

# MOL Group

## Initiatives to Reduce CO2 Emissions in the Ferry and Coastal Shipping Business (Promoting the Construction of LNG-fueled Ships)



**MOL** 商船三井

**Mitsui O.S.K. Lines**

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Ferry Sunflower Limited



# **1. Overview of the MOL Group's coastal shipping business**

## **2. MOL Group's Efforts to Reduce Fuel Consumption (CO2)**

### **3. Ferry Sunflower**

**LNG-fueled New Ferries for Osaka-Beppu Route**

### **4. Challenges for Expanding LNG-fueled Ships**

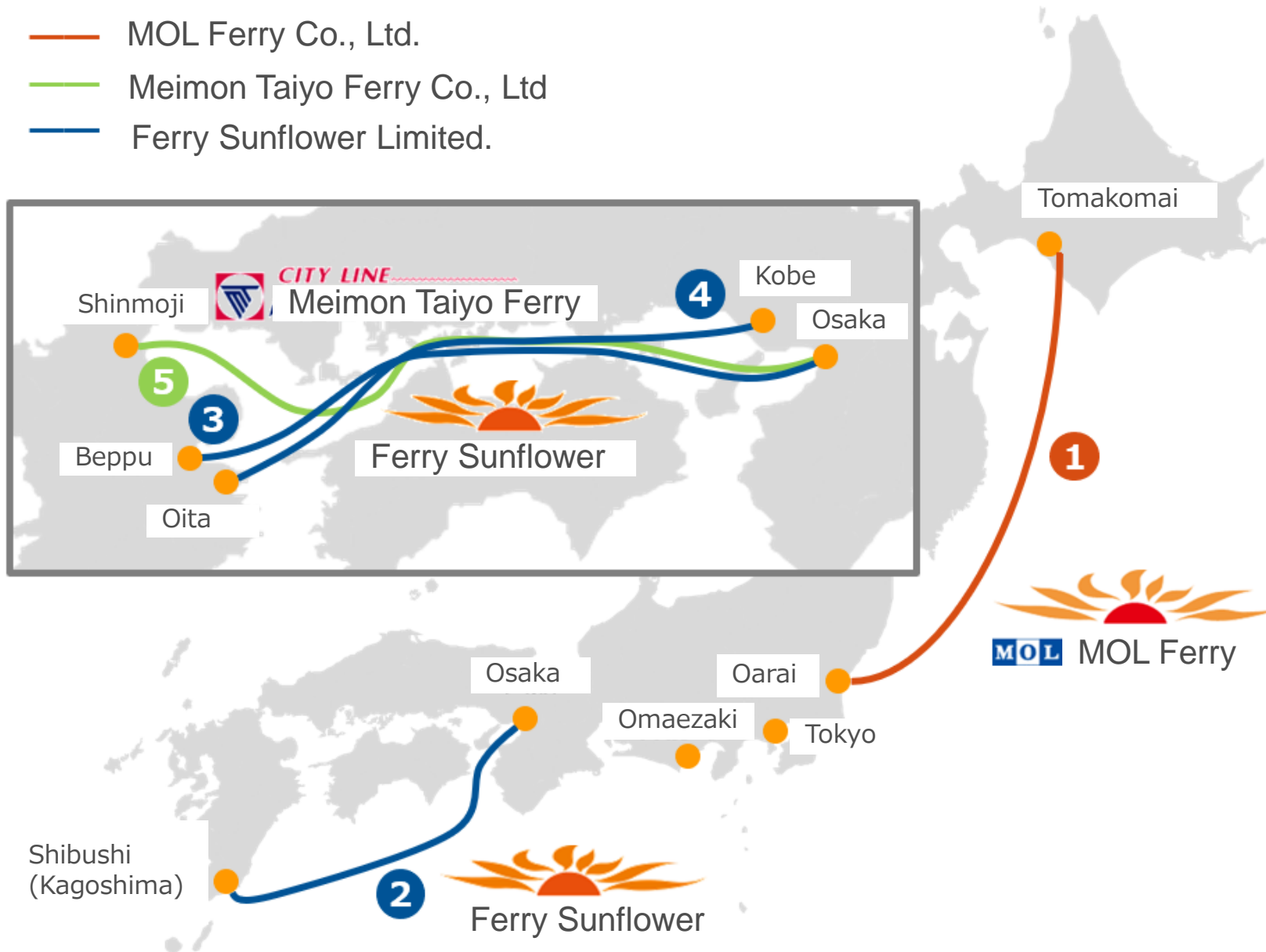
# 1. Overview of the MOL Group's coastal shipping business

