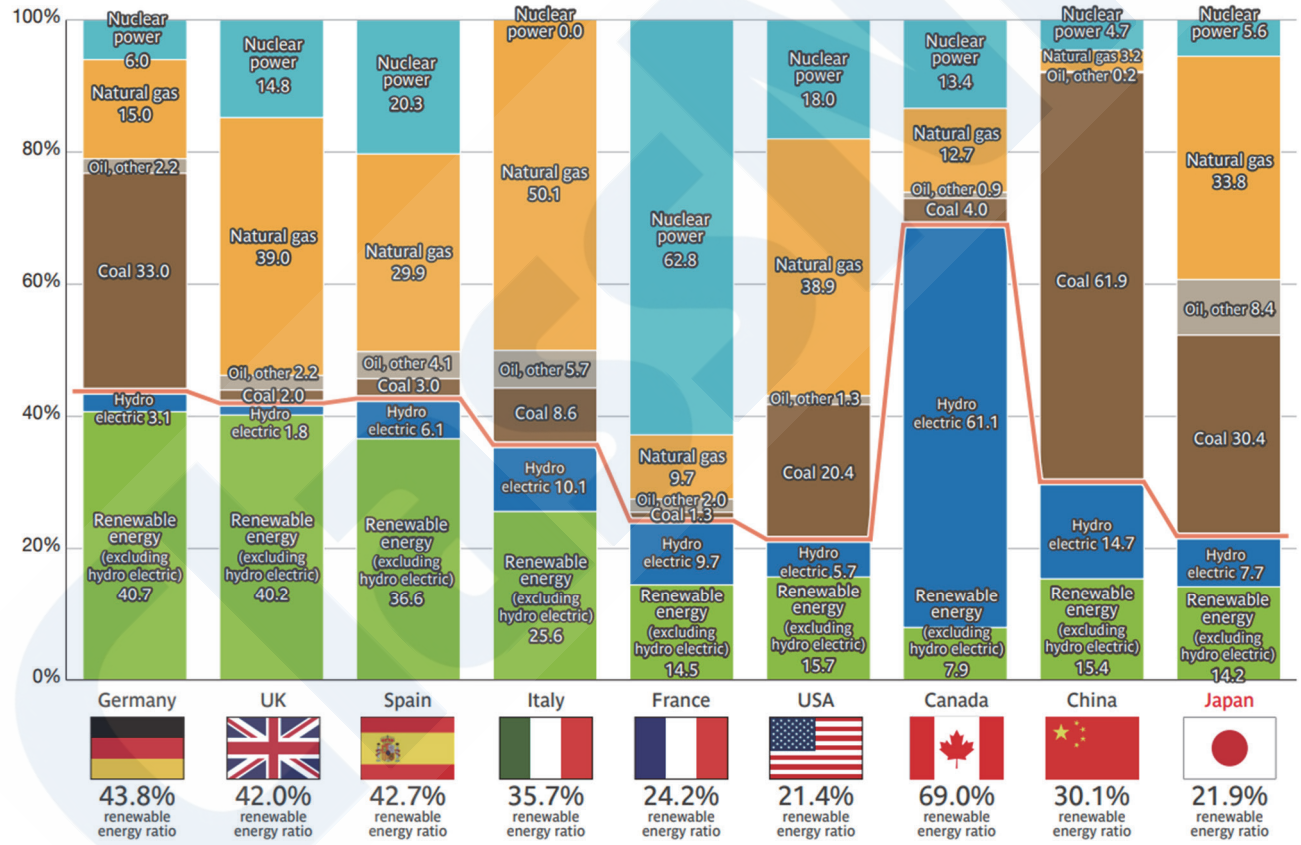
Prospects for Offshore Wind Power and ClassNK's Initiatives for the Safety of Related Work Vessels

Renewable Energy Department, Business Assurance Division, ClassNK

1. PROSPECTS FOR OFFSHORE WIND POWER GENERATION IN JAPAN

At present, the world depends on fossil fuels for more than 80 % of its energy supply, but considering the increasing frequency of abnormal torrential rains and other severe weather events, which appear to be traceable to global warming in recent years, a transition to renewable energy in order to reduce emissions of greenhouse effect gases (GHG) has become an urgent issue in both the advanced nations and other countries.

