
LNG Training of Tokyo Gas



Yutaka Shirakawa

Senior Manager, Energy Production Department

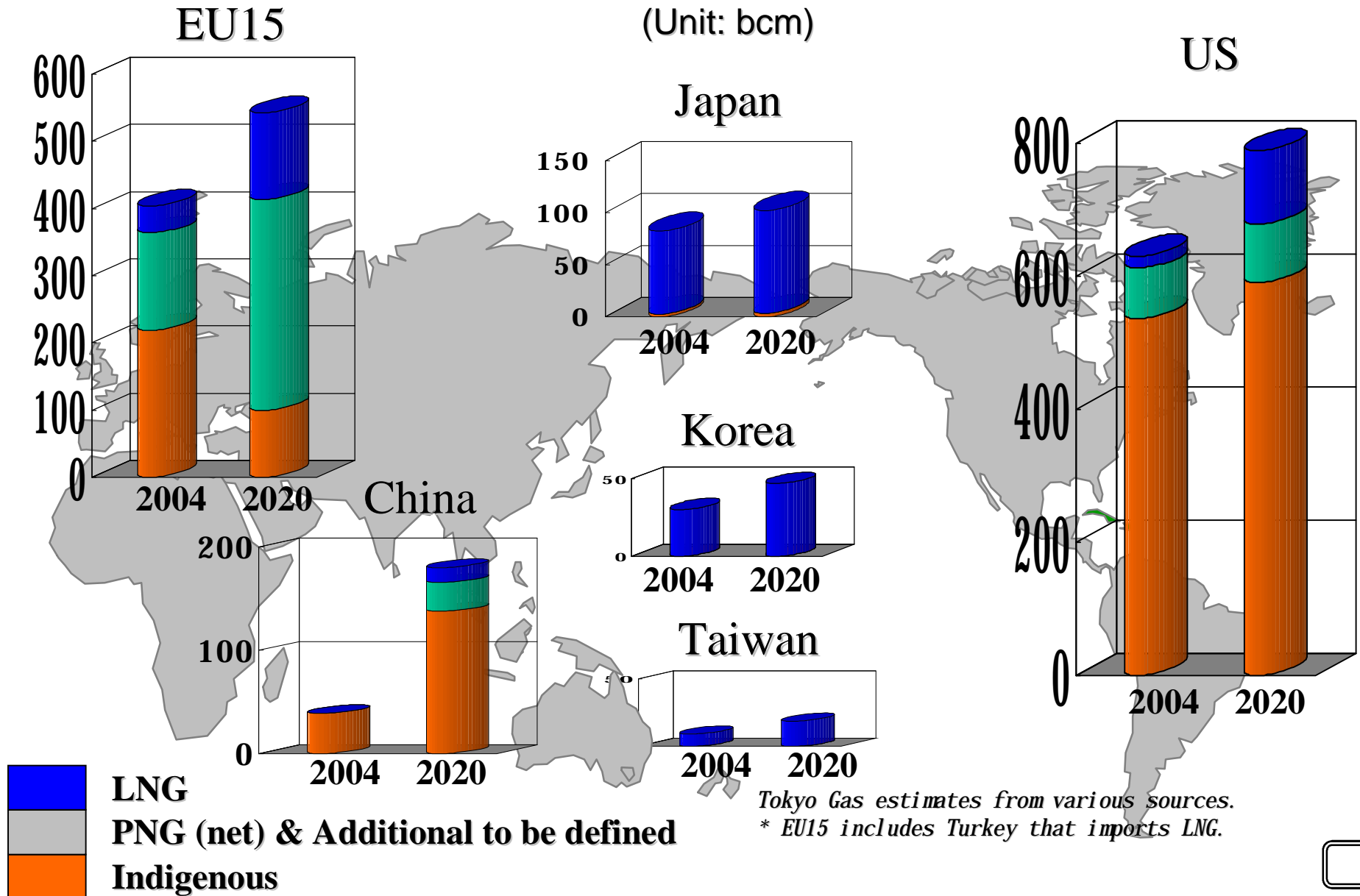
Tokyo Gas Co., Ltd.

