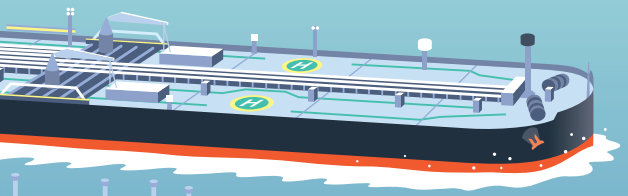
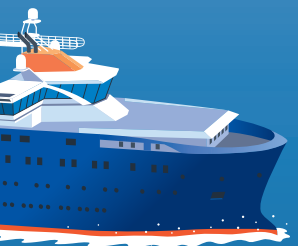
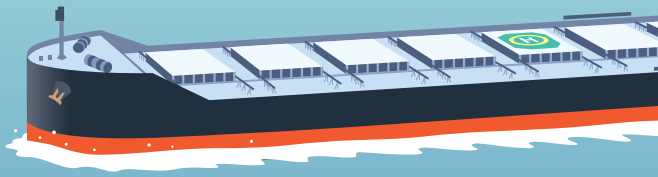
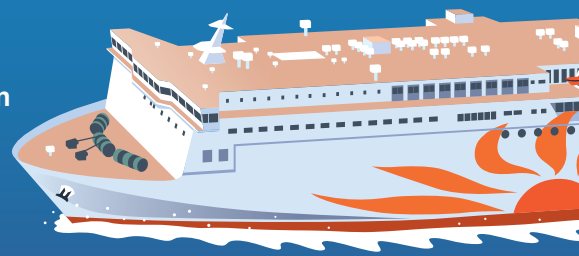
MOL
Mitsui O.S.K. Lines









A Vessel

for Every Need Supporting Everyday Life

and Industries Around the World

Ships bring efficiency and convenience to the movement of people and cargo.
Of course, ships come in all types, from yachts to fishing boats and military vessels.
But the ships that transport people and cargo are called “merchant vessels.”
Just about everything we rely on in our everyday lives arrives by ship.
99% of commodities, energy resources, and materials imported to and exported from Japan
– an island nation surrounded by the sea – travels by merchant vessels.
It’s no exaggeration to say that merchant ships are indispensable to our lives.

CONTENTS

Message

An ‘Ocean Shipping Supermarket’

The Mitsui O.S.K. Lines, Ltd. (MOL) Group is a multimodal ocean shipping operator with a global fleet of merchant vessels that support everyday life as well as industries all over the world.

MOL Group vessels come in all shapes, types, and sizes, making the group an “ocean shipping supermarket.”

This brochure introduces how these vessels transport the commodities needed for our lives and industries and offers an in-depth look at the structure and characteristics of different merchant vessels.

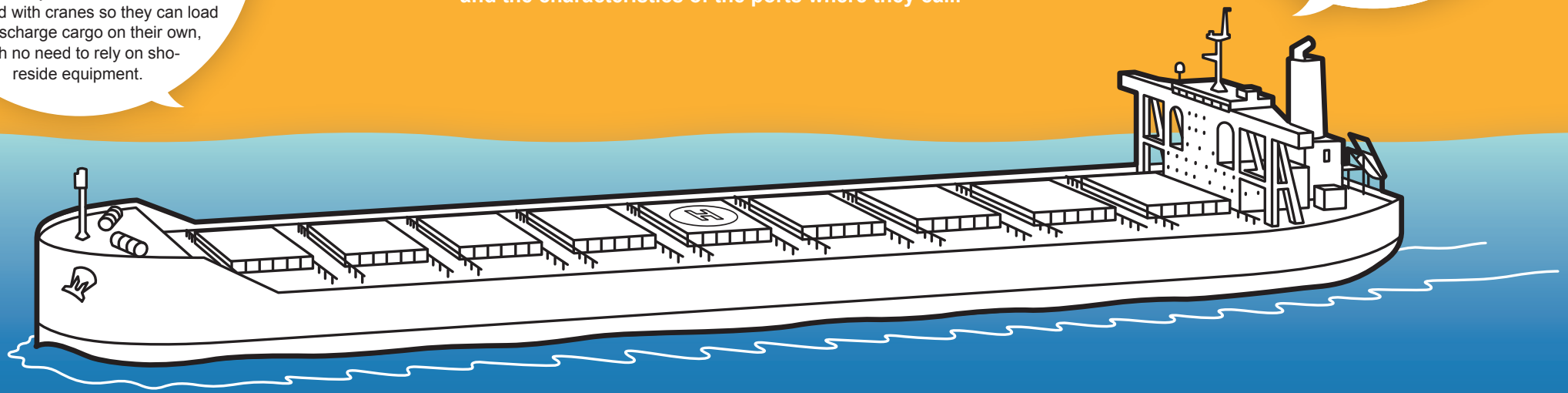
1

Dry Bulkship Transport

Vessels vary in size, but some are equipped with cranes so they can load and discharge cargo on their own, with no need to rely on shoreside equipment.

Bulkships transport huge volumes of cargoes such as iron ore, coal, grain, salt, aluminum, and copper ore without packing or packaging. These vessels are called "bulkers," "dry bulkers," "bulk carriers," or "dry bulk ships," since they transport "dry cargo" in "bulk." Bulkships vary widely in size and configuration, depending on the cargo they carry and the characteristics of the ports where they call.

Bulkships have about five to nine cargo holds, covered by hatches that are opened for cargo loading and discharging.



Bulkships Come in Various Sizes to Meet Any Transport Need

Merchant vessels have grown in size throughout their long history, always in pursuit of greater economic efficiency. Among them, bulkships come in a variety of sizes.

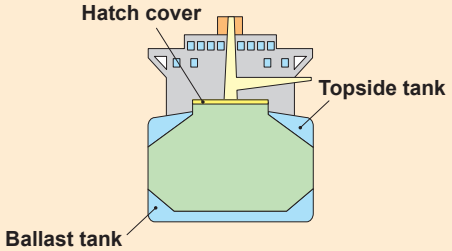
"Capesize" vessels are so large that they cannot pass through the Panama Canal, and have to sail around the Cape of Good Hope and Cape Horn, hence the name "Capesize." The "Panamax," on the other hand is the largest class of ship that can pass through the Panama Canal. It is built to meet the canal's passage requirements, which specify that ships can be no longer than about 274 meters long and 32 meters wide. "Handy" class bulkers have smaller hulls than the Panamax. They are so named because their relatively small size offers the convenience of being able to call in and out of almost any port in the world. Another feature of "Handy" bulkers is that they are equipped with their own cranes to handle cargo.

	Standard deadweight tonnage	LOA	Main cargoes
Very Large Ore Carrier (VLOC)	250,000	About 330m	Iron ore
Capesize	180,000	About 292m	Iron ore, coking coal
Panamax	82,000	About 229m	Iron ore, cocking coal, thermal coal, grain
Handymax	58,000	About 190m	Thermal coal, grain, salt, cement, steel product
Small Handy	38,000	About 180m	Steel product, cement, grain,ore

Structure / Characteristics

Bulkships have "topside tanks," triangular ballast tanks (filled with water to stabilize the vessel) fitted at both shoulders/wings of the cargo holds. These help the ship maintain the proper trim no matter how much cargo is on board. The sides on the lower part of the hold are designed with a hopper configuration to maximize loading/discharging efficiency by preventing cargo from accumulating in the corners.

Some bulkers have cranes for loading/discharging, while others rely on shoreside equipment. In general, vessels larger than Panamax do not have cranes. Hatch covers at the top of the hold are opened only during loading/discharging.

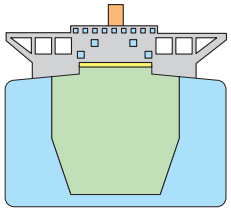


Dedicated Bulkships by Cargo

Generally, an optimal type of bulkship is chosen based on cargo volume, port scale, facilities, and equipment. But some dedicated bulkships are designed and constructed to transport a specific cargo in the safest, most economical, and most efficient manner.

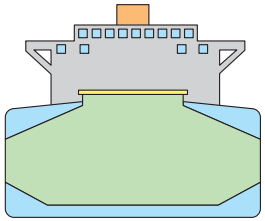
Iron Ore Carriers

Iron ore has a high specific gravity, so the cargo hold is designed to be narrow, with the cargo heaping up in the center. These large vessels without cranes represent the mainstream in economical, efficient transport of iron ore.



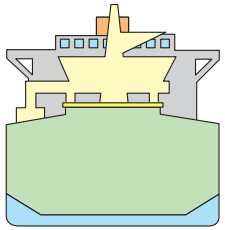
Coal Carriers

These vessels transport coal for thermal power generation. They are designed to match the water depth and discharging equipment at a dedicated berth for a power station. The wide-breadth type (80,000 - 90,000DWT) is the mainstream, as this configuration allows the ship to load a large volume of coal and still navigate safely in shallow waters.



