

Feasibility Study Report on the LNG bunkering hub development plan at the Port of Yokohama (Summary)

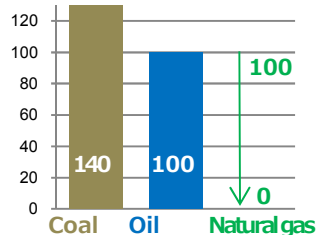
Environmental regulations - Advantages of LNG

The global sulfur cap will be strengthened from 2020.

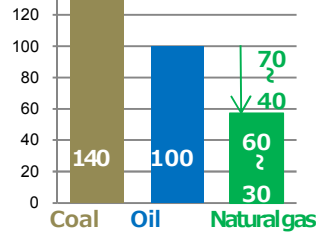


*Emission Control Area (ECA): North Sea & Baltic Sea, the coast of North America and US Caribbean Sea

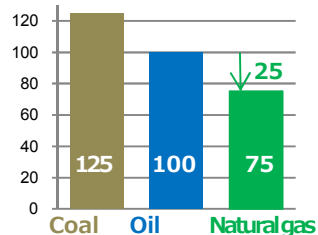
Sulfur oxide (SO_x)



Nitrogen oxide (NO_x)



Carbon dioxide (CO₂)



*Relative values when oil is set to 100

Advantages of the Port of Yokohama as a LNG bunkering Hub

【Advanced existing infrastructure】

There are many existing LNG bases located next to the port, and the supply cost can be reduced by using existing facility.

【Operation of a LNG fuelled ship and LNG bunkering】

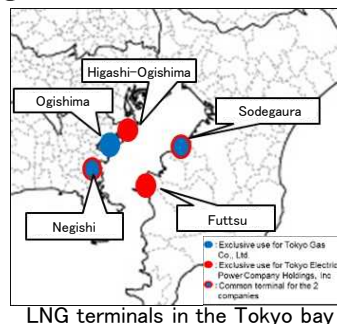
The operation of a LNG fuelled tugboat "Sakigake" started in August 2015, and related business operators and administrative agencies accumulate know-how of LNG bunkering.

【Geographical characteristics

- Position as International Container Hub】

The port of Yokohama is located on the Pacific side and it serves as the first or last bunkering base in the Asian side of the Trans Pacific route.

It is designated as an International Container Hub, and many ships such as container ships, pure car carriers and cruise ships call at it.



LNG terminals in the Tokyo bay

The Steering committee for LNG bunkering at the port of Yokohama (the committee was held from Jun. to Dec. 2016)

【Purpose of the study】

To build LNG bunkering Hub and enhance the competitiveness of Japanese ports, the Steering Committee conducts a feasibility study, focused on the port of Yokohama as a model case.

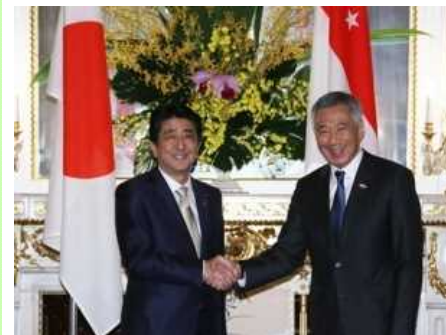
【List of Member】

- Tokyo Gas co., Ltd
- Nippon Yusen Kabushiki Kaisha (NYK Line)
- Yokohama Kawasaki International Port co., Ltd
- City of Yokohama
- Agency for Natural Resources and Energy
- Ports and Harbours Bureau, Ministry of Land, Infrastructure, Transport and Tourism(MLIT)
- Maritime Bureau, MLIT
- Japan Coast Guard Headquarters (Observer)
- Ministry of Economy, Trade and Industry
- Kanto Regional Development Bureau, MLIT

Topics

【Japan-Singapore Summit】

Aiming at strengthening collaboration between Singapore and Japan on LNG Bunkering.



September 28, 2016

【Conclusion of International MOU】

The Port authorities of 8 representatives from 7 countries concluded the MOU to promote LNG as a marine fuel.



October 5, 2016

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Roadmap for the development of LNG bunkering base

Phase I (started)

Optimization of “Truck to Ship” bunkering

Optimize the existing “Truck to Ship” LNG Bunkering operation by approximating the LNG tank lorry and the LNG fuelled ship.
 ⇒The optimization has been realized since November 2016.



LNG fuelled tugboat “Sakigake”
 LNG tank lorry
 Truck to Ship bunkering

Phase II (2020)

Introduction of “Ship to Ship” Bunkering

Introduce a LNG bunkering ship and start “Ship to Ship” bunkering, using the LNG terminal in Tokyo bay (Sodegaura terminal) where required facilities are already in place for supplying LNG to bunkering ships.