▶The information in this presentation is based upon forecasts and reflects prevailing conditions and our view as of this date, all of which are accordingly subject to change. In preparing this presentation, we have relied upon and assumed, without independent verification, the accuracy and completeness of all information available from public sources.

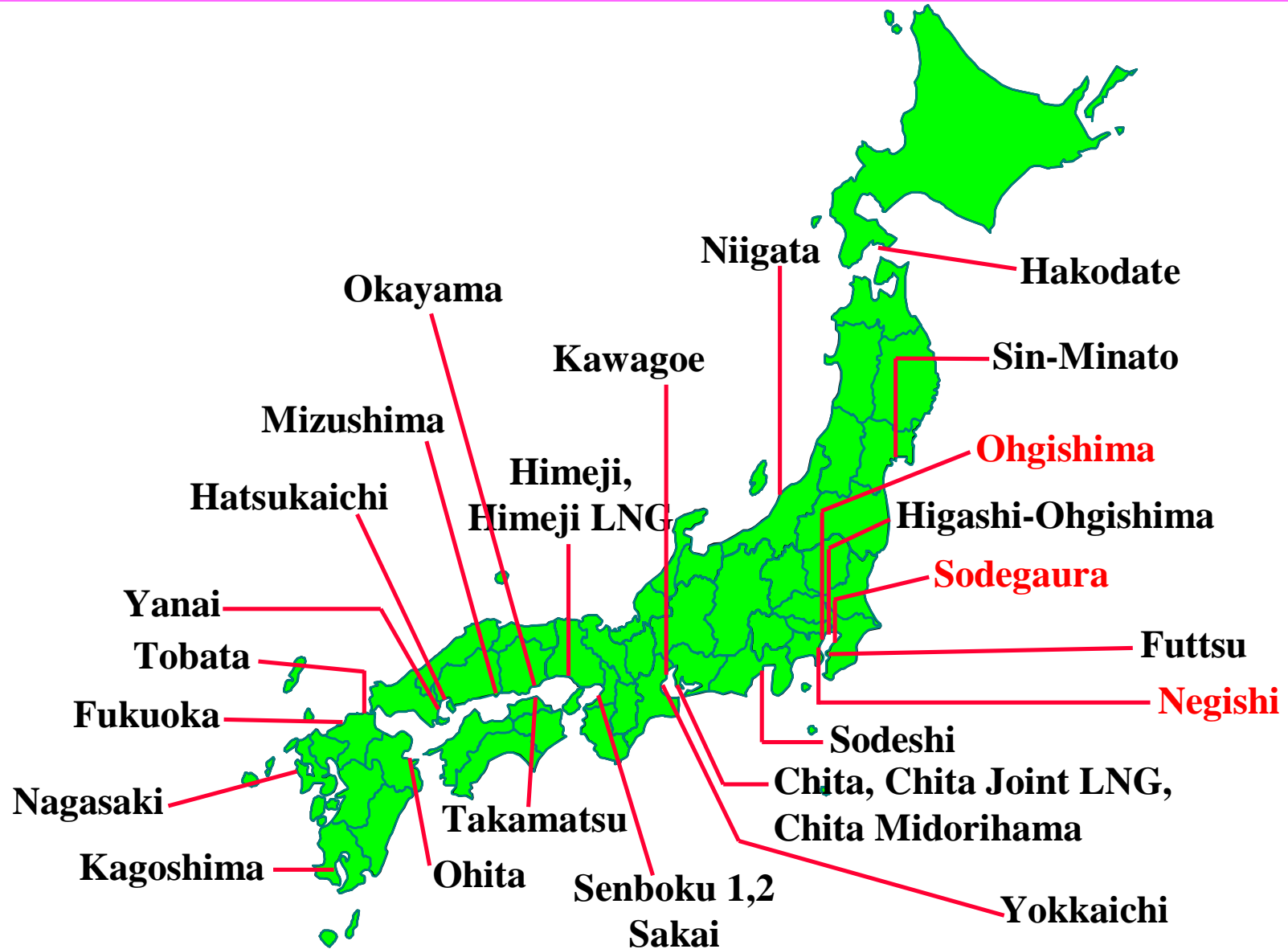
▶This presentation was prepared by Tokyo Gas Co., Ltd exclusively for GASEX 2006(the “Purpose”). Neither this document nor any of its contents may be used for any other purpose without the prior written consent of Tokyo Gas. Unless agreed otherwise, this presentation shall remain the property of, and shall be treated as confidential and proprietary to Tokyo Gas.