Woodchip Carriers

This type of vessel is specially designed to carry woodchips, the raw material for paper. The specific gravity of woodchips is low, so the hold is designed to maximize cargo capacity. In addition, wood chips do not shift very much in transit, eliminating the need for topside tanks.



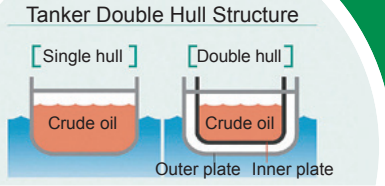
Iron ore carrier discharging cargo

Coal carrier loading on cargo

Woodchip carrier discharging cargo

2

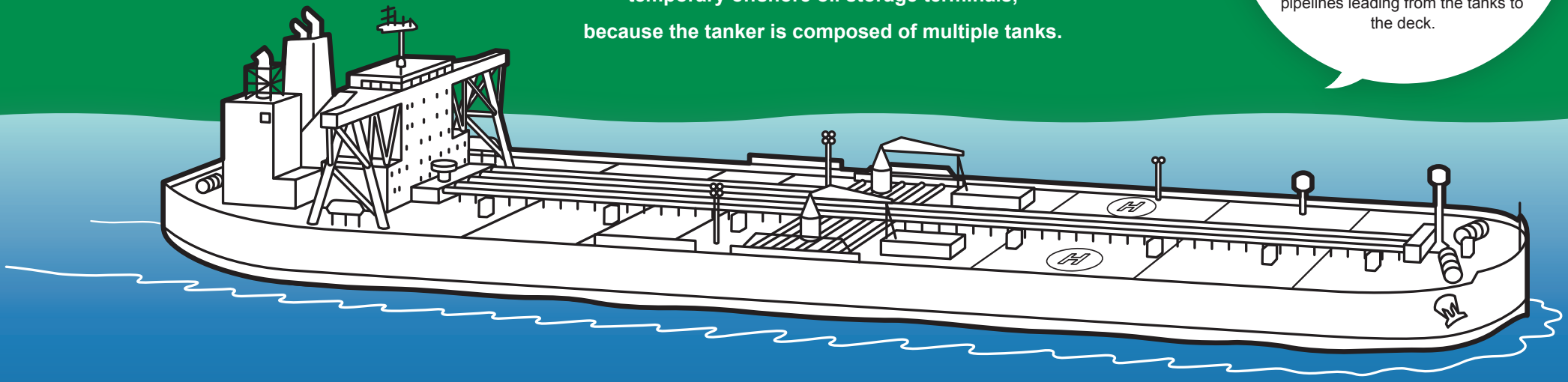
Energy Transport
(Tankers)



A double-hull structure is adopted to prevent the leakage of liquid cargoes such as crude oil in the event of an accident that breaches the outer hull.

Tankers transport crude oil, which is the world's primary energy source, refined petroleum products like gasoline, and other liquid cargoes such as chemical products. Tankers, of course, are built to transport oil, but can also serve as temporary offshore oil storage terminals, because the tanker is composed of multiple tanks.

Tankers have multiple tanks, and cargo is loaded and discharged through pipelines leading from the tanks to the deck.



Highly Specialized Expertise in Operations Tailored to Cargo Characteristics

Speaking of tankers, let's start with the ones that carry oil. Among the larger ones are those that transport crude oil, an energy resource that underpins the global economy and our everyday lives. "Product tankers" also play an essential role, carrying petroleum products such as gasoline, naphtha, kerosene, and diesel oil, and "chemical tankers" transport liquid chemical products including methanol, benzene, toluene, and alcohol.

Liquefied petroleum gas (LPG) tankers carry products such as propane and butane.

Tankers Tailored to Cargo Characteristics

1

VLCC

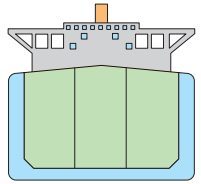
Crude oil storage tanks with a tanker in the background

Structure / Characteristics

Crude oil has different properties, depending on where it is produced. For this reason, the cargo tanks on these vessels are normally separated into two or three blocks lengthwise and another several blocks crosswise. In most cases, the cargo is discharged by connecting the pipes of the vessel to the pipes of the terminal (sea berth) located in deep water far offshore.

Crude Oil Tankers

Petroleum products support our daily lives, and crude oil, the raw material for these products, is a critical energy source. Tankers have become larger to increase the efficiency of crude oil transport, and the first very large crude oil carrier (VLCC) made its debut in the 1960s. Other sizes of tankers are also available to meet global demand, contributing to a stable supply.



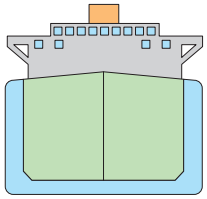
Crude Oil Tankers: Types / Sizes

	Standard deadweight tonnage	LOA
Very Large Crude oil Carrier (VLCC)	200,000 ～ 320,000	About 333 ～ 339.50m
Suezmax tanker	140,000～150,000	About 274.30m
Aframax tanker	80,000 ～ 120,000	About 245.50 ～ 259.97m

Product Tankers/Chemical Tankers

The basic hull structure and loading/discharging methods of product tankers and chemical tankers closely resemble those of crude oil tankers. However, product/chemical tankers typically have more cargo tanks, enabling them to co-load a wider variety of cargoes. Usually, each tank is equipped with respective pipelines and cargo pumps to prevent cross-contamination of different cargoes.

To prevent corrosion, cargo tanks are constructed using corrosion-resistant materials such as stainless steel, and special coatings are applied inside the tanks and pipelines.



Product Tankers: Types/Sizes

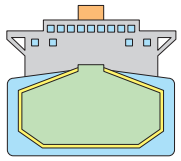
	Standard deadweight tonnage	LOA
MR type (Medium range)	25,000 ～ 60,000	About 160 ～ 183m
LRI type (Large Range 1)	55,000 ～ 80,000	About 228m
LRII type (Large Range 2)	80,000 ～ 160,000	About 245m

Product tanker (LRI type)

Chemical tanker

LPG Tanker

LPG Tankers



Very Large Gas Carriers (VLGCs) are employed mainly for long-distance transport of Liquid Petroleum Gases (LPGs). As the boiling points of liquefied propane and liquefied butane are minus 42.2°C and minus 0.5°C respectively, the cargo tanks are made of a special steel that can withstand these ultra-low temperatures and the vessels feature a re-liquefaction system to keep the cargo temperature below the boiling point.

Another type of LPG tanker liquefies the cargo by pressurizing it instead of lowering the temperature. This method is used mainly on smaller vessels such as coastal ships. In addition, recent newbuilding VLGCs are all equipped with dual-fuel engines that can use LPG as fuel, reducing emissions of CO_2, SOx, and PM.

World's 1st 'Methanol tanker' Equipped with Methanol-fueled Main Engine

Methanol tankers are a type of chemical tanker designed to transport methanol, a type of alcohol used as a raw material for formalin, fuel for alcohol lamps, and so on. In 2016, MOL introduced a methanol dual-fuel vessel, which can run on methanol or conventional fuel oil. As of 2023, the company operates five of the 25 methanol dual-fuel vessels in service worldwide.

Methanol, when used as marine fuel, reduces carbon dioxide (CO_2) emissions by up to 15% and nitrogen oxide (NOx) emissions by up to 80%, compared to conventional fuel oil-powered engines. It can also significantly reduce emissions of sulfur oxides (SOx) and particulate matter (PM), since it does not contain sulfur. In addition, if methanol derived from non-fossil raw materials is used, GHG emissions can be further reduced.

In February 2023, MOL became the first company in the world to successfully reduce total GHG emissions during an 18-day transatlantic voyage to net zero* on a life cycle basis, from fuel production to consumption, by using bio-methanol fuel.

* Taking into account the fuel production process, it refers to the total amount of greenhouse gas (GHG) emissions as virtually zero on a life-cycle basis.

