CHINA CLASSIFICATION SOCIETY

RULES FOR CERTIFICATION OF SHIP ENERGY EFFICIENCY MANAGEMENT

2011

Effective from January 01 2012

Beijing

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Annex

Chapter 1 General

Section 1 General Requirements

1.1.1 Purpose

1.1.1.1 The Rules for Certification of Ship Energy Efficiency Management (hereinafter referred as the Rules) is hereby formulated with the purpose of establishing the ship energy efficiency certification system and ship energy efficiency database, and satisfying the requirements of ship owners, operators, charterers, cargo owners, ports, administration and other relevant parties for the ship energy efficiency management standard and ship energy efficiency certification.

1.1.2 Application

1.1.2.1 The rules are applicable to the following energy efficiency certification services provided by China Classification Society (hereinafter referred as CCS):

(1) Energy management certification, including certification of company energy efficiency management and certification of energy efficiency management of ship in service;

(2) Energy efficiency verification of ship in service, including verification of ship energy efficiency management plan, ship energy efficiency data and improvement performance of ship energy efficiency;

1.1.3 Definition and Abbreviation

1.1.3.1 In addition to the following terms and definitions, the rules also adopt relevant terms and definitions related to ISO9000, ISO14001, ISM CODE and IMO.MEPC.1/Circ.681-684:

(1) **Company**
Company means the owner of the ship or any other organization or person such as the manager, who has assumed the responsibility for operation of the ship from the ship owner.

(2) **Branch**
Branch means the organization which is controlled by the company as a component of the company, subordinate to the same energy efficiency management system.

(3) **Energy efficiency**
Utilization ratio of energy, i.e. the relationship between the result obtained and the energy used.

(4) **Energy efficiency factors**
The factors that influence the ship energy consumption, energy efficiency and CO_2 emission during the ship transportation/operation.

(5) **Energy efficiency management system**
It is a part of the company management system, which is utilized to establish energy efficiency policy and goals, manage energy efficiency factors, and realize the integration of policy and goals, including the company structure, responsibilities, usual practice, procedures, processes and resources.

(6) **Energy efficiency policy**
The objectives of the ship energy efficiency management officially released by top management of the company.

(7) **Energy efficiency goal**

The overall requirements for the reduction of ship energy consumption, improvement of energy efficiency and reduction of CO_2 emission that the company plans to meet.

(8) **Energy efficiency index**

The specific requirements stipulated for the achievement of the energy efficiency goal, which are applicable to the whole or part of the company (including ships).

(9) **Energy efficiency data**

The energy efficiency data means all the data related to the calculation of the energy consumption, energy efficiency and CO_2 emission.

(10) **Energy efficiency management baseline**

The level of the energy consumption, energy efficiency and CO_2 emission determined by the company as the comparison basis in accordance with the energy efficiency management of the ship or fleet.

(11) **Energy efficiency management benchmark**

The level of the energy consumption, energy efficiency and CO_2 emission determined by the company in accordance with the comparison between the same types of ship.

(12) **Energy efficiency design index**①

It is a measure of the CO_2 efficiency of new ships, i.e. the CO_2 emission of the ship calculated in accordance with the propulsion power required and the fuel oil consumed by auxiliary power at a certain speed under normal maximum sea load

(13) **Energy efficiency operational indicator**②

Energy Efficiency Operational Indicator is defined as the ratio of mass of CO_2 (M) emitted per unit of transport work, namely, the ratio of CO_2 emission from the fuel consumption to the quantity of cargo/ number of people multiplied by transport distance, which is used to measure the ship energy efficiency during a certain period.

(14) **Energy consumption intensity index**③

The energy consumption by the unit transport turnover of ships in service

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① In accordance with IMO.MEPC.1/Circ.681 Interim Guidelines on the Method of Calculation of Energy Efficiency Design Index for New Ships

② In accordance with IMO.MEPC.1/Circ.684 Guidelines for Voluntary Use of Energy Efficiency Operational Indicator. The basic expression of EEOI of one voyage is:

$$EEOI = \frac{\sum_j FC_j \times C_{Fj}}{m_{cargo} \times D}$$

The calculation formula of the average value of EEOI in a certain period or several voyages:

$$AverageEEOI = \frac{\sum_i \sum_j (FC_{ij} \times C_{Fj})}{\sum_i (m_{cargo,i} \times D_i)}$$

where: j refers to the type of fuel;

i refers to the number of voyages;

FC_{ij} is the consumption of fuel j in the i voyage;

C_{Fj} refers to the conversion factor between fuel consumption and CO_2 emission;

m_{cargo} is the deadweight (in tonnes);

D is the distance (nautical miles) of the cargo.

③ Extracted from the 12th Five-Year Planning of Energy Conservation and Emission Reduction in Highway and Waterway Transportation by competent Chinese authority.

(15) **CO_2 emission intensity index**[①]

The CO_2 emission in unit transport turnover of ships in service

(16) **Audit**

It means the systematical and independent verification process with the purpose of determining whether the energy efficiency management activities and relevant results comply with the system requirements or planning arrangements, and whether the arrangements are effectively implemented for the intended objectives.

(17) **Verification**

It means the specific audit and verification activity carried out for the ship energy efficiency data and ship energy efficiency improvement.

(18) **Auditor**

The qualified personnel who are authorized to carry out the energy efficiency audit. [②]

(19) **Lead auditor**

The qualified auditor authorized to take charge of the auditing team composed of one or more auditors.

(20) **Objective evidence**

Quantitative or qualitative information, records or statements of fact pertaining to safety or the existence and implementation of an Energy Efficiency Management System element, which is based on observation, measurement or test and which can be verified.

(21) **Non-conformity**

Non-conformity means an observed situation where objective evidence indicates the non-fulfillment of a specified requirement.

(22) **Major non-conformity**

It means the non-conformity which leads to the severe deviation from the expected ship energy consumption, energy efficiency and CO_2 emission, or one or more non-conformities in a certain element or key process of the system which results in the systematic failure or regional failure.

(23) **Observation**

"Observation" means a statement of fact made during an energy efficiency management audit and substantiated by objective evidence. It may also be a statement made by the auditor referring to a weakness or potential deficiency in the energy efficiency management system which, if not corrected, may lead to a nonconformity in the future.

(24) **Anniversary date**

Anniversary Date means the day and month of each year that corresponds to the date of expiry of the relevant CEEMC or SEEMC.

(25) **Short term certificate**

Short Term certificates means certificates issued by CCS after the completion of the initial or renewal audits and before issue of full term certificates, the validity of which is not to exceed five months.

1.1.3.2 For the purpose of the Rules, the abbreviations used therein are as follows:

(1) IMO International Maritime Organization;

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① Extracted from the 12th Five-Year Planning of Energy Conservation and Emission Reduction in Highway and Waterway Transportation by competent Chinese authority.

② The qualification and relevant requirements of the auditor shall comply with relevant regulations of CCS.

(2) MEPC Marine Environment Protection Committee of International Maritime Organization;

(3) EEDI Ship Energy Efficiency Design Index;

(4) EEOI Ship Energy Efficiency Operational Indicator;

(5) SEEMP Ship Energy Efficiency Management Plan;

(6) EEMS Energy Efficiency Management System;

(7) CEEMC Company Energy Efficiency Management Certificate;

(8) SEEMC Ship Energy Efficiency Management Certificate;

(9) SEEVS Ship Energy Efficiency Verification Statement.

1.1.4 Reference documents

1.1.4.1 The development of the Rules is based on relevant requirements of following international organization conventions, standards, guidance and rules of CCS:

(1) IMO.MEPC.1/Circ.681 Interim Guidelines on the Method of Calculation of Energy Efficiency Design Index for New Ships;

(2) IMO.MEPC.1/Circ.682 Interim Guidelines on Voluntary Verification of Energy Efficiency Design Index;

(3) IMO. MEPC.1/Circ.683 Guidance for the Development of Ship Energy Efficiency Management Plan;

(4) IMO.MEPC.1/Circ.684 Guidelines For Voluntary Use of the Ship Energy Efficiency Operational Indicator;

(5) ISO14064-l:2007 Greenhouse Gases--Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals;

(6) ISO14064-2:2007 Greenhouse Gases--Part 2: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals;

(7) ISO14064-3:2007 Greenhouse Gases--Part 3: Specification with Guidance for the Validation and Verification of Greenhouse Gas Assertions;

(8) ISM CODE International Management Code for the Safe Operation of Ships and for Pollution Prevention;

(9) ISO 9000 Quality Management System-Fundamentals and Vocabulary;

(10) ISO 900 1 Quality Management System-Requirements;

(11) ISO 14001 Environmental Management System- Requirements with Guidance for Use;

(12) ISO 19011 Guidelines for Quality and/or Environmental Management System Auditing;

(13) GB/723331-2009 Energy Management System- Requirements with Guidance;

(14) The 12th Five-Year Planning of Energy Conservation and Emission Reduction in Highway and Waterway Transportation by competent Chinese authority;

(15) CCS's Rules For Certification Of Safety Management System For Safe Operation Of Ships And Pollution Prevention (2010).

1.1.5 Implementation Guidelines

1.1.5.1 CCS also develops the Guidelines for the Implementation of the Guidelines for the best practices of the Ship Energy Efficiency, providing guidance for the establishment and perfection of energy efficiency management system, and providing reference for the auditors in the energy efficiency certification and verification.

1.1.6 Compatibility with other standards and rules

1.1.6.1 The Chapter 2 hereof specifies the requirements for the ship energy efficiency management system. For the sake of convenience, the chapter takes the contents of ISM CODE, ISO 14001, and ISO 9001 into proper consideration during the formulation in order to enhance the compatibility.

1.1.6.2 The chapter does not include the requirements for other management system, such as the quality, environment, occupational health and safety, financial or risk management system, etc, but the requirements contained herein can be coordinated or integrated with other management system standards. The Appendix 1-4 specifies the relationship between requirements for the ship energy efficiency management system in Chapter 2 hereof and the contents of ISM CODE, ISO 14001-2004 and ISO 9001-2008.

1.1.6.3 The requirements for the energy efficiency certification contained in Chapter 4 hereof and the energy efficiency audit in Chapter 5 takes the Rules For Certification Of Safety Management System For Safe Operation Of Ships And Pollution Prevention (2011) of CCS into proper consideration. The audit duration of the company/ship energy efficiency management certification is completely consistent with that of the DOC and SMC audit, so several audits can be carried out simultaneously after coordination.

Section 2 Application and Fees

1.2.1 Application

1.2.1.1 Companies, ships or other relevant parties (principals) applying for the energy efficiency management certification and energy efficiency verificationis to submit a written application to CCS or its local branches, and if necessary, certification service contract and/or agreement may be signed.

(1) The company who apply for the energy efficiency management certificate must undertake the responsibilities of ship operation.

(2) May solely apply for the ship energy efficiency management certification, no matter whether the company has obtained the CEEMC

(3) May solely apply for the ship energy efficiency verification, no matter whether the ship has obtained the SEEMC.

1.2.2 Fees

1.2.2.1 The applicant is to pay audit fees, traffic fees and other expenses as necessary in accordance with CCS tariff and/or contract and/or agreements.

1.2.2.2 The applicant is to pay relevant fees should the audit be terminated or the related activities be duplicated due to the applicant.

Section 3 Responsibilities and Limitation of Liability

1.3.1 Responsibilities and Obligations

1.3.1.1 Responsibilities and Obligations of the company

(1) The certification of energy efficiency management (including the company energy efficiency management certification, ship energy efficiency management certification and ship energy efficiency verification) conducted by CCS does not relieve the company, management, officers or seafarers of their obligation to comply with relevant national and international energy and environmental protection regulations;

(2) The company and/or ship applying for the energy efficiency certification by CCS is to ensure the authenticity and accuracy of the ship energy efficiency data and relevant information;

(3) The company and/or ship applying for the energy efficiency certification by CCS are responsible for:

① developing, implementing, maintaining and improving EEMS (company/ship);

② promptly notifying CCS of major modifications of EEMS, including major organization adjustments (such as the establishment of branches) and major changes that influence the energy efficiency (company);

③ promptly notifying CCS of the modification of the ships operated (company);

④ promptly applying for the periodical and additional audit (company/ship);

⑤ providing necessary resources and cooperation for the audit team (company/ship);

⑥ regularly submitting the energy efficiency data and annual energy efficiency evaluation reports to the society(company/ship).

1.3.1.2 Responsibilities and obligations of CCS

(1) Ensuring the energy efficiency certification complying with the Rules and the requirements of flag states and relevant organizations such as IMO;

(2) Ensuring to have, within its organization, competence on:

① understanding and implementing the regulations rules and standards with which audited company and/or are to ensure compliance;

② evaluating the energy efficiency management system and verifying the ship energy efficiency data or the improvement of ship energy efficiency;

③ auditing, verifying and issuing the energy efficiency management certificate and verification statement.

(3) CCS is to ensure that personnel providing consultancy services and those providing the certification are completely independent;

(4) CCS's management of energy efficiency certification service is to ensure that:

① auditors who participate in the certification service have the practical knowledge of the energy efficiency certification procedures;

② auditors comply with relevant requirements relating to education, training, work and audit experience;

③ the qualification and experience of auditor(s) are adequate and appropriate for the size and/or complexity of the company and/or ship to be audited.

(5) CCS has established and implemented a documented auditor training system to provide theoretical and supervised training for auditor(s) and ensures the qualification and continuous updating of the knowledge and competence of personnel who are to perform energy efficiency management certification and ship energy efficiency verification;

(6) CCS has established and implemented a documented system ensuring that the certification process is performed in accordance with the requirements of the Rules, including the process of the energy efficiency management certification and the procedures and instructions of the ship energy efficiency verification.

1.3.1.3 Responsibilities of the audit team

(1) The auditor is responsible for:

① planning and carrying out assigned responsibilities effectively and efficiently;

② ensuring compliance with the applicable requirements and other appropriate directives;

③ reporting any major obstacles affecting the audit process encountered in performing the audit;

④ organizing specialist technical assistance required to fulfill the competence requirements of the audit where necessary;

⑤ promptly notifying non-conformities and observations identified to the company and/or ship;

⑥ clearly, conclusively and promptly reporting the audit and verification results;

⑦ making the audit report and verification report available to the company and/or shipboard ;

⑧ verifying the effectiveness of corrective actions taken by the company and/or ship;

⑨ ensuring the confidentiality of relevant certification documents and prudently treating the sensitive information.

(2) If the audit team comprises two or more auditors, the lead auditor is to be nominated to be responsible for managing the team and controlling the audit.

1.3.2 Limitation of liability

1.3.2.1 CCS is to sufficiently ensure the integrity and effectiveness of the energy efficiency management certification and ship energy efficiency verification.

1.3.2.2 A certificate issued by CCS is only a statement that at the time of audit the Company/ship had established and implemented energy efficiency management system including verification result of energy efficiency data in accordance with the requirements of the Rules. It is possible that unauthorized change(s) made by the Company and/or the ship energy efficiency management system or their failure in effective implementation of the system due to subjective reasons thereafter will lead to noncompliance with the certificate issued. Compliance with the rules and all applicable requirements of IMO, flag states and related organizations remains the responsibility of the Company and/or the ship.

1.3.2.3 The maintenance of the certificate is conditional upon the company's and/or ship's continued compliance with the requirements of the Rules. CCS reserves the right to withdraw or invalid the certificate when the company or the ship does not request the audit required by the rules or fails to pay fees according to the requirement of 1.2.2 or there is evidence for failure of the Company or the ship in implementing EEMS specified by the rules.

1.3.2.4 The ship energy efficiency verification statement of CCS verified the result of onsite audit is on the basis of the energy efficiency data and relevant information provided by the applicant and ship the on-site audit and verification.

Section 4 Disagreement and Arbitration

1.4.1 Disagreement

1.4.1.1 The right of interpretations on the rules published by CCS is to be left solely to the headquarters of CCS. The rules are translated by CCS into English. In case of any ambiguity to the English version, the currently effective Chinese version of the rules is to be considered as solely authoritative.

1.4.1.2 Where the company, ship or other applicant (principal) raises an objection to the energy efficiency management audit or ship energy efficiency verification carried out by the auditor of CCS, they may appeal in writing to the unit where the auditor serves. Where the handling of the appeal by the unit is not considered satisfactory, they may appeal in writing to the headquarters of CCS along with detailed background materials. The Headquarters will make the final judgment.

1.4.1.3 The costs arising from any investigation carried out by the Headquarters of CCS on request are to be paid by the appellant, except for those cases in which the appeal proves justified.

1.4.2 Arbitration

1.4.2.1 CCS will be liable only for the loss or damage resulting directly from its negligent act. In no event shall CCS be liable for any indirect or consequential losses or damages.

1.4.2.2 Notwithstanding the previous paragraph, CCS will be liable for the loss or damage due to negligent act judicially attributed exclusively to CCS or its employees, agents or other parties acting on behalf of CCS. And in no case shall the amount of this liability exceed five times the fee(s) charged by CCS in respect of the service(s) in question. CCS's liability for the loss or damage is specially excluded when such loss or damage arises out of an act:

(1) by an employee of CCS acting outside the terms or scope of his/her employment; or

(2) by any agent or other party acting on behalf of CCS, when such act exceeds the authority granted in writing by CCS to such agent or party.

1.4.2.3 Any claim for any loss or damage set forth above is to be made in writing within six months of the date the damage first discovered or the loss occurred; failure of doing so will be deemed as an absolute waiver of this right.

1.4.2.4 Unless otherwise agreed with CCS, any dispute of whatsoever nature in respect to the Rules or the service(s) provided in accordance with the Rules shall be referred to China Maritime Arbitration Commission and arbitrated in accordance with its arbitration rules effective at the time of request for arbitration. The arbitration award shall be final and binding upon both interested parties.

1.4.3 Applicable laws

The laws of the Peoples Republic of China shall apply.

Section 5 Availability and Confidentiality of Information

1.5.1 Availability of Information

1.5.1.1 Sufficient and correct information necessary for certification of energy efficiency management system and ship energy efficiency verification is to be made available to CCS by the company, ship or other applicant (principal).

1.5.1.2 The company and the ship obtaining energy efficiency management certificate from CCS shall promptly notify CCS of the events that have caused or possibly cause major impact to the ship energy efficiency within the validity of the certificate.

1.5.2 Confidentiality

1.5.2.1 CCS will not disclose sensitive and proprietary information, to which it has access during certification of energy efficiency management system, to individuals and organizations not specified in the contract including the staff in CCS that are not related to the service, except as required by laws and regulations.

Chapter 2 Ship Energy Efficiency Management System Requirements

Section 1 General Requirements

2.1.1 Considering that energy consumption, energy efficiency and CO_2 emission of ships in service are influenced by various factors, also considering that the needs such as meeting the domestic and international requirements, reducing the cost and achieving the sustainable development of the ship owners, improving the ship energy efficiency more economically and effectively and reducing the CO_2 emission, the ship energy efficiency management should be developed and implemented systematically. The most effective approach is to establish the ship energy efficiency management system which could be part of or integrated into the overall structured management system of the company.

2.1.2 This chapter specifies the requirements for the ship energy efficiency management system, which is the basis for the development of the energy efficiency system and the self-evaluation as well as the energy efficiency management certification by CCS.

2.1.3 The successful implementation of the requirements set forth herein shall depend on the commitment of the top management of the company and the participation of the ship and shore staff. Through the implementation of the ship energy efficiency management system, the company/ship may:

-- combine the energy efficiency management with the international conventions, laws, regulations, standards and other requirements through the systematic theory, and prompt mutual coordination to reduce the energy consumption of the ship reasonably, improve the energy efficiency and reduce the CO_2 emission.

-- utilize the process method to optimize and control the energy efficiency factors during the ship transportation/operation, for the purpose of controlling and continuously improving the whole process of the energy efficiency management.

