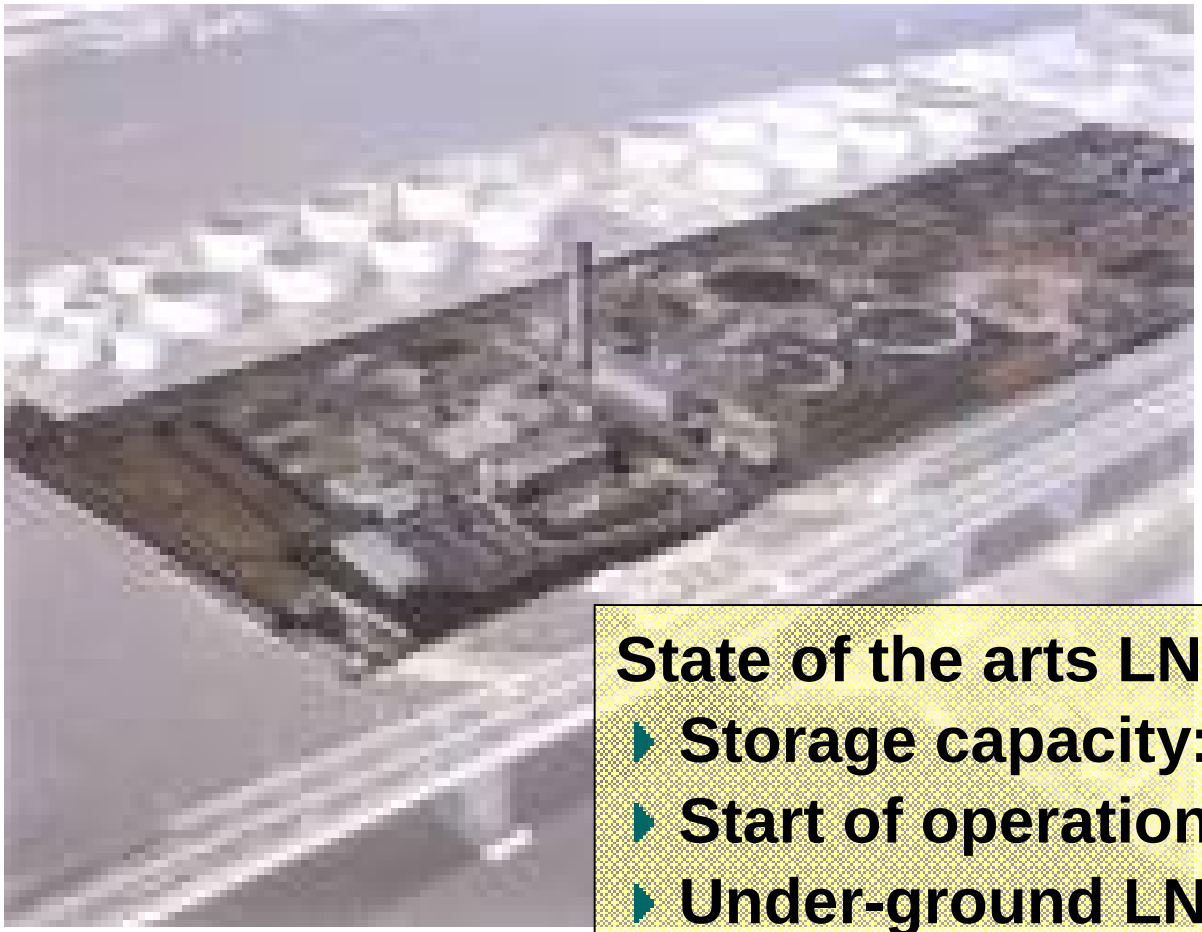
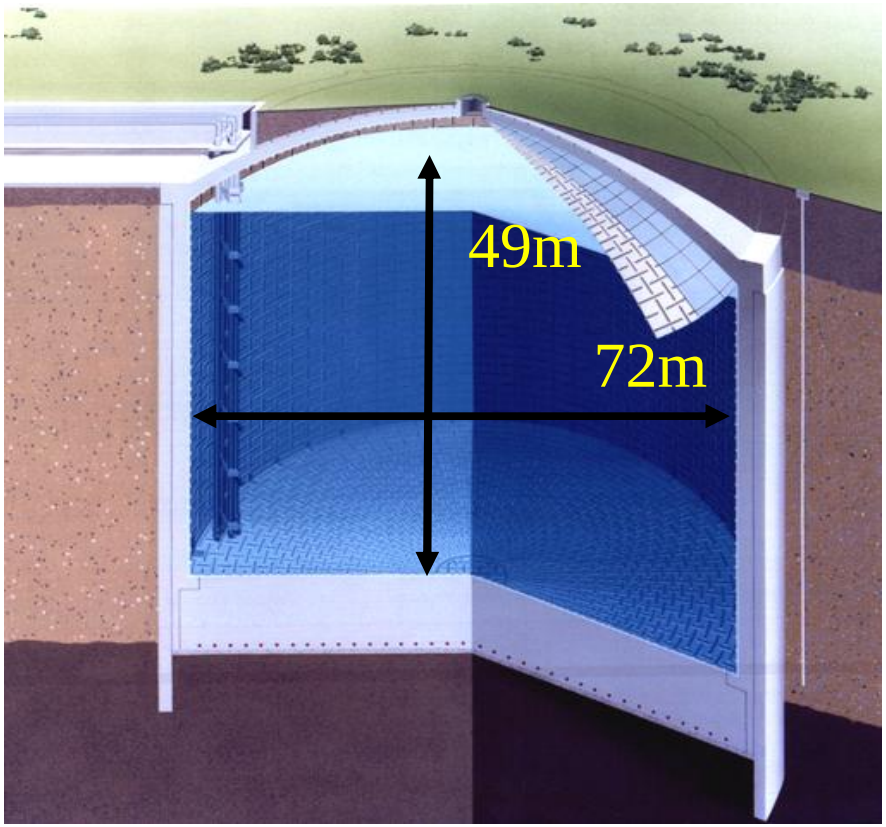


(Image view)

State of the arts LNG terminal

- **Storage capacity: 0.6mkl**
- **Start of operation: 1998**
- **Under-ground LNG tank**

The Safest LNG Tanks in the World



(Image view)

Under-ground Tank at Tokyo Gas, Ohgishima Terminal

Conclusion

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- Tokyo Gas has remarkable track record of stable and safe LNG handling with its specially established education and training program.
- LNG education and training program can provide trainees with a wide variety of LNG knowledge and know-how in response to the requirements of LNG industry. We have accepted lots of trainees so far from both domestic and overseas companies.
- We are convinced that our education and training program will be extremely worthwhile for not only inexpert but also experienced engineers and operators of LNG terminals to get new and useful knowledge and skills.

End of Presentation