A methanol and heavy oil dual-fuel methanol tanker, emblazoned with "Powered by Methanol" on the hull

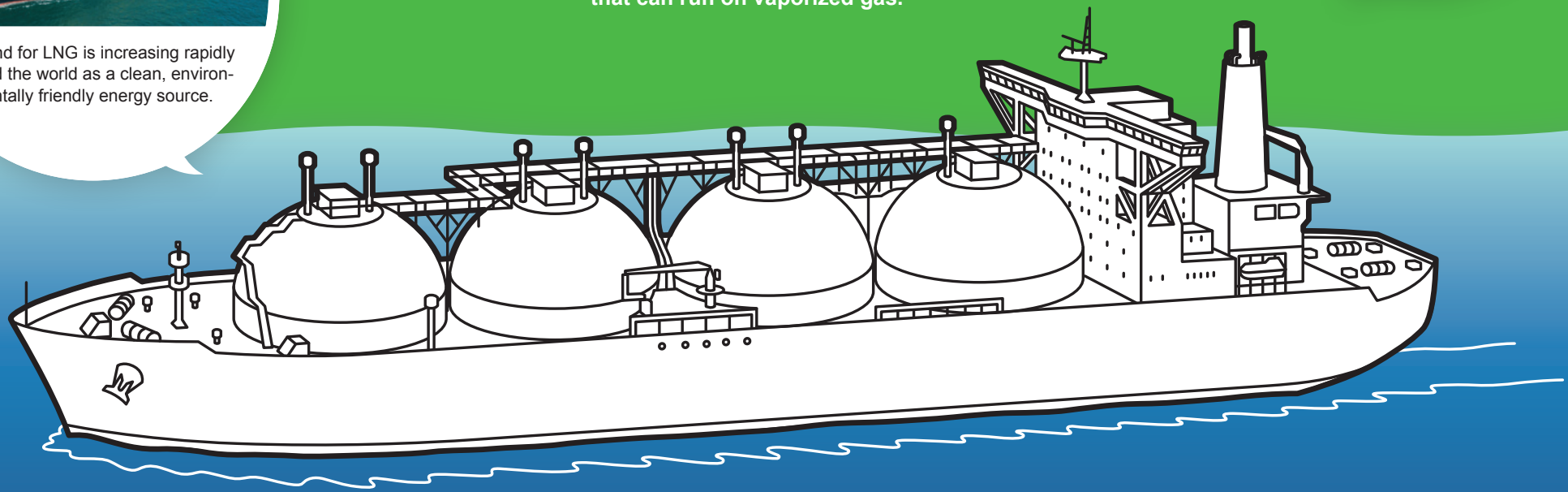
3

Energy Transport
(LNG Carriers)

Demand for LNG is increasing rapidly around the world as a clean, environmentally friendly energy source.

Tankers that transport liquefied natural gas are called LNG carriers. These vessels boast a range of advanced, versatile technologies – tanks made of special material to keep the cargo at an ultra-low temperature, emergency shut down devices to prevent incidents during cargo handling operations, and turbine engines that can run on vaporized gas.

LNG carrier at berth, discharging cargo into pipelines connected to an onshore facility



Aiming for Stable Transport to Meet Expanding Demand for Clean Energy

The *Senshu Maru*

Demand for liquefied natural gas (LNG) is rapidly increasing around the world, because it is a clean, environmentally friendly energy source that does not produce sulfur oxides (SOx) and emits 30% to 40% less nitrogen oxide (NOx) and carbon dioxide (CO_2) than oil or coal.

Japan's first LNG carrier, the *Senshu Maru* — jointly owned by three Japanese shipping companies and operated by MOL — entered service in 1984. Since then, we have accumulated a great deal of know-how and experience in LNG transport, and have achieved safe operations backed by our advanced transport technology and skilled personnel. We operate 97 LNG carriers, the world's largest fleet (as of 2023), and started operation of an icebreaking LNG carrier in 2018. A pioneer in LNG transport, MOL remains on the cutting edge in the development and operation of LNG carriers.

Senshu Maru
~ Retired after 36 Years of Service

The first Japanese LNG carrier, the *Senshu Maru*, safely completed 733 voyages between Bontang, Indonesia, and Japan, which marked 733 voyages. The voyages reached a distance of 2 million nautical miles, or about 93 times around the Earth. The total volume of LNG transported was 90 million m^3, equivalent to about 497 days of electricity for every Japanese household. After discharging its last cargo in Japan, the vessel headed to India, and was retired in December 2020.

LNG Carriers Transport Clean Energy

1


LNG carrier

▶ LNG Carriers

The transport of natural gas started through overland pipelines, but LNG carriers made it possible to transport massive volumes via sea. LNG is the liquid form of natural gas at the cryogenic temperature of minus 161.5°C, which takes up about 1/600th the volume of natural gas in its gaseous state, allowing efficient transport by ships. Japan's first LNG carrier, the Senshu Maru, which was launched for operation by MOL in 1984, had a cargo tank capacity of 125,562m^3. Today's mainstream vessels are in the 150,000 –170,000m^3 class.

Natural gas consists mainly of methane. When it burns, it emits no sulfur oxide (SOx) and less carbon dioxide (CO_2) and nitrogen oxide (NOx) than crude oil or coal. Further, it gets cleaner when converted into LNG as hydrogen sulfide, carbon dioxide, water content, and so on are eliminated during the liquefaction process. In addition, as natural gas weighs less than air, it does not accumulate in low spots if it leaks and its spontaneous combustion temperature is relatively high, so that natural gas has earned high regard not only as a cleaner fuel, but also as a safer one.

LNG carriers load and discharge their cargo through pipelines connected to shoreside facilities. Loading ports have equipment that liquefies natural gas before loading, while receiving terminals have facilities to re-gasify LNG.

Structure/Characteristics

LNG's boiling point is extremely low—minus 161.5°C—so transporting it by sea requires advanced technologies such as tanks made of materials especially engineered to withstand ultra-low temperatures—ferronickel, stainless steel, and aluminum alloys—and the outer layers are covered by thick heat insulation. Cargo tanks are like giant thermos bottles; however, part of the cargo is affected by the outside temperature and naturally vaporizes during transport. Known as "boil-off gas," this can be used as fuel for the vessel. LNG carriers are also equipped with sophisticated technologies such as emergency shutdown devices to ensure safe operation.

2

Very large ethane carrier (VLEC)

Ethane Carriers

Ethane is the second largest component of natural gas after methane. The calorific value by volume is about 1.75 times that of methane. Ethane is gaseous under atmospheric pressure and liquefies at about minus 90°C. It is used mainly as feedstock for ethylene, an important base chemical.

Shale gas extraction began to flourish in the U.S. early in the 21st century, leading to higher export volumes of ethane. Ethane, a by-product of gas extraction, has created huge opportunities for dedicated ethane carriers. In the past, mainstream ethane carriers were mid-sized vessels with capacities of 20,000–30,000m^3, but in 2016, the world's first very large ethane carrier (VLEC), with a capacity of 87,000m^3, went into service.

Structure / Characteristics

Like LNG and/or LPG, Ethane is being liquefied for transportation and can be used as propulsion fuel.

Cargo containment system varies by vessel but in general is similar to the ones for LNG and / or LPG carries.

Thermos-like LNG Carriers, 3 Cargo Tank Types

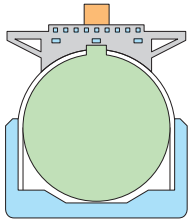
The major characteristic of LNG carriers is the cargo tank, which stores the cargo at an ultra-low temperature. There are mainly three types of tanks — Moss type, Membrane type, and Self-supporting Prismatic shape IMO type B (SPB).

Moss-type LNG carrier

Moss-type LNG carrier

The spherical cargo tank is independent from the hull, and this unique configuration enables each tank to accommodate its internal pressure.

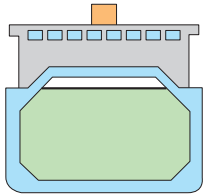
Compared to other types, this type has a smaller surface area for its tanks, contributing to the suppression of boil-off gas. Besides, quality control of the tanks is simpler due to fewer welding points. Additionally, in 2014, a new type of spherical tank called the "continuous tank cover type" (commonly known as the "*Sayaendo*" (= pea pod) was introduced.)



Membrane-type LNG carrier

Membrane-type LNG carrier

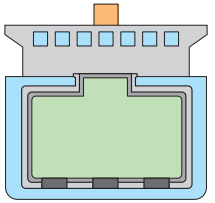
Cargo is maintained at lower temperature to absorb the expansion of the gas by using thin inside tanks and covering them with a wrinkled stainless steel "membrane." It features high visibility toward the front of the vessel because of greater space efficiency in the cargo tanks and minimal protrusions on the deck. Some Ethane carriers adopt this cargo tank type.



SPB-type LNG carrier

Self-supporting Prismatic shape IMO type B (SPB) LNG carrier

This self-supporting prismatic shape tank uses aluminum alloy or stainless steel, with heat insulation on the exterior. This type of tank has the advantage of allowing for broader use on deck because it is more easily fitted on the hull in comparison with spherical cargo tanks and has no protruding structures on deck.