In the several European nations, the share of power generation by renewable energy (except hydropower) in the electric power generation mix has already reached around 40 % (see Fig. 1). Wind power generation is the most widely disseminated form of renewable energy in the European nations and the United States. The share of wind power in total generated output now exceeds 20 % in the United Kingdom, Germany and elsewhere.



Source: Created by the Agency for Natural Resources and Energy based on the IEA "Market Report Series—Renewables 2023" (Power Generation in Each Country as of 2022), IEA database, and the Comprehensive Energy Statistics of Japan (FY2022 confirmed figures).

Fig. 1 Comparison of power generation mix by country (2022)

In contrast to those European countries, in Japan, the share of power generation (preliminary figures) using renewables (except conventional hydropower) in 2023 fiscal year was 15.3 % of total generated output. The shares for solar power, wind power, biomass, etc., which are generally called "new energy," were limited to 9.8 % for photovoltaic (PV) power, 4.1 % for biomass and 1.1 % for wind power.

In view of this situation, in February 2025, the Seventh Basic Energy Plan formulated by the Cabinet announced a policy of increasing the share of renewables, including conventional hydropower, to approximately 40 % to 50 % in FY 2040, and also proposed raising the share of wind power to 4 % ~ 8 % (see Table 1). For solar power, which had been in the vanguard in the

diffusion of renewable energy in Japan until now, the introduction of new generating methods such as perovskite solar cell is expected to result in increased generating capacity, but together with this, high expectations are also placed on offshore wind power.

Table 1　Outlook for introduction of renewable energy based on Japan's Seventh Basic Energy Plan

		FY 2023 (preliminary report)	FY 2040 (outlook)
Energy self-sufficiency		**15.2 %**	**Approx. 30-40 %**
Generated output		**985.4 billion kWh**	**1.1 to 1.2 trillion kWh**
Power generation mix	**Renewables**	**22.9 %**	**Approx. 40-50 %**
	Solar (PV) power	9.8 %	Approx. 23-29 %
	Wind power	1.1 %	Approx. 4-8 %
	Hydropower	7.6 %	Approx. 8-10 %
	Geothermal power	0.3 %	Approx. 1-2 %
	Biomass	4.1 %	Approx. 5-6 %
	Nuclear power	**8.5 %**	**Approx. 2 %**
	Thermal power	**68.6 %**	**Approx. 30-40 %**
Final energy consumption		**300 million kL**	**Approx. 260 to 270 million kL**
GHG reduction rate (compared to FY 2013)		**22.9 %** *Actual results in FY 2022	**73 %**

Source: Outline of the Seventh Strategic Energy Plan (SEP), p. 9
https://www.enecho.meti.go.jp/en/category/others/basic_plan/pdf/7th_outline.pdf

Full-scale wind power development in Japan started from port and harbour areas where the relationship with fishing rights was already well-organized, but at present, the center of development activities is continuing to shift to general public waters. By type of foundation, offshore wind turbines are classified as the fixed type or floating type. Most existing offshore wind turbines in Japan are the bottom fixed type, in which the structure supporting the wind turbine is fixed directly to the sea bed. However, in comparison with the waters of northern Europe, where the wind power field is particularly advanced, the water depth of Japan's coastal waters quickly becomes deeper in offshore areas. Since the waters where the fixed type can be installed are limited, 2030s and beyond, high expectations are placed on development of the floating type, in which the wind turbine is mounted on a floating structure and moored to the sea bed with anchor chains, etc (see Fig. 2).