▶This presentation is presented for discussion and illustrative purposes only. Tokyo Gas expressly disclaims any liability relating to, resulting from the use or omissions from any of the information or statements contained herein.

Outlook for Natural Gas Consumption



LNG Receiving Terminals in Japan



Philosophy of LNG Training

- ▶ 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



- ▶ 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.

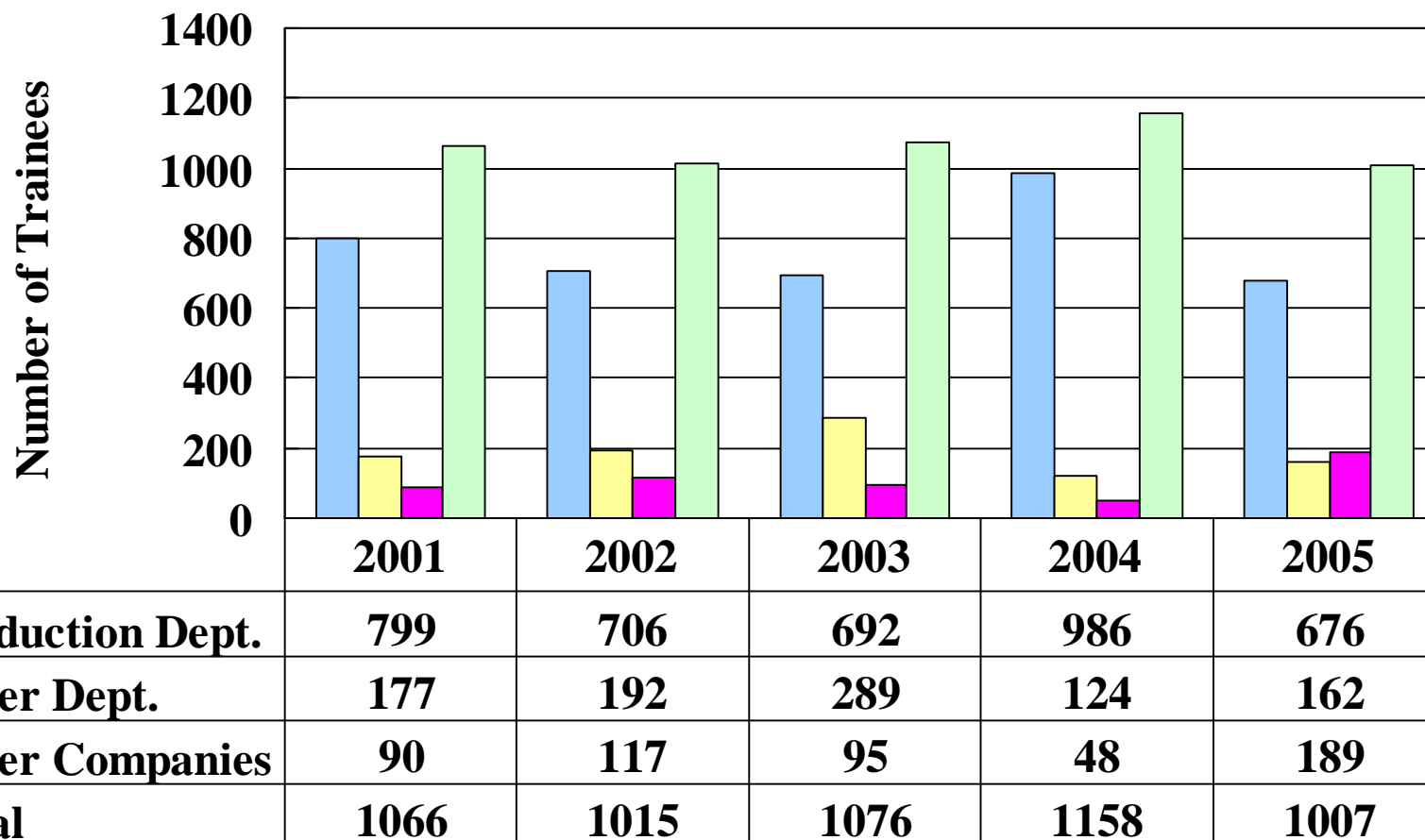
	Operation	Maintenance		
		Mechanical	Electricity	Instrumentation
Basic		<u>Training curriculum for the other companies</u>		
Advanced				
Senior				