Business field	Name of consolidated subsidiary	Route, no. of ships, etc.
Liners (ferries/RORO ships)	MOL Ferry Co., Ltd. ( <a href="https://www.sunflower.co.jp/index.html/">https://www.sunflower.co.jp/index.html/</a> ) Ferry Sunflower Limited. ( <a href="https://www.ferry-sunflower.co.jp/">https://www.ferry-sunflower.co.jp/</a> )	Kanto - Hokkaido (1 route, 2 round trips/day *except Sundays) Kanto - Kyushu <RORO> (2 routes, 1 round trip each/day *except Sundays) Kansai - Kyushu (3 routes, 1 round trip each/day) No. of ships in service: 10 ferries, 5 RORO ships
Trampers/Specialized ships (bulkcarriers/tankers)	MOL Coastal Shipping, Ltd. ( <a href="https://www.mol-naikou.co.jp/">https://www.mol-naikou.co.jp/</a> )	Specialized ships: 11 ships (Salt, LPG, coal, biomass, black oil, etc.)  Trampers: 14 ships (bulk carriers)
Tugboats	NIHON TUG-BOAT CO., LTD. ( <a href="https://nihon-eisen.co.jp/">https://nihon-eisen.co.jp/</a> ) Green Shipping, Ltd. ( <a href="http://www.greenship.co.jp/">http://www.greenship.co.jp/</a> ) GREEN KAIJI KAISHA,LTD.、 the rest	No. of ships in service: 36 ships in total (Hokkaido - Kyushu)

Affiliates accounted for by the equity method: Meimon Taiyo Ferry Co., Ltd. (ferry business) and Asahi Tanker Co., Ltd. (tanker operations)

# (Reference) Mitsui O.S.K. Lines Group Ferry route network

- MOL Ferry Co., Ltd.
- Meimon Taiyo Ferry Co., Ltd
- Ferry Sunflower Limited.



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# 2. MOL Group's Efforts to Reduce Fuel Consumption (CO2)

## MOL Group Environmental Vision 2.1

For the next generation on board this planet, the MOL Group will work collaboratively with our partners and stakeholders with creativity to resolve environmental issues. We will continue to provide solutions for issues of high importance such as the preservation of the marine environment, protection of biodiversity and prevention of air pollution, and in order to tackle climate change with utmost urgency, the MOL Group will make a concerted effort to achieve net zero GHG emissions by 2050. With these contributions for the sustainable development of our society and the preservation of nature, from the blue oceans, we sustain people's lives and ensure a prosperous future.

**Climate Change  
Countermeasures**



**Preservation of  
marine  
environments**



**Protection of  
biodiversity**



**Prevention of Air  
Pollution**



## Medium- to long-term targets

① Deploy net zero emissions ocean-going vessels in the 2020s

② Reduce GHG emissions intensity by approximately 45% by 2035 (versus 2019\*)

③ With the concerted effort throughout the Group, achieve net zero GHG emissions by 2050

\* Intend to acquire certification in compliance with SBT guidance for marine transport

# Actual Examples of Initiatives in Coastal Business

## Phase 1: Proactive adoption of energy-saving technologies



Energy-saving device attached to the propeller (PBCF)



Adoption of double-reversing propeller

Hybrid propulsion engine  
Energy-saving ship type  
Navigational support system, etc