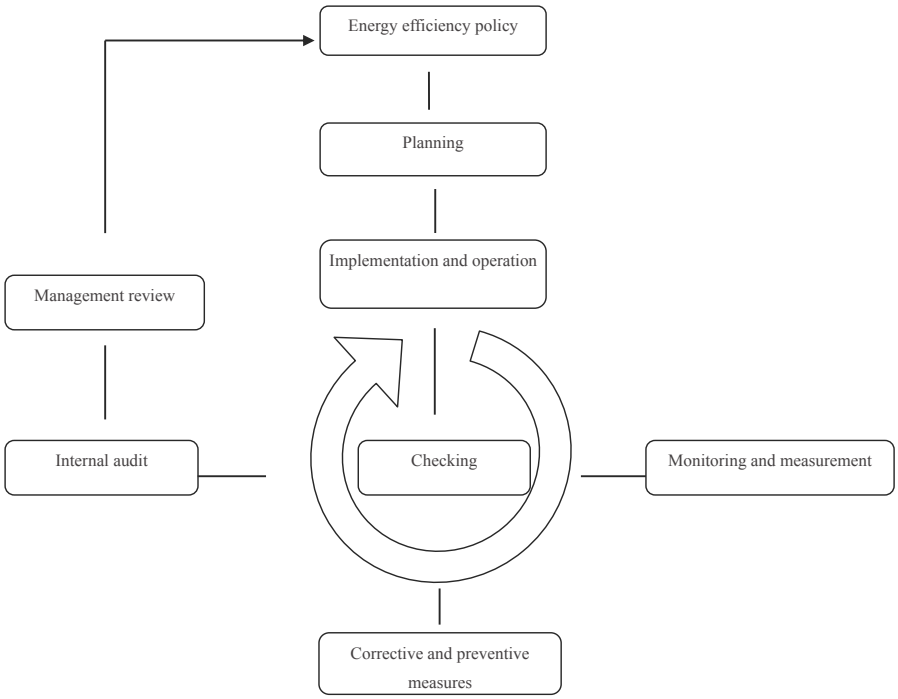
-- apply advanced and effective energy-saving technique and method, explore and utilize the best energy-saving practice and experience.

-- improve the effectiveness of the ship energy efficiency and the overall performance.

-- ensure the related parties or interested parties have established suitable ship energy efficiency management system by successfully implementing the requirements of this chapter. .

2.1.4 The operation mode of the ship energy efficiency management system is as follows:

Continuous improvement



2.1.5 The energy efficiency management system requirements is based on the operation mode of plan-do-check-action. The interpretation and contents of PDCA are as follows:

Planning: Identify and confirm the energy efficiency factors of the company/ship; identify relevant international conventions, laws, regulations, standards and other requirements; identify and utilize suitable energy-saving technology and optimal energy-saving practice; determine the energy efficiency management standards through analysis and determine the benchmark when applicable; establish energy efficiency policy, goals and indexes, and develop energy efficiency management plan.

Do: Provide necessary resource, specify the functions, responsibilities and limits of authority, specify training requirements related to competence, training and awareness and provide training accordingly, establish information exchange mechanism, keep necessary documents and records, implement operation control, implement energy efficiency management plan accordingly.

Check and correction: Monitor, measure and evaluate the energy efficiency management activities and energy efficiency goals, identify and rectify the non-conformity, and carry out internal audit and review.

Action: Take proper measures to continuously improve the energy efficiency management performance.

2.1.6 The comprehensiveness , complexity, quantity of system documents, and amount of invested resources of the energy efficiency management system depend on several factors such as the system coverage, size of the company, type and route of ships, technical conditions of ships and requirements of relevant parties.

2.1.7 The fulfillment of the requirements herein can improve the energy efficiency management performance of the company/ship, however, the successful implementation of the energy efficiency management system needs relevant technical support and technical methods to be used. Therefore, companies/ships should adopt the optimal and feasible energy-saving technology and methods, and take the cost efficiency of the energy-saving technology and methods into full consideration under the acceptable economic conditions.

2.1.8 The company is to develop, implement, maintain and continuously improve documented energy efficiency management system as required in the chapter, in order to reduce the energy consumption of the ship, improve the energy efficiency and reduce the CO_2 emission. The company is to determine the coverage of the energy efficiency management system and have it documented.

Section 2 Management Responsibilities

2.2.1 Commitment of the management

2.2.1.1 The top management shall make commitments for the development, implementation, maintenance and continuous improvement of the energy efficiency management system, and provide evidence through following activities:

(1) complying with the applicable international conventions, laws, regulations, standards and other requirements within the company;

(2) formulating and implementing the energy efficiency policy and goals, as the component of the strategy and development of the company;

(3) conducting management review;

(4) ensuring the required resources available for the energy efficiency management system.

2.2.2 Energy efficiency policy

2.2.2.1 The top management is to establish the energy policy of the company and ensure that it can:

(1) apply to the characteristics of the ship transportation/operation and coordinate with the existing other management system policies of the company;

(2) include the commitment of the reduction of the ship energy consumption, improvement of energy efficiency, reduction of CO_2 emission and continuous improvement;

(3) include the commitment to comply with the international conventions, laws, regulations, standards and other requirements applicable to the ship energy efficiency management;

(4) provide framework for the formulation and evaluation of the energy efficiency goals and indexes;

(5) be documented for full understanding and implementation by all employees;

(6) be accessible to relevant parties.

2.2.3 Functions, responsibilities and limitations

2.2.3.1 In order to facilitate the ship energy efficiency management, the managers are to clearly specify and document the functions, responsibilities and limitations, and make proper communications.

2.2.3.2 The top management is to designate special management representatives, no matter whether he is accountable to other aspects. The management representatives shall play the following role in the energy efficiency management system:

(1) ensure the development, implementation and maintenance of the energy efficiency management system as required herein;

(2) report the effective functioning of the energy efficiency management system to the top management for review, and provide improvement suggestions;

(3) responsible for the external liaison related to the energy efficiency management system.

Section 3 Planning

2.3.1 Energy efficiency factors

2.3.1.1 The company is to develop, implement and maintain one or more procedures with the purpose of:

(1) identifying the existing or potential energy efficiency factors of the ship transportation/operation service within the coverage of the energy efficiency management system, including the planned or new transportation/operation activities;

(2) evaluating the energy efficiency factors and determining the energy efficiency priority factors according to the international conventions, laws, regulations, standards and other requirements, as well as the characteristics of the ship transportation/operation service of the company, etc.

2.3.1.2 The company is to document and update the information.

2.3.2 International conventions, laws, regulations, standards and other requirements

2.3.2.1 The company is to develop, implement and maintain one or more procedures with the purpose of:

(1) promptly establishing the access to the international conventions, laws, regulations, standards and other requirements;

(2) identifying international conventions, laws, regulations, standards and other requirements applicable to the ship energy efficiency management.

2.3.2.2 The company is to comply with applicable international conventions, laws, regulations, standards and other requirements during development, implementation and maintenance of the energy efficiency management system.

2.3.3 Energy efficiency management baseline and benchmark

2.3.3.1 The company is to formulate, implement and maintain one or more procedures with the purpose of establishing the energy efficiency management baseline. When appropriate, the energy efficiency management benchmark is to be established as the main basis for the formulation of the energy efficiency goals and indexes and the evaluation of the energy efficiency performance.

2.3.3.2 The established energy efficiency baseline and benchmark is to be documented.

2.3.4 Energy efficiency goals and indexes

2.3.4.1 During the formulation of the energy efficiency goals and indexes, the company is to:

(1) Develop, implement and maintain the documented energy efficiency goals and indexes for relevant internal functions and levels and all ships. The energy efficiency goals and indexes shall include the energy efficiency operational indexes formulated by the International Maritime Organization and the energy efficiency indexes stipulated by flag states, such as the energy intensity indexes and CO_2 emission intensity indexes of the ships in service stipulated by Chinese competent authority. The goals and indexes shall be measurable.

(2) Take the international conventions, laws, regulations, standards and other requirements①, energy efficiency management baseline and/or benchmark and the energy factors under the priority control into full consideration. In addition, the optional energy-saving technical proposals and other requirements for the finance, operation and other related parties, etc shall also be considered.

(3) Update or adjust the energy efficiency goals and indexes in due time.

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① Pay attention to the energy goals and indexes published by the competent authority, such as the 12th Five-Year Planning of Energy Conservation and Emission Reduction in Highway and Waterway Transportation formulated by competent Chinese authority which raises the main indexes of the energy conservation and emission reduction of the ships of the country: in the aspect of the energy intensity indexes, by 2015, the energy consumption of the unit transport volume of the ship in operation will reduce by 15% compared with 2005, including 16% and 14% respectively in the marine and inland river ships; in the aspect of the CO_2 emission intensity indexes, the CO_2 emission of the unit transport volume of the ship in operation will reduce by 15% compared with 2005, including 17% and 15% respectively in the marine and inland river ships.

2.3.5 Energy efficiency management plan

2.3.5.1 The company is to formulate and implement the company energy efficiency management plans and ship energy efficiency management plans according to the energy efficiency goals and indexes.

2.3.5.2 There is a wide variety of possibilities for energy efficiency improvements for the existing fleet. While there are many options available, they are not cumulative, are often area and trade dependent and likely to require the agreement and support of a number of different stakeholders if they are to be utilized most effectively. As a result, it is likely that the pathway to the most efficient combination of measures will be unique to each vessel within each shipping company. The company and ships are to adopt the optimal proposals considering the compatibility of each energy-saving measure in accordance with the characteristics of the ship, the ship navigation area, trade and other relevant requirements.

2.3.5.3 The ship energy efficiency could be improved through four steps in the energy efficiency management plans, i.e. planning, implementation, monitoring, self-evaluation and improvement.

2.3.5.4 The formulation of energy efficiency management plans shall refer to the Guidance for the Development of Ship Energy Efficiency Management Plan of IMO, or the guidelines/guidance of other industrial organizations as much as possible. The contents of the energy efficiency management plans is to include:

(1) responsibilities and limitations related to functions and levels;

(2) energy efficiency measures and requirements;

(3) Schedule;

(4) monitoring and measuring requirements;

(5) the evaluation requirements and the date of next evaluation.

2.3.5.5 The company is to develop, implement and maintain one or more procedures to control the formulation and implementation of the energy efficiency management plan. Also, in the planning process, particular consideration should be given to minimize any onboard administrative burden.

Section 4 Implementation and Operation

2.4.1 Resources

2.4.1.1 The company is to provide appropriate resources for the development, implementation, maintenance and continuously improvement in the energy efficiency management system, especially:

(1) provide qualified ship staff and shore staff;

(2) equip with necessary energy efficiency measuring tools for ships /equipment ;

(3) fully identify and utilize the best energy-saving management practice and experience, as well as the effective energy-saving technology and methods;

(4) provide sufficient funds.

2.4.2 Competence, training and awareness.

2.4.2.1 The company is to ensure that all the employees related to the ship energy efficiency management have corresponding competence based on necessary education, training, skills and experience, and keep relevant records.

2.4.2.2 The company is to identify training needs related to the energy efficiency management system, and provide training or other measures;

2.4.2.3 The company is to provide job skill training for employees who have great impact on the energy efficiency management and keep proper records;

2.4.2.4 The company is to take proper measures to make all employees realize:

(1) the significance of compliance with the energy efficiency policy and energy efficiency management system;

(2) the benefits from reduction of the ship energy consumption, improvement in the energy efficiency and reduction of CO_2 emission, as well as the energy efficiency improvement performance by personal work improvement ;

(3) the consequence of the deviation from the specified operation procedure.

2.4.3 Exchange of information

2.4.3.1 The company is to develop, implement and maintain one or more procedures with the purpose of communicating the relevant information related to the energy efficiency factors and energy efficiency management system:

(1) The exchange of information between internal levels and functions (including ashore and aboard);

(2) The collection, handling and documentation of relevant external information.

2.4.3.2 The company is to determine whether the external exchange concerning the energy efficiency factors and the effective functioning of energy efficiency management system shall be carried out. In case it is determined, the company is to document and implement the decision.

2.4.4 Documents

2.4.4.1 The energy efficiency management system shall comprise of:

(1) documents and records required by this chapter;

(2) documents and records required by planning, operation and control of the energy efficiency management process of the company;

(3) the description of the main factors of the energy efficiency management system and their interrelation, as well as the query approach of relevant documents.

2.4.5 Document control

2.4.5.1 The company is to develop, implement and maintain one or more procedures to control the documents required by the energy efficiency management system (the record is also a kind of document which should be controlled in accordance with 2.4.6), so as to:

(1) approve the document by the authorizer before release for suitability and sufficiency;

(2) review, update and re-approve the document as necessary;

(3) identify the modification and revision to the document;

(4) ensure the current version of the document available;

(5) ensure the document clearly stated and specified;

(6) ensure the external document identified, collected and distributed properly;

(7) prevent the use of invalid document. In case the invalid document is kept for a certain purpose, a proper mark shall be made.

2.4.6 Record control

2.4.6.1 The company is to establish and maintain necessary records to verify the compliance with the energy efficiency management system and the energy efficiency performance obtained.

2.4.6.2 The company is to establish and maintain one or more procedures for identification, storage, protection, tracking and disposition of the records.

2.4.6.3 All the records shall be legible, clear and retroactive.

2.4.7 Operation control

The company is to identify and plan the operations related to the energy efficiency factors in the transport or service of the ship according to energy efficiency policies, goals and indexes, in order to guarantee that the operations are carried out through the following modes under specified conditions:

(1) formulate, provide and implement the documented procedures and/or operation guidelines for the possible deflected operation due to lack of documents;

(2) specify the operational criteria in the procedures;

(3) notify the related/interested parties of the applicable procedures and requirements when the operation control involves.

The operations shall include:

① The design, manufacture, modification and purchase of ships

a) The advanced ship design concepts shall be adopted during ship design, manufacture and modification , fully taking the usage of renewable energy and alternative resources, the usage of existing energy-saving technology, the usage of energy-saving equipment and materials into account, to reduce the ship energy consumption, improve the energy efficiency and reduce the CO_2 emission. When appropriate, the following aspects could be considered:

- Wind energy usage: For instance, install the sail on the new or existing ship;
- Solar energy usage: For instance, install photovoltaic equipment extensively on the new or existing ship, as the propulsive power or auxiliary power;
- Alternative resource usage: Such as the usage of newly emerged alternative resources;
- Optimization of ship molded lines: For instance, the new ship adopts the advanced molded line, and the existing ship improves the molded line such as installation of bulbous bow, etc.;
- Optimization of propulsive mode: For instance, the electric propulsive mode or diesel-electricity joint propulsive mode, etc is adopted;
- Optimization of propeller: Such as the adoption of the new type propeller or contra rotating propeller;

- Optimization of inflow of propeller: Improvements to the water inflow to the propeller using arrangements such as fins and/or nozzles could increase propulsive efficiency power and hence reduce fuel consumption;

- Optimization of hull resistance: Hull resistance can be optimized by new technology-coating systems;

- Optimization of rudder blade: The change of shape of rudder blade (such as installation of conduit, etc) can improve the propulsive efficiency;

- Heading control system (autopilot): Install advanced heading control system on the new ship or update or improve the heading control system of the existing ship;

- Optimization of diesel engine and boiler: The adoption of low-consumption and high-efficiency main and auxiliary engines and boilers, etc.;

- Installation of waste heat recovery (WHR) system.

b) Energy efficiency design index shall be calculated and verified according to the requirements of IMO or the competent authorities, and the ship energy consumption, energy efficiency and CO_2 emission indexes shall be effectively reviewed and/or verified before the ship comes into service.

c) The energy consumption and energy efficiency shall be evaluated in detail before the purchase of ship. The low-consumption ship in compliance with the conventions and regulations will be chosen by the company with priority.

② Maintenance and repair of ships and equipment

a) The company and ships are to identify the equipment and facilities with great influence on the energy consumption, energy efficiency and CO_2 emission, and :

- carry out effective maintenance and repair to maintain good working conditions;

- give priority to the energy-saving technology and products when choosing the updated and alternative equipment.

b) Take the following items into consideration if applicable:

- Hull cleaning and maintenance;

- New technology-coating systems on the hull;

- propeller cleaning and polishing;

- Propulsion system maintenance;

- Power station equipment maintenance;

- Energy consumption equipment maintenance.

③ Energy management and fuel purchase

a) Proper measures shall be taken to effectively manage the usage of the ship energy including:

- optimization of the energy consumption of cargo operation on ships (optimization of the position of the refrigerated container);
- optimization of daily energy consumption management of the accommodation space on the ship;
- the usage of shore-based power.

b) The company is to properly control the purchase and usage of the ship fuel, and when applicable, the company is to:

- evaluate and choose the fuel supplier according to their competence to satisfy the requirements of the company;
- evaluate and determine the standards or rules for the fuel used, including the fuel quality, availability and economical efficiency, etc;
- measure and/or verify the purchased ship fuel;
- specify the requirements for the fuel bunkering, storage, management and usage.

④ Management of the ship transport/operation

a) The company is to determine and control the management process of the company and ships and the operation process of the ship and equipment, which have great impact on the ship energy consumption, energy efficiency and CO_2 emission.

b) When appropriate, the processes may include:

- fleet management: such as improvement of fleet plan and reduction of ballast voyage;
- improved voyage planning: such as selection of the best route;
- determination of weather routing: the selection of weather routing;
- optimized speed: the selection of the optimum speed;
- optimized ship handling: the optimum trim and ballast;
- optimized cargo operation: sufficient communication between the ship and port to seek for the optimum loading and unloading plan;
- optimized diesel engine: adopt the new technology (electronic control, common rail) to improve the fuel injection of diesel engine and enhance the combustion efficiency;
- utilization of new fuel additive: catalyze and gasify the diesel oil to make it fully burnt in the cylinder, in order to enhance the fuel efficiency.

⑤ Cooperation with related/interested parties

a) In addition to the ship owners and ship operators, the energy consumption and energy efficiency during the ship transport/operation are related to other related/interested parties, who may be designers, yards and relevant equipment manufacturers with respect to ship characteristics or, charterers, ports and traffic management organizations with respect to ship operation. All involved parties should consider the inclusion of efficiency measures in their operations both individually and collectively.

b) The company and ships are to maintain good communication with the above mentioned related/interested parties to gain the support and cooperation from them. The better coordination among such stakeholders is, the more improvement can be expected. In most cases, such coordination or total management is better made by a company rather than by a ship.

2.4.8 Emergency preparation and response

2.4.8.1 The company is to develop, implement and maintain one or more procedures to identify the potential emergency situations and accidents which may have an impact on the ship energy consumption and energy efficiency, and prepare emergency response programs.

2.4.8.2 The emergency situations and accidents taking into account shall include but not limited to:

(1) the fuel leakage and emission caused by accidents;

(2) the fuel wastage and accidental emission caused by the ship and equipment malfunction or operation false during the bunkering, storage, usage and sludge oil emission;

2.4.8.3 The company and ships are to respond to the emergency situations and accidents, prevent and/or mitigate the subsequent effects

2.4.8.4 The company and ships are to regularly review the emergency preparation and response program, and make proper revisions when necessary, especially after the occurrence of the emergency accident and situations.

2.4.8.5 When applicable, the company and ships are to regularly test the above procedures such as drills and exercise.

Section 5 Check and Correction

2.5.1 Monitoring and measuring

2.5.1.1 General

(1) The company is to develop, implement and maintain one or more procedures to carry out routine monitoring and measuring on the key characteristics with great influence on the ship energy consumption, energy efficiency and CO_2 emission, and regularly conduct statistics and analysis.

(2) Record the monitoring and measuring results

2.5.1.2 Monitoring methods

The ship energy consumption, energy efficiency and CO_2 emission shall be monitored and measured by an established method.

(1) Adopt the international standards or internationally recognized monitoring methods. The EEOI and its measuring and calculating methods formulated by International Maritime Organization (IMO) are the internationally recognized monitoring methods which can be used to obtain the energy efficiency data of the ship and/or fleet in operation. The company and ships may adopt EEOI and its measuring and calculating methods as the main monitoring methods;

In case EEOI is adopted, the information related to the fuel type and quantity, voyage distance and goods type and quantity, etc shall be collected and calculated as required by relevant documents formulated by IMO. If applicable, the EEOI rolling average index may be calculated to monitor the ship energy efficiency;

(2) Adopt monitoring methods stipulated or recommended by the authority of the flag country, such as the energy intensity index of ships in service, CO_2 emission index of ships in service and corresponding measuring and calculating methods formulated by the authority of Chinese flag country;

(3) In case it is convenient and/or beneficial to the company or ship, other energy efficiency indexes and monitoring methods may be adopted. When doing so, the principles and specific requirements of such energy efficiency indexes and monitoring methods shall be planned and specified before adoption.