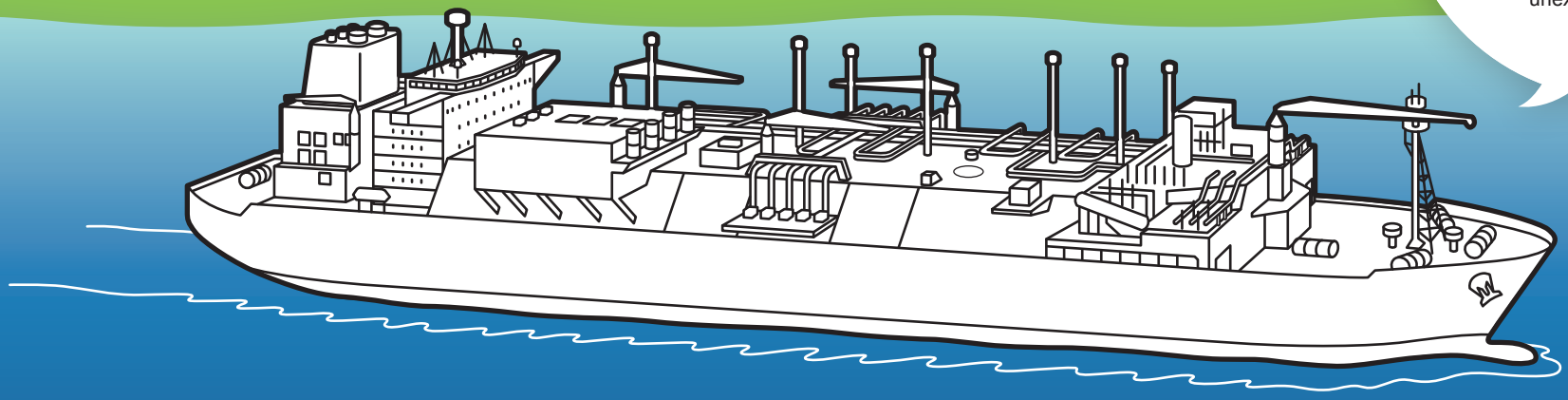
4

Energy Transport
(Offshore Business)

Vessels can also serve as terminals at sea

Our vessels play active roles in marine resource development and offshore energy production. Some vessels are berthed offshore to produce crude oil and gas. Some serve as LNG receiving terminals, and more. This section introduces a wide array of vessels involved in our offshore business.

Vessels are used in unexpected places!



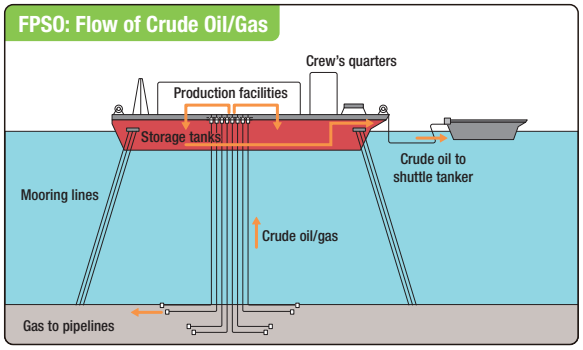
Broadening the Offshore Business Field

Originally offshore business were focused on floating production, storage and offloading systems (FPSOs) and floating storage and regasification units (FSRUs), which are vessels that operate at a fixed offshore site instead of sailing as a transport vessel.

However, in recent years, many offshore wind farms are being developed far from land, increasing the demand of a variety of vessels for supporting the installation and maintenance of wind turbines and transporting maintenance personnel.

Vessels Play Key Roles in Crude Oil and Gas Production

Floating production, storage and offloading system (FPSO)



Floating Production Storage and Offloading Systems (FPSOs)

FPSO stands for "floating production, storage and offloading system." Oil reservoir fluids extracted from deep-sea oil fields are brought into an FPSO and separated into crude oil and gas by processing equipment on deck. Treated crude oil is transferred to the cargo tanks in the FPSO's hull, and regularly offloaded onto shuttle tankers. Treated gas is used as fuel for the FPSO. It is also transported to shore via pipeline or re-injected back into oil wells. This entire series of operations is performed aboard the FPSO. Many FPSOs are converted second-hand oil tankers. The mooring equipment, production equipment, offloading equipment, and so on are installed on the FPSO after hull reinforcement.

Shuttle tanker

Subsea support vessel

Shuttle Tankers

Shuttle tankers transport crude oil from FPSOs or other offshore production facilities to onshore terminals. These tankers are equipped with dynamic positioning systems (which electronically control the ship's maneuvering to maintain its position), bow loading systems (offshore loading equipment mounted on the bow), and so on to ensure safe loading operation without anchoring, even under severe sea, weather, and tide conditions.

Subsea support vessels

Subsea support vessels are used to install, maintain, repair, and remove subsea facilities, playing key roles in every phase of the offshore oil and gas business, including exploration, development, and production.

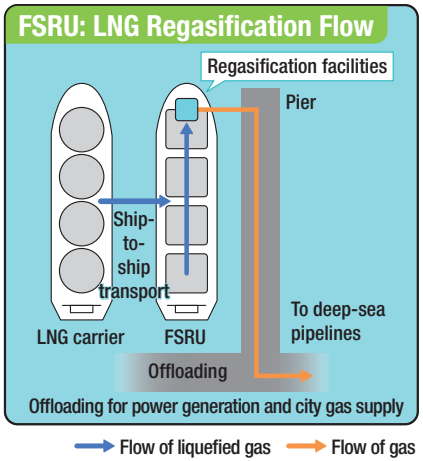
These vessels feature dynamic positioning systems, remote operated vehicle, deep-sea cranes, and other equipment to implement these operations.

Vessels Serve as LNG Receiving / Regasification Terminals

Floating storage & regasification unit (FSRU)

Floating Storage & Regasification Units (FSRUs)

FSRU stands for Floating Storage and Regasification Unit. The main roles of FSRUs are serving as offshore LNG receiving terminals that store LNG discharged from LNG carriers and also re-gasifying it on demand and offloading high-pressure gas to onshore pipelines. Many FSRU projects are in progress around the world, because of lower costs and faster implementation compared to building onshore LNG receiving terminals.



Vessels Playing Essential Roles in Decarbonizing Society

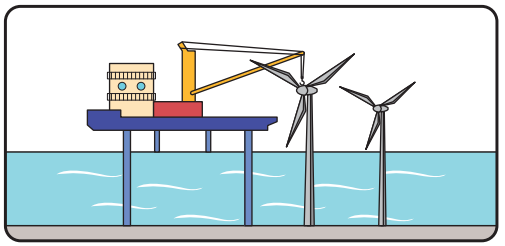
Self-elevating platform (SEP)

Self-Elevating Platforms (SEPs)

Self-Elevating Platforms (SEPs) are vessels that can install wind turbines and foundations for construction of offshore wind farm spread worldwide, mainly in Europe.

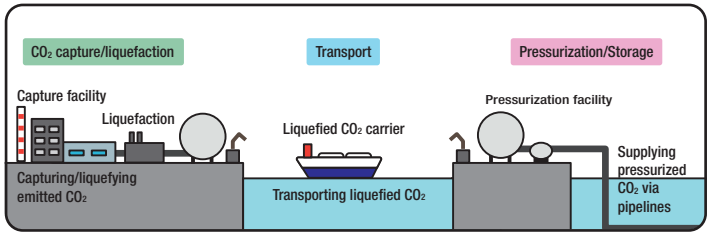
SEPs have legs to hoist the hull above seawater, stabilizing the vessel for safe and reliable installation work using the large crane onboard at offshore field.

SEPs also play active roles in supporting projects other than offshore wind farms, such as maintenance of offshore oil/gas wells.


SEP diagram

Liquefied CO_2 Carriers

Liquefied CO_2 carriers are a means of efficiently transporting captured and liquefied CO_2 to storage or usage sites in the carbon dioxide capture utilization and storage (CCUS) value chain, which is attracting worldwide attention. Studies are underway on various ship sizes and dual-purpose carriers that can also transport next-generation clean energy, as MOL works to respond flexibly to various transportation needs.



Conceptual diagram of the liquefied CO_2 carrier

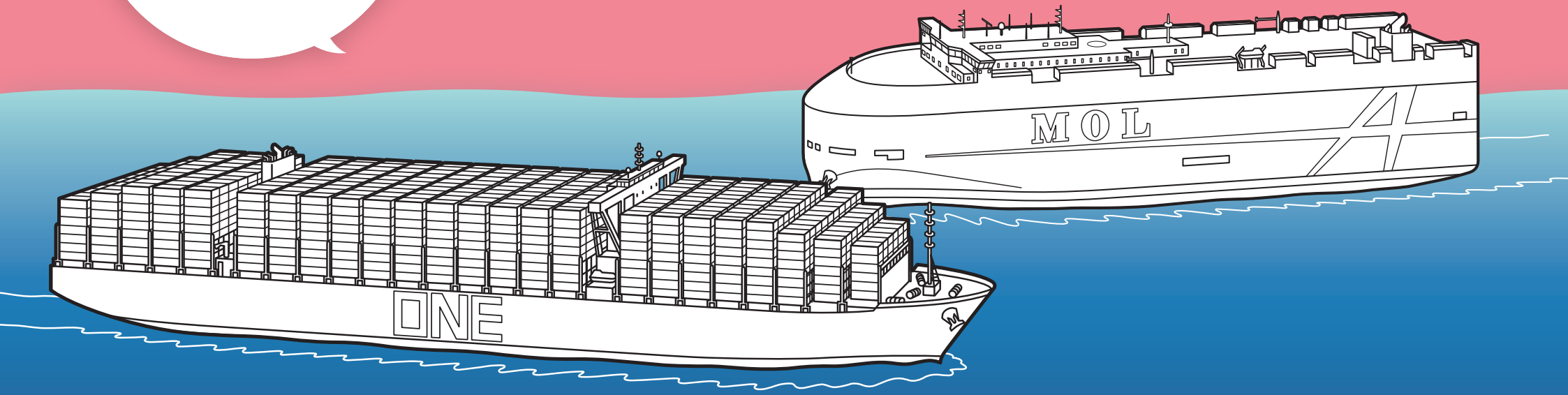
5

Product Transport

Bulkships carry resources and tankers carry energy.
Here, we have other types of vessels that carry finished products.
This section introduces car carriers that transport automobiles
and containerships that
carry a wide variety of cargoes such as apparel, appliances,
and other items we use every day.