## Phase 2: Promoting the introduction of LNG-fueled ships



2019 Tugboat "Ishin" completed.



2020 Participation in building the bulk carrier "Isemirai"



2022 Construction of "Sunflower Kurenai Murasaki" is scheduled to be completed.

## Phase 3: Promoting the use of new fuels and renewable energy



PROJECT Promoting the E5 Project



Building EV tankers

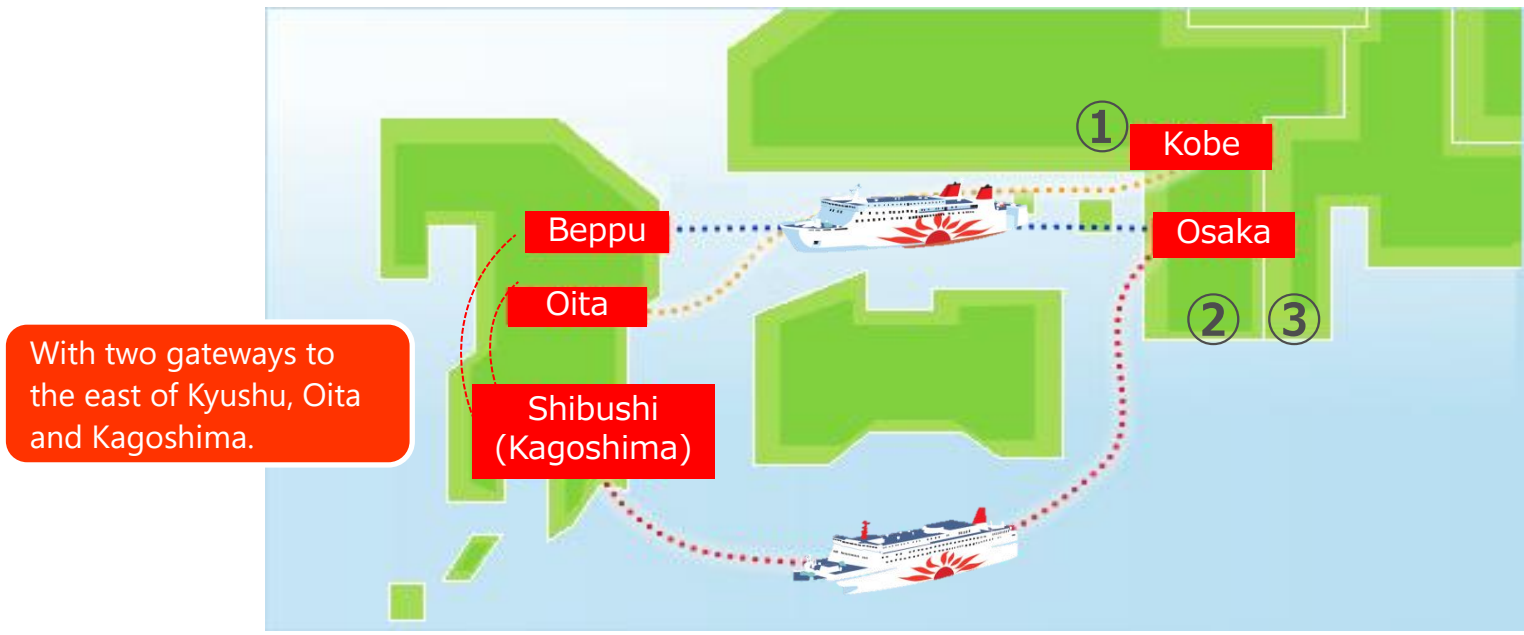
Practical use of new fuels (Ammonia, hydrogen, and biofuel)  
Promoting the shift to EVs/FCVs

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# (Reference 1) Introduction of Routes Operated by Ferry Sunflower Limited

DAILY SERVICE OF SIX SHIPS ON THREE ROUTES, EACH DEPARTING IN THE EVENING AND ARRIVING AT THE DESTINATION THE FOLLOWING MORNING



With two gateways to the east of Kyushu, Oita and Kagoshima.



## ① Kobe ⇄ Oita

Day of the week	From Kobe to Oita	
	Departure	Arrival
Sun.-Thu.	19:00 →	Next morning 06:20
Fri.-Sat.	19:50 →	Next morning 07:20

Day of the week	From Oita to Kobe	
	Departure	Arrival
Sun.-Thu.	19:15 →	Next morning 06:35
Fri.-Sat.	19:30 →	Next morning 07:55

## ② Osaka ⇄ Beppu

Day of the week	From Osaka to Beppu	
	Departure	Arrival
Sun.-Thu.	19:05 →	Next morning 06:55
Fri.-Sat.	19:55 →	Next morning 07:45