2.5.1.3 Monitoring system

(1) The company is to establish a monitoring system (including procedures for data collection and assignment of relevant responsible persons, etc.), in order to obtain continuous and reliable data;

(2) To avoid the unnecessary administrative burden on ships crew member, monitoring shall be carried out as far as possible by utilizing data obtained from the following ways:

① utilizing data obtained from existing required records such as official log-books, engine logs and oil record books, etc. by shore staff;

② installation dedicated software for data recording and transporting;

③ the necessary data could be obtained or confirmed during internal audits or routine visits when necessary.

2.5.1.4 Monitoring and measuring equipment

The company is to ensure that the monitoring and measuring equipment is calibrated, verified and properly maintained. Relevant records shall be kept.

2.5.2 Evaluation

2.5.2.1 The company is to develop, implement and maintain one or more self-evaluation procedures to carry out regular self-evaluation on energy consumption, energy efficiency and CO_2 emission of the ships and/or fleets in operation with the data collected through monitoring. The evaluation shall include:

(1) the implementation of the energy efficiency goals, indexes and energy efficiency management plans;

(2) the compliance with applicable international conventions, laws, regulations, standards and other requirements;

(3) the assessment of the energy efficiency improvement performance in accordance with energy efficiency management baseline and/or benchmark.

2.5.2.2 The company is to record the results of the above regular evaluations.

2.5.3 Incentive

2.5.3.1 The company is to establish and improve supervision and incentive scheme within the company's relevant internal functions and levels for the issue of ship energy efficiency

2.5.4 Voluntary report

2.5.4.1 The company may release the voluntary report on the ship and/or fleet energy consumption and energy efficiency to public as own or related parties requirement, or disclose the actions taken and subsequent energy efficiency improvement, in order to obtain the recognition and rewards from the national administrations, port authority, partner and other related parties.

2.5.5 Non-conformity, correction, corrective actions and preventive measures

2.5.5.1 The company is to develop, implement and maintain one or more procedures to deal with the identified or potential non-conformities, and take corrective and preventive measures. The procedures shall provide following requirements:

(1) identify and correct the non-conformities, and take proper measures to mitigate the effects;

(2) investigate and analyze the non-conformities to determine the root cause, and take corrective measures to prevent recurrence;

(3) evaluate the needs for preventive measures of potential non-conformities, when necessary prepare and implement preventive measures to avoid the occurrence of non-conformities;

(4) the measures taken are to correspond with the severity of problems;

(5) record the results of the corrective and preventive measures;

(6) evaluate the effectiveness of the corrective and preventive measures.

2.5.5.2 The company is to ensure that necessary revisions are made to the energy efficiency management system documents related to the corrective and preventive measures.

2.5.6 Internal audit

2.5.6.1 The company is to develop, implement and maintain the internal audit procedure of the energy efficiency management system. The procedure shall include the audit standards, scope, frequency and methods, and responsibilities for planning and implementation of the audit, reporting of audit results, and keeping relevant records. The company is to conduct the internal audit to the energy efficiency management system according to the planned time intervals, in order to:

(1) determine whether the energy efficiency management system:

① complies with the demands of the company and requirements of this document;

② has been effectively implemented and maintained.

(2) Report the audit results to top management

① The internal audit plan shall be made according to the influence of the company energy-saving and results of previous internal audits. The designation of auditors and implementation of the audit shall ensure the independence and justice of the whole audit process.

② Record the results of the internal audit and notify relevant department and personnel of problems discovered during the audit, in order to make necessary modifications.

Section 6 Management Review

2.6.1 General

2.6.1.1 The top management is to review the company's energy efficiency management system according to the planned time intervals, in order to ensure its continuous suitability, sufficiency and effectiveness. The review shall look after the time of evaluation and improvement of the energy efficiency management system (including energy efficiency management policies, goals and indexes) and the needs for modification. The records of management review shall be kept.

2.6.2 Review input

2.6.2.1 The management review input shall include:

(1) internal audit and evaluation results;

(2) communication with and feedback from relevant external parties;

(3) energy efficiency improvement performance of the company;

(4) realization of the goals and indexes;

(5) implementation of the corrective and preventive measures;

(6) the subsequent measures determined by previous management reviews;

(7) objective changes in the energy efficiency management system;

(8) improvement suggestions.

2.6.3 Review output

The management review output shall include:

(1) the continuous improvement measures in the energy efficiency management system and energy-saving;

(2) major decisions on the modification of energy efficiency management baseline and/or benchmark, policies, goals and indexes;

(3) resource needs

Chapter 3 Ship Energy Efficiency Data Requirements

Section 1 General Requirements

3.1.1 Energy efficiency data and information

3.1.1.1 The company and/or ships is to determine the energy efficiency indexes and monitoring methods as required by 2.5.1.2 of Chapter 2 of the Rules. In case other energy efficiency indexes and monitoring methods specified in 2.5.1.2(3) are used, the company and/or ships is to notify the principles, monitoring specific requirements for the energy efficiency indexes and monitoring methods in writing to CCS.

3.1.1.2 The basic data and information for calculation of EEOI, energy intensity index and CO_2 emission index of ships in service include:

(1) voyage distance;

(2) voyage cargo capacity (ton/TEU/person);

(3) fuel quantity and type used;

(4) all information which may influence the CO_2 emission quantity;

(5) relevant information if a ship is connected with shore power;

(6) relevant information if a ship uses shore cranes except her own.

3.1.1.3 When calculating the above energy efficiency indexes, the company is to identify the special voyage within each transport cycle and separately calculate, so as to reflect the accurate operation energy efficiency management level of the ship.

3.1.1.4 The company is to develop procedures concerning EEOI, energy intensity index and CO_2 emission index of ships in service, including:

(1) data collection and record

(2) regular monitoring and measuring

(3) quality control and verification of energy efficiency data

(4) report of energy efficiency data

3.1.2 Reporting energy efficiency data

3.1.2.1 Ships are to regularly report the basic data for calculation of the energy efficiency indexes required by 3.1.1.2 of the Rules, and other energy efficiency data and relevant information required to the company.

3.1.2.2 The company or ships certified by CCS for energy efficiency management is to regularly submit energy efficiency basic data and/or other energy efficiency data as required in the Section 2 of this chapter to CCS.

3.1.3 Statistics and analysis of energy efficiency data

3.1.3.1 The company is to develop a statistical and analysis system including EEOI, energy intensity index and CO_2 emission index of ships in service and/or other relevant energy efficiency data, in order to meet the following requirements:

(1) unified data format convenient for reporting, statistics and analysis;

(2) statistical and analysis functions in different periods;

(3) calculating function of the rolling average value of EEOI, energy intensity index and CO_2 emission index of ships in service;

(4) analyzing function of the trend of change in energy efficiency indexes and the improvement points;

(5) graph output function.

Section 2 Energy Efficiency Data and Submission Requirements

3.2.1 The energy efficiency data submitted to CCS for different type of ship is as follows:

3.2.1.1 Container ship (only carrying containers)

(1) Voyage① number;

(2) Actual distance of each voyage;

(3) Beginning and ending time of each voyage;

(4) Quantity and type of fuel consumed, including fuel consumption during voyage and in harbor;

(5) Cargo capacity of each voyage, including deadweight (total weight of containers and cargo)\TEU (quantity of empty and loaded containers);

(6) Ballast.

3.2.1.2 Ships for carriage of containers and other type of cargoes

(1) Voyage number;

(2) Actual distance of each voyage;

(3) Beginning and ending time of each voyage;

(4) Quantity and type of fuel consumed, including fuel consumption during voyage and in harbor;

(5) Cargo capacity in each voyage, every loaded TEU shall be calculated as weight of 10 tons and empty TEU as weight of 2 tons;

(6) Ballast.

3.2.1.3 Bulk carrier, tanker, gas carrier, ro-ro cargo ship, general dry cargo ship

(1) Voyage number;

(2) Actual distance of each voyage;

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① The voyage mentioned herein means the time period from one port departure to the next port departure

(3) Beginning and ending time of each voyage;

(4) Quantity and type of fuel consumed, including the fuel consumption during voyage and in harbor;

(5) Cargo capacity in each voyage;

(6) Ballast;

(7) Average ship speed in the voyage.

3.2.1.4 Passenger ship (including ro-ro passenger ship)

(1) Voyage number;

(2) Actual distance of each voyage;

(3) Beginning and ending time of each voyage;

(4) Quantity and type of fuel consumed, including the fuel consumption during voyage and in harbor;

(5) The passenger capacity and cargo capacity of the ship in each voyage;

(6) Ballast.

3.2.2 The format of the ship energy efficiency data report refers to Appendix 4

3.2.3 Requirements for self-evaluation report of the company/ship energy efficiency

3.2.3.1 The company/ship shall develop the company/ship energy efficiency self-evaluation report according to energy efficiency improvement plan, which shall at least include the followings:

(1) Main energy efficiency measures taken within the cycle;

(2) Energy efficiency data, energy efficiency improvement performance, trend of energy efficiency change and cause analysis;

(3) Achievement of energy efficiency goals and indexes;

(4) Problems identified and improvement plans.

3.2.4 Requirements for submission of the energy efficiency data and energy efficiency self-evaluation report

3.2.4.1 The company or ship that requests the energy efficiency management certification for the first time shall submit the relevant ship energy efficiency data and self-evaluation report to CCS as required by 5.2.1.2 and 5.3.1.2 of the Rules.

3.2.4.2 The company or ship certified by CCS for energy efficiency management shall submit the relevant energy efficiency data and energy efficiency self-evaluation report to CCS on a regular basis.

3.2.4.3 The ship that applies to CCS for verification of the energy efficiency data or energy efficiency improvement performance is to submit the relevant ship energy efficiency data to CCS at the same time.

Section 3 Ship Energy Efficiency Management System of China Classification Society

3.3.1 CCS's ship energy efficiency management system is developed for the energy efficiency data statistics, analysis and remote management service. The company users may apply for registration of the system, which can be used to replace the requirements of 3.1.3.1 of the Rules.

3.3.2 The system has the following basic functions

3.3.2.1 Statistics and output of the energy efficiency indexes (i.e. EEOI, unit transport volume energy consumption/ CO_2 emission index of the ship in service, CO_2 emission of unit transportation volume, CO_2 emission per nautical mile, utilization rate of deadweight, speed reduction ratio) and other operational energy efficiency data (such as energy consumption, voyage distance and cargo capacity) on the basis of the classified items (company, ship type, ship age, tonnage and navigation route etc.).

3.3.2.2 Analysis of energy efficiency indexes

(1) Trend analysis: Analyze the change trend of the energy efficiency indexes;

(2) Comparison analysis: The comparison between the energy efficiency indexes of two or more types;

(3) Correlation analysis: The analysis of the correlation between the energy efficiency indexes.

3.3.2.3 Providing the services of energy efficiency data management and index inquiry to the outside, and output the detailed statistics and analysis diagrams or simple statistical data according to the limitation of authorization.

3.3.3 System application

3.3.3.1 Providing services of energy efficiency management tools and energy efficiency information to the companies, to facilitate to understand the policies, laws, regulations and industrial information, to assess the energy efficiency conditions of the ship/fleet, to analyze and compare the energy efficiency trend and make improvement.

3.3.3.2 The auditors may log on the system to look through and analyze the relevant energy efficiency data within the scope of authorization when searching for support during the audit preparation and formulation of audit reports.

3.3.3.3 The port state governments or organizations, port authorities, industrial organizations and relevant shipping parties may check the energy efficiency index of a single ship.

3.3.3.4 The authority may use the system according to the authorization and agreement, in order to gain the fundamental data support for the formulation of relevant policies and regulations.

3.3.4 Entry and correction of energy efficiency data

3.3.4.1 When applying for initial certification of energy efficiency management system and ship energy efficiency verification, the energy efficiency data submitted by the company/ship is to be confirmed by the responsible auditor of CCS before entry into the energy efficiency database.

3.3.4.2 The auditors of CCS are responsible for verification of the ship energy efficiency data and examination of the energy efficiency self-evaluation reports submitted by the company/ship during the field audit. In case of errors found in the ship energy efficiency data, the auditors shall promptly notify CCS's headquarters to correct the energy efficiency database.

Chapter 4 Energy Efficiency Certification

Section 1 General Requirements

4.1.1 Energy efficiency management certification

4.1.1.1 Goals of energy efficiency management certification

(1) To determine the compliance of the company's/ships EEMS with the Rules and requirements of IMO, flag state and other relevant organizations;

(2) To determine the effectiveness of the implementation of EEMS, and ensure the energy efficiency goals specified in the company/ship have been achieved;

(3) To facilitate the company to improve the awareness of energy efficiency and energy efficiency management skills of personnel ashore and aboard ship;

(4) To encourage the company to adopt and implement the rules, guidelines and standards of the flag states, port authorities and industrial organizations within the scope of the EEMS.

4.1.2 Basic requirements for the energy efficiency management certification

4.1.2.1 The company is to develop, implement and maintain the ship energy efficiency management system to ensure the implementation of the energy efficiency policies.

4.1.2.2 The energy efficiency management system is to be capable of compliance with the following purposes.

(1) The energy efficiency management goals of the company are:

① to reduce the unit transport energy consumption, and improve the fuel utilization efficiency;

② to reduce the CO_2 emission and mitigate the impact on the environment;

③ to adopt more efficient energy efficiency programs, and continuously improve the ship energy efficiency;

④ to keep improving the awareness of energy efficiency and energy efficiency management skills of personnel ashore and aboard ship.

(2) The energy efficiency management standards, including:

① requirements set forth in Chapter 2 of the Rules;

② conventions, regulations and guidelines of IMO concerning the ship energy efficiency;

③ requirements of the flag state, port authority and relevant industrial organization.

4.1.2.3 The company's energy efficiency management system is to cover relevant departments, branches and ships.

4.1.2.4 The ship applying for the energy efficiency management certification, the company undertaking the operation responsibilities and related parties is to establish and implement the ship energy efficiency management system as required in Chapter 2, which has covered the ship.

4.1.2.5 The energy efficiency audit is to be carried out to the company and/or ship that intends to obtain the energy efficiency management certification of CCS as specified in Chapter 5 of the Rules.

4.1.2.6 When conducting the energy efficiency management certification to the company, a sampling audit is to be conducted as defined in Chapter 5.

4.1.2.7 In case the company energy efficiency complies with the requirements in the Chapter 2 and 3 of the Rules, CCS shall issue the Company Energy Efficiency Management Certificate (CEEMC).

4.1.2.8 In case the ship energy efficiency complies with the requirements in the Chapter 2 and 3 of the Rules, CCS shall issue the Ship Energy Efficiency Management Certificate.

4.1.2.9 The additional classification symbol will be assigned to the ships classed with CCS and certified by CCS for the energy efficiency management system.

4.1.2.10 Periodical and additional audit, if required, are to be carried out for the company and/or ship having obtained the energy efficiency management certification in accordance with the requirements of Chapter 5 in the Rules in order to retain the validity of certificate.

4.1.2.11 Renewal audit is to be carried out for the company and/or ship in accordance with the requirements of Chapter 5 in the Rules. If it is considered that the company's and/or ships EEMS is operated effectively, CEEMC and/or SEEMC will be reissued by CCS.

4.1.2.12 The ship energy efficiency data and energy efficiency self-evaluation report are to be submitted regularly by the company and/or ship that have obtained the energy efficiency management certification to CCS as required in Chapter 3 of the Rules.

4.1.3 Energy efficiency verification

4.1.3.1 The ship energy efficiency verification includes the following three items, which can all be verified in one time, or applied for verification individually:

(1) Verification of the ship energy efficiency management plan to be prepared according to relevant IMO regulations and implemented onboard;

(2) Verification of the ship energy efficiency data;

(3) Verification of the ship energy efficiency improvement performance within one period.

4.1.3.2 The energy efficiency verification shall be carried out as required in Chapter 5 of the Rules, and the Ship Energy Efficiency Verification Statement (SEEVS) will be issued upon the completion of the verification.

4.1.4 As a voluntary activity, the company may publish the company/ship energy efficiency management certificate, the company/ship energy efficiency verification report (including the ship energy efficiency data confirmed by the auditor) and ship energy efficiency verification statement, in order to exhibit the status of the energy efficiency or energy efficiency measures taken and the effect of these measures to the public or related parties.

4.1.5 The certification of company/ship energy efficiency management and ship energy efficiency verification conducted by CCS does not relieve the company and/or ship of their obligation related to energy efficiency management.

Section 2 Certification Certificates and Verification Statement

4.2.1 Issue of energy efficiency management certificates

4.2.1.1 Company energy efficiency management certificate (CEEMC)

(1) A CEEMC (in the form as specified in Appendix 7 of the Rules) is to be issued to the company by CCS after initial or subsequent renewal audits.

(2) Where the scope of EEMS of the company covers its branch offices, the names of those offices are to be listed in the CEEMC and the Annex.

4.2.1.2 Ship energy efficiency management certificate (SEEMC)

(1) Short-term energy efficiency management certificate

A short-term SEEMC is to be issued by branch offices of CCS when a ships energy efficiency management is found in compliance with the approved EEMS of the company and the requirements of the Rules after initial or subsequent renewal audits, and the classification certificate and statutory certificates are valid. The form of SEEMC may refer to Appendix 8 of the Rules.

(2) Full-term energy efficiency management certificate

A full-term SEEMC (in the form as specified in Appendix 8 of the Rules) is to be issued by the headquarters of CCS within the validity of short-term SEEMC when the corrective actions against the non-conformities (if any) have been taken and verified by the auditors of CCS to be effective to close them out.

4.2.2 Validity of the certificates

4.2.2.1 The validity of the certificates is as follows:

(1) The certificates are to be valid for a period not exceeding five years from the date of completion of initial audit subjected to periodical audit① prescribed in the Rules during this period.

(2) When a renewal audit is completed within three months of the expiry date of the existing certificate, the new certificate is to be valid from the date of completion of the renewal audit for a period not exceeding five years from the date of expiry of the existing certificate.

(3) When a renewal audit is completed more than three months before the expiry date of the existing certificate, the new certificate is to be valid from the date of completion of the renewal audit for a period not exceeding five years.

(4) Where SEEMC renewal audit is carried out after the expiry date of existing SEEMC, the new SEEMC is to be valid from the date of completion of the renewal audit for a period not to exceed five years since the expiry date of existing SEEMC.

(5) Where renewal audit has been completed and a new SEEMC cannot be issued or placed on board the ship before the expiry date of the existing certificate, CCS may endorse the existing certificate and such a certificate should be accepted as valid for a further period which should not exceed five months from the expiry date.

4.2.3 Extension of the certificate

4.2.3.1 If it is estimated that a ship at the time when a SEEMC expires is not in a port in which the renewal audit may be conducted and the company applies for extension in writing prior to the expiry date, extension could be accepted but not longer than three months. Renewal audit is to be completed within three months, otherwise SEEMC will be invalid automatically.

① Periodical audit means annual audit of CEEMC and intermediate audit of SEEMC.

4.2.4 Invalidation, withdrawal and reinstatement of certificates

4.2.4.1 CEEMC

(1) Reasons for which a CEEMC may become invalid include:

① The company does not request the annual audit of CEEMC;

② Corrective actions are not completed within the agreed schedule and insufficient evidence that the corrective actions are being carried out, or no objective evidence for the reasons of failure to take the corrective actions could be provided;

③ Amendments to Chapter 2 of the Rules are not taken into account;

④ There is evidence of an unresolved major non-conformity;

⑤ The ship energy efficiency data and company energy efficiency self-evaluation reports are not submitted on a regular basis as stipulated of the Rules.

(2) Reasons for which a CEEMC may be withdrawn include:

① Withdrawal of CEEMC is requested by the company;

② The company's EEMS operation is verified not in compliance with the requirements of Chapter 2 of the Rules by the audit;

③ Significant incidents which may cause major impact to ship energy efficiency occur for the fleet managed by the company's EEMS found through the audit or by other means, and no handling and reporting to CCS are taken by the company in accordance with the relevant procedures;

④ There is evidence that the company energy efficiency data and energy efficiency measures records contain false information;

⑤ Payment of certification fees is not made in time and no appropriate action is taken either.