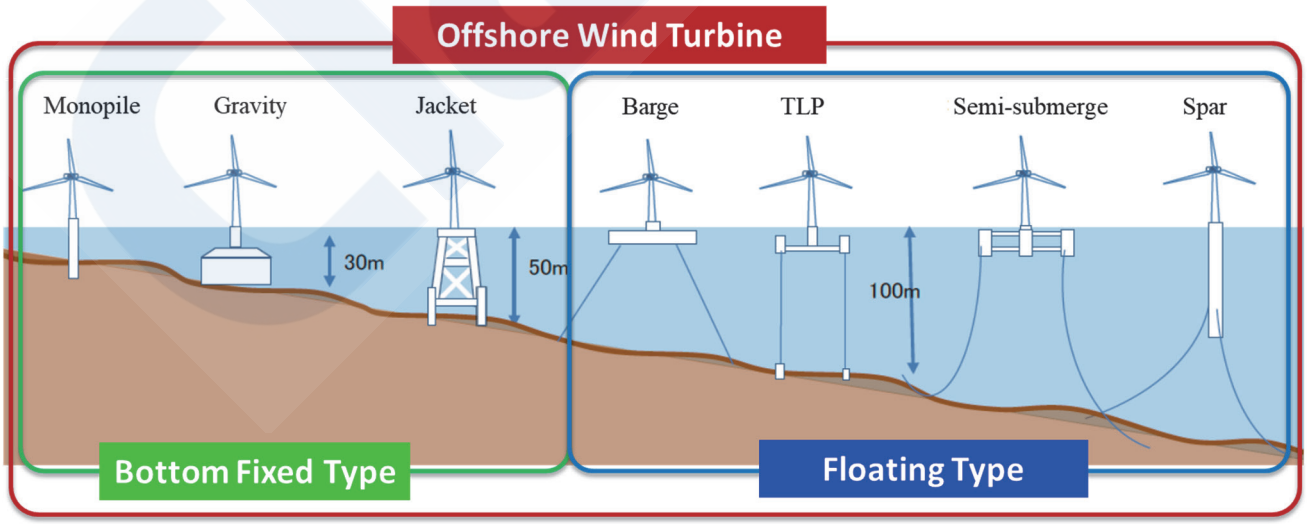


Fig. 2　Offshore wind turbine installation methods

It may be noted that Japan's Exclusive Economic Zone (EEZ), within which Japan has the right to develop wind power, etc., is the world's 6th largest, covering approximately 4.5 million km^2, which is equivalent to more than 11 times Japan's land area,

and contains vast potential wind power energy (see Fig. 3). Since the development of this kind of domestically-produced energy is also critical from the viewpoint of Japan's national energy security, a revision of the Act on Promoting the Utilization of Sea Areas for the Development of Marine Renewable Energy Power Generation Facilities to make it possible to install offshore wind power generation facilities in Japan's Exclusive Economic Zone was approved by the Japanese Diet on June 3, 2025.

In August of 2025, the "Vision for Offshore Wind Power Industry (2nd) (Public-Private Council on Enhancement of Industrial Competitiveness for Offshore Wind Power Generation)," which was formulated under the leadership of the Ministry of Economy, Trade and Industry (METI) and the Ministry of Land, Infrastructure, Transport and Tourism (MLIT), set various targets, including the drafting of proposals for offshore wind power projects with a capacity of 30 to 45 GW by 2040, with at least 15 GW to be the floating type, and the drafting of proposals for large-scale floating-type offshore wind power aiming by FY 2029 to meet this goal.