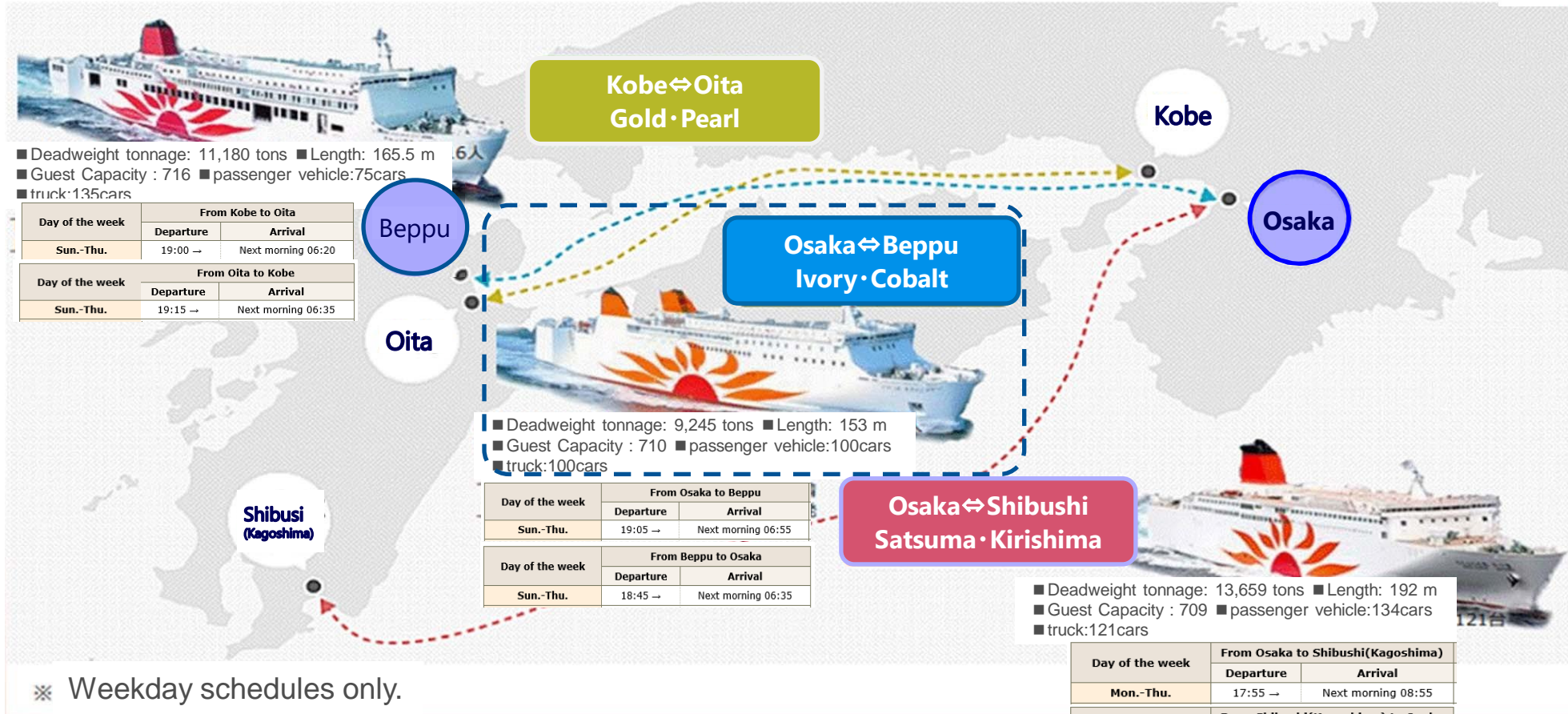
Day of the week	From Beppu to Osaka	
	Departure	Arrival
Sun.-Thu.	18:45 →	Next morning 06:35
Fri.-Sat.	19:35 →	Next morning 07:35

## ③ Osaka ⇄ Shibushi (Kagoshima)

Day of the week	From Osaka to Shibushi(Kagoshima)	
	Departure	Arrival
Mon.-Thu.	17:55 →	Next morning 08:55
Fri.	17:55 →	Next morning 08:55
Sat.	17:55 →	Next morning 09:40
Sun.	17:00 →	Next morning 08:55

Day of the week	From Shibushi(Kagoshima) to Osaka	
	Departure	Arrival
Mon.-Thu.	17:55 →	Next morning 07:40
Fri.	17:55 →	Next morning 07:50
Sat.	18:30 →	Next morning 08:50
Sun.	17:00 →	Next morning 07:40

# (Reference 2) LNG-fueled Ferry Service Route (Osaka-Beppu Route)



- Ferry Sunflower Limited is building two ferries to replace two existing ferries currently in service on the Osaka-Beppu route.
- “Sunflower Kurenai” and “Sunflower Murasaki” will be in service in spring 2023 and March 2023, respectively.