(3) In case the CEEMC is invalid or withdrawn, CCS is to immediately notify the company in writing that the CEEMC is withdrawn from the date of signature of the notification, and request that the CEEMC be surrendered.

4.2.4.2 SEEMC

(1) Reasons for which a SEEMC may become invalid include:

① The company does not request the intermediate audit of SEEMC;

② Corrective actions are not completed within the agreed schedule and no sufficient evidence that the corrective actions are being carried out, or no objective evidence for the reasons of failure to take the corrective actions could be provided;

③ Amendments to Chapter 2 of the Rules are not taken into account;

④ There is evidence of an unresolved major non-conformity;

⑤ The ship energy efficiency data and self-evaluation reports are not submitted on a regular basis as stipulated of the Rules;

⑥ When a ships company changes.

(2) Reasons for which a SEEMC may be withdrawn include:

① Withdrawal of SEEMC is requested by the Company;

② Ship energy efficiency management is verified not in compliance with the requirements for issuance of SEEMC in 4.2.1.2(1) of the Rules by the intermediate and/or additional audit;

③ There is evidence that the company energy efficiency data and energy efficiency measures records contain false information;

④ The incidents which caused or may cause major impact to ship energy efficiency occur and no handling and reporting to CCS are taken in accordance with the relevant procedures;

⑤ The ships classification is suspended or withdrawn, and/or other statutory certificates become invalid;

⑥ Ships operation is ceased, such as loss or recycling of a ship;

⑦ Payment of certification fees is not made in time and no appropriate action is taken either.

(3) In case the SEEMC is invalid or withdrawn, CCS is to immediately notify the master or the company in writing that the SEEMC is withdrawn from the date of signature of the notification, and request that the SEEMC be surrendered.

4.2.4.3 Reinstatement of the certificates

(1) Where the company applies for the reinstatement of CEEMC after it has been invalidated, an additional audit to the extent and scope of initial audit is to be carried out. The expiry date of the new CEEMC is to be calculated from the completion date of additional audit to the expiry date of the withdrawn CEEMC;

(2) Where the ship applies for the reinstatement of SEEMC after it has been invalidated, an additional audit to the extent and scope of initial audit is to be carried out. The expiry date of the new SEEMC is to be calculated from the completion date of additional audit to the expiry date of the withdrawn SEEMC.

4.2.5 Availability, reissue, amendments or surrender of the certificates

4.2.5.1 Availability of certificates

(1) The Company is to make available original CEEMC and copies of SEEMC for each ship for reference;

(2) Each ship is to keep the original SEEMC on board for reference.

4.2.5.2 Reissue of certificates

Applications to CCS for reissuing the relevant certificate or documents are immediately to be made by the company in case of the CEEMC and/or SEEMC being lost or damaged.

4.2.5.3 Amendments of certificates

(1) Whenever any amendment occurs to the content of a certificate, the company is to immediately apply to CCS for amending or re-issuing the certificate;

(2) Whenever the ships managed by the company change, CCS is to be immediately notified by the company.

4.2.5.4 Surrender of certificates

(1) Except those reissued due to loss, the original CEEMC and/or SEEMC are to be surrendered to CCS immediately when the new CEEMC and/or new SEEMC are issued to the company;

(2) Both of CEEMC and SEEMC are to be surrendered to CCS immediately whenever the EEMS certification for the company or its ships terminates;

(3) Where the lost original certificate is found after it is reissued, the original one is to be immediately surrendered to CCS by the company.

4.2.6 Issuance of the ship energy efficiency verification statement

The ship energy efficiency verification statement (SEEVS) is to be issued after the verification of the ship energy efficiency. The format of SEEVS refers to the Appendix 9 of the Rules.

Chapter 5 Energy Efficiency Audit

Section 1 General Requirements

5.1.1 Energy efficiency management audit

The energy efficiency audit includes the energy efficiency management system audit and energy efficiency verification.

5.1.2 Type and period of audit

5.1.2.1 Initial audit

(1) The initial audit of EEMS for any company, which has applied to CCS for CEEMC for the first time, is to be carried out by CCS, to verify that its EEMS has been established, implemented and maintained, and is in compliance with the requirements of Chapter 2 of the Rules;

(2) The initial audit of EEMS for any ship, which has applied to CCS for SEEMC for the first time, is to be carried out by CCS, to verify that the company's EEMS has been established, implemented and maintained on board the ship, and is in compliance with the requirements of Chapter 2 of the Rules.

5.1.2.2 Annual audit

All companies holding CEEMC which is certified by CCS are to be subjected to annual audit. Annual audit is to be carried out within three months before and after each anniversary date of the CEEMC.

5.1.2.3 Intermediate audit

All ships holding SEEMC which is certified by CCS are to be subjected to at least one intermediate audit within the validity of SEEMC. The intermediate audit is to be carried out between the second and third anniversary dates after the initial audit or last renewal audit.

5.1.2.4 Renewal audit

(1) All companies or ships certified by CCS are to apply for renewal audit before the expiry date of the CEEMC or SEEMC, otherwise the CEEMC or SEEMC would be invalidated automatically.

(2) The CEEMC or SEEMC will be renewed by CCS after satisfactory completion of the renewal audit.

5.1.2.5 Additional audit

(1) An additional audit for the CEEMC is to be requested if:

① incidents which caused or may cause major impact to ship energy efficiency occur to the company;

② substantial modifications are made to the EEMS of the company;

③ the scope of certification of EEMS changes;

④ CCS needs to follow up the effectiveness of corrective actions for non-conformities;

⑤ the requirements for additional audit specified in Appendix 6.

(2) An additional audit for a ships SEEMC is to be requested if:

① incidents which caused or may cause major impact to ship energy efficiency occur to the ship;

② the ship is put into service after being laid up for over six months;

③ CCS needs to follow up the effectiveness of corrective actions for non-conformities;

④ the requirements for additional audit specified in Appendix 6.

(3) According to the conditions described in above (1) and/or (2), additional audit could be completely or partially carried out for the EEMS.

5.1.3 Submission of annual energy efficiency data and self-evaluation report

All the ships and companies whose energy efficiency management have certified by CCS are to submit the ship energy efficiency data and energy efficiency self-evaluation report to CCS as stipulated in Chapter 3 of the Rules.

5.1.4 Certification changes

Various audits involving CEEMC/SEEMC changes are to be performed in accordance with the requirements of Appendix 6 of the Rules.

5.1.5 Planning the audit

5.1.5.1 CCS, on receipt of an application, is immediately to nominate an audit team consisted of qualified auditors to carry out the audit.

5.1.5.2 The audit team is to communicate with the company and/or ship in time and produce an audit plan. The audit plan is to be designed to cover all factors and give priority to key points with reasonable dispatch of labor and arrangement of time in accordance with the requirements of the Rules and the specific situations of the audited party. The audit plan is to be communicated to all those involved in the audit.

5.1.6 Preparing the audit

5.1.6.1 The company is to make necessary audit preparation in accordance with the audit plan to ensure smoothly implementation of the field audit.

5.1.6.2. The company is to ensure that the ship being audited is to be under normal operating conditions and the ship is not to be in dry dock or laid up.

5.1.7 Executing the audit

5.1.7.1 Each audit is to start with an opening meeting, participated by the audit team and the company's and/or the ships staff and presided by the lead auditor, the purpose of which is to:

(1) introduce the audit team to the company's and/or ships management;

(2) explain the scope and objective of the audit;

(3) explain the methods and procedures to be used to conduct the audit;

(4) establish the official communication line between the auditor(s) and the company and/or the ship;

(5) confirm that resources, documentation and facilities needed to perform the audit are available; and

(6) confirm the time and date of the closing meeting and any possible interim meetings.

5.1.7.2 Appropriate working documents① are be used to facilitate the audit and to document the results. In order to gather information for the assessment of the energy efficiency management system, pre-established working documents are not to restrict activities or investigations that are carried out by the auditor(s) during the audit.

5.1.7.3 The auditor(s) is to determine the effectiveness of the EEMS in meeting the requirements, on the basis of:

(1) document review of EEMS;

(2) the objective evidence of effective implementation of the EEMS, which is to be collected through interviews, review of documentation and records, observation of activities and examination of the conditions.

5.1.7.4 The auditor(s) is to carry out on-site verification of the energy efficiency data and examination of self-evaluation reports of the company and/or ship, including:

(1) the authenticity of the energy efficiency data involved in the reports;

(2) the implementation of the energy efficiency improvement measures taken by the company and/or ship and the energy efficiency improvement performance stated in the reports.

5.1.7.5 Audit findings are to be documented in a clear, concise manner and supported by objective evidence. These are to be reviewed by the auditor(s) in order to determine which are to be reported as major non-conformities, non-conformities, or observations.

5.1.7.6 At the end of the audit, prior to preparing the audit report, the auditor(s) is to hold a close meeting with the senior management of the company or ship and those responsible for the functions concerned. The purpose is to present major non-conformities, non-conformities and observations to the company's or ships management, in such a manner so as to ensure that they clearly understand the results of the audit.

5.1.8 Audit report

5.1.8.1 The audit report is to be prepared by the lead auditor, based on the results of site audit, and includes:

(1) the date of completion of the audit and the date on which audit report is submitted;

(2) the scope and objectives of the audit;

(3) audit team members, company's representative;

(4) main energy efficiency measures taken within the cycle;

(5) energy efficiency data and energy efficiency improvement performance;

(6) realization of energy efficiency goals and indexes;

(7) all major non-conformities, non-conformities and observations identified during the energy efficiency management audit;

(8) audit conclusion.

5.1.8.2 The ship is to maintain the ship energy efficiency audit report.

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① Working documents may include checklists used for evaluating SMS elements, forms for reporting observations and documenting supporting evidence.

5.1.9 Corrective action follow-up

5.1.9.1 Non-conformity report (NCR)

(1) The NCR is to clearly state the fact identified as noncompliant with the requirements of the company's EEMS and/or the IMO or flag administration;

(2) The content of the non-conformity report is to be complete and concise;

(3) When writing NCRs, auditors are to, whenever possible, include a reference to the applicable requirement of the Companies EEMS, and when necessary for the sake of clarity, restate the requirement;

(4) NCRs are to include a reference to the relevant clause or sub-clause of Chapter2 of the Rules and IMO document.

5.1.9.2 Where major non-conformities are identified, the company and/or ship is responsible for formulating, implementing corrective actions and closing out the MNC within the agreed time frame. An additional audit is to be carried out by CCS not exceeding three months from the date of completion of the audit, and the CEEMC/ SEEMC is to be endorsed or re-issued based on the satisfactory audit results.

5.1.9.3 A CEEMC or SEEMC may be issued, endorsed or renewed before all identified non-conformities have been closed out provided that a schedule has been agreed between the company and/or ship and the auditor(s) for implementation of the necessary corrective actions. Additional audit(s) may be necessary depending on the nature of any non-conformity identified. The company is responsible for applying for any additional audit required by CCS within three months.

5.1.9.4 The corrective measures are to be confirmed by the audit team of CCS and carried out within an agreed time period, which is not exceeding one month for the non-conformities, and three months for the non-conformities needed to be followed-up through additional audit and major non-conformities . The implementation of the corrective measures is be verified through conducting field additional audit, or providing the implementation evidence to the auditor of CCS within the agreed time period for confirmation.

5.1.9.5 Where the non-conformities found onboard the ship are related to insufficient shore support through the audit, the corrective measures are to be formulated by the company.

5.1.10 Suspension of audit and verification

The audit and verification may be suspended in case the company and/or ship is lack of necessary conditions of audit and verification or the audit team assesses that the audit cannot reach the intended purpose or there is evidence that the company energy efficiency data and energy efficiency measures records contain false information, and the company and/or ship is to be notified of the reasons.

5.1.11 Handling of complaint

5.1.11.1 CCS is to notify the company and/or ship to verify the veracity of the complaint and take appropriate measures if any formal complaint is raised to the certification of energy efficiency management conducted by CCS.

5.1.11.2 CCS is to determine whether an additional audit(s) or re-verification to be carried out depending on the nature of the complaint and other circumstance. In addition, CCS is to carry out verification of the effective functioning of the EEMS related to any compliant in next planned audit to the company and/or ship.

Section 2 Company Energy Efficiency Management Audit

5.2.1 Initial audit

5.2.1.1 The initial audit of the company consists of document review and field audit:

(1) Document review: to review the company's EEMS document to be in compliance with the requirements in Chapter 2 of the Rules;

(2) Field audit: to verify the compliance and the effective functioning of the company's EEMS.

5.2.1.2 Document submission

(1) The company is to submit the following documents to CCS for review:

① the energy efficiency management documents defined in Chapter 2 of the Rules;

② the business license and other relevant qualification document of the company;

③ the energy efficiency management plans of the company;

④ the energy efficiency data of the ship covered by EEMS and the self-evaluation reports of the company at least in the past one year (as defined in Chapter 3 of the Rules).

(2) If deemed necessary, CCS may request the company to provide any supporting document and information.

5.2.1.3 Document review

(1) CCS is to carry out the review after the document specified in 5.2.1.2 is submitted by the company;

(2) If this review reveals that the documents are not in compliance with the requirements of Chapter 2 of the Rules, CCS may request the company to take appropriate corrective measures.

5.2.1.4 Field audit

(1) The field audit to a company is to collect and verify the following objective evidence:

① the implementation period of EEMS (at least three months);

② the records from the internal audits performed by the company, ashore including branch offices and on board;

③ the energy efficiency data of the ship covered by EEMS at least one year (not applicable to new ships);

(2) Sampling audit is to be carried out to the ships covered by EEMS to the proportion of two or three ships for each type except those holding SEEMC issued by CCS. In case quantity of ship of a certain type is less than three, all of them are to be audited. Sampling audit to ships during company audit may be waived when all the ships covered by EEMS have obtained the SEEMC issued by CCS;

(3) The initial audit is to cover all the elements and activities of EEMS;

(4) The audit is to cover all the relevant departments and levels of the company. Where a company assigns EEMS responsibilities to branch offices, the field audit is to include a sample of those offices not less than the quantity listed in below 5.2.1.4 (4). The sample selected is to address each requirement of EEMS relevant to that office.

Table 5.2.1.4 (4)

The total number of branch offices performing the same activities	The number of branch offices to be audited
1	1
2 to 3	2
4 to 6	3
> 6	$\sqrt{X}$ Integer is to be taken.

5.2.2 Annual audit

5.2.2.1 Annual audit is to be carried out by CCS within the validity period of CEEMC according to the requirements of the Rules to maintain the validity of CEEMC, which has same scope and extent as initial audit and is to focus on the followings:

(1) any modification of the company's EEMS and document review as defined in the Rules;

(2) the effective functioning of the company's EEMS;

(3) the annual energy efficiency evaluation reports, ship energy efficiency data, and the submission to CCS;

(4) the energy efficiency improvement performance of the company;

(5) follow-up of the changes of conventions, regulations, standards and industrial requirements and compliance evaluation;

(6) realization and adjustment of the energy efficiency management goals and indexes;

(7) any modification of the scope of certification;

(8) the corrective actions against the non-conformities identified during the last audit.

5.2.2.2 Annual audit is to be carried out with same scope as initial audit, same sample quantity of branch offices and ships and avoiding selection of samples of last audit. If an additional branch office is included by the company in its EEMS during the period of validity of the CEEMC, it is to be verified at the next planned audit. The CEEMC is to be re-issued after the additional audit.

5.2.3 Renewal audit

5.2.3.1 A renewal audit is to be completed prior to the expiry date of the CEEMC.

5.2.3.2 The scope, sampling quantity of branch offices and ships and the sampling requirements of the renewal audit are same as annual audit in 5.2.2.2 of the Rules.

5.2.3.3 In addition to the contents of annual audit, the renewal audit is to focus on the followings during the valid period of the certificate:

(1) the effective functioning and modification of the company's EEMS;

(2) adjustment and realization of the energy efficiency management goals and indexes;

(3) the continuous improvement performance of the company and ship energy efficiency.

5.2.4 Additional audit

5.2.4.1 If any circumstances described in 5.1.2.5 (1) of the Rules takes place, the company is to apply to CCS for an additional audit to confirm its compliance with the requirements of the Rules and the validity of the CEEMC.

5.2.4.2 CCS is to define scope and extent of the additional audit depending on its nature.

5.2.5 Verification and examination of the company energy efficiency data and self-evaluation reports

5.2.5.1 The energy efficiency data and energy efficiency self-evaluation reports submitted to CCS by the company are to be verified, audited and examined during initial audit, annual audit and renewal audit of the CEEMC.

Section 3 Ship Energy Efficiency Management Audit

5.3.1 Initial audit

5.3.1.1 The purpose of initial audit of the ships EEMS is to verify the effectiveness of the company's EEMS onboard the ship and compliance with appropriate requirements of the Rules, IMO and flag states etc. The initial audit of the ships EEMS includes necessary document review and shipboard audit.

5.3.1.2 Following documents are to be submitted to CCS:

(1) the EEMS documents of the company and ship;

(2) the ship energy efficiency management plan (SEEMP);

(3) the ship energy efficiency data at least in the past one year (for new ships more than three months) and the ship energy efficiency self-evaluation reports as defined in Chapter 3 of the Rules;

(4) other related documents.

5.3.1.3 Document review

(1) CCS is to carry out the review after the document specified in 5.3.1.2 is submitted by the company;

(2) If this review reveals that the documents are not in compliance with the requirements of Chapter 2 of the Rules, IMO and flag states etc., CCS may request the company or ship to take appropriate corrective measures.

5.3.1.4 Shipboard audit

(1) At least, the following objective evidences are to be focused on and verified during shipboard audit:

① the implementation period of EEMS in the company and onboard (at least three months);

② the internal audit records of the ship energy efficiency management;

③ the recent energy efficiency data verification of the ship (more than one year at least);

④ the implementation of SEEMP onboard the ship and the verification of ship energy efficiency improvement performance;

⑤ the familiarization of the master and senior officers with the implementation requirements of EEEMS and SEEMP;

⑥ ship energy efficiency self-evaluation reports.

(2) Shipboard audit is to verify the compliance and effectiveness of all the EEMS elements.

5.3.2 Intermediate audit

5.3.2.1 Intermediate audit is to be carried out by CCS to verify the effective functioning of the EEMS within the validity period of the SEEMC and compliance with the requirements of the Rules in order to maintain its validity .

5.3.2.2 The intermediate audit has the same scope and extent as initial audit and is to focus on the followings:

(1) any modification of the company's /ships EEMS and document review as defined in the Rules;

(2) the effective functioning of the ships EEMS;

(3) ship energy efficiency evaluation reports, ship energy efficiency data, and submission to CCS;

(4) realization and adjustment of the ship energy efficiency management goals and indexes;

(5) the energy efficiency improvement performance of the ship;

(6) follow-up of the changes of conventions, regulations, standards and industrial requirements related to ship energy efficiency and compliance evaluation;

(7) verification of effectiveness of the corrective actions against the non-conformities identified during the last audit.

5.3.3 Renewal audit

5.3.3.1 A renewal audit is to be completed prior to the expiry date of the SEEMC.

5.3.3.2 In addition to the contents of intermediate audit, the renewal audit is to focus on the followings during the valid period of the certificate:

(1) the overall effective functioning of the EEMS onboard the ship;

(2) adjustment and realization of the energy efficiency management goals and indexes;

(3) the continuous improvement performance of the ship energy efficiency.

5.3.4 Additional audit

5.3.4.1 If any circumstances described in 5.1.2.5 (2) of the Rules takes place, the ship is to apply to CCS for an additional audit to confirm its compliance with the requirements of the Rules and the effective functioning of EEMS.

5.3.4.2 CCS is to define scope and extent of the additional audit depending on its nature.

5.3.5 Verification and examination of the ship energy efficiency data and self-evaluation reports

5.3.5.1 The ship energy efficiency data and energy efficiency self-evaluation reports submitted to CCS are to be verified, audited and examined during initial audit, intermediate audit and renewal audit of the SEEMC.

