



# Japanese Green Ships

Green Technology for Sustainable Growth of Maritime Sector

# Features of Japanese Shipbuilding & Ship Machinery Industries



## Quality

For many years, the Japanese shipbuilding industry has been making efforts to improve the quality of its products. The high quality of Japanese ships enabled them to realize the advanced functionality, excellent performance and superior durability. In addition, the high quality of Japanese ships contributes to reduction of their life cycle costs.



## Reliability

Japanese shipbuilding industry is sustained by high-skilled craftsmen. They are all dedicated technical specialists who take pride in their works. These high-skilled craftsmen have gained the customers' confidence over the years.



## Technology

Energy-saving technology is one of the strengths of Japanese ships. Japanese shipbuilding and ship machinery industries have been making efforts to develop energy efficiency technologies since the Oil Shocks in the 1970s. These technologies contribute to the reduction of CO<sub>2</sub> emissions from the ships and to the approach toward the global warming.



## Innovation

A number of new technologies in various fields have been developed in Japan. Having faced with a lot of trial and errors in the R&D processes, Japanese shipbuilding and ship machinery industries have accumulated knowledge and experiences that can be utilized for the new technologies.

The collaboration with the creative ideas and sophisticated technologies turns into the innovation. The Japanese shipbuilding and ship machinery industries are always seeking the possibility of the innovation, in view of providing the customers with the solutions to their needs.

# Growing Demand for Energy-Saving Technology

The Japanese shipbuilding and ship machinery industries have excellent energy-saving / environmentally-sound technologies.

Due to the global warming and increasing oil prices, the maritime transportation is facing with following tasks:

## International frameworks to regulate the emission of the greenhouse gas

The global warming is an urgent task for all mankind.

In 2011, in order to confront this task in the maritime sector, the IMO (International Maritime Organization) adopted the amendment of the MARPOL Convention (International Convention for the Prevention of Pollution from Ships), and established the international framework to regulate the emission of the greenhouse gas from the ocean going shipping.

The greenhouse gas regulation, or the CO<sub>2</sub> emission control, will be applied to new-built ocean going ships of 400 GT and above, for which the building contract is placed on or after 1 January 2013. New ships which do not satisfy the CO<sub>2</sub> emission control will be abandoned to be in the services for the ocean going shipping. The regulating standard of the CO<sub>2</sub> emission control will be tightened in a phased manner (see the figure below), and thus further development of the energy-saving technologies will be required to the industries.

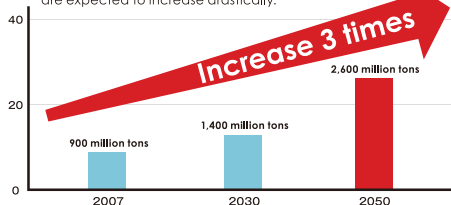
Japanese shipbuilding and ship machinery industries have developed a number of energy-saving technologies that can fully meet the CO<sub>2</sub> emission control. Japanese industries provide with the ships and the ship machinery with excellent environmental features that can meet the demands of the customers intending to reduce the life cycle costs of the ships.

## Escalating Fuel prices

Oil prices, which directly affect the maritime fuel prices, tend to increase these days. In addition, increasing demand of the emerging countries will raise the oil prices in the future.

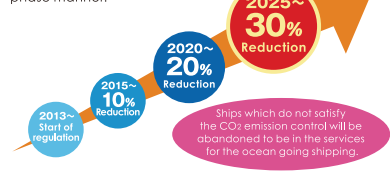
### The CO<sub>2</sub> emission forecast in the international maritime sector (million tons)

Due to the increase in the trade volume of emerging countries, CO<sub>2</sub> emissions in international maritime sectors are expected to increase drastically.



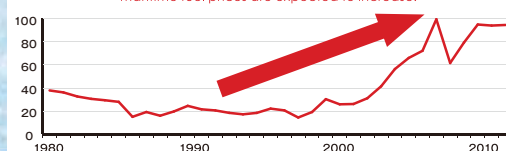
### The CO<sub>2</sub> emission control for new-built ships

From 2013, CO<sub>2</sub> emission control for new ships will be made tougher in a phase manner.



### Forecast of fuel prices

Due to the trade increase of the emerging countries, maritime fuel prices are expected to increase.

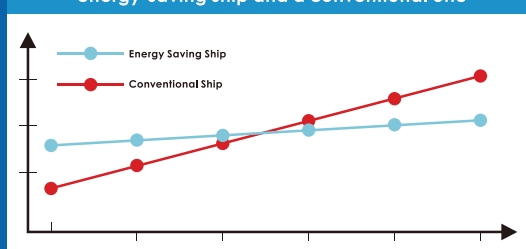


Crude Oil, West Texas Intermediate 40 APL, Midland Texas, US\$ pre barrel  
 ※ Monthly average spot prices of West Texas Intermediate (WTI) in New York • Mercantile Exchange.  
 Source : IMF Primary Commodity Prices

## Reduction in the life cycle cost of ships

Compared with the ordinary ships, the initial costs of the energy saving ships tend to be relatively higher. However, from the viewpoint of the total life cost of ships, the cost of energy saving ships will be lower than that of the ordinary ones.