# 3 . Ferry Sunflower LNG-fueled New Ferries for Osaka-Beppu Route

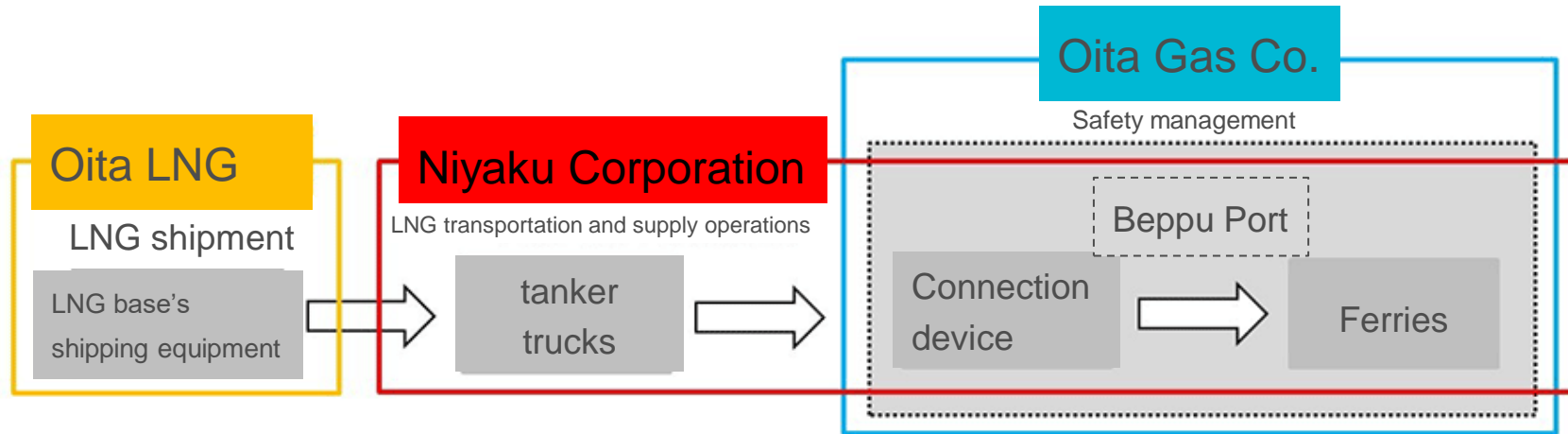
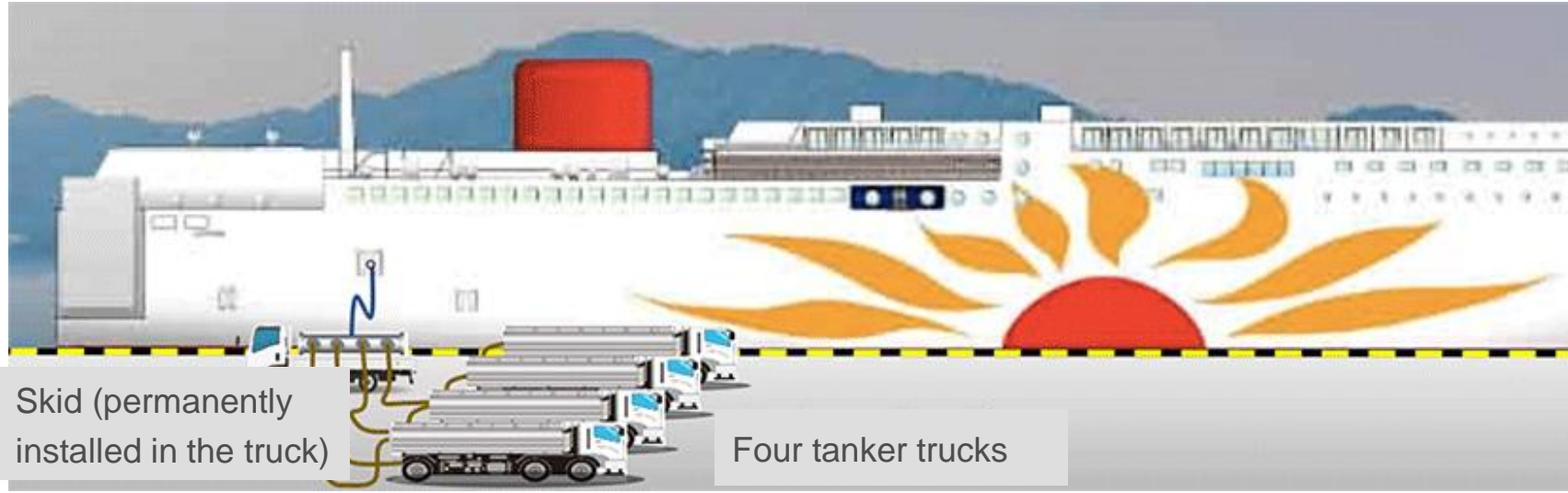