5.3.5.2 The ship energy efficiency data within the audit period that have been verified to be correct may be confirmed by the auditor with signature.

Section 4 Ship Energy Efficiency Verification

5.4.1 The purpose of the ship energy efficiency verification is to verify the compliance, authenticity and accuracy of the stipulated contents. The ship energy efficiency verification consists of the following three aspects:

(1) review of ship energy efficiency management plan(SEEMP);

(2) verification of ship energy efficiency data;

(3) review of ship energy efficiency improvement performance.

5.4.2 The process of the ship energy efficiency verification is to be referred as defined in 5.1.5～5.1.8 of the Rules.

5.4.3 The requirements of document submission and review of the ship energy efficiency verification

5.4.3.1 The following documents are to be submitted to CCS for verification according to the requirement of 5.4.3.2:

(1) Ship energy efficiency management plan;

(2) Ship energy efficiency data (as per the requirements in Chapter 3 of the Rules);

(3) Evidence and performance data of the ship energy efficiency improvement.

5.4.3.2 The document of above-mentioned 5.4.3.11is to be submitted for review of the ship energy efficiency management plan, documents of 5.4.3.1 (1) and (2) for the ship energy efficiency data verification, and documents of 5.4.3.1 (1) to (3) for review of the ship energy efficiency improvement performance.

5.4.3.3 The auditor of CCS is to review the above-mentioned documents prior to the field verification.

5.4.4 The contents and requirements of the shipboard verification

5.4.4.1 Review of ship energy efficiency management plan

(1) Whether the ship carries the Ship Energy Efficiency Management Plan SEEMP;

(2) Whether the plan complies with the requirements of the guidelines of IMO;

(3) Whether the actual situations of the ship and her operations have been taken into consideration, and the plan is easy to operate.

5.4.4.2 Verification of ship energy efficiency data

(1) Whether the data obtaining approach of the energy efficiency and responsibilities are clearly stated, and the measuring equipment meets the requirements and has been effectively controlled;

(2) To verify the energy efficiency data within the stipulated period (or voyage), including check and field confirmation of the energy efficiency data records;

(3) To check whether the calculating method of EEOI and other relevant energy efficiency indexes complies with the requirements, and verify the calculation results.

5.4.4.3 Review of ship energy efficiency improvement performance

(1) To verify the ship energy efficiency data and energy efficiency indexes before the improvement of energy efficiency as defined in 5.4.4.2;

(2) To verify the ship energy efficiency data and energy efficiency indexes after the improvement of the energy efficiency as defined in 5.4.4.2;

(3) To verify the improvement performance of various energy efficiency indexes.

Appendix 1

Cross reference between Energy Efficiency Management System Requirements and ISM CODE

Chapter 2 Ship Energy Efficiency Management System-Requirements		ISM CODE- International Management Code for the Safe Operation of Ships and for Pollution Prevention	
General requirements	2.1	1 1.3	General Rules Scope of application
		1.1	Definition
		1.4	Basic requirements for the safety management system
Management responsibilities	2.2		
Management commitments	2.2.1		
Energy efficiency policy	2.2.2	2	Safety and environment protection policy
Functions, responsibilities and limitations	2.2.3	3 4 5	Company responsibilities and authority Designated person(s) Master's responsibilities and authority
Planning	2.3		
Energy efficiency factors	2.3.1		
International conventions, laws, regulations, standards and other requirements	2.3.2	1.2	Objectives
Energy efficiency management baseline and benchmark	2.3.3	1.2	Objectives
Energy efficiency goals and indexes	2.3.4	1.2	Objectives
Energy efficiency management plans	2.3.5		
Implementation and operation	2.4		
Resources	2.4.1	3	Company responsibilities and authority
Competence, training and awareness	2.4.2	6.1~6.5	Resource and personnel
Exchange of information	2.4.3	6.6,6.7	Resource and personnel
Documents	2.4.4	11	Documentation
Document control	2.4.5		
Record control	2.4.6		
Operation control	2.4.7	7 10	Shipboard operations Maintenance of the ship and equipment
Emergency preparation and response	2.4.8	8	Emergency preparedness

Chapter 2 Ship Energy Efficiency Management System-Requirements		ISM CODE- International Management Code for the Safe Operation of Ships and for Pollution Prevention	
Check and correction	2.5	12	Company verification, review and evaluation
Monitoring and measuring	2.5.1		
General	2.5.1.1		
Monitoring methods	2.5.1.2		
Monitoring system	2.5.1.3		
Monitoring and measuring equipment	2.5.1.4		
Evaluation	2.5.2	12	Company audit, review and evaluation
Incentive	2.5.3		
Voluntary report	2.5.4		
Non-conformity, correction, corrective actions and preventive measures	2.5.5	9	reports and analysis of non-conformities, accidents and hazardous occurrences
Internal audit	2.5.6	12	Company audit, review and evaluation
Management review General Review input Review output	2.6 2.6.1 2.6.2 2.6.3	12	Company audit, review and evaluation

Appendix 2

Cross reference between Energy Efficiency Management System Requirements and ISO14001-2004

Chapter 2 Ship Energy Efficiency Management System Requirements		ISO14001-2004 Environmental Management System-Requirements with Guidance for Use	
Overall requirements	2.1	1	Scope
		2	Normative references
		3	Terms and definitions
		4	Environmental Management System Requirements
		4.1	General requirements
Management responsibilities Management commitments	2.2 2.2.1	4.4.1	Resource, roles, responsibility and authority
Energy efficiency policy	2.2.2	4.2	Environmental policy
Functions, responsibilities and limitations	2.2.3	4.4.1	Resource, roles, responsibility and authority
Planning	2.3	4.3	Planning
Energy efficiency factors	2.3.1	4.3.1	Environmental aspects
Laws, regulations, standards and other requirements	2.3.2	4.3.2	Legal and other requirements
Energy efficiency management baseline and benchmark	2.3.3	4.3	Planning
Energy efficiency goals and indexes Energy efficiency management plans	2.3.4 2.3.5	4.3.3	Objectives, targets and programme(s)
Implementation and operation	2.4	4.4	Implementation and operation
Resources	2.4.1	4.4.1	Resource, roles, responsibility and authority
Competence, training and awareness	2.4.2	4.4.2	Competence, training and awareness
Exchange of information	2.4.3	4.4.3	Communication
Documents	2.4.4	4.4.4	Documentation
Document control	2.4.5	4.4.5	Control of documents
Record control	2.4.6	4.5.4	Control of records
Operation control	2.4.7	4.4.6	Operational control
Emergency preparation and response	2.4.8	4.4.7	Emergency preparedness and response
Monitoring and measuring	2.5	4.5	Checking

Chapter 2 Ship Energy Efficiency Management System Requirements		ISO14001-2004 Environmental Management System-Requirements with Guidance for Use	
General	2.5.1	4.5.1	Monitoring and measurement
Monitoring methods	2.5.1.1		
Monitoring system	2.5.1.2		
Monitoring and measuring equipment	2.5.1.3		
Monitoring and measuring	2.5.1.4		
Evaluation	2.5.2	4.5.2	Evaluation of compliance
Incentive	2.5.3		
Voluntary report	2.5.4		
Non-conformity, correction, corrective actions and preventive measures	2.5.5	4.5.3	Nonconformity, corrective action and preventive action
Internal audit	2.5.6	4.5.5	Internal audit
Management review General Review input Review output	2.6 2.6.1 2.6.2 2.6.3	4.6	Management review

Appendix 3

Cross reference between Energy Efficiency Management System Requirements and ISO9001-2008

Chapter 2 Ship Energy Efficiency Management System Requirements		ISO9001-2008	
Overall requirements	2.1	1	Scope
		2	Normative references
		3	Terms and definitions
		4	Quality management system
		4.1	Overall requirements
Management responsibilities	2.2	5	Management responsibility
Management commitments	2.2.1	5.1	Management commitment
Energy efficiency policy	2.2.2	5.3	Quality policy
Functions, responsibilities and limitations	2.2.3	5.5	Responsibility, authority and communication
Planning	2.3	5.4	Planning
Energy factors Laws, regulations, standards and other requirements Energy efficiency management baseline and benchmark	2.3.1 2.3.2 2.3.3	5.4.2	Quality management system planning
Energy efficiency goals and indexes	2.3.4	5.4.1	Quality objectives
Energy efficiency management plans	2.3.5	5.4.2	Quality management system planning
Implementation and operation	2.4	7	Product realization
Resources	2.4.1	6 6.1 6.2 6.2.1	Resource management Provision of resources Human resources General
Competence, training and awareness	2.4.2	6.2.2	Competence, training and awareness
Exchange of information	2.4.3	5.5.3 7.2.3	Internal communication Customer communication
Documents	2.4.4	4.2 4.2.2	Documentation requirements Quality manual
Document control	2.4.5	4.2.3	Control of documents
Record control	2.4.6	4.2.4	Control of records

Chapter 2 Ship Energy Efficiency Management System Requirements		ISO9001-2008	
Operation control	2.4.7	7	Product realization
		7.1	Planning of product realization
		7.2	Customer-related processes
		7.2.1	Determination of requirements related to the product
		7.2.2	Review of requirements related to the product
		7.3	Design and development
		7.3.1	Design and development planning
		7.3.2	Design and development inputs
		7.3.3	Design and development outputs
		7.3.4	Design and development review
		7.3.5	Design and development verification
		7.3.6	Design and development validation
		7.3.7	Control of design and development changes
		7.4	Purchasing
		7.4.1	Purchase process
		7.4.2	Purchasing information
		7.4.3	Verification of purchased products
		7.5	Production and service provision
		7.5.1	Control of production and service provision
		7.5.2	Validation of processes for production and service provision
		7.5.3	Identification and traceability
		7.5.4	Customer property
		7.5.5	Preservation of product
		8.3	Control of nonconforming product
Emergency preparation and response	2.4.8	8	Measurement, analysis and improvement
Check and correction	2.5	8.1 8.2 8.2.1 8.2.3 8.2.4 8.4	General Monitoring and measurement Customer satisfaction Monitoring and measurement of processes Monitoring and measurement of product Analysis of data
Monitoring and measuring General Monitoring methods Monitoring system	2.5.1 2.5.1.1 2.5.1.2 2.5.1.3	7.6	Control of monitoring and measuring equipment

Chapter 2 Ship Energy Efficiency Management System Requirements		ISO9001-2008	
Monitoring and measuring equipment	2.5.1.4	8.2.3 8.2.4	Monitoring and measurement of processes Monitoring and measurement of product
Evaluation	2.5.2	8.3 8.5	Control of nonconforming product Improvement
Incentive	2.5.3		Continual improvement
Voluntary report	2.5.4	8.5.1 8.5.2	Corrective action Preventive action
Non-conformity, correction, corrective actions and preventive measures	2.5.5	8.5.3	
Internal audit	2.5.6	8.2.2	Internal audit
Management review General Review input Review output	2.6 2.6.1 2.6.2 2.6.3	5.6 5.6.1 5.6.2 5.6.3	Management review General Review input Review output

Appendix 4

Ship Energy Efficiency Data Forms

Form a: for bulk carrier, tanker, general dry cargo ship, gas carrier, ships carrying containers and other type of cargoes, and ro-ro cargo ship

Name of ship: Voyage No.:

Voyage	Port of departure	Port of arrival	Voyage distance (nautical mile) [1]	Fuel consumption quantity (t)				Cargo capacity (t)			Beginning and ending time
				Heavy fuel oil [2]	Light fuel oil [3]	Diesel oil [4]	Others	Cargo capacity-t	-TEU Cargo capacity-TEU	Ballast capacity [5]-t	
1											
2											
3											
…											
N											

Form b: for container ship

Name of ship: Voyage No.:

Voyage	Port of departure	Port of arrival	Voyage distance (nautical mile) [1]	Fuel consumption quantity (t)				Cargo capacity (t)			Beginning and ending time
				Heavy fuel oil [2]	Light fuel oil [3]	Diesel oil [4]	Others	Cargo capacity-t	-TEU Cargo capacity-TEU	Ballast capacity [5]-t	
1											
2											
3											
…											
N											

Form c: for passenger ship (including ro-ro passenger ship)

Name of ship: Voyage No.:

Voyage section			Voyage distance (nautical mile)[1]	Fuel consumption quantity (t)				Cargo capacity (t)			Beginning and ending time
	Port of departure	Port of arrival		Heavy fuel oil[2]	Light fuel oil[3]	Diesel oil[4]	Others	Tonnage	Number of people	Ballast capacity[5]-t	
1											
2											
3											
…											
N											

Note: [1] The voyage distance means the actual distance of the ship, taken from the ship official log book;

[2] Heavy fuel oil means the ISO8217 Grades RME through RMK (HFO), including the 380, 250, 180, 120 and 100 etc.

[3] Light fuel oil means ISO8217 Grades RMA through RMD (MDO).

[4] Diesel means ISO8217 Grades DMX through DMC (MGO), including 0, -10 and -20 etc.

[5] The ballast capacity means the ballast water quantity in three loading conditions, i.e. empty, full load and partial load.

Appendix 5

Audit Requirements on the Modification of CEEMC/SEEMC

	Scenario	Type of audit	Minimum scope of audit	Carried out by	Certificate issued
1	Change of company name	Confirmation on site	① Verify that Company organization and responsibilities remain essentially unchanged. ② Ensure that necessary changes have been made to EEMS documentation.	Auditor	Reissue DOC with new name (expiry date as pervious certificate)
2	Change of company address	Confirmation on site	Verify the modification in the next annual audit	Auditor	Reissue DOC with new address (expiry date as pervious certificate)
3	Increase the coverage of CEEMC	Additional audit on site	① Review changes to EEMS ② Review the effective functioning of the company/ship energy efficiency management system within the newly increased ships, and verify relevant energy efficiency data. ③ Review the internal audit results.	Auditor	Issue a new CEEMC including the newly increased ships, with the same expiry date as the previous CEEMC.
4	Change of ship's name	Verification on board	Verify correct name on all certificates and documents.	Auditor or surveyor	Change name on existing SEEMC and subsequently issue new certificate
5	Change of flag	Verification on board	① Verify the ship has valid statutory certificates and flag endorsement. ② Verify the compliance with relevant requirements of the flag state	Auditor or surveyor	Issue a new SEEMC (expiry date as pervious certificate)
6	Change of company	Initial shipboard audit	Carry out audit as defined in 5.3.1 of the Rules.	Auditor	Issue a new SEEMC

Appendix 6

CEEMC Format

CHINA CLASSIFICATION SOCIETY

No._____

COMPANY ENERGY EFFICIENCY MANAGEMENT CERTIFICATE

Issued under China Classification Society's Rules For Certification Of Ship Energy Efficiency Management by China Classification Society.

Name and address of the Company：_____

Company Identification Number：_____

The branches included：_____

THIS IS TO CERTIFY that, the energy efficiency management system and energy efficiency data① of the company have been audited verified to comply with China Classification Society's *Rules For Certification Of Ship Energy Efficiency Management, Guidance For The Development Of A Ship Energy Efficiency Management Plan (SEEMP)(IMO. MEPC.1/Circ.683) and Guidelines For Voluntary Use Of The Ship Energy Efficiency Operational Indicator (EEOI)* (IMO.MEPC.1/Circ.684).Scopes of Accreditation are as below:

1. Type of ship②: _____

2. Type of cargo: _____

3. Main shipping routes _____

Completion date of the initial/renewal verification on which this certificate is based: _____

This certificate is valid until_____, subject to periodical verification.

Issued at ：_____ _____

Date of issue：_____ **CHINA CLASSIFICATION SOCIETY**

① The details of company energy efficiency data refer to the audit report.

② Ship list of the company refers to appendix.

COMPANY ENERGY EFFICIENCY MANAGEMENT CERTIFICATE

APPENDIX

No. _____

No.	Name of ship	IMO.No	Type of ship	Gross tonnage	Flag	Remark

COMPANY ENERGY EFFICIENCY MANAGEMENT CERTIFICATE

ENDORSEMENT FOR ANNUAL VERIFICATION

No._____

THIS IS TO CERTIFY that, at the periodical verification required by China Classification Society's *Rules For Certification Of Ship Energy Efficiency Management*, the energy efficiency management system and the energy efficiency data were found to comply with China Classification Society's *Rules For Certification Of Ship Energy Efficiency Management,* Guidance for *The Development Of A Ship Energy Efficiency Management Plan (SEEMP)*(IMO.MEPC.1/Circ.683)and *Guidelines For Voluntary Use Of The Ship Energy Efficiency Operational Indicator (EEOI)* (IMO.MEPC.1/Circ.684).

1st ANNUAL VERIFICATION Signature：_____

Place：_____

Date：_____

2nd ANNUAL VERIFICATION Signature：_____

Place：_____

Date：_____

3rd ANNUAL VERIFICATION Signature：_____

Place：_____

Date：_____

4th ANNUAL VERIFICATION Signature：_____

Place：_____

Date：_____

Appendix 7

SEEMC Format

CHINA CLASSIFICATION SOCIETY

No._____

SHIP ENERGY EFFICIENCY MANAGEMENT CERTIFICATE

Issued under China Classification Society's *Rules for Certification of Ship Energy Efficiency Management.*

Name of ship：_____

Port of registry：_____

Type of ship：_____

Gross tonnage：_____

IMO Number: _____

THIS IS TO CERTIFY that the energy efficiency management system and energy efficiency data① of this ship:

1 have been audited/verified according to China Classification Society's *Rules for Certification of Ship Energy Efficiency Management*;

2 have been recognized to comply with China Classification Society's *Rules For Certification Of Ship Energy Efficiency Management & Guidance for The Development of Ship Energy Efficiency Management Plan (MEPC.1/Circ.683)\Guidelines for Voluntary Use of The Ship Energy Efficiency Operational Index* (MEPC.1/Circ.684).

Completion date of the initial/renewal verification on which this certificate is based: _____

This certificate is valid until：_____, subject to periodical verification.

Issued at：_____ _____

Date of issue：_____ **CHINA CLASSIFICATION SOCIETY**

① The details of ship energy efficiency data refer to China Classification Society's audit report .

SHIP ENERGY EFFICIENCY MANAGEMENT CERTIFICATE

No._____

ENDORSEMENT FOR INTERMEDIATE VERIFICATION AND ADDITIONAL VERIFICATION (IF REQUIRED)

THIS IS TO CERTIFY THAT, at the periodical verification required by China Classification Society's Rules for Certification Of Ship Energy Efficiency Management, the ship energy efficiency management system and energy efficiency data were found to comply with China Classification Society's Rules for Certification of Ship Energy Efficiency Management & the Guidance for The Development Of A Ship Energy Efficiency Management Plan (SEEMP)(IMO.MEPC.1/Circ.683), Guidelines for Voluntary Use of The Ship Energy Efficiency Operational Index (EEOI)(IMO.MEPC.1/Circ.684).

INTERMEDIATE VERIFICATION
（to be completed between the second and third anniversary date)

Signature：_____

Place：_____

Date：_____

ADDITIONAL VERIFICATION

Signature：_____

Place：_____

Date：_____

ADDITIONAL VERIFICATION

Signature：_____

Place：_____

Date：_____

Records of Ship Energy Efficiency Management

No._____

Notes:
1 This Record shall be permanently attached to SEEMC. The SEEMC shall be available on board the ship at all times.

2 The Record shall be in both Chinese and English. In case of dispute or discrepancy, the Chinese version shall prevail.

3 Entries in boxes shall be made by inserting either: a cross (x) for the answers "yes" and "applicable"; or a dash ( )for the answers "no" and "not applicable", as appropriate.

4 Unless otherwise stated, the rules mentioned in this Record refer to CCS's Rules for Certification of Ship Energy Efficiency , and regulations or circulars refer to those adopted by the International Maritime Organization.