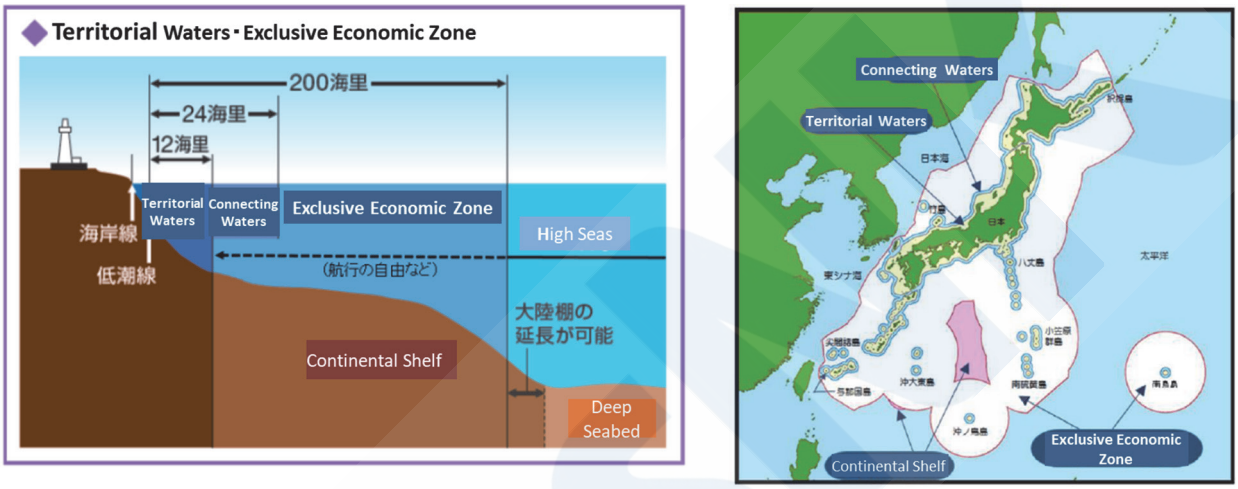


Fig. 3 Japan's Exclusive Economic Zone (EEW)

On the other hand, installation work for offshore wind farms consists of various stages, including transportation of the wind turbine components and supporting structure, trial assembly at the base port, foundation installation work, cable-laying work, installation of the wind turbine, etc. Various types of work vessels are also required in this work, according to the type of work. Figs 4 and 5 show the main construction processes for an offshore wind farm and the types and applications of the vessels.

Fig. 4 Offshore wind farm construction processes

Ship Category	Purpose of Use
SEP (Self Elevating Platform)	Self-Elevating work Platforms used for offshore installation of foundation components and wind turbine parts for offshore wind turbines.
CTV (Crew Transfer Vessel)	Boats transporting workers and materials to offshore wind turbines
SOV (Service Operation Vessel)	Offshore support vessels with multiple accommodation facilities that can operate offshore for a certain period of time, allowing maintenance technicians to be dispatched to multiple offshore wind turbines
CLV (Cable Laying Vessel)	Work vessels that lay and bury power cables between wind turbines in offshore wind farms, connecting them to offshore substations and land
AHTSV (Anchor Handling Tug Supply Vessel)	Multipurpose vessels used for towing and installing floating offshore wind turbines, laying mooring facilities, and transporting materials

（Source of photos）Following companies' Web site
SEP：SHIMIZU Corporation, CTV：NYK、Tokyo Kisen, SOV：MOL, CLV：TOYO Construction, AHTSV：KLINE Offshore

Fig. 5　Types and applications of work vessels

2.　HEIGHTENED NECESSITY OF SAFETY MEASURES FOR WORK SHIPS

As described in the previous chapter, construction of offshore wind power facilities based on Japan's energy policy is becoming in full swing, and in the actual construction, it is necessary to use a large number of work vessels and handle heavy and long objects at sea over long periods of time. Moreover, expansion of construction work to the waters of Japan's Exclusive Economic Zone and an increase in work in deeper waters are also foreseen in the future. Considering the fact that serious accidents and incidents have already been seen occasionally in work related to offshore wind power development up until now, it is thought that safety measures for work vessels will become even more important than in the past.

Non-Japanese developers and constructor with track records in Europe are also involved in offshore wind power development in Japan. There have been calls in those companies for the introduction of international safety management methods based on the experience of the oil and gas industry, requests for clarification of international safety standards and the safety standards of the companies themselves, and assessment of the safety levels of the work vessels to be used in Japan. In response, there is a view among owners and operators of work vessels in Japan that safety management is basically the responsibility of the contractor side, and some have expressed confusion about assessments by unfamiliar international safety management methods (see Fig. 6).

Japanese Companies	Foreign Companies
■ There have been no major accidents so far, and safety management is a matter for the construction team. We want to avoid any unnecessary hassle if possible.	■ The client is also responsible for safety management. ■ I'm unfamiliar with Japanese ship-related laws and regulations. (Non-self-propelled vessels are not subject to inspections and are not required to have crew on board, for example.)
■ We are not familiar with the items required by international management methods. ■ We have never undergone an overseas inspection before, so we are worried. There is also the language barrier. ■ Overseas companies have high demands, and we are struggling to keep up.	■ It's difficult to evaluate the safety and soundness of Japanese work vessels (including barges). ■ I'd like to confirm differences between international standards and my own company's standards.