Outline of the vessels

	<b>New ferries Sunflower Kurenai Sunflower Murasaki</b>	<b>Current ferries Sunflower Ivory Sunflower Cobalt</b>
Gross tonnage (tons)	about 17,300	9,245
LOA/beam (m)	about 199.9/28.0	153.0/25.0
Fuel	LNG/Oil A	Oil C
Interior space (m <sup>2</sup> )	about 8,300	4,950
Passenger capacity	763	710
Private room capacity (%)	374 (50%)	146 (20%)
Loading capacity (trucks)	130	92
Loading capacity (passenger vehicle)	100	97

- The ferries embody the environmental impact-reducing ferry, which was planned as a part of the "ISHIN NEXT - MOL SMART SHIP PROJECT"
- The use of LNG fuel will achieve excellent environmental performance, reducing carbon dioxide (CO<sub>2</sub>) emissions by 20% compared to current vessels, and virtually eliminating sulfur oxides emissions.
- Aiming to revive the service of the "Queen of the Seto Inland Sea" to match the 100-year history of the Osaka-Beppu route. (Track records: Approx. 180,000 passengers and 30,000 passenger cars in 2019)
- Increasing truck space to meet modal shift demand. (Track records: Approx. 50,000 trucks in 2019)

# Outline of LNG Fuel Supply to Ferries (Truck-to-ship Method)



Approximately 50 tons per day will be supplied in the truck-to-ship method to the ferry on the north side of Pier 3 at Beppu Port in Oita Prefecture. LNG fuel is transported by four tanker trucks from Oita LNG, a Kyushu Electric Power Group company. The ferry is replenished with fuel via a connection device called a “skid.” It will take three to four hours (including the time required for preparation and cleanup work), commencing after the ferry is emptied and completing well in advance of the start of accepting the next trucks.



Fuel supply is scheduled to start around the end of 2022, in step with the building completion of the ferry. The carrier will consider changing to ship-to-ship supply using LNG supply barges in the future.

# Aims and Effects of LNG Fuel Conversion

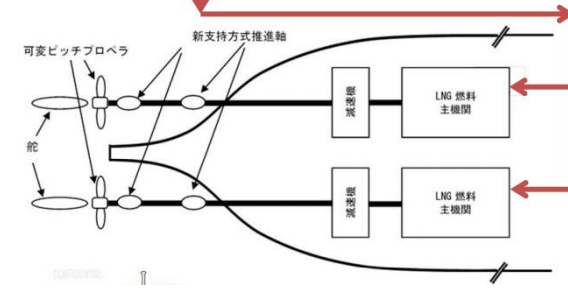
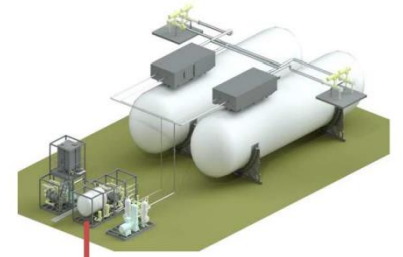
## Reduction of environmental impact through the use of LNG-fueled main engines

- Sulfur oxides (SOx): Almost zero emissions
- Nitrogen oxides (NOx): Complies with IMO Tier III requirements
- Carbon dioxide emissions: 20-25% or more reduction based on the emissions from fuel oil





## Evaluation for the introduction of new ships

- Received the highest rating of five stars under the Energy Conservation Rating System for Coastal Shipping.
- Adopted for the Fiscal 2019 Project for Improving Operational Efficiency of Domestic Ships.