Training Curriculum for Other Companies



- ▶ 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



Mechanical Engineering

Course	Principal coverage
Machine Specialist - Basic Course	<ul style="list-style-type: none">- 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

Course	Principal coverage
Electrical Specialist - Basic courses	<ul style="list-style-type: none">- 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

Course	Principal coverage
Instrumentation Specialist - Basic course	<ul style="list-style-type: none">- 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

Course	Principal coverage
Manufacturing - Basics Course	<ul style="list-style-type: none">- 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

- ▶ 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 dismantled equipments for the maintenance if available.
- ▶ Trainees get a practical explanation of operation in detail.

Negishi Terminal



- First LNG terminal in Asia**
- ▶ **Storage capacity: 1.2mkl**
 - ▶ **Start of operation: 1966**
 - ▶ **Cryogenic power generation**

(Image view)

LNG Cryogenic Power Generation

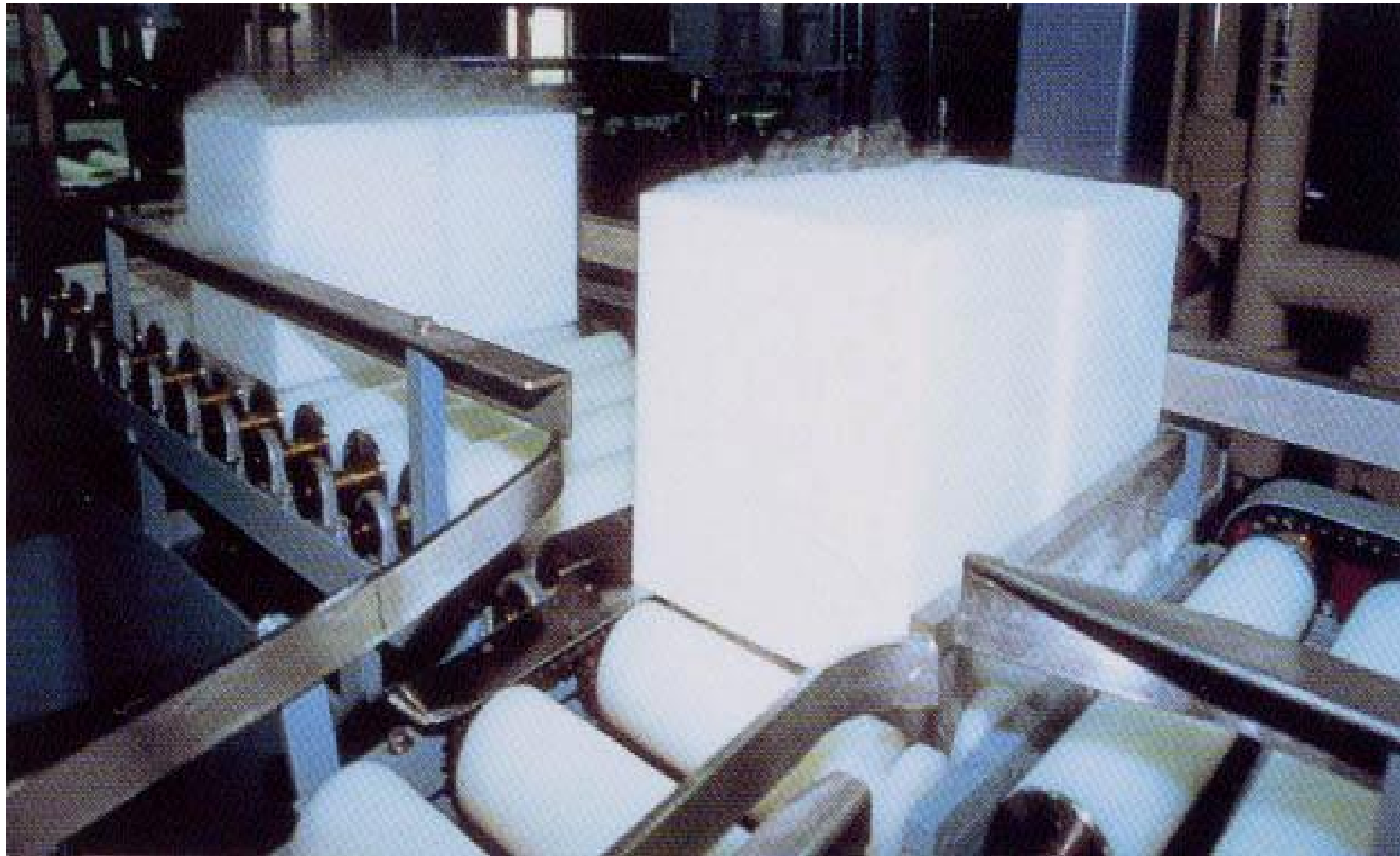


(Image view)

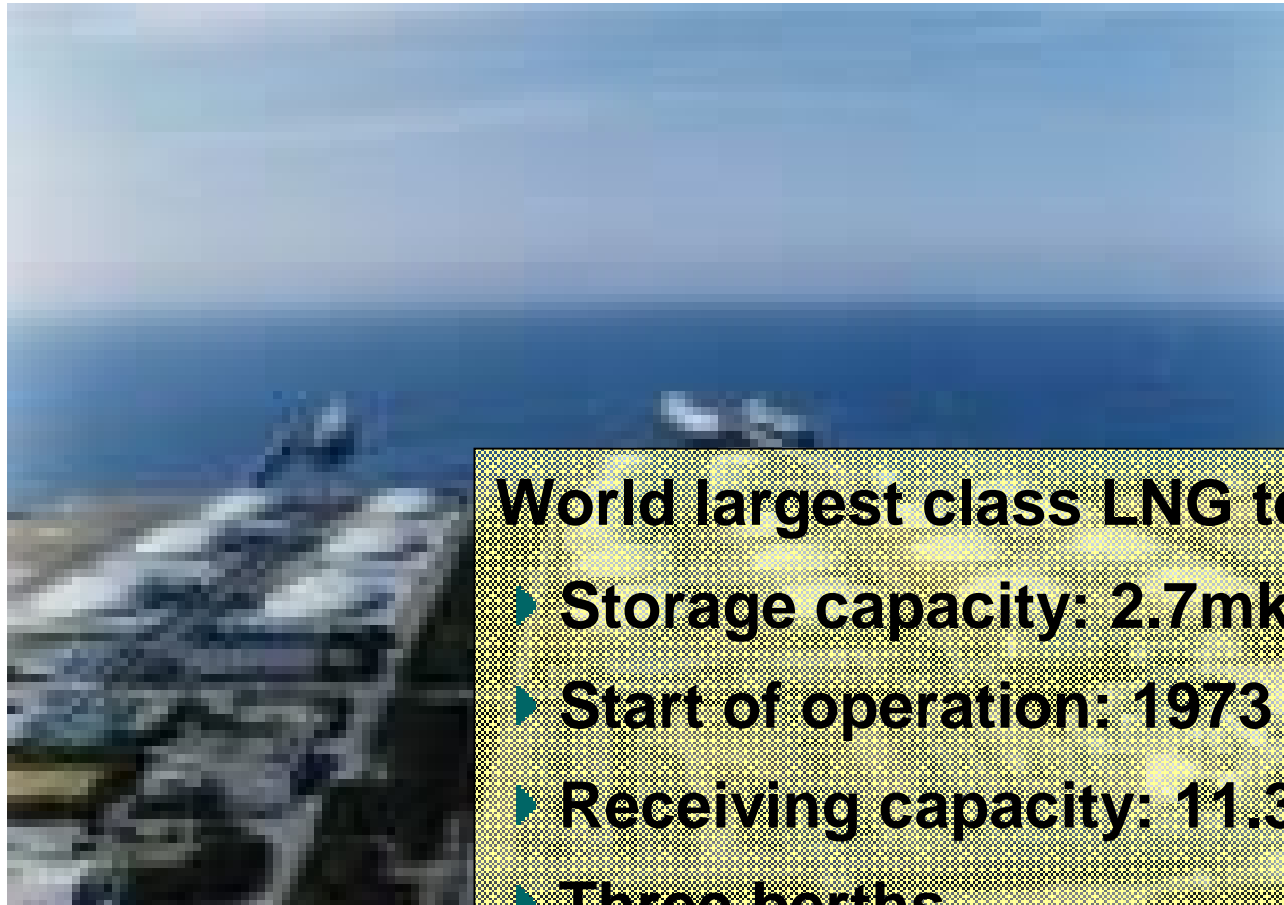
Cold Warehouse by LNG Cryogenic Energy TOKYO GAS