Today's containerships can carry more than 20,000 TEUs

The FLEXIE series car carrier can accommodate a wide range of vehicles



Leaders in Ocean Transport, Connecting the World with a Network of Sea Routes

In contrast to bulkships, tankers, and LNG carriers that transport energy resources and raw materials, MOL's car carriers and containerships carry finished products in large quantities.

Japan's automobile exports began in earnest in the late 1950s, and currently about 4 million vehicles are exported annually. In response to booming car exports, dedicated vessels called pure car carriers (PCCs) were developed to ensure the safe, efficient transport of completed vehicles (mainly automobiles).

In addition, containerships, which have spurred innovation in global logistics and are sometimes referred to as the greatest human invention of the 20th century, are important vessels that support the foundation of ocean transport. The efficiency of product transport has continued to advance, and today's largest vessels can carry more than 20,000 containers at one time.

Cargo handling before the RoRo method was developed

The *Oppama Maru*, the first ship in Japan to use the RoRo method

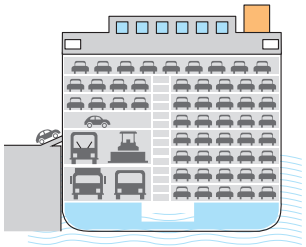
A Revolution in Automobile Transport

In the early days of Japanese autos exports, completed cars were loaded by crane, one by one, aboard conventional vessels, and unloaded the same way at their destination. the advent of car carriers. This method was time-consuming and labor-intensive, and vehicles were often damaged during cargo handling operations or while underway.

MOL teamed up with automakers on joint research that led to the realization of a completely new idea: the roll-on/roll-off (RoRo) method, in which automobiles are driven on and off the vessel.

'Floating Multi-story Parking Lots' for Efficient Mass Transport of Vehicles

The car carrier



Car Carriers

These vessels are called pure car carriers (PCCs) or pure car and truck carriers (PCTCs), and they are designed specifically to transport self-propelled cargoes such as automobiles and construction machinery. In 1965, MOL launched Japan's first specialized car carrier equipped with loading/unloading equipment, the *Oppama Maru*.

Structure / Characteristics

PCCs and PCTCs have a multi-story deck structure, like multi-level parking lots. Because their unique hull shape exposes a large area to the wind, they are more susceptible to "leeway," in which the vessel is pushed by the wind and proceeds at an angle, than other ships. MOL's car carriers feature rounded bows with a diagonal cut to reduce crosswinds and improve fuel efficiency, and the sides are stepped over the entire length of the vessel to reduce the effects of crosswinds.

Some of the cargo decks are "liftable decks," which means their height can be adjusted in accordance with vehicle height, so vessels can load not only passenger cars, but also taller vehicles such as buses, trucks, and even large construction machinery. To maximize loading capacity, the drivers leave just 30cm between the front of one car and the rear of the next, and a mere 10cm from side to side.

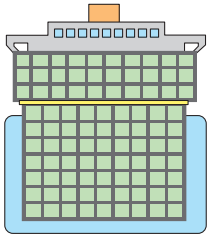
In the days of the *Oppama Maru*, car carriers could hold about 1,200 vehicles, but current PCCs and PCTCs have capacities of up to 8,500 units. Loading capacity is calculated for standard passenger cars measuring 4.125m long and 1.55m wide. MOL's FLEXIE series vessels, delivered in 2018, have capacities of 6,800 units, and can flexibly accommodate a wide variety of vehicles. They have 14 decks, six of which are height-adjustable, and can load cargo as tall as 5.6m. And the rampway can hold cargo weighing up to 150 tons. These modern vessels can transport virtually any type of vehicle and a range of other self-propelled cargoes as well.

Door-to-door Transport with International Standard Containers

20,000 TEU-class containership. LOA: 400m, breadth: 58.8m
※ Current ship name and hull are different from the above image.

Containerships

These vessels carry cargoes that are loaded into international standard shipping containers. Shipping routes and schedules are set in advance like bus or train services, and vessels periodically call at predetermined ports. In addition, containerized cargoes can be swiftly and easily reloaded to trucks and rail cars, making it possible to provide integrated door-to-door transport service.



Structure / Characteristics

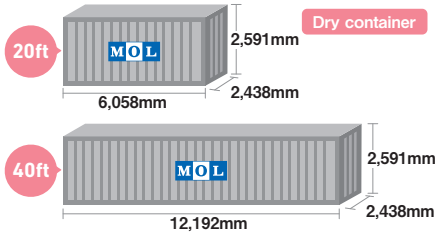
Containerships call at dedicated terminals that have container loading and unloading facilities and equipment. So generally, these vessels are not equipped with onboard cranes. Vertical rails called “cell guides” are installed in cargo holds to load containers efficiently, and the containers are lashed to keep them in place. “Lashing bridges” serve as scaffolds for lashing operations on deck. In addition, containerships can sail at higher speeds than other ship types to maintain stable calling schedules.

Shipping containers, which were introduced in the 1950s, had a massive impact on the trade and transport of commodities and products, not to mention the development of global supply chains. At the time, ocean cargo transport depended mainly on labor-intensive and inefficient cargo loading processes. In fact, labor costs accounted for the majority of logistics expenses. However, the use of standardized shipping containers has made it possible to transport large quantities of miscellaneous goods safely and inexpensively.

Shipping Containers: Size, Numbering, and TEUs

Shipping containers are available in many styles, making them adaptable for various cargo contents and shapes. The most common type, which transports a wide variety of cargoes, is called “dry containers.” “Refrigerated (reefer) containers” transport frozen and refrigerated cargoes. “Open top containers” have no roof, so they can accommodate oversize items. Similarly, “flat rack containers” have no sides or doors, and are also used for shipment of non-standard sized cargo. And “tank containers” carry liquid cargo. Sizes, strength, external dimensions, and the numbering system for shipping containers are standardized by the International Standardization Organization (ISO).

- **There are basically two lengths for containers: 20 feet and 40 feet.**
- **Numbers on the container designate its owners, type, and size.**
- **Loading capacity and transport records of containerships are expressed in “TEUs,” a term that stands for “Twenty-foot Equivalent Unit.” A 20-foot container is 1 (one) TEU. A 40-foot container is counted as 2 TEUs.**



Refrigerated (reefer) container
A refrigeration unit is installed in the container to maintain a pre-set temperature

Flat rack container
Transporting long, heavy-weight, or oversized cargo, which cannot be accommodated in a standard container

‘FLEXIE’ series car carriers offer the flexibility to transport a wide variety of vehicles

A car carrier arrives at the terminal where cars are lined up waiting to be unloaded

Containers, unloaded from the vessel by crane, are placed directly onto chassis

Crewmembers on a lashing bridge check loaded containers

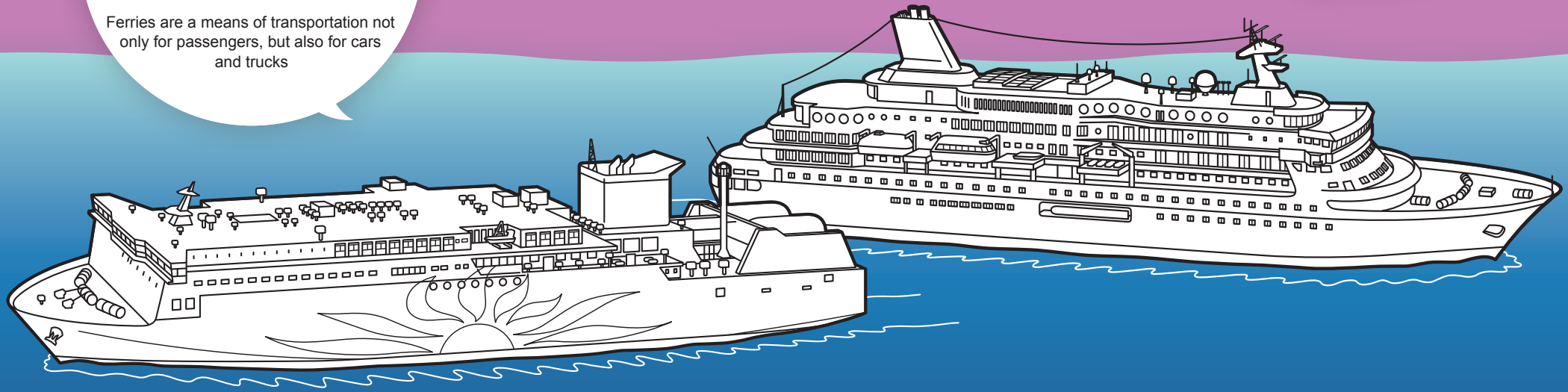
6

Passenger Transport

The oldest means of transportation for taking people on their travels is the ship. Today, cruise ships ply routes around Japan and all over the world, providing not just a means of travel but also a leisurely escape that allows people to "enjoy time and space," as well as a means of travel. In addition, ferries have grown with the spread of car and truck transportation, and play key roles in Japan's domestic logistics network. But like cruise ships, traveling by ferry also opens up new horizons in leisure-time activity, an element of the "Casual Cruise" concept.