1 Ship information

1.1 Name of ship：_____

1.2 IMO Number：_____

1.3 Date of building contract：_____

1.4 Gross tonnage：_____

1.5 Deadweight：_____

1.6 Type of ship：_____

1.7 Name and address of the company：_____

2 Main energy-consumption equipment

2.1 Main propulsion system:

Type and Quantity : _____

Rated Power and Speed: _____

Manufacturer and Date of Manufacture: _____

2.2 Generator Plants：

Type & Quantity of Prime Mover: _____

Rated Power and Voltage: _____

2.3 Boiler：

Type & Quantity: _____

Design Pressure: _____

2.4 Incinerator：

Type/Model: _____

3 Ship energy efficiency management system document

3.1 The energy efficiency management system document as required in Chapter 2 of the Rules is being operated on board the ship.…….....…….....…… ☐

The date from which the implementation of energy efficiency management system document on board the ship starts：_____

3.2 The ship energy efficiency management plan (SEEMP) in compliance with the requirements of the Rules and IMO circulars has been formulated and implemented on board the ship. ..... ☐

4 Measuring methods of ship energy efficiency

4.1 Energy efficiency operational indicator……..... ☐

4.2 Energy consumption intensity index and CO_2 emission intensity index stipulated by Chinese government ……..... ☐

4.3 Other energy efficiency indexes and measuring methods..... ☐

5 Ship energy efficiency data records

5.1 The ship energy efficiency data/indexes (including EEOI) and self-evaluation reports of each period within the valid period of the certificate are kept on board the ship……..... ☐

5.2 The ship energy efficiency data/indexes have been verified as defined in Chapter 5 of the Rules..... ☐

This is to certify that this Record is correct in all respects.

Issued at: _____(Place of issuing)

(YY/MM/DD)_____(Date of issue)

Auditor _____

(Signed by)

(stamp)

Appendix 8

SEEVS Format

CHINA CLASSIFICATION SOCIETY

No._____

SHIP ENERGY EFFICIENCY VERIFICATION STATEMENT

THIS IS TO CERTIFY THAT, at the request of the company, the ship energy efficiency management plan (SEEMP), energy efficiency data and energy efficiency improvement performance① have been verified by the undersigned auditor(s) according to the applicable provisions of China Classification Society's Rules For Certification of Ship Energy Efficiency Management, Guidance for The Development of A Ship Energy Efficiency Management Plan (IMO. MEPC.1/Circ.683) & Guidelines for Voluntary Use of The Ship Energy Efficiency Operational Index (EEOI) (IMO.MEPC.1/Circ.684). Details are as below：

Name of ship：_____

Port of registry：_____

Type of ship：_____

Gross tonnage：_____

IMO Number：_____

SEEMP：_____

EEOI or other energy efficiency data：_____

Issued at：_____ _____

Date of issue：_____ Auditor to **CHINA CLASSIFICATION SOCIETY**

① Delete as appropriate.

Appendix 9

Notification of Invalidation of Energy Efficiency Management Certificate

CHINA CLASSIFICATION SOCIETY

No._____

Invalidation/Withdrawal Notification of Energy Efficiency Management Certificate

☐ Company energy efficiency management certificate
☐ Ship energy efficiency management certificate

Name of ship:	(Company/ship) IMO Number:
Name/address of company:	(Company/ship) Energy Efficiency Management Certificate No.:
Reasons for invalidation/withdrawal of the certificate： 1. Clause ( ) of 2.2.4.1 of China Classification Society's Rules For Certification of Ship Energy Efficiency Management 2. Clause ( ) of 2.2.4.2 of China Classification Society's Rules For Certification of Ship Energy Efficiency Management 3. Others (please specify):	
Auditor (signature): _____ Date: _____ _____ China Classification Society (Seal) Received by: Signature: _____ Title: _____ Date: _____	

ANNEX 1

MEPC.1/Circ.681
17 August 2009

INTERIM GUIDELINES ON THE METHOD OF CALCULATION OF THE ENERGY EFFICIENCY DESIGN INDEX FOR NEW SHIPS

1 The Marine Environment Protection Committee, at its fifty-ninth session (13 to 17 July 2009), recognized the need to develop an energy efficiency design index for new ships in order to stimulate innovation and technical development of all elements influencing the energy efficiency of a ship from its design phase. The Committee, being mindful that the applicability of the EEDI formula to all categories of ships and the feasibility and applicability of the technical parameters (i.e. $f_{eff(i)}$ and f_w) in the EEDI formula need to be further refined to improve the method of calculation of the EEDI; agreed to circulate the Interim Guidelines on the method of calculation of the energy efficiency design index for new ships, as set out in the annex.

2 Member Governments and observer organizations are invited to use the interim guidelines, for the purpose of test and trials on a voluntary basis:

.1 for ships with conventional propulsion systems (main engine mechanical drive); and

.2 to the extent possible, for ships with non-conventional propulsion systems (e.g., diesel-electric propulsion, turbine propulsion or hybrid propulsion systems).

3 Member Governments and observer organizations are also invited to provide the outcome and experiences in applying the interim Guidelines to future sessions of the Committee for further improvement of the method of calculation of the EEDI for new ships.

ANNEX

INTERIM GUIDELINES ON THE METHOD OF CALCULATION OF THE ENERGY EFFICIENCY DESIGN INDEX FOR NEW SHIPS

1 Definitions

For the purpose of these Guidelines, the following definitions should apply:

.1	Passenger ship	a ship which carries more than 12 passengers as defined in SOLAS chapter 1, regulation 2
.2	Dry cargo carrier	a ship which is constructed generally with single deck, topside tanks and hopper tanks in cargo spaces, and it is intended primarily to carry dry cargo in bulk, and includes such types as ore carriers and combination carriers, as defined in SOLAS chapter IX, regulation 1
.3	Gas tanker	a gas carrier as defined in SOLAS chapter II-1, regulation 3
.4	Tanker	an oil tanker as defined in MARPOL Annex I, regulation 1 or chemical tanker and a NLS tanker as defined in MARPOL Annex II, regulation 1
.5	Containership	a ship designed exclusively for the carriage of containers in holds and on deck
.6	Ro-ro cargo ship: Vehicle carrier	A multi deck ro-ro cargo ship designed for the carriage of empty cars and trucks
.7	Ro-ro cargo ship: Volume carrier	A ro-ro cargo ship, with a deadweight per lanemetre less than 4① tons/m, designed for the carriage of cargo transportation units
.8	Ro-ro cargo ship: Weight carrier	A ro-ro cargo ship, with a deadweight per lanemetre of 4① tons/m or above, designed for the carriage of cargo transportation units
.9	General cargo ship	A ship with a multi-deck or single-deck hull designed primarily for the carriage of general cargo
.10	Ro-ro passenger ship	A passenger ship as defined in SOLAS chapter II-1, Part A, regulation 2.23

Ships falling within more than one of the ship types should be considered as being the ship type with the lower baseline.

① The value should be further investigated during the period of voluntary use of the EEDI.

2 Energy Efficiency Design Index (EEDI)

The attained new ship Energy Efficiency Design Index (EEDI) is a measure of ships CO_2 efficiency and calculated by the following formula:

$$\frac{\left(\prod_{j=1}^{M} f_j\right)\left(\sum_{i=1}^{nME} P_{ME(i)}\, C_{FME(i)} \cdot SFC_{ME(i)}\right) + \left(P_{AE} \cdot C_{FAE} \cdot SFC_{AE}*\right) + \left(\left(\prod_{j=1}^{M} f_j \cdot \sum_{i=1}^{nPTI} P_{PTI(i)} - \sum_{i=1}^{neff} f_{eff(i)} \cdot P_{AEeff(i)}\right) C_{FAE} \cdot SFC_{AE}\right) - \left(\sum_{i=1}^{neff} f_{eff(i)} \cdot P_{eff(i)} \cdot C_{FME} \cdot SFC_{ME}\right)}{f_i \cdot Capacity \cdot V_{ref} \cdot f_w}$$

* If part of the Normal Maximum Sea Load is provided by shaft generators, SFC_{ME} may – for that part of the power – be used instead of SFC_{AE}

Note: This formula may not be able to apply to diesel-electric propulsion, turbine propulsion or hybrid propulsion system.

Where:

.1 C_F is a non-dimensional conversion factor between fuel consumption measured in g and CO_2 emission also measured in g based on carbon content. The subscripts $_{MEi}$ and $_{AEi}$ refer to the main and auxiliary engine(s) respectively. C_F corresponds to the fuel used when determining *SFC* listed in the applicable EIAPP Certificate. The value of C_F is as follows:

Type of fuel	Reference	Carbon content	C_F (t-CO_2/t-Fuel)
1. Diesel/Gas Oil	ISO 8217 Grades DMX through DMC	0.875	3.206000
2. Light Fuel Oil (LFO)	ISO 8217 Grades RMA through RMD	0.86	3.151040
3. Heavy Fuel Oil (HFO)	ISO 8217 Grades RME through RMK	0.85	3.114400
4. Liquified Petroleum Gas (LPG)	Propane Butane	0.819 0.827	3.000000 3.030000
5. Liquified Natural Gas (LNG)		0.75	2.750000

.2 V_{ref} is the ship speed, measured in nautical miles per hour (knot), on deep water in the maximum design load condition (*Capacity*) as defined in paragraph 3 at the shaft power of the engine(s) as defined in paragraph 5 and assuming the weather is calm with no wind and no waves. The maximum design load condition shall be defined by the deepest draught with its associated trim, at which the ship is allowed to operate. This condition is obtained from the stability booklet approved by the Administration.

.3 *Capacity* is defined as follows:

.3.1 For dry cargo carriers, tankers, gas tankers, containerships, ro-ro cargo and general cargo ships, deadweight should be used as *Capacity*.

.3.2 For passenger ships and ro-ro passenger ships, gross tonnage in accordance with the International Convention of Tonnage Measurement of Ships 1969, Annex I, regulation 3 should be used as *Capacity*.

.3.3 For containerships, the capacity parameter should be established at 65% of the deadweight.

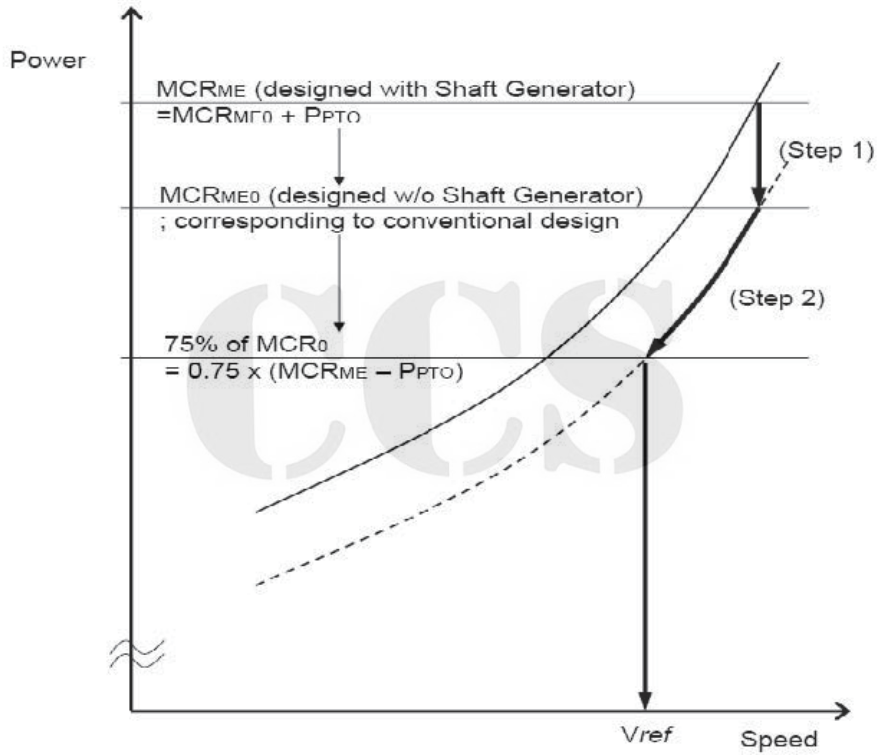
.4 Deadweight means the difference in tonnes between the displacement of a ship in water of relative density of 1,025 kg/m^3 at the deepest operational draught and the lightweight of the ship.

.5 P is the power of the main and auxiliary engines, measured in kW. The subscripts $_{ME}$ and $_{AE}$ refer to the main and auxiliary engine(s), respectively. The summation on i is for all engines with the number of engines (^{nME}). (See the diagram in the Appendix.)

.5.1 $P_{ME(i)}$ is 75% of the rated installed power (MCR) for each main engine (i) after having deducted any installed shaft generator(s):

$$P_{ME(i)} = 0.75 \times (MCR_{MEi} - P_{PTOi})$$

The following figure gives guidance for determination of $P_{ME(i)}$:



.5.2 $P_{PTO(i)}$ is 75% output of each shaft generator installed divided by the relevant efficiency of that shaft generator.

.5.3 $P_{PTI(i)}$ is 75% of the rated power consumption of each shaft motor divided by the weighted averaged efficiency of the generator(s).
In case of combined PTI/PTO, the normal operational mode at sea will determine which of these to be used in the calculation.

Note: The shaft motor's chain efficiency may be taken into consideration to account for the energy losses in the equipment from the switchboard to the shaft motor, if the chain efficiency of the shaft motor is given in a verified document.

.5.4 $P_{eff(i)}$ is 75% of the main engine power reduction due to innovative mechanical energy efficient technology.

Mechanical recovered waste energy directly coupled to shafts need not be measured.

.5.5 $P_{AEeff\ (i)}$ is the auxiliary power reduction due to innovative electrical energy efficient technology measured at $P_{ME(i)}$.

.5.6 P_{AE} is the required auxiliary engine power to supply normal maximum sea load including necessary power for propulsion machinery/systems and accommodation, e.g., main engine pumps, navigational systems and equipment and living on board, but excluding the power not for propulsion machinery/systems, e.g., thrusters, cargo pumps, cargo gear, ballast pumps, maintaining cargo, e.g., reefers and cargo hold fans, in the condition where the ship engaged in voyage at the speed (V_{ref}) under the design loading condition of *Capacity*.

.1 For cargo ships with a main engine power of 10000 kW or above, P_{AE} is defined as:

$$P_{AE(MCRME>10000KW)} = \left(0.025 \times \sum_{i=1}^{nME} MCR_{MEi}\right) + 250$$

.2 For cargo ships with a main engine power below 10000 kW, P_{AE} is defined as:

$$P_{AE(MCRME<10000KW)} = 0.05 \times \sum_{i=1}^{nME} MCR_{MEi}$$

.3 For ship types where the P_{AE} value calculated by .1 or .2 above is significantly different from the total power used at normal seagoing, e.g., in cases of passenger ships, the P_{AE} value should be estimated by the consumed electric power (excluding propulsion) in conditions when the ship is engaged in a voyage at reference speed (V_{ref}) as given in the electric power table①, divided by the weighted average efficiency of the generator(s).

.6 V_{ref}, *Capacity* and *P* should be consistent with each other.

.7 *SFC* is the certified specific fuel consumption, measured in g/kWh, of the engines. The subscripts $_{ME(i)}$ and $_{AE(i)}$ refer to the main and auxiliary engine(s), respectively. For engines certified to the E2 or E3 duty cycles of the NO_x Technical Code 2008, the engine Specific Fuel Consumption ($SFC_{ME(i)}$) is that recorded on the EIAPP Certificate(s) at the engine(s) 75% of MCR power or torque rating. For engines certified to the D2 or C1 duty cycles of the NO_x Technical Code 2008, the engine Specific Fuel Consumption ($SFC_{AE(i)}$) is that recorded on the EIAPP Certificate(s) at the engine(s) 50% of MCR power or torque rating.

For ships where the P_{AE} value calculated by 2.5.6.1 and 2.5.6.2 is significantly different from the total power used at normal seagoing, e.g., conventional passenger ships, the Specific Fuel Consumption (SFC_{AE}) of the auxiliary generators is that recorded in the EIAPP Certificate(s) for the engine(s) at 75% of P_{AE} MCR power of its torque rating.

SFC_{AE} is the weighted average among $SFC_{AE(i)}$ of the respective engines *i*.

For those engines which do not have an EIAPP Certificate because its power is below 130 kW, the *SFC* specified by the manufacturer and endorsed by a competent authority should be used.

① **Note:** The electric power table is often verified and approved by the Administration/Recognized Organization as documentation relating to SOLAS chapter II-1, Part D, regulation 40.1.1. The electric power table shows a generator load summary in kW and lists generators in service at different conditions of ship operation, e.g., "normal seagoing at full passenger load", where the ambient conditions are as follows: outside temperature is 35°C, the relative humidity is 85% and the seawater temperature is 32°C.

.8 f_j is a correction factor to account for ship specific design elements.

The f_j for ice-classed ships is determined by the standard f_j in Table 1.

Table 1

Correction factor for power f_j for ice-classed ships

For further information on approximate correspondence between ice classes, see HELCOM Recommendation 25/7①

Ship type	f_j	Limits depending on the ice class			
		IC	IB	IA	IA Super
Tanker	$\frac{0.516 L_{PP}^{1.87}}{\sum_{i=1}^{nME} P_{iME}}$	$\begin{cases} max\ 1.0 \\ min\ 0.72 L_{PP}^{0.06} \end{cases}$	$\begin{cases} max\ 1.0 \\ min\ 0.61 L_{PP}^{0.08} \end{cases}$	$\begin{cases} max\ 1.0 \\ min\ 0.50 L_{PP}^{0.10} \end{cases}$	$\begin{cases} max\ 1.0 \\ min\ 0.40 L_{PP}^{0.12} \end{cases}$
Dry cargo carrier	$\frac{2.150 L_{PP}^{1.58}}{\sum_{i=1}^{nME} P_{iME}}$	$\begin{cases} max\ 1.0 \\ min\ 0.89 L_{PP}^{0.02} \end{cases}$	$\begin{cases} max\ 1.0 \\ min\ 0.78 L_{PP}^{0.04} \end{cases}$	$\begin{cases} max\ 1.0 \\ min\ 0.68 L_{PP}^{0.06} \end{cases}$	$\begin{cases} max\ 1.0 \\ min\ 0.58 L_{PP}^{0.08} \end{cases}$
General cargo ship	$\frac{0.0450 \cdot L_{PP}^{2.37}}{\sum_{i=1}^{nME} P_{iME}}$	$\begin{cases} max\ 1.0 \\ min\ 0.85 L_{PP}^{0.03} \end{cases}$	$\begin{cases} max\ 1.0 \\ min\ 0.70 L_{PP}^{0.06} \end{cases}$	$\begin{cases} max\ 1.0 \\ min\ 0.54 L_{PP}^{0.10} \end{cases}$	$\begin{cases} max\ 1.0 \\ min\ 0.39 L_{PP}^{0.15} \end{cases}$

For other ship types, f_j should be taken as 1.0.

.9 f_w is a non-dimensional coefficient indicating the decrease of speed in representative sea conditions of wave height, wave frequency and wind speed (e.g., Beaufort Scale 6), and should be determined as follows:

.9.1 It can be determined by conducting the ship-specific simulation of its performance at representative sea conditions. The simulation methodology should be prescribed in the Guidelines developed by the Organization and the method and outcome for an individual ship shall be verified by the Administration or an organization recognized by the Administration.

.9.2 In case that the simulation is not conducted, f_w value should be taken from the "Standard f_w" table/curve. A "Standard f_w" table/curve, which is to be contained in the Guidelines, is given by ship type (the same ship as the "baseline" below), and expressed in a function of the parameter of *Capacity* (e.g., DWT). The "Standard f_w" table/curve is to be determined by conservative approach, i.e. based on data of actual speed reduction of as many existing ships as possible under representative sea conditions.

.9.3 f_w should be taken as one (1.0) until the Guidelines for the ship-specific simulation (paragraph .9.1) or f_w table/curve (paragraph .9.2) becomes available.

.10 $f_{eff(i)}$ is the availability factor of each innovative energy efficiency technology. $f_{eff(i)}$ for waste energy recovery system should be one (1.0).

.11 f_i is the capacity factor for any technical/regulatory limitation on capacity, and can be assumed one (1.0) if no necessity of the factor is granted.

① HELCOM Recommendation 25/7 may be found at http://www.helcom.fi .

f_i for ice-classed ships is determined by the standard fi in Table 2.