Fig. 6　Comparison of the thinking of Japanese and overseas companies on safety management
Japanese companies

Since the first mission of the Society is to contribute to improving the safety of ships, we understand the intentions of the overseas companies. However, on the other hand, we also think it is necessary not only to contribute to improving the safety management of Japanese work vessels but also to enable smooth chartering of vessels in domestic offshore wind power construction by bridging the gap between the thinking of the two sides, while also taking into consideration the views of the owners and operators of work vessels on the Japanese side.

In the case of ships registered by a ship classification society ("classified ships"), the integrity of the hull, engine and shipboard equipment are verified by classification surveys. For ship subject to the ISM Code, the Society also examines the ship's operational management system. Nevertheless, among work vessels engaged in coastal operation, the actual situation is that some have not acquired ISM certification, even though they are registered with the Society, and furthermore there are many vessels, such as non-self-propelled crane vessels and other towed vessels, those not covered by the scope of regulatory ship survey requirements.

In light of this reality, the Society has been providing a new business service called "Marine Assurance Service" since 2024. Unlike conventional ship surveys, which mainly concern the overall construction of the hull, etc. and the ship's equipment, this service is intended to verify the experience and qualifications of ship crews and assess the usage of safety management and operation of the onboard equipment, focusing on work procedures and work judgment criteria, from the viewpoint of the charterers of the vessel, before the chartering agreement for each project. The next chapter presents an overview of this new service.

3. ClassNK MARINE ASSURANCE SERVICE

3.1 Overview

The Society's Marine Assurance Service consists of two types of services, General Ship Inspection and DP Operation Assessment, as described below.

① General Ship Inspection

[Purpose]

To support the judgments of charterers by performing third-party assessments of the safety management/operational condition of work vessels to ensure compliance with predetermined standards.

[Content of work]

Premised on the condition that the vessel will be engaged in the specified work, the Society assesses the experience and history of the ship crews and the management/operation of work manuals and onboard equipment from the viewpoint of the charterer (reliable implementation of work, existence of potential accident risks). This work is classified in three types, based on differences in the standards used.

1) International Marine Contractors Association(IMCA) eCMID inspection
2) Assessment of conformity with the clients' internal standards
3) Independent assessment by the Society based on international standards, etc.

The IMCA eCMID (electronic Common Marine Inspection Document) inspection system is an inspection system for ship safety management systems which is operated by the IMCA, an international body with approximately 700 member companies including constructors in the petroleum/gas and renewable energy sectors, business development companies, educational institutions, ship classification societies and others. eCMID inspections are conducted in accordance with the flow in Fig. 7.