Image of “Ship to Ship” bunkering to a container ship



Image of “Ship to Ship” bunkering to a cruise ship

【Required facilities】

- LNG bunkering ship
- Improvement of LNG Terminal

Investment
 Approx. 6 billion yen

Phase III (After the demand reaches a certain scale)

Strengthen of “Ship to Ship” bunkering

Strengthen of the bunkering operation by introducing new LNG supply system and 2nd bunkering ship at the Port of Yokohama.

【 Required facilities 】

- New LNG Supply system
- LNG bunkering ship (2nd vessel)


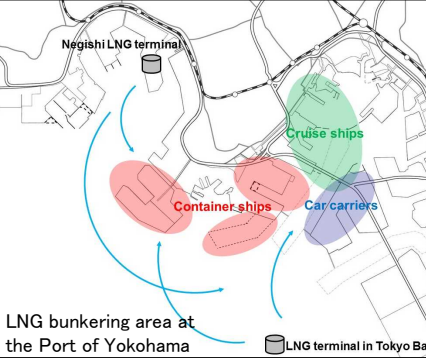


Image of a shipping from Negishi LNG terminal



LNG bunkering area at the Port of Yokohama
 Negishi LNG terminal
 Cruise ships
 Container ships
 Car carriers
 LNG terminal in Tokyo Bay

Investment
 Approx. 10 billion yen

Demand forecast

The demand of LNG fuel will moderately increase because new LNG fuelled ships will build mainly in the case of replacing existing ships.

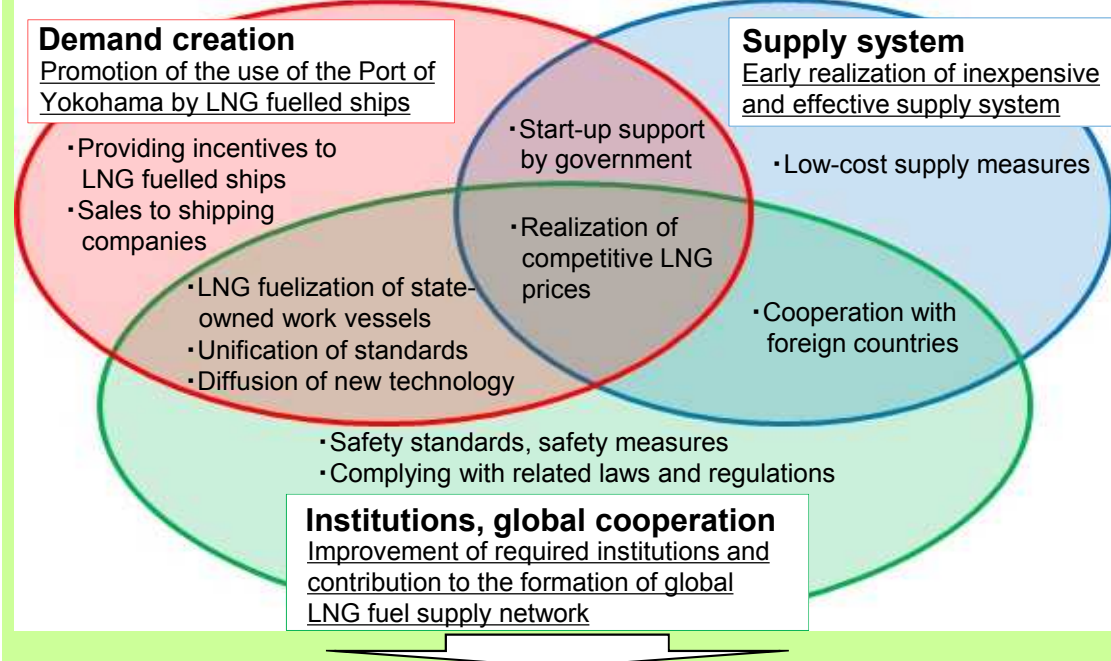
Forecast of conversion rate to LNG fuel	Period	Conversion rate to LNG fuel	Demand forecast of LNG fuel around Yokohama Port	Conversion rate to LNG fuel	Annual LNG demand (kilo ton per year)
				2025-2030	5%~27%
			10%	180 - 500	
			20%	360 - 1,000	

*Forecast by various investigation institutions

Business profitability

It is necessary to increase the volume of demand around 100,000 ton to 150,000 ton per year to secure the business profitability in Phase II. It requires many efforts towards the realization of LNG Bunkering Hub due to the limitation of the demand at the beginning of Phase II.

Towards the realization



National Government, City of Yokohama, Yokohama Kawasaki International Port Co., Ltd., and private enterprises promote it together