Table 2

Capacity correction factor f_i for ice-classed ships

For further information on approximate correspondence between ice classes, see HELCOM Recommendation 25/7①

Ship type	f_i	Limits depending on the ice class			
		IC	IB	IA	IA Super
Tanker	$\frac{0.00115 L_{PP}^{3.36}}{capacity}$	$\begin{cases} max\ 1.31 L_{PP}^{-0.05} \\ min\ 1.0 \end{cases}$	$\begin{cases} max\ 1.54 L_{PP}^{-0.07} \\ min\ 1.0 \end{cases}$	$\begin{cases} max\ 1.80 L_{PP}^{-0.09} \\ min\ 1.0 \end{cases}$	$\begin{cases} max\ 2.10 L_{PP}^{-0.11} \\ min\ 1.0 \end{cases}$
Dry cargo carrier	$\frac{0{,}000665 \cdot L_{PP}^{3.44}}{capacity}$	$\begin{cases} max\ 1.31 L_{PP}^{-0.05} \\ min\ 1.0 \end{cases}$	$\begin{cases} max\ 1.54 L_{PP}^{-0.07} \\ min\ 1.0 \end{cases}$	$\begin{cases} max\ 1.80 L_{PP}^{-0.09} \\ min\ 1.0 \end{cases}$	$\begin{cases} max\ 2.10 L_{PP}^{-0.11} \\ min\ 1.0 \end{cases}$
General cargo ship	$\frac{0{,}000676 \cdot L_{PP}^{3.44}}{capacity}$	1.0	$\begin{cases} max\ 1.08 \\ min\ 1.0 \end{cases}$	$\begin{cases} max\ 1.12 \\ min\ 1.0 \end{cases}$	$\begin{cases} max\ 1.25 \\ min\ 1.0 \end{cases}$
Containership	$\frac{0.1749 \cdot L_{PP}^{2.29}}{capacity}$	1.0	$\begin{cases} max\ 1.25 L_{PP}^{-0.04} \\ min\ 1.0 \end{cases}$	$\begin{cases} max\ 1.60 L_{PP}^{-0.08} \\ min\ 1.0 \end{cases}$	$\begin{cases} max\ 2.10 L_{PP}^{-0.12} \\ min\ 1.0 \end{cases}$
Gas tanker	$\frac{0.1749 \cdot L_{PP}^{2.33}}{capacity}$	$\begin{cases} max\ 1.25 L_{PP}^{-0.04} \\ min\ 1.0 \end{cases}$	$\begin{cases} max\ 1.60 L_{PP}^{-0.08} \\ min\ 1.0 \end{cases}$	$\begin{cases} max\ 2.10 L_{PP}^{-0.12} \\ min\ 1.0 \end{cases}$	1.0

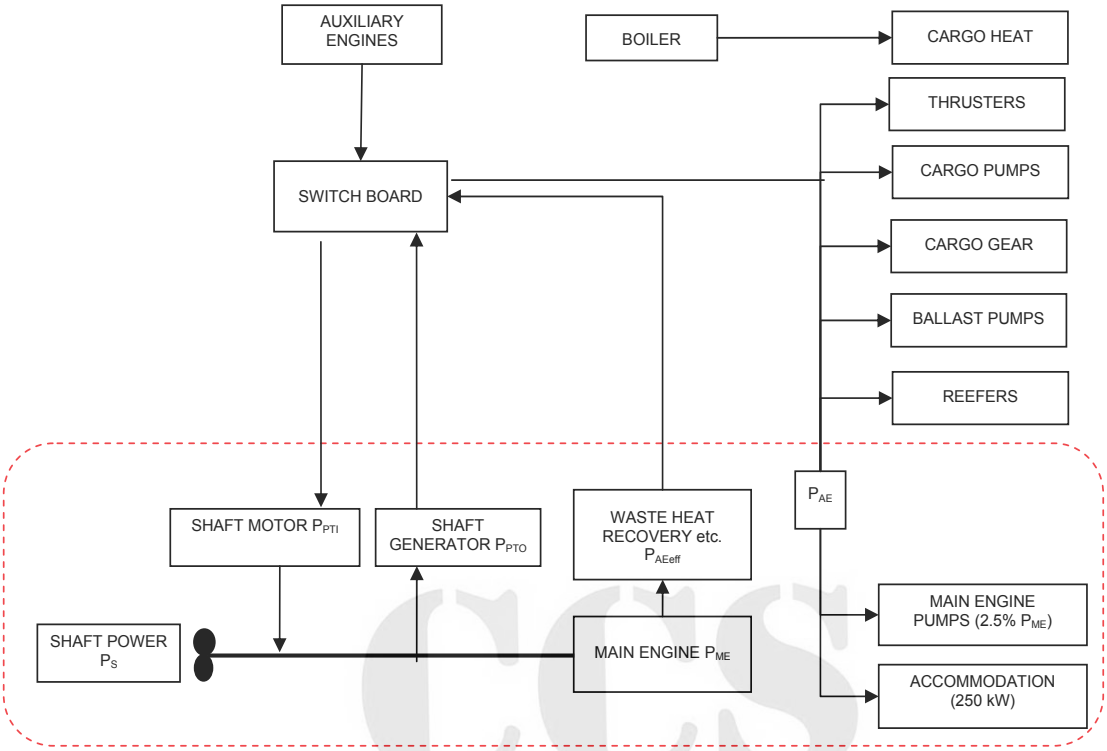
For other ship types, f_i should be taken as 1.0.

.12 *Length between perpendiculars, L_{pp}* means 96 per cent of the total length on a waterline at 85 per cent of the least moulded depth measured from the top of the keel, or the length from the foreside of the stem to the axis of the rudder stock on that waterline, if that were greater. In ships designed with a rake of keel the waterline on which this length is measured shall be parallel to the designed waterline. The length between perpendiculars (L_{pp}) shall be measured in metres.

① HELCOM Recommendation 25/7 may be found at http://www.helcom.fi.

Appendix

A generic and simplified marine power plant



Note 1: Mechanical recovered waste energy directly coupled to shafts need not be measured.

Note 2: In case of combined PTI/PTO, the normal operational mode at sea will determine which of these to be used in the calculation.

ANNEX 2

MEPC.1/Circ.682
17 August 2009

INTERIM GUIDELINES FOR VOLUNTARY VERIFICATION OF THE ENERGY EFFICIENCY DESIGN INDEX

1 The Marine Environment Protection Committee, at its fifty-ninth session (13 to 17 July 2009), recognizing the need to develop a method for voluntary verification of the energy efficiency design index for new ships in order to promote uniform use of the Interim Guidelines on the method of calculation of the energy efficiency design index for new ships (MEPC.1/Circ.681), agreed to circulate the Interim Guidelines on voluntary verification of the energy efficiency design index, as set out in the annex.

2 Member Governments are invited to use the annexed Interim Guidelines for the purpose of tests and trials on a voluntary basis.

3 Member Governments and observer organizations are also invited to provide the outcome and experiences in applying the Interim Guidelines to future sessions of the Committee for further improvement of the Interim Guidelines.

ANNEX

INTERIM GUIDELINES FOR VOLUNTARY VERIFICATION OF THE ENERGY EFFICIENCY DESIGN INDEX

1 GENERAL

The purpose of these Guidelines is to assist verifiers of Energy Efficiency Design Index (EEDI) of ships in conducting the verification, on a voluntary basis, of the EEDI which should be calculated in accordance with the Interim Guidelines on the Method of Calculation of the EEDI for New Ships ("EEDI Guidelines", hereafter), and assist shipowners, shipbuilders and manufacturers being related to the energy efficiency of a ship and other interested parties in understanding the procedures of the voluntary EEDI verification.

2 DEFINITIONS①

2.1 *Verifier* means an organization which conducts the voluntary EEDI verification in accordance with these Guidelines, including Administrations, classification societies and other organizations which possess technical expertise necessary for conducting the EEDI verification.

2.2 *Ship of the same type* means a ship of which hull form (expressed in the lines such as sheer plan and body plan) excluding additional hull features such as fins and of which principal particulars are identical to that of the base ship.

2.3 *Ship of a similar type* means a ship of which hull form (expressed in the lines such as sheer plan and body plan) excluding additional hull features such as fins and of which principal particulars are largely identical to that of the base ship.

2.4 *Tank test* means model towing tests, model self-propulsion tests and model propeller open water tests. Numerical tests may be accepted as equivalent to model tests if they are performed under documented conditions agreed by the shipbuilder and shipowner.

3 APPLICATION

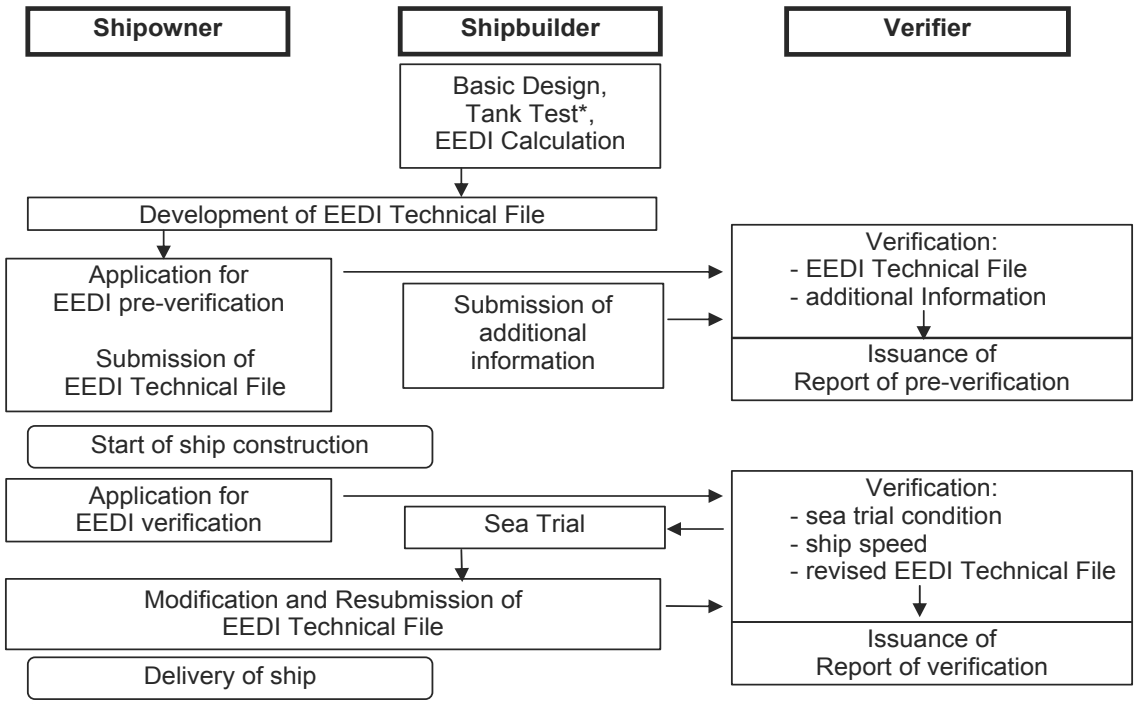
These Guidelines should be applied on a voluntary basis to new ships for which an application for an EEDI verification has been submitted to a verifier.

4 PROCEDURES FOR VERIFICATION

4.1 General

Attained EEDI should be calculated in accordance with the EEDI Guidelines. Voluntary EEDI verification should be conducted on two stages: preliminary verification at the design stage, and final verification at the sea trial. The basic flow of the verification process is presented in Figure 1.

① Other terms used in these guidelines have the same meaning as those defined in the EEDI Guidelines.



* To be conducted by a test organization or a shipbuilder itself.

Figure 1 – Basic Flow of Verification Process

4.2 Preliminary verification at the design stage

4.2.1 For the preliminary verification at the design stage, a shipowner should submit to a verifier an application for the verification and an EEDI Technical File containing the necessary information for the verification and other relevant background documents.

4.2.2 EEDI Technical File, which is to be developed by either a shipowner or a shipbuilder, should include at least but not limited to:

.1 deadweight (DWT) or gross tonnage (GT) for passenger and ro-ro passenger ships, the shaft power of the main and auxiliary engines, the ship speed on deep water in the maximum design loaded conditions at the 75% of the maximum continuous rate (MCR) for the main engine, the specific fuel consumption (SFC) of the main engine at the 75% of MCR power, the SFC of the auxiliary engines at the 50% MCR power, and the electric power table for certain ship types, as necessary, as defined in the EEDI Guidelines;

.2 power curves (kW – knot) estimated at design stage under fully loaded condition and sea trial condition;

.3 principal particulars and the overview of propulsion system and electricity supply system on board;

.4 estimation process and methodology of the power curves at design stage;

.5 description of energy saving equipment; and

.6 calculated value of the Attained EEDI.

4.2.3 Sea trial conditions should be set in fully loaded condition, if possible – e.g., in case of tankers.

4.2.4 The SFC of the main and auxiliary engines should be quoted from the approved NO_x Technical File. For the confirmation of the SFC, a copy of the approved NO_x Technical File should be submitted to the verifier. In case NO_x Technical File has not been approved at the time of the application for preliminary verification, the test reports provided by manufacturers should be used. In this case, at the time of the sea trial verification, a copy of the approved NO_x Technical File should be submitted to the verifier.

Note: SFC in the NO_x Technical File are the values of a parent engine, and the use of such value of SFC for the EEDI calculation for member engines may have the following technical problems for further consideration:

- The definition of "member engines" given in NO_x Technical File is broad and specification of engines belonging to the same family group may vary; and

- The rate of NO_x emission of the parent engine is the highest in the group/family – i.e. CO_2 emission, which is in the trade-off relationship with NO_x emission, can be lower than the other engines in the group/family.

Thus, for member engines of which specifications are different from the parent engine, how to determine SFC should be considered further. For instance, measured values of SFC at test bed of manufacturers could be used.

4.2.5 The power curves used for the preliminary verification at the design stage should be based on reliable results of tank test. A tank test for an individual ship may be omitted based on technical justifications such as availability of the results of tank tests for ships of the same/similar type.

4.2.6 The verifier may request the shipbuilder for additional information on top of those contained in Technical File, as necessary, to examine the calculation process of the Attained EEDI. The estimation of the ship speed at the design stage much depends on each shipbuilder's experiences, and it may not be practicable for any person/organization other than the shipbuilder to fully examine the technical aspects of experience-based parameters such as the roughness coefficient and wake coefficient. Therefore, the preliminary verification should focus on the calculation process of the Attained EEDI that should follow the EEDI Guidelines.

Note: A possible way forward for more robust verification is to establish a standard methodology of deriving the ship speed from the outcomes of tank test, by setting standard values for experience-based correction factors such as roughness coefficient and wake coefficient. In this way, ship-by-ship performance comparison could be made more objectively by excluding the possibility of arbitrary setting of experience-based parameters. If such standardization is sought, this would have an implication on how the ship speed adjustment based on sea trial results should be conducted in accordance with paragraph 4.3.8 of these Guidelines.

Note: For ensuring the quality of tank tests, it would be desirable in the future that an organization conducting a tank test be authorized by the Administration or an organization recognized by it in accordance with the guidelines developed by the Organization.

4.2.7 Additional information that the verifier should request the shipbuilder to provide directly to it (i.e. not to be contained in Technical File) includes but not limited to:

.1 descriptions of a tank test facility; this should include the name of the facility, the particulars of tanks and towing equipment, and the records of calibration of each monitoring equipment;

.2 lines of a model ship and an actual ship for the verification of the appropriateness of the tank test; the lines (sheer plan, body plan and half-breadth plan) should be detailed enough to demonstrate the similarity between the model ship and the actual ship;

.3 lightweight of the ship and displacement table for the verification of the deadweight;

.4 detailed report on the method and results of the tank test; this should include at least the tank test results at sea trial condition and at fully loaded condition;

.5 detailed calculation process of the ship speed, which should include the estimation basis of experience-based parameters such as roughness coefficient, wake coefficient; and

.6 reasons for exempting a tank test, if applicable; this should include lines and tank test results of the ships of same/similar type, and the comparison of the principal particulars of such ships and the ship in question. Appropriate technical justification should be provided for regarding the tank test unnecessary.

4.2.8 Such additional information may contain shipbuilders' confidential information. Therefore, after the verification, the verifier should return all or part of such information to the shipbuilder at its request.

4.3 Final verification of the Attained EEDI at sea trial

4.3.1 Prior to the sea trial, a shipowner should submit the application for the verification of EEDI together with the final displacement table and the measured lightweight, or a copy of the survey report of deadweight, as well as a copy of NO_x Technical File as necessary.

4.3.2 The verifier should attend the sea trial and confirm:

.1 propulsion and power supply system, particulars of the engines, and other relevant items described in the EEDI Technical File;

.2 draft and trim;

.3 sea conditions;

.4 ship speed; and

.5 shaft power of the main engine.

4.3.3 Draft and trim should be confirmed by the draft measurements taken prior to the sea trial. The draft and trim should be as close as practical to those at the assumed conditions used for estimating the power curves.

4.3.4 Sea conditions should be measured in accordance with ISO15016:2002 or the equivalent.

4.3.5 Ship speed should be measured in accordance with ISO15016:2002 or the equivalent and at more than two points of which range includes the 75% of MCR power.

4.3.6 The shaft power of the main engine should be measured by shaft power meter or estimated by fuel rack. Otherwise, it should be measured by a method which the engine manufacturer recommends and the verifier approves.

4.3.7 The shipbuilder should develop power curves based on the measured ship speed and the measured shaft power of the main engine at sea trial. For the development of the power curves, the shipbuilder should calibrate the measured ship speed, if necessary, by taking into account the effects of wind, tide and waves in accordance with ISO15016:2002 or the equivalent.

4.3.8 The shipbuilder should compare the power curves obtained as a result of the sea trial and the estimated power curves at the design stage. In case differences are observed, the Attained EEDI should be recalculated, as necessary, in accordance with the following:

.1 for ships for which sea trial is conducted in fully loaded condition (e.g., tankers): the Attained EEDI should be recalculated using the measured ship speed at sea trial at 75% of MCR power; and

.2 for ships for which sea trial cannot be conducted in fully loaded condition (e.g., dry bulkers): if the measured ship speed at 75% of MCR power of the main engine at the sea trial conditions is different from the expected ship speed on the power curve at the corresponding condition, the shipbuilder should recalculate the Attained EEDI by adjusting ship speed in fully loaded condition by an appropriate correction method that is agreed by the verifier.

An example of possible methods of the speed adjustment is given in Figure 2: MEPC.1/Circ.6

Note: Further consideration would be necessary for speed adjustment methodology in 4.3.8.2. One of concerns relates to a possible situation where the power curve for sea trial condition is estimated in excessively conservative manner (i.e. power curve is shifted in a leftward direction) with the intention to get an upward adjustment of the ship speed by making the measured ship speed at sea trial easily exceed the lower-estimated speed for sea trial condition at design stage.

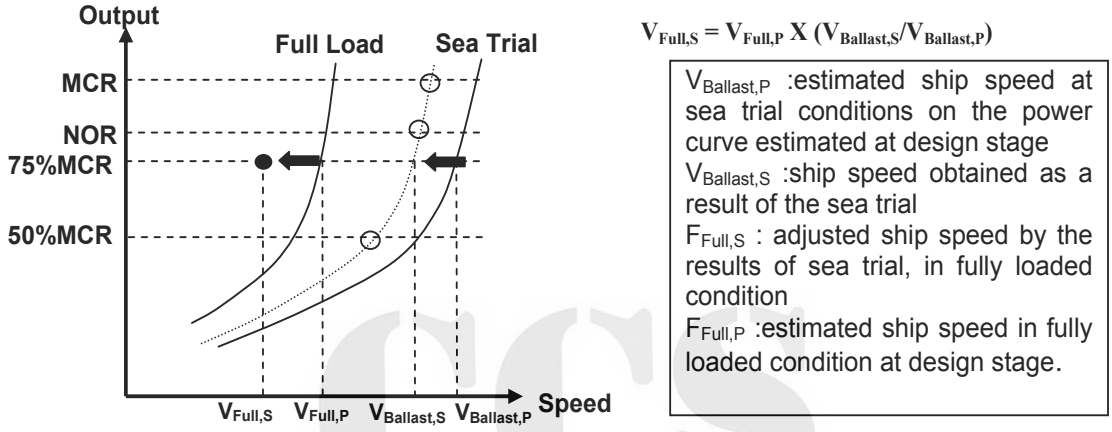


Figure 2 – An Example of Possible Ship Speed Adjustment

4.3.9 In case where the Attained EEDI is calculated at the preliminary verification by using SFC based on the manufacturer's test report due to the non-availability at that time of the approved NO_x Technical File, the shipowner or the shipbuilder should recalculate the Attained EEDI by using SFC in the approved NO_x Technical File.