- Low-carbon fuels that can be widely adopted with proven technologies.
- Key transition fuels for 2030-2035.
- Transition to carbon-neutral fuels is possible through the practical use of methanation technology.



# (Reference) Comparison of LNG Fuel Supply Methods

	Truck to Ship		Shore to Ship	Ship to Ship
	Direct tanker truck connection	Skid method		
				
<b>LNG supply</b>	LNG fuel is loaded to an LNG tanker truck at an LNG terminal and transported by land to the supply point (port).	LNG fuel is loaded to an LNG tanker truck at an LNG terminal and transported by land to the supply point (port).	LNG fuel is loaded to LNG tanker trucks at an LNG terminal and transported by land to a tank at the supply point (port), and supplied from the tank to the ship.	LNG fuel is loaded to an LNG bunker barge at an LNG terminal. The LNG bunker barge proceeds to the supply port to deliver LNG fuel to the ship.
<b>LNG cargo handling</b>	An LNG hose is directly connected from the LNG tanker truck. LNG fuel is supplied with a tank pressure difference to the ship.	Multiple LNG tanker trucks are connected to a skid, and LNG fuel is sent through LNG hoses. LNG fuel is supplied with a tank pressure difference or pressurization to the ship via a pump installed in the skid.	An LNG hose or a hard arm is connected from the LNG tank on land. LNG fuel is supplied with a tank pressure difference or pumping on the land side to the ship.	An LNG hose is connected from the LNG bunker barge. LNG fuel is supplied through a pump on the barge.
<b>Supply lot</b>	~25m <sup>3</sup>	~100m <sup>3</sup> (depending on the number of connections)	Current maximum 7,000m <sup>3</sup>	Current largest bunker barge type 20,000m <sup>3</sup>
<b>Supply rate</b>	10m <sup>3</sup> /h	30m <sup>3</sup> /h	Depending on the land facility	1,000~1,600m <sup>3</sup> /h
<b>Features</b>	Conventional LNG tanker trucks can be used without special equipment on the land side. The initial investment and operating costs are low, but the supply capacity is limited.	Simultaneous LNG fuel supply from multiple LNG tanker trucks is possible. The investment cost for the skid is required. The power source for the skid (if a pump is installed) and a skid storage yard must be secured.	The supply capacity (lot or rate) depends on the facility, but constant LNG fuel demand is essential because the installation location is fixed. As this serves as a permanent facility, there is conflict with existing facilities.	This method ensures a highly flexible fuel supply in operation time and supply volume, but it requires to increase the operating rate to cover the high investment and operating costs. Barge size should be decided based on a supply that corresponds to demand and to profit.
<b>Application</b>	Harbor workboat	Large domestic ships and large ferries		Ocean-going ships
	Domestic ships and small ferries			

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## 4. Issues and Demands for Expansion of LNG Fueled Ships

At this stage LNG-fueled ships are highly practical to reduce GHG emission, but their economic competitiveness is not sufficient. From this, It is difficult for the businesses to be motivated to use the alternative fuel.

1) The biggest challenge is the inflated cost of shipbuilding and operations.

Ferries 「Sunflower Kurenai・Murasaki」	Tugs 「Ishin」
	
Price of shipbuilding: 20%-30% more than that of a regular ferry	Normal tugboat price + Several hundred million yen
Repair costs, seafarer costs, and shore support costs also increase.  LNG fuel costs are expected to be more favorable than fuel oil costs in the medium to long term, but it is unclear whether investment capital cost differences can be covered.	

2) Physical limitations of the ships' structure

- The new ferries on the Beppu route reduce the number of load-capacity by about 10% to install the LNG fueled engine.



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