Dry Ice Production by LNG Cryogenic Energy



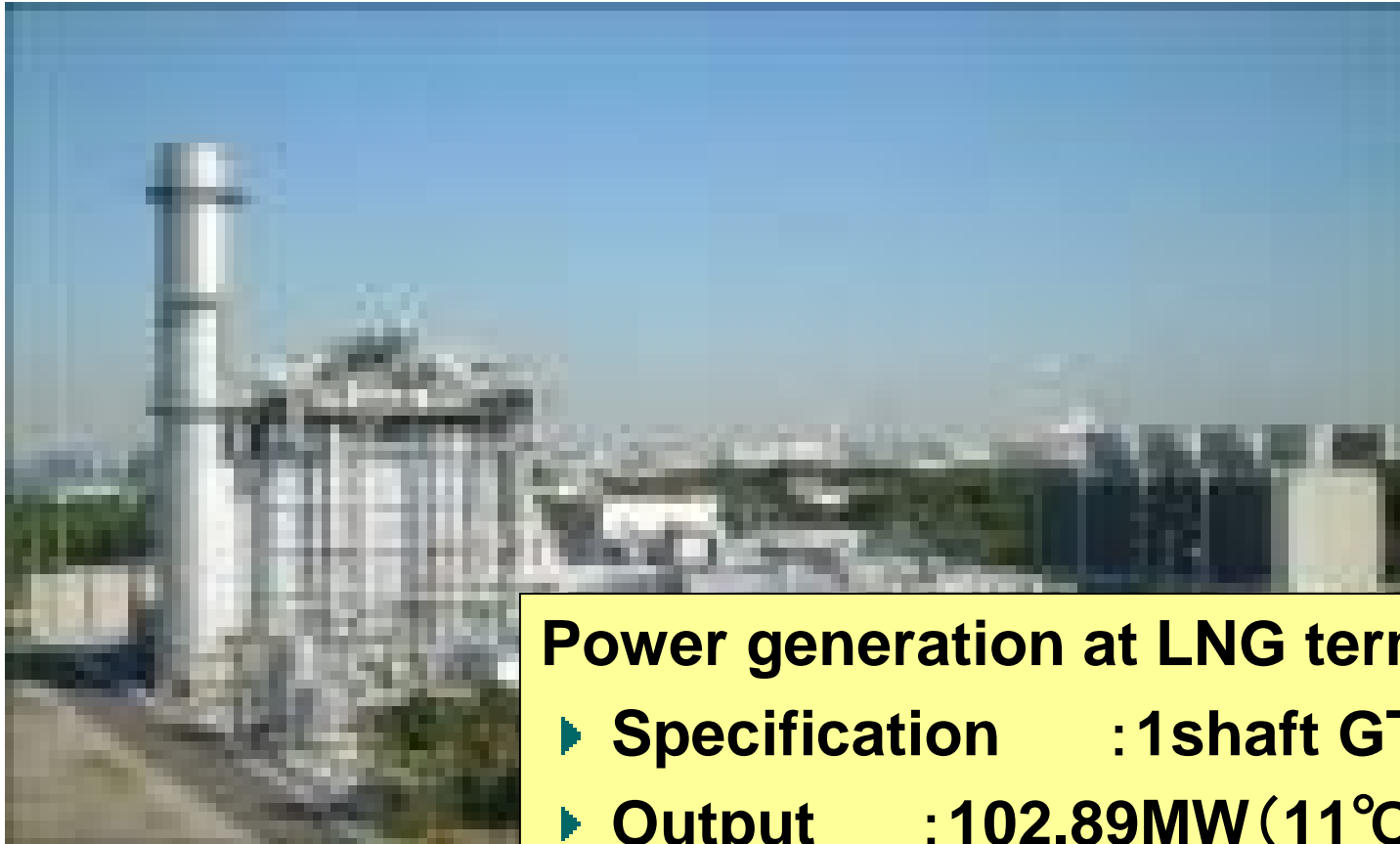
Sodegaura Terminal



World largest class LNG terminal

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

(Image view)



(Image view)

Power generation at LNG terminal

- ▶ Specification : 1 shaft GTCC
- ▶ Output : 102.89MW (11°C)
- ▶ Efficiency : 45% (HHV)

Lorry and Satellite Terminal

LNG lorry



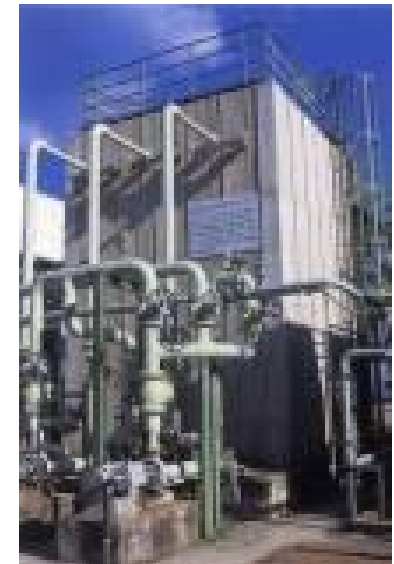
(Image view)