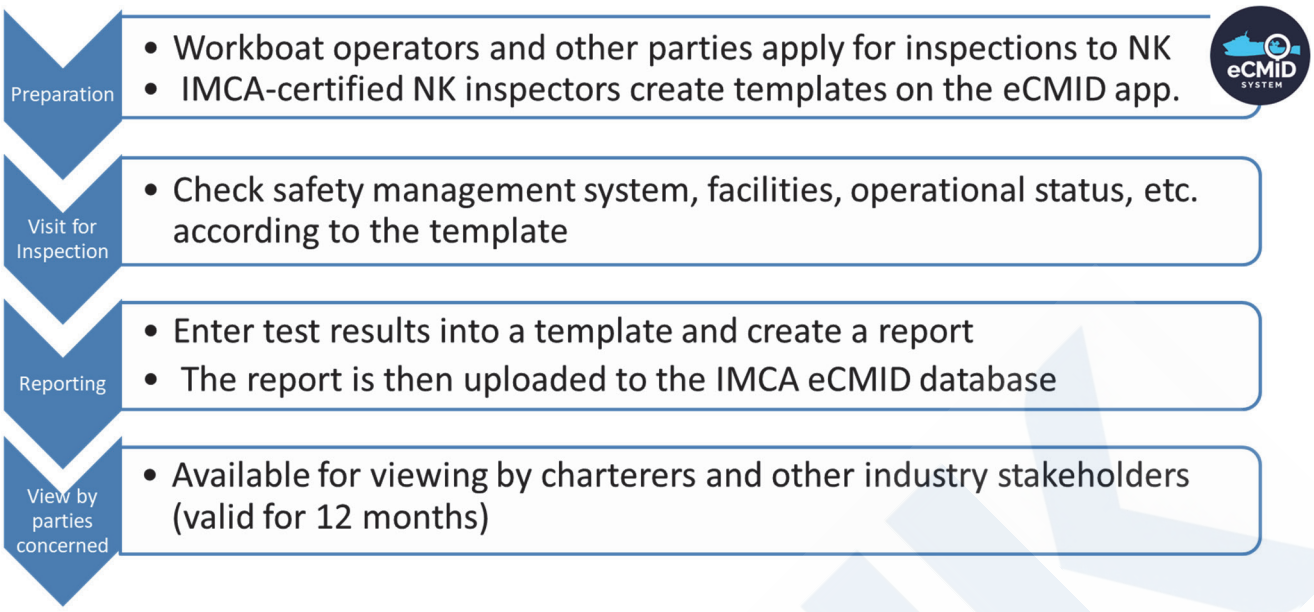


Fig. 7　Flow of IMCA eCMID inspections

IMCA eCMID inspections can only be performed by certified inspectors whose work experience, etc. have been examined by the IMCA. At present, the Society has two inspectors who have receiving certification by the IMCA, and can respond to inspection requests with using both Japanese and English.

Upon receiving an application for inspection from a work vessel operator, etc., a certified inspector inputs the information on the ship type, etc. of the work vessel concerned and creates a template. Based on this template, the inspector then arranges the schedule with the applicant, visits the site and checks the safety management system and equipment of the ship, and prepares a report. The report is uploaded to the IMCA eCMID database and can be viewed by related parties. The period of validity is 12 months. The items examined in the IMCA eCMID inspection are as shown in Fig. 8.

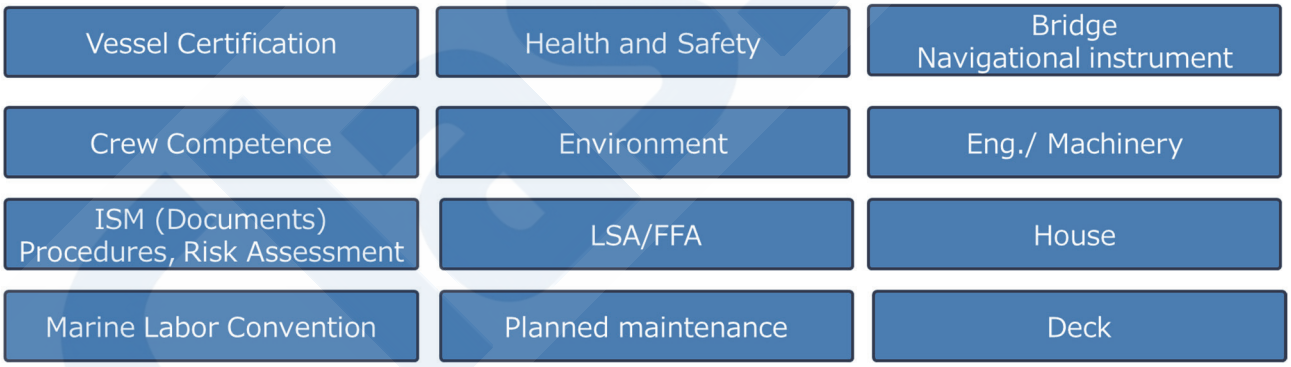


Fig. 8　Examination items in IMCA eCMID inspections

② DP Operation Assessment

[Purpose]

The dynamic positioning system (DPS) has an extremely important function in offshore construction, for example, for carrying out construction while maintaining the proper separation distance from the structure under construction, and in cable-laying work, laying the cable on the specified route without applying excessive tension. In the unlikely event of an abnormality in the DPS, it will become impossible to maintain the ship's position accurately, possibly resulting in a collision between the vessel and the wind turbine foundation during construction. If a malfunction occurs while personnel are moving to another vessel, there is a danger of accidents, such as drowning　and also being crushed between the two vessels in the worst case.

Although the DPS of classified ships is examined in classification survey, these surveys are conducted periodically at set intervals, so changes in the condition of a device may occur after a survey. The DP Operation Assessment is carried out as a third-party assessment of the DPS operation and management system to support judgments by charterers.

[Content of work]

The inspector examines whether adequate study and countermeasures have been implemented for the DPS operation management system and the work concerned. For example, the inspector checks whether operation and management are being carried out with an awareness of the response in the unlikely event of a malfunction.