### Comparison of life cycle costs between an energy-saving ship and a conventional one







**Japan Marine United Corporation**

## **G(Green Ship) Series**

This series of ships reduces environmental loads and fuel consumption by 25%, in comparison with the ordinary ships. By applying the optimum-designed hull and low-fuel consumption engine with the waste heat recovery system, this series of ships achieve high performances with lower environmental impacts. Also, this series of ships are equipped with the optimum navigation system called 'Sea-Nave', which provides enhanced energy saving performance.

## **Bulk Carrier**



**SHIN KURUSHIMA DOCKYARD CO., LTD**

## **HOKUSHO MARU**

The HOKUSHO MARU is one of the SES (Super Eco Ship)s constructed by the Tandem Hybrid method. This ship realizes lower fuel consumption, lower environmental effect and improvement in the navigation safety and working environment. The contra-rotating effect, produced by a pod type propeller and a controllable pitch propeller, realizes excellent propulsion efficiency and reduction of the fuel consumption. The pod type propeller realizes the smooth acceleration and deceleration by the inverter-controlled system.

# Japanese



**Oshima Shipbuilding Co., Ltd.**

## **SOYO**

This ship applies the air lubrication system that reduces the frictional resistance between the hull and the seawater by blowing air bubbles on the vessel's bottom. The energy needed to blow the air bubbles is minimized by utilizing the air from the turbocharger of the main engine. This ship reduces the CO<sub>2</sub> emission by 3% to 8%.



**Mitsubishi Heavy Industries, Ltd.**

## **MALS-14000CS**

The MALS (Mitsubishi Air Lubrication System) is a system that can reduce the friction resistance between the hull and the seawater: The air from the blower, installed onboard, turns into air bubbles which covers the bottom of the ship, like a carpet. By utilizing the advanced simulation technologies, or the computational fluid dynamics (CFD), the position of the blower and the amount of the air bubbles are adjusted to minimize the fuel consumption and the impact on the environment.



## **Container Ship**

**Japan Marine United Corporation**  
**eFuture-13000C**

This concept vessel reduces the CO<sub>2</sub> emissions and fuel consumption by 30%. In order to enhance the propulsion performance, this ship applies the twin-skeg hull, contra-rotating propellers, innovative front-bonnet design and power plant with high efficiency. In addition, the solar battery panels are installed over the upper deck to utilize the natural solar energy.



## **Green Ships**

### **Others**

**Naikai Zosen Corporation**

## **JUPITER SPIRIT**

The STEP (Spray TEaring Plate) is an energy-saving device, made up of a pair of plates attached to both sides of the bow. The STEP removes waves beating the bow, while keeping the ship's speed and fuel efficiency. The STEP has a simple structure and its weight is just approximately 8 tonnages. In comparison with the ships without this device, the JUPITER SPIRIT reduces the fuel consumption by approximately 3%.



**Mitsubishi Heavy Industries, Ltd.**

## **SAYAENDO**

The Sayaendo features a peapod-shaped continuous cover for the MOSS spherical tanks that are integrated with the ship's hull. The continuous cover contributes to securing the ship's strength, realizing the weight reduction and reducing the wind pressure during the navigation. Also, by applying the new turbine plant reutilizing the steam used for the rotation of the turbine, the ship reduces the fuel consumption by 25% per unit cargo basis.



# Japanese Energy-Saving Technology

The Japanese shipbuilding and ship machinery industries have developed the CO<sub>2</sub> reduction technologies, for the purpose of meeting the regulation of greenhouse gas emissions. The combination of the component technologies has realized the Japanese high-end energy saving ships. The followings are some examples of these component technologies.

## Hull Technology



The hull technology contributes to the reduction of the friction resistance between the hull and the seawater, which causes the majority of the drag to a ship. The "Air Lubrication System" sends air bubbles to the bottom of the ship to reduce the friction resistance. Optimum hull forms will be designed for each category of ships. Energy-saving painting will reduce the friction resistance.

## Engine system



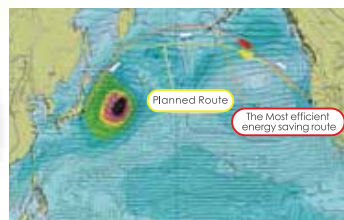
The engine is one of the most essential machinery of the ships. Japanese manufacturers, with the high-end and sophisticated technology, have developed the CO<sub>2</sub> reduction engines, and the turbocharger with a small generator that utilizes the exhaust gas to produce the electricity.

## Propulsion Machinery



An energy-saving propeller is a prominent component for the energy saving shipping. The hybrid power system applies the solar battery to reduce CO<sub>2</sub> emissions.

## Operation



For the navigation, the weather routing technology is utilized to analyze weather information, and to provide the optimum shipping route, taking into account the features of each ship.

### Bodies Concerned

The Cooperative Association of Japan Shipbuilders (CAJS)  
The Shipbuilder's Association of Japan (SAJ)  
Japan Ship Machinery And Equipment Association (JSMEA)  
ClassNK

### Pictures courtesy of

MTI Ltd. / Nippon Paint Marine Coating Co., Ltd.  
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Japan Marine United Corporation







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