Ferries are a means of transportation not only for passengers, but also for cars and trucks

The *Nippon Maru* is a cruise ship owned and operated by MOL



Creating Relaxing Voyages with Heartfelt Hospitality

Cruise ships are used not only as a means of transportation, but also as a fun way to travel. The ship travels to its destination port while passengers experience the cuisine, watch a show, or just relax and enjoy the sea. Passengers can enjoy the entire cruise at their own pace.

Ferries are the liners that carry passengers, cars, trucks, and semitrailers all together. Generally, cars, trucks, and so on are accommodated in a space inside the hull, and they are loaded and unloaded using a rampway. The upper decks house guest rooms, a restaurant, and a large public bath, providing a comfortable space not only for passengers but also for truck drivers.

MOL Group ferries also play a vital role in the logistics business, transporting industrial raw materials, finished products, and foodstuffs by connecting important supply centers and markets with the largest sea and land transport network in Japan.

Hospitality and a Full Range of Facilities for Enjoyment Onboard

The *Nippon Maru*
No. of passenger cabins: 199
Max. passenger capacity: 449

Swimming pool

Cruise Ships

In the cruise business, the saying goes that the ship itself is the destination. The *Nippon Maru* is complete with staterooms and suites on each deck, restaurants, a lounge, theaters, a bar, luxurious spa and salon services, boutiques, and a Grand Bath that offers a panoramic view of the open sea. Away from the hustle and bustle of everyday life, we offer a relaxing space at sea where you can spend your time freely.

Sailing through scenic areas instead of taking the shortest route to the destination, and sometimes slow down the speed, so passengers can see marine animals - that's the creative approach our planners and captains take as they determine routes and orchestrate the experience our passengers will enjoy.

The *Nippon Maru*, thanks to its compact size, can call at a variety of ports, including charming, out-of-the-way islands. This feature, along with its attentive hospitality and meticulously prepared cuisine, creates a sense of closeness with passengers, contributing to its excellent reputation in the cruise market.

Structure / Characteristics

The *Nippon Maru* is also equipped with a "Fin Stabilizer" anti-roll system to maximize passenger comfort throughout the voyage. In addition, tender boats, which not only serves as a landing craft and lifeboats, but also allows high mobility during port calls, adding a new dimension to cruises aboard the *Nippon Maru*.

Ferries Efficiently Transport People and Cargo in Japan's Coastal Waters

This ferry can accommodate 590 passengers, 146 passenger cars, and 154 trucks

Ferries

- Ferry travel integrates both transportation and accommodation, making trips more affordable. Plus if travelers bring their cars on board, they will have greater mobility when they reach their destination.
- When it comes to cargo transport, ferries give drivers a chance to rest while their cargo continues to move. In addition, ferries allow for "unmanned sailing" transporting only trailers without drivers aboard. What's more, transporting cargo and people by ferry reduces CO_2 emissions, the key cause of global warming, compared to other modes of transport. So they are expected to be an essential part of the "modal shift" promoted by Japan's Ministry of Land, Infrastructure, Transport and Tourism. Ferries also help address the shortage of long-haul truck drivers and reduce labor burdens.

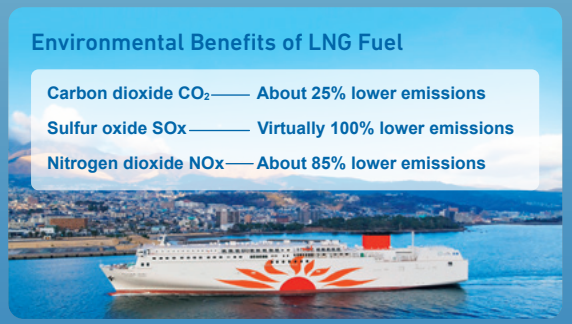
An example of a passenger cabin

Spa

A New Era of LNG-fueled Ferries, Friendly to Both People and the Environment

In 2023, Japan's first LNG-fueled ferries, the *Sunflower Kurenai* and *Sunflower Murasaki*, entered service. The vessels are the first ferries in Japan equipped with high-performance dual-fuel engines that can use both LNG and heavy oil as fuel. The use of LNG fuel is expected to reduce CO_2 emissions by about 25%, SOx by 100%, and NOx by about 85%.

Generations of families can get together to enjoy a cruise trip. Under the concept of *kizuna*, or "bonding" with family members, the ferries are designed to allow passengers to experience a new category of travel, which we call the "Casual Cruise."



'Modal Shift' Changes the Logistics Industry

The "Modal Shift" has been attracting a lot of attention lately. This refers to the concept of switching from truck transportation to more environmentally friendly modes of transportation such as ocean transport by coastal vessels and rail transportation. This represents an effective approach to environmental problems, which are becoming more serious every year.

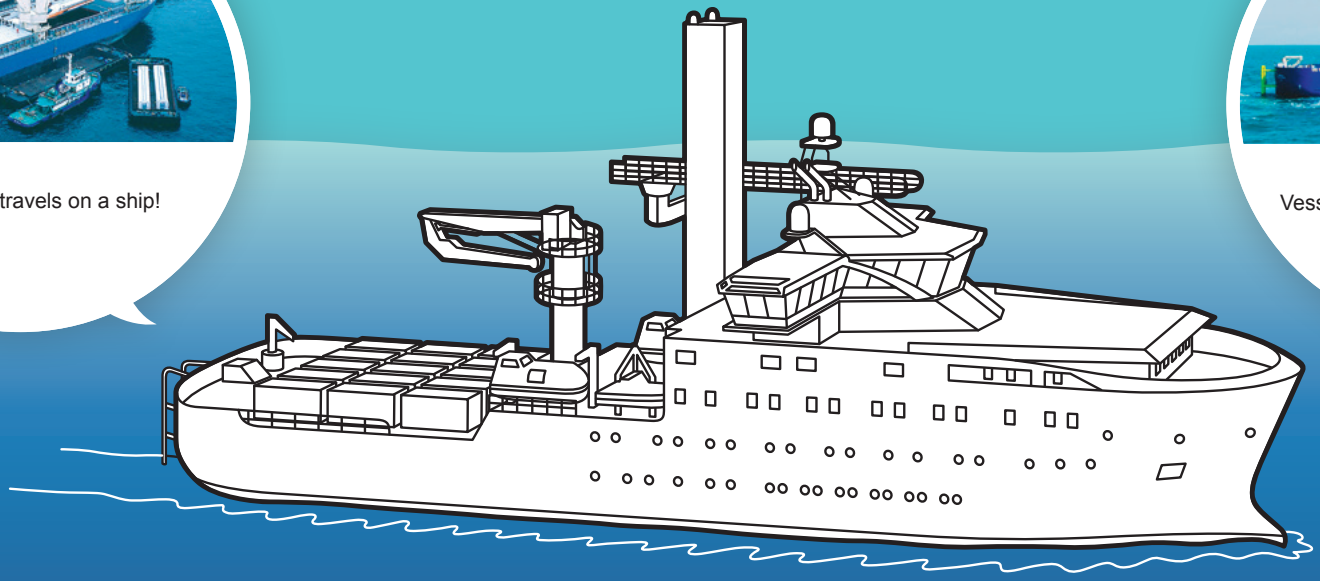
MOL will fulfill its social responsibility as a shipping company by contributing to the Modal Shift, while working to swiftly introduce LNG-fueled vessels with lower environmental impact.

7

Vessels Operating in Specialized Fields

Take a look at the wide variety of MOL Group vessels in service, some of which are highly specialized for different purposes.

A bullet train travels on a ship!



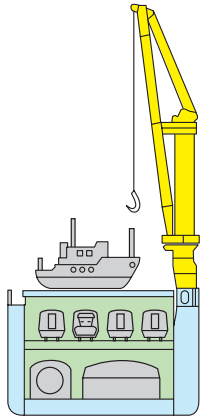
Vessels also play an essential role in offshore wind farms

Powerful Enough to Carry Any Cargo, Oversize or Heavyweight

A heavy lifter loading subway cars

Heavy Lifters

These vessels specialize in carrying heavy cargoes such as plant components, large construction machinery, rail cars, and so on, each of which weighs more than 30 tons. The holds are box-shaped, creating a boxy space with few protrusions, with wide hatches on deck to facilitate cargo loading and unloading cargo. In addition, a solid, movable partition can separate the holds into upper and lower sections. That means our heavy lifters can accommodate all kinds of cargoes, of any length, weight, or shape. Large cargoes that cannot fit in the holds are carried on the highly reinforced weather decks. These vessels are also equipped with powerful cranes to unload heavy cargo under their own power. Another feature is the large-capacity ballast tanks on both sides of the vessel to prevent the vessel from tilting too far during loading and unloading operations.