3.2 Status of Implementation of Marine Assurance Service and Feedback Based on Results

Since 2024, the Society has provided its Marine Assurance Service for candidate chartered ships in construction work related to offshore wind power. Based on the results of this service to date, this section of the article provides feedback on items that are considered to be useful as reference for safety improvement to those concerned in Japan.

3.2.1 Overall Trends in the Results of General Ship Inspections

At the time of this writing, the Society had conducted General Ship Inspections for 10 ships. Based on the results, the points that should be noted as feedback are as follows.

◆ In the case of non-self-propelled ships, a safe operation management plan should be prepared, considering the actual condition and content of work of the ship concerned.

◆ Work implementation records should be prepared properly and stored carefully.

◆ Equipment maintenance and servicing should be performed in a planned manner, and records of that work should be retained properly.

The following describes typical examples of each of the examination items.

① Implementation of Risk Assessments

In order to secure work safety in each individual job accompanied by danger, it is important to consider what kinds of risks can occur in a chain reaction if some kind of unexpected trouble, etc. occurs during work. In such cases, it is essential to take countermeasures to ensure that the chain reaction of risk is effectively cut.

Therefore, the General Ship Inspection checks whether "study of the effects of accidents that occur as a result of trouble during work in individual jobs and their countermeasures (= risk assessment) is being carried out." Specifically, the following items are checked:

✓ Definition of works that require a risk assessment and records of the risk assessments

✓ Whether the personnel who perform the jobs actually participate in the risk assessments (signature)

✓ Whether identification of risk factors, assessments of the degree of danger, and reevaluation of the degree of danger after countermeasures are implemented are being carried out or not.

As a result of this process, the feedback items based on approximately 80 % of cases, that is, items requiring improvement, discovered in about 8 out of 10 in the inspections to date, are as follows:

◆ The Form to be used in risk assessments of the ship concerned should be decided.

◆ Not only the written procedures for risk assessments, but also materials to be used in training personnel and records of that training should be established.

◆ When evaluations of the degree of danger and planning of risk reduction measures for each job have been carried out, the risk after implementation of countermeasures should be reevaluated.

In Japan, there is a tendency to consider safety countermeasures simply in terms of having and maintaining qualifications and observing the safety rules formulated based on past cases. However, it is important to reduce potential risks by studying preventive measures flexibly, in line with the actual working environment, procedures, etc.

② Emergency Response Procedure Manual

In the unlikely event that a major accident, fire, explosion, grounding, marine pollution accident, etc. actually occurs, it is necessary to develop an emergency response procedure manual in order to promptly prevent the spread of the disaster by calmly responding to the situation which has occurred on the ship using the ship's equipment. Therefore, when conducting inspections, the Society checks the following items:

✓ Has an Emergency Procedure specific to the ship in question been prepared?

✓ Do the crew members acknowledge and understand the content of the Procedure?

Based on the same 80 % cases as in ①, the feedback items are as follows:

◆ An Emergency Response Procedure should be established, and emergency response training drills should be carried out to confirm the effectiveness of the Procedure.

◆ When crew members confirm the Emergency Procedure, the records (signature) of confirmation should be retained.

◆ Firefighter's outfits and other lifesaving equipment should be stored in a condition where they can be used immediately.

◆ Handbooks concerning firefighter's outfits and lifesaving equipment should be carried on the ship at all times.

As also described as a general tendency, it is important to incorporate this in the Emergency Procedure, while having a concrete image in line with the actual situation of the ship in question. It is also important not to be satisfied simply with completing the preparation of the Procedure manual, but also to consider how emergency procedures can be carried out quickly and surely under emergency conditions.

③ Work Permit System

When performing work, it is necessary to ensure that the organization has implemented adequate countermeasures in preparation for rare events. It is also essential to share information about the situation, especially in case the works which are performed simultaneously in parallel may increase potential risks, persons in a position with a comprehensive view of the work as a whole should make efforts to avoid such situations. From this perspective, it was considered necessary to introduce the Work Permit system. For this system, the following items are checked when carrying out an inspection:

✓ Is the Work Permit system applied in the ship?

✓ Is work that requires the Work Permit system clearly defined?