4.3.10 The shipowner or the shipbuilder should revise an EEDI Technical File, as necessary, by taking into account the results of sea trial. Such revision should include, as applicable, the adjusted power curve based on the results of sea trial (namely, modified ship speed at 75% of MCR power of the main engine at full-loaded condition) and SFC described in the approved NO_x Technical File, and the recalculated Attained EEDI based on these modifications.

4.3.11 The EEDI Technical File, if revised, should be submitted to the verifier for the confirmation that the (revised) Attained EEDI is calculated in accordance with the EEDI Guidelines.

5 ISSUANCE OF THE EEDI VERIFICATION REPORT

5.1 The verifier should issue the Report on the Preliminary Verification of EEDI after it verified the Attained EEDI at design stage in accordance with Sections 4.1 and 4.2 of these Guidelines.

5.2 The verifier should issue the report on the Verification of EEDI after it verified the Attained EEDI after the sea trial in accordance with Sections 4.1 and 4.3 of these Guidelines.

ANNEX 3

MEPC.1/Circ.683
17 August 2009

GUIDANCE FOR THE DEVELOPMENT OF A SHIP ENERGY EFFICIENCY MANAGEMENT PLAN (SEEMP)

1 The Marine Environment Protection Committee, at its fifty-ninth session (13 to 17 July 2009), recognizing the need to develop management tools to assist a shipping company in managing the environmental performance of its ships, agreed to circulate the Guidance for the development of a ship energy efficiency management plan, as set out in the annex.

2 Member Governments are invited to bring the annexed Guidance to the attention of their Administrations, industry, relevant shipping organizations, shipping companies and other stakeholders concerned and to promote the use of the Guidance on a voluntary basis.

3 Member Governments and observer organizations are also invited to provide information of the outcome and experiences in applying the Guidance to future sessions of the Committee.

ANNEX

GUIDANCE FOR THE DEVELOPMENT OF A SHIP ENERGY EFFICIENCY MANAGEMENT PLAN (SEEMP)

CONTENTS

1 INTRODUCTION

1.1 There are around 70,000 ships engaged in international trade and this unique industry carries 90% of world trade. Sea transport has a justifiable image of conducting its operations in a manner that creates remarkably little impact on the global environment. Compliance with the MARPOL Convention and other IMO instruments and the actions that many companies take beyond the mandatory requirements serve to further limit the impact. It is nevertheless the case that enhancement of efficiencies can reduce fuel consumption, save money and decrease environmental impacts for individual ships. While the yield of individual measures may be small, the collective effect across the entire fleet will be significant.

1.2 In global terms it should be recognized that operational efficiencies delivered by a large number of ship operators will make an invaluable contribution to reducing global carbon emissions.

1.3 A Ship Energy Efficiency Management Plan provides a possible approach for monitoring ship and fleet efficiency performance over time and some options to be considered when seeking to optimize the performance of the ship.

2 GENERAL

2.1 The purpose of a Ship Energy Efficiency Management Plan (SEEMP) is to establish a mechanism for a company and/or a ship to improve the energy efficiency of a ship's operation. Preferably, the ship-specific SEEMP is linked to a broader corporate energy management policy for the company that owns, operates or controls the ship, recognizing that no two shipping companies or shipowners are the same, and that ships operate under a wide range of different conditions.

2.2 Many companies will already have an environmental management system (EMS) in place under ISO14001 which contains procedures for selecting the best measures for particular vessels and then setting objectives for the measurement of relevant parameters, along with relevant control and feedback features. Monitoring of operational environmental efficiency should therefore be treated as an integral element of broader company management systems.

2.3 This document provides guidance for the development of a SEEMP that should be adjusted to the characteristics and needs of individual companies and ships. The SEEMP is intended to be a management tool to assist a company in managing the ongoing environmental performance of its vessels and as such, it is recommended that a company develops procedures for implementing the plan in a manner which limits any onboard administrative burden to the minimum necessary.

2.4 The SEEMP should be developed as a ship-specific plan by the shipowner, operator or any other party concerned, e.g., charterer. The SEEMP seeks to improve a ship's energy efficiency through four steps: *planning, implementation, monitoring*, and *self-evaluation and improvement*. These components play a critical role in the continuous cycle to improve ship energy management. With each iteration of the cycle, some elements of the SEEMP will necessarily change while others may remain as before.

3 APPLICATION

Planning

3.1 Planning is the most crucial stage of the SEEMP, in that it primarily determines both the current status of ship energy usage and the expected improvement of ship energy efficiency. Therefore, it is encouraged to devote sufficient time to planning so that the most appropriate, effective and implementable plan can be developed.

Ship-specific measures

3.2 Recognizing that there are a variety of options to improve efficiency – speed optimization, weather routeing and hull maintenance, for example – and that the best package of measures for a ship to improve efficiency differs to a great extent depending upon ship type, cargoes, routes and other factors, the specific measures for the ship to improve energy efficiency should be identified in the first place. These measures should be listed as a package of measures to be implemented, thus providing the overview of the actions to be taken for that ship.

3.3 During this process, therefore, it is important to determine and understand the ship's current status of energy usage. The SEEMP then identifies energy-saving measures that have been undertaken, and determines how effective these measures are in terms of improving energy efficiency. The SEEMP also identifies what measures can be adopted to further improve the energy efficiency of the ship. It should be noted, however, that not all measures can be applied to all ships, or even to the same ship under different operating conditions and that some of them are mutually exclusive. Ideally, initial measures could yield energy (and cost) saving results that then can be reinvested into more difficult or expensive efficiency upgrades identified by the SEEMP.

3.4 Guidance on Best Practices for Fuel-Efficient Operation of Ships set out in paragraph 4 below can be used to facilitate this part of the planning phase. Also, in the planning process, particular consideration should be given to minimize any onboard administrative burden.

Company-specific measures

3.5 The improvement of energy efficiency of ship operation does not necessarily depend on single ship management only. Rather, it may depend on many stakeholders including ship repair yards, shipowners, operators, charterers, cargo owners, ports and traffic management services. For example, "Just in time" – as explained in 4.5 – requires good early communication among operators, ports and traffic management service. The better coordination among such stakeholders is, the more improvement can be expected. In most cases, such coordination or total management is better made by a company rather than by a ship. In this sense, it is recommended that a company also establish an energy management plan to manage its fleet (should it not have one in place already) and make necessary coordination among stakeholders.

Human resource development

3.6 For effective and steady implementation of the adopted measures, raising awareness of and providing necessary training for personnel both on shore and on board are an important element. Such human resource development is encouraged and should be considered as an important component of planning as well as a critical element of implementation.

Goal setting

3.7 The last part of planning is goal setting. It should be emphasized that the goal setting is voluntary, that there is no need to announce the goal or the result to the public, and that neither a company nor a ship are subject to external inspection. The purpose of goal setting is to serve as a signal which involved people should be conscious of, to create a good incentive for proper implementation, and then to increase commitment to the improvement of energy efficiency. The goal can take any form, such as the annual fuel consumption or a specific target of Energy Efficiency Operational Indicator (EEOI). Whatever the goal is, the goal should be measurable and easy to understand.

Implementation

Establishment of implementation system

3.8 After a ship and a company identify the measures to be implemented, it is essential to establish a system for implementation of the identified and selected measures by developing the procedures for energy management, by defining tasks and by assigning them to qualified personnel. Thus, the SEEMP should describe how each measure should be implemented and who the responsible person(s) is. The development of such a system can be considered as a part of planning, and therefore may be completed at the planning stage.

Implementation and record-keeping

3.9 The planned measures should be carried out in accordance with the predetermined implementation system. Record-keeping for the implementation of each measure is beneficial for self-evaluation at a later stage and should be encouraged. If any identified measure cannot be implemented for any reason(s), the reason(s) should be recorded for internal use.

Monitoring

Monitoring tools

3.10 The energy efficiency of a ship should be monitored quantitatively. This should be done by an established method, preferably by an international standard. The EEOI developed by the Organization is one of the internationally established tools to obtain a quantitative indicator of energy efficiency of a ship and/or fleet in operation, and can be used for this purpose. Therefore, EEOI could be considered as the primary monitoring tool, although other quantitative measures also may be appropriate.

3.11 If used, the EEOI should be calculated in accordance with the Guidelines developed by the Organization (MEPC.1/Circ.684). If deemed appropriate, a Rolling Average Index of the EEOI values may be calculated to monitor energy efficiency of the ship over time.

3.12 In addition to the EEOI, if convenient and/or beneficial for a ship or a company, other measurement tools can be utilized. In the case where other monitoring tools are used, the concept of the tool and the method of monitoring may be determined at the planning stage.

Establishment of monitoring system

3.13 It should be noted that whatever measurement tools are used, continuous and consistent data collection is the foundation of monitoring. To allow for meaningful and consistent monitoring, the monitoring system, including the procedures for collecting data and the assignment of responsible personnel, should be developed. The development of such a system can be considered as a part of *planning*, and therefore should be completed at the planning stage.

3.14 It should be noted that, in order to avoid unnecessary administrative burdens on ships' staff, monitoring should be carried out as far as possible by shore staff, utilizing data obtained from existing required records such as the official and engineering log-books and oil record books, etc. Additional data could be obtained as appropriate.

Self-evaluation and improvement

3.15 *Self-evaluation and improvement* is the final phase of the management cycle. This phase should produce meaningful feedback for the coming first stage, i.e. planning stage of the next improvement cycle.

3.16 The purpose of self-evaluation is to evaluate the effectiveness of the planned measures and of their implementation, to deepen the understanding on the overall characteristics of the ship's operation such as what types of measures can/cannot function effectively, and how and/or why, to comprehend the trend of the efficiency improvement of that ship and to develop the improved SEEMP for the next cycle.

3.17 For this process, procedures for self-evaluation of ship energy management should be developed. Furthermore, self-evaluation should be implemented periodically by using data collected through monitoring. In addition, it is recommended to invest time in identifying the cause-and-effect of the performance during the evaluated period for improving the next stage of the management plan.

Voluntary reporting/review

3.18 Some shipowners/operators may wish to make public the results of the actions they have taken in their SEEMP and how those actions have impacted the efficiency of their ship(s). These efforts should be incentivized as voluntary reporting and review, which could have a number of benefits. Some national Administrations, ports or partnerships may wish to recognize the efforts of these leading shipowners/operators. For example, some ports now offer environmentally-differentiated harbour fees or other rewards to those ships that qualify as "green" and a growing number of consumer products companies increasingly utilize only verifiably green transportation options in moving their products to market. Such a proposed framework is complementary to and can easily coexist with currently successful national and international energy efficiency and emissions reductions programmes outside IMO.

4 GUIDANCE ON BEST PRACTICES FOR FUEL-EFFICIENT OPERATION OF SHIPS

4.1 The search for efficiency across the entire transport chain takes responsibility beyond what can be delivered by the owner/operator alone. A list of all the possible stakeholders in the efficiency of a single voyage is long; obvious parties are designers, shipyards and engine manufacturers for the characteristics of the ship, and charterers, ports and vessel traffic management services, etc., for the specific voyage. All involved parties should consider the inclusion of efficiency measures in their operations both individually and collectively.

Fuel-Efficient Operations

Improved voyage planning

4.2 The optimum route and improved efficiency can be achieved through the careful planning and execution of voyages. Thorough voyage planning needs time, but a number of different software tools are available for planning purposes.

4.3 IMO resolution A.893(21) (25 November 1999) on Guidelines for voyage planning provides essential guidance for the ship's crew and voyage planners.

Weather routeing

4.4 Weather routeing has a high potential for efficiency savings on specific routes. It is commercially available for all types of ship and for many trade areas. Significant savings can be achieved, but conversely weather routeing may also increase fuel consumption for a given voyage.

Just in time

4.5 Good early communication with the next port should be an aim in order to give maximum notice of berth availability and facilitate the use of optimum speed where port operational procedures support this approach.

4.6 Optimized port operation could involve a change in procedures involving different handling arrangements in ports. Port authorities should be encouraged to maximize efficiency and minimize delay.

Speed optimization

4.7 Speed optimization can produce significant savings. However, optimum speed means the speed at which the fuel used per tonne mile is at a minimum level for that voyage. It does not mean minimum speed; in fact sailing at less than optimum speed will consume more fuel rather than less. Reference should be made to the engine manufacturer's power/consumption curve and the ship's propeller curve. Possible adverse consequences of slow speed operation may include increased vibration and sooting and these should be taken into account.

4.8 As part of the speed optimization process, due account may need to be taken of the need to coordinate arrival times with the availability of loading/discharge berths, etc. The number of ships engaged in a particular trade route may need to be taken into account when considering speed optimization.

4.9 A gradual increase in speed when leaving a port or estuary whilst keeping the engine load within certain limits may help to reduce fuel consumption.

4.10 It is recognized that under many charter parties the speed of the vessel is determined by the charterer and not the operator. Efforts should be made when agreeing charter party terms to encourage the ship to operate at optimum speed in order to maximize energy efficiency.

Optimized shaft power

4.11 Operation at constant shaft RPM can be more efficient than continuously adjusting speed through engine power (see 4.7). The use of automated engine management systems to control speed rather than relying on human intervention may be beneficial.

Optimized ship handling

Optimum trim

4.12 Most ships are designed to carry a designated amount of cargo at a certain speed for a certain fuel consumption. This implies the specification of set trim conditions. Loaded or unloaded, trim has a significant influence on the resistance of the ship through the water and optimizing trim can deliver significant fuel savings. For any given draft there is a trim condition that gives minimum resistance. In some ships, it is possible to assess optimum trim conditions for fuel efficiency continuously throughout the voyage. Design or safety factors may preclude full use of trim optimization.

Optimum ballast

4.13 Ballast should be adjusted taking into consideration the requirements to meet optimum trim and steering conditions and optimum ballast conditions achieved through good cargo planning.

4.14 When determining the optimum ballast conditions, the limits, conditions and ballast management arrangements set out in the ship's Ballast Water Management Plan are to be observed for that ship.

4.15 Ballast conditions have a significant impact on steering conditions and autopilot settings and it needs to be noted that less ballast water does not necessarily mean the highest efficiency.

Optimum propeller and propeller inflow considerations

4.16 Selection of the propeller is normally determined at the design and construction stage of a ship's life but new developments in propeller design have made it possible for retrofitting of later designs to deliver greater fuel economy. Whilst it is certainly for consideration, the propeller is but one part of the propulsion train and a change of propeller in isolation may have no effect on efficiency and may even increase fuel consumption.

4.17 Improvements to the water inflow to the propeller using arrangements such as fins and/or nozzles could increase propulsive efficiency power and hence reduce fuel consumption.

Optimum use of rudder and heading control systems (autopilots)

4.18 There have been large improvements in automated heading and steering control systems technology. Whilst originally developed to make the bridge team more effective, modern autopilots can achieve much more. An integrated Navigation and Command System can achieve significant fuel savings by simply reducing the distance sailed "off track". The principle is simple; better course control through less frequent and smaller corrections will minimize losses due to rudder resistance. Retrofitting of a more efficient autopilot to existing ships could be considered.

4.19 During approaches to ports and pilot stations the autopilot cannot always be used efficiently as the rudder has to respond quickly to given commands. Furthermore at certain stage of the voyage it may have to be deactivated or very carefully adjusted, i.e. heavy weather and approaches to ports.

4.20 Consideration may be given to the retrofitting of improved rudder blade design (e.g., 'twist-flow' rudder).

Hull maintenance

4.21 Docking intervals should be integrated with ship operator's ongoing assessment of ship performance. Hull resistance can be optimized by new technology-coating systems, possibly in combination with cleaning intervals. Regular in-water inspection of the condition of the hull is recommended.

4.22 Propeller cleaning and polishing or even appropriate coating may significantly increase fuel efficiency. The need for ships to maintain efficiency through in-water hull cleaning should be recognized and facilitated by port States.

4.23 Consideration may be given to the possibility of timely full removal and replacement of underwater paint systems to avoid the increased hull roughness caused by repeated spot blasting and repairs over multiple dockings.

4.24 Generally, the smoother the hull, the better the fuel efficiency.

Propulsion system

4.25 Marine diesel engines have a very high thermal efficiency (~50%). This excellent performance is only exceeded by fuel cell technology with an average thermal efficiency of 60%. This is due to the systematic minimization of heat and mechanical loss. In particular, the new breed of electronic controlled engines can provide efficiency gains. However, specific training for relevant staff may need to be considered to maximize the benefits.

Propulsion system maintenance

4.26 Maintenance in accordance with manufacturers' instructions in the company's planned maintenance schedule will also maintain efficiency. The use of engine condition monitoring can be a useful tool to maintain high efficiency.

4.27 Additional means to improve engine efficiency might include:

Use of fuel additives;
Adjustment of cylinder lubrication oil consumption;
Valve improvements;
Torque analysis; and
Automated engine monitoring systems.

Waste heat recovery

4.28 Waste heat recovery is now a commercially available technology for some ships. Waste heat recovery systems use thermal heat losses from the exhaust gas for either electricity generation or additional propulsion with a shaft motor.

4.29 It may not be possible to retrofit such systems into existing ships. However, they may be a beneficial option for new ships. Shipbuilders should be encouraged to incorporate new technology into their designs.

Improved fleet management

4.30 Better utilization of fleet capacity can often be achieved by improvements in fleet planning. For example, it may be possible to avoid or reduce long ballast voyages through improved fleet planning. There is opportunity here for charterers to promote efficiency. This can be closely related to the concept of "just in time" arrivals.

4.31 Efficiency, reliability and maintenance-oriented data sharing within a company can be used to promote best practice among ships within a company and should be actively encouraged.

Improved cargo handling

4.32 Cargo handling is in most cases under the control of the port and optimum solutions matched to ship and port requirements should be explored.

Energy management

4.33 A review of electrical services on board can reveal the potential for unexpected efficiency gains. However care should be taken to avoid the creation of new safety hazards when turning off electrical services (e.g., lighting). Thermal insulation is an obvious means of saving energy. Also see comment below on shore power.

4.34 Optimization of reefer container stowage locations may be beneficial in reducing the effect of heat transfer from compressor units. This might be combined as appropriate with cargo tank heating, ventilation, etc. The use of water-cooled reefer plant with lower energy consumption might also be considered.

Fuel Type

4.35 Use of emerging alternative fuels may be considered as a CO_2 reduction method but availability will often determine the applicability.

Other measures

4.36 Development of computer software for the calculation of fuel consumption, for the establishment of an emissions "footprint", to optimize operations, and the establishment of goals for improvement and tracking of progress may be considered.

4.37 Renewable energy sources, such as wind, solar (or Photovoltaic) cell technology, have improved enormously in the recent years and should be considered for onboard application.

4.38 In some ports shore power may be available for some ships but this is generally aimed at improving air quality in the port area. If the shore-based power source is carbon efficient, there may be a net efficiency benefit. Ships may consider using onshore power if available.

4.39 Even wind assisted propulsion may be worthy of consideration.

4.40 Efforts could be made to source fuel of improved quality in order to minimize the amount of fuel required to provide a given power output.

Compatibility of measures

4.41 This document indicates a wide variety of possibilities for energy efficiency improvements for the existing fleet. While there are many options available, they are not cumulative, are often area and trade dependent and likely to require the agreement and support of a number of different stakeholders if they are to be utilized most effectively.

Age and operational service life of a ship

4.42 All measures identified in this document are potentially cost effective as a result of high oil prices. Measures previously considered unaffordable or commercially unattractive may now be feasible and worthy of fresh consideration. Clearly, this equation is heavily influenced by the remaining service life of a ship and the cost of fuel.

Trade and sailing area

4.43 The feasibility of many of the measures described in this guidance will be dependent on the trade and sailing area of the vessel. Sometimes ships will change their trade areas as a result of a change in chartering requirements but this cannot be taken as a general assumption. For example wind-enhanced power sources might