Tugboats are Indispensable in Escorting Large Vessels in and out of Port

A tugboat assists an LNG carrier entering port

Tugboats

Tugboats are used to push and pull vessels and marine equipment and facilities. Sizes vary depending on their intended use. Harbor tugs, which assist in the arrival and departure of large vessels in port are mainly in the 150-200-ton class, and ocean-going tugs, which transport large plant equipment in open sea crossings, can range up to several thousand tons.

Tugboats feature powerful engines because they need to move much larger vessels and structures. Harbor tugs are equipped with azimuth thruster propellers that rotate 360° for extremely tight turns, and do not require a rudder. Fenders, such as used tires or plastic bumpers, are attached around perimeter of the tugboat as cushioning materials. These prevent damage when tugboats come into direct contact with the hulls of vessels they are assisting.

Installation and Maintenance of Optical Submarine Cables Supporting High-speed Communications

Cable-laying ship (photo courtesy of KDDI Cableships & Subsea Engineering Inc.)

Cable-laying ships

Cable-laying ships are used to install, repair, and recover optical submarine cables. A dynamic positioning system (a system to automatically control the vessel's position) is installed to keep the vessel in a fixed position as it constantly moves with the waves and wind, since the vessel must be maintained in a precise position during the work. Cable-laying vessels are equipped with a "cable tank" for housing cables, a "drum cable engine" for repeatedly winding and unwinding cables, a "linear cable engine" for laying cables at high speed, and an underwater robot used for repair, survey, and burial cables. Space on the deck is used as a staging area. These vessels also have a "cable control room," where work is constantly monitored onscreen to ensure safe, efficient completion of each task.

Contributing Extensively to the Offshore Wind Power Value Chain

Wind power generation is becoming increasingly popular as a natural energy source that can generate large volumes of electricity at relatively low cost. Development of offshore wind power generation requires different types of vessels: those carrying equipment as well as those transporting engineers for the installation and maintenance to sites far out at sea. The MOL Group is developing the following fleet to precisely respond to demand at each stage.

Service Operation Vessel (SOV)

SOVs are offshore support vessels with accommodations that allow technicians to stay offshore wind farms for long periods of time. These vessels also feature dynamic positioning systems (DPS) to maintain a safe distance between the vessel and offshore wind turbines at all times. SOVs are also equipped with a motion compensated gangway that has a function to absorb any ship motion caused by waves, in order to safely transfer technicians from the vessel to Transition Piece of offshore wind turbine.

Crew Transfer Vessel (CTV)

CTVs (with a capacity of 12-24 passengers) operate from a base port to bring engineers to offshore wind farms that are relatively close to shore. The fenders attached to the bow of the vessel are pressed against the offshore wind turbine to stabilize the hull and then engineers board the offshore wind turbine platform. Aluminum catamarans are the mainstream hull type.

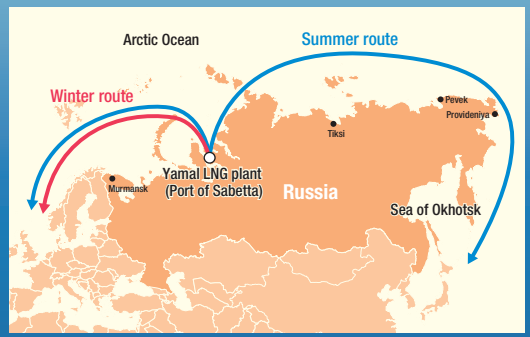
▶ The SEPs(Self-Elevating Platforms) introduced on P.14 is also one of the vessels active in the offshore wind power generation business.

Icebreaking LNG Carrier <Yamal LNG Project>

Russia's Yamal Peninsula holds the nation's the largest natural gas reserves. Yamal, which means "end of the Earth" in Russian, is an isolated region inside the Arctic Circle about 2,500km from Moscow. The area is covered in ice for most of the year and the temperature drop to minus 40°C in the winter. The icebreaking LNG carrier was developed to transport large volumes of LNG from the Yamal Peninsula.

In 2018, the world's first icebreaking LNG carrier, operated by MOL, went into service. It transports LNG to all parts of the world throughout the year, with specifications that allow navigation through seas with ice as thick as 2.1m—the special "ice bow" shape makes it easy to break the ice under the surface of the water, and the equipment on deck is protected against icing and freezing. In the summer, the icebreaking LNG carrier travels to East Asia via the Northern Sea Route, and in the winter, supplies LNG via Europe.

Icebreaking LNG carrier. Tank capacity is 172,000m^3



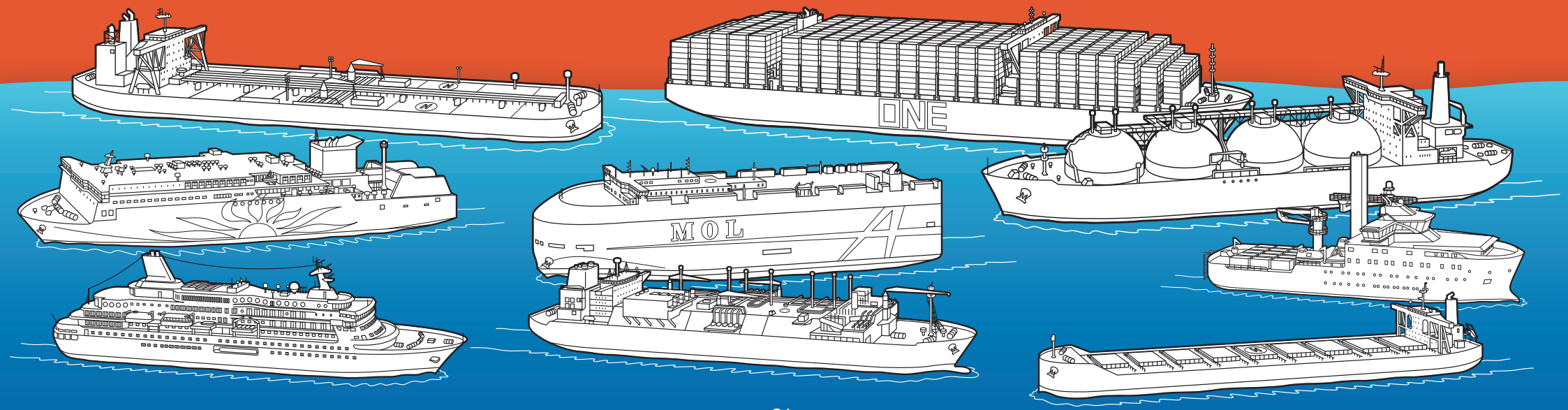
8

Ship Trivia

How big is a ship?

What kind of fuel is used to power the ship?

Here are some fun facts about ships that you may or may not be aware of.



The History and Future of Marine Fuels

Ocean transport using ships has been around since ancient times. Fuels and propulsion systems have come and gone, and transport capacity has been improved with modernization, but today, efforts to reduce environmental impact are accelerating. Let's take a look at how fuels have changed over the years.


Sailing ship


The *Hideyoshi Maru*


The *Kinai Maru*

Wind

Before fuel was used as a source of power to move ships, mariners relied on wind for propulsion. In the 15th century, large sailing ships, called carrack ships, were built mainly in Spain and Portugal, and in 1492, Columbus crossed the Atlantic Ocean on the *Santa Maria*. And from 1519-22, Magellan's *Victoria* completed a circumnavigation of the world. Sailing ships continued to develop, opening up new horizons of exploration and trade.

Coal

In the 1800s, the Industrial Revolution brought steam engines and coal-fueled steamships gradually became popular. In 1807, the *Clermont*, an outer-wheel steamboat, began commercial service carrying passengers between New York City and Albany on the Hudson River. In 1878, 25 years after the arrival of the "black ships" in Japan, Mitsui O.S.K. Lines built its first steamer, the *Hideyoshi Maru*, to transport coal produced in the Miike coal mine.

Oil

In the 1900s, oil superseded coal as the mainstream marine fuel. Oil has a higher energy density than coal, meaning more energy can be gained from the same volume. This meant less onboard space had to be devoted to fuel storage, so ships could carry more cargo. It also eliminated the need to constantly shovel coal into the boilers, reducing the number of crewmembers needed. Since the 1950s, a fuel called marine heavy fuel oil, made up largely from residues generated in the oil refining process, came into wide use, and remains the mainstream marine fuel to this day.