✓ Are the items listed in each Work Permit system appropriate?

✓ Are the records of operation of the Work Permit system managed properly?

Based on the above-mentioned 80 % cases, the feedback items are as follows:

◆ The Work Permit system should be established in line with the actual situation of the ship.

◆ In the Work Permit application form, in addition to the work items, the countermeasures for securing safety should also be described (e.g., when performing work using fire, a watch person should also be assigned, etc.).

◆ A record showing that the items described in the Work Permit application form were carried out properly should be retained.

In Japan, the person in charge of construction is sometimes responsible for securing work safety, and the decision to start work is based on the judgment of the work site. If construction operations have been carried out in this manner without significant problems until now, those concerned may feel that requiring separate work permit system from a safety section is needlessly complicated. However, with the increasingly large scale of projects like the construction of offshore wind power facilities, management to ensure construction safety, including the response at the work site by an expert line, will be important.

④ Lockout/Tagout System

The Lockout/Tagout system means taking physical preventive action so that certain operations cannot be performed during work (Lockout), and taking visual actions that can be understood by anyone (Tagout). This system is generally applied in conjunction with the above-mentioned work permit system.

For example, when performing an "intermediate valve exchange," the shut-off valve is locked (Lockout) so it cannot be operated, and when performing "electrical construction work," the breaker is cut off and a "Do not operate" tag is placed on it (Tagout).

The following items concerning this system are checked in inspections.

✓ Has the Lockout/Tagout System been introduced?

✓ Are lockout/tagout records being retained?

✓ Is implementation of the Lockout/Tagout System linked to work permits?

In this case, the feedback items are based on 90 % of inspections, and are as follows.

◆ The Lockout/Tagout system should be used effectively to reduce the possibility of human error.

◆ A person in charge of control of the objects subject to Lockout should be assigned, and records of Lockout control should be retained.

The Lockout/Tagout system is premised on the fact that humans tend to make mistakes. With the progressively larger scale

of construction projects such as offshore wind power, and the increasing number of persons engaged in construction, this system will also become increasingly important.

3.2.2 General Trend of DP Operation Assessment Service

Up to the time when this paper was written, the Society had provided the DP Operation Assessment Service for four ships. As checks of the qualifications/experience of crew members and examination of the documents, the Society verified that a DP operation manual, DP checklist, Activity Specific Operating Guidelines (ASOG) and written Emergency Response Procedures, etc. had been prepared and are being used. Upon request, we also witnessed DP trials, and evaluated the redundancy of DP system was ensured , also the performance of its crew based on the trial, and reported the results in a written report. The results of these activities and the feedback items based on them are as follows.

◆ When it was not possible to check records of a DP trial of a ship within the past 12 months in the examination of documents, the Society witnessed an offshore DP trial and verified the redundancy of all related devices and the proficiency of the crew.

◆ In many cases, the qualifications of the DP operator did not satisfy the requirements of the IMCA Guidelines, which require a DP Certificate from the Nautical Institute or DNV certification. However, since the track record of offshore construction in Japan is still small, there are many cases where it would be difficult for operators to comply with the requirement of the Nautical Institute for actual operating time. To address this need, the Society established standards separate from the IMCA Guidelines, and recognizes a certificate of completion of a ClassNK-certified training course or a DP operator's certificate issued by the DP manufacturer as a qualification.

◆ Multiple persons should be assigned as DP operators for one shift in case of unforeseen situations, etc.

4. CONCLUSION

This paper has presented an overview of the Marine Assurance Service of ClassNK, together with concrete examples, and has introduced some of the results of implementation. Those who received this service expressed the following impressions:

- The service clarified the points that should be improved on the ship, when compared with the thinking of international safety management standards and regulations.
- Although we had not used "Work permits," "Lockout/Tagout System," "Risk Assessment," etc. until now, we understood the usefulness of these tools in contributing to safe operation.

It is especially noteworthy that these inspections by the Society also resulted in chartering of Japanese work vessels by overseas companies in some cases.

Continuously, the Society will try to bridge the gap between Japanese coastal work vessels and the international standards for work vessels considered by European companies, and to improve safety and foster mutual understanding between the charterers of work vessels and work vessel owners and operators, through this Marine Assurance Service.