LNG tank



Air-fin type vaporizer

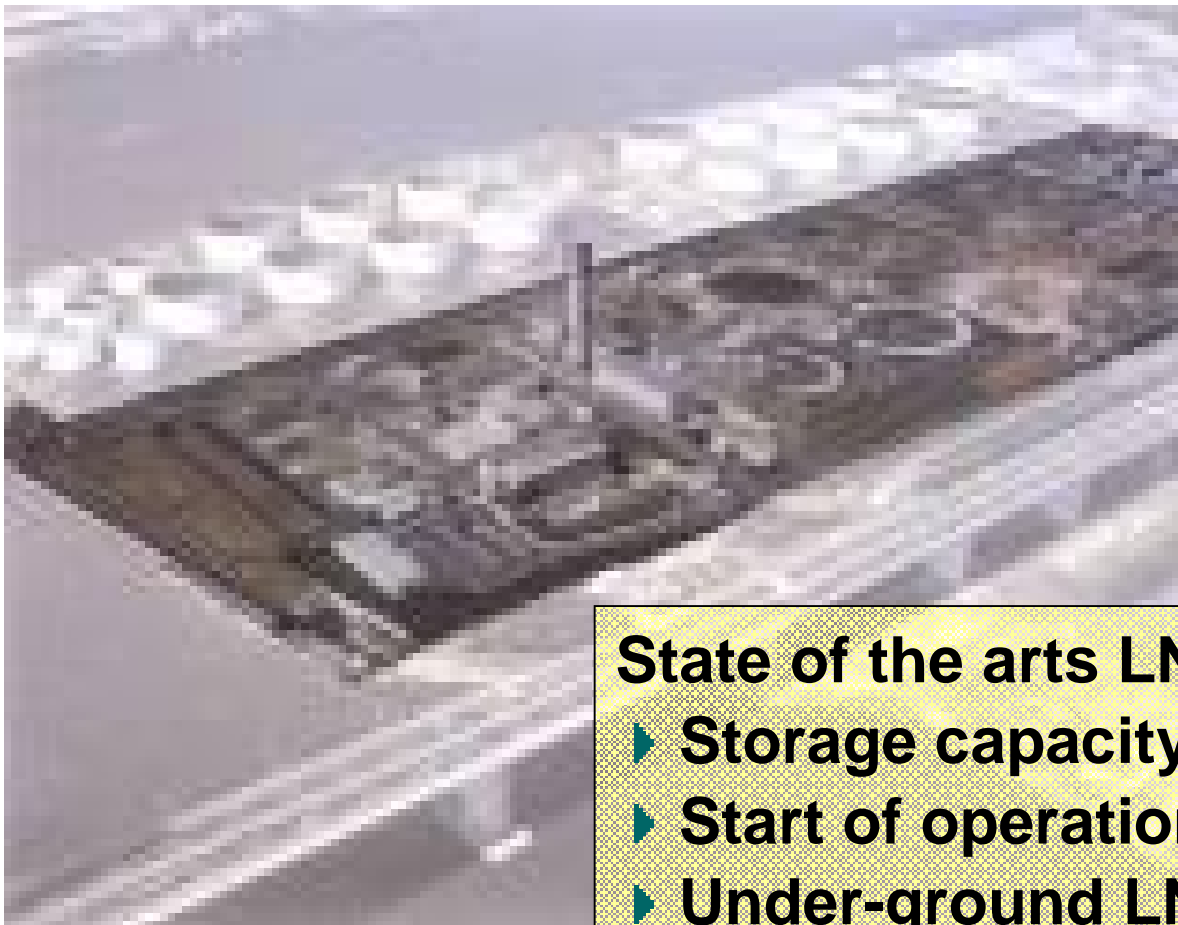


Open rack type vaporizer

Small scale LNG terminal for detached inland supply area

▶ **7,700 cargos in 2004**

Ohgishima Terminal

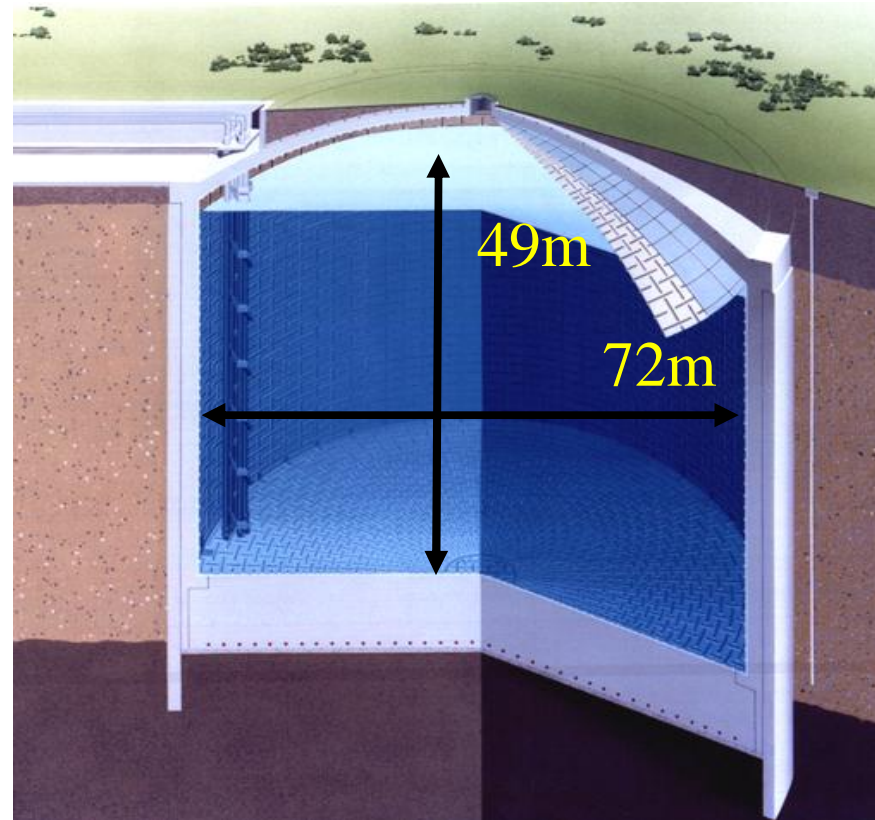


(Image view)

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

- ▶ 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 inexperienced but also experienced engineers and operators of LNG terminals to get new and useful knowledge and skills.

End of Presentation