Next-generation Fuels

Heavy fuel oil is an inexpensive and convenient fuel, but its combustion in an engine generates air pollutants such as sulfur oxides (SOx) and nitrogen oxides (NOx), and greenhouse gases (GHGs) such as CO_2. For this reason, marine emission regulations have been progressively tightened for ships, as with automobile emission regulations. The shipping and shipbuilding industries are working toward the goal of zero-emission vessels, and various initiatives are underway to enable the use of new next-generation marine fuels to achieve zero emissions from ships.

Once Again, Challenging the Future of the Earth with the Power of Wind

Wind Challenger

The "Wind Challenger" uses sails to utilize wind power, a renewable energy source, for propulsion of the ship. The installation of sails allows vessels to maintain the same speed while reducing their use of fossil fuels. By maximizing the installation of sails, in other words, combining the time-honored technology of sailing ships with modern state-of-the-art equipment and expertise, it's possible to significantly reduce the fuel consumption of large cargo vessels, which in turn reduces GHG emissions.

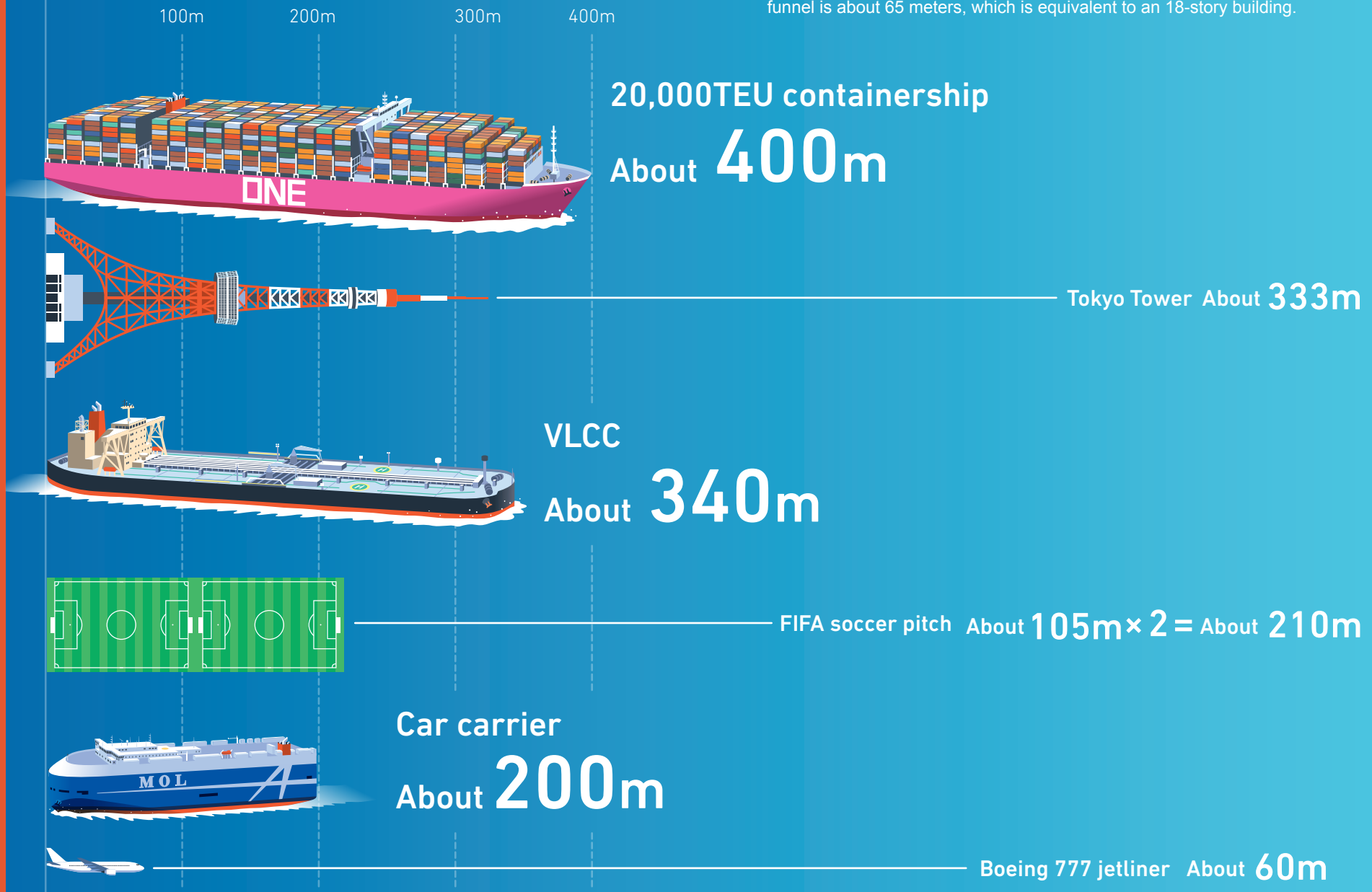
Wind Hunter

The "Wind Hunter Project" combines the offshore wind energy technology used in the Wind Challenger Project with stable energy utilization technology using hydrogen produced by wind energy. Through promotion of this project, MOL is studying the operation of zero-emission vessels and ways to supply hydrogen for onshore consumption, aiming to contribute to the realization of a decarbonized and hydrogen society.

How big is a ship?

Today's large merchant vessels can measure up to around 400 meters long. That's about the same dimensions as the height of Tokyo Tower, or the width of Tokyo Station.

In addition, the distance from the keel of the vessel to the tip of the funnel is about 65 meters, which is equivalent to an 18-story building.



How many crews are necessary to run a vessel?

As you have read, huge merchant vessels transport large volumes of cargo, but these massive ships require only about 25 people to keep them on the move. Following is an overview of the work of the crewmembers onboard a vessel.

Total 25 persons

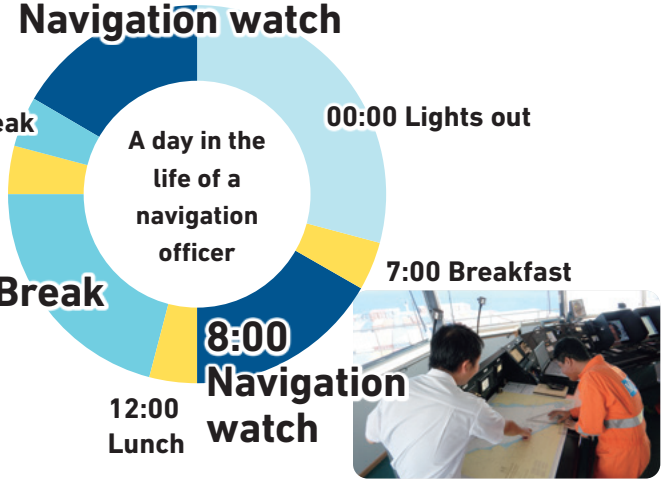
* The number of crewmembers depends on the type of ship and the type of contract. But most mainstream vessels require 20 to 30 crewmembers.

Skillfully maneuvering huge vessels to safely deliver cargo

Deck Department

● Navigation Officers (First ~ Third), Able Seamen (A/B), etc.

Main duties Maneuvering and navigation duty/voyage planning/ cargo management/hull maintenance/ communication with shore, other vessels



(Example) Third Mate

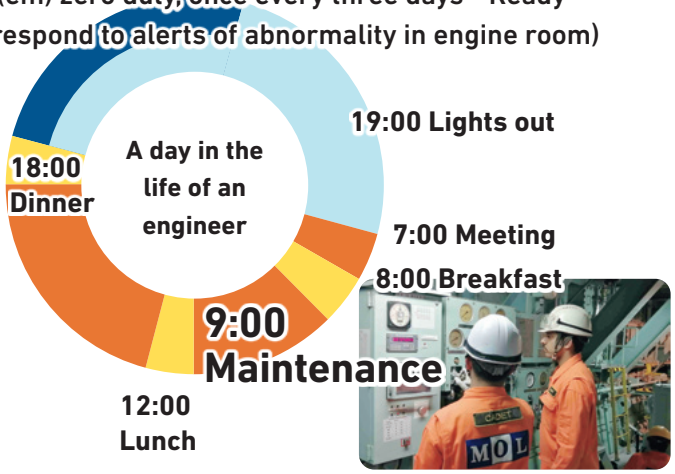
Maintaining huge engines to keep them operating at peak performance

Engine Department

● Engineer (First~Third), oiler, etc.

Main duties Operation and management of main and auxiliary engines/ repair and maintenance of all onboard machinery/ power generation and desalination for ship operation and daily life/bunkering planning and bunkering

(M (em) zero duty, once every three days—Ready to respond to alerts of abnormality in engine room)



Supporting the lives of crewmembers

Purser Department

● Purser ····· 2nd Steward, 2nd Cook

Main duties Preparing meals for crewmembers

A Vessel

for Every Need Supporting Everyday Life
and Industries Around the World

Mitsui O.S.K. Lines, Ltd.
1-1 Toranomon 2-chome, Minato-ku, Tokyo 105-8688, Japan
https://www.mol.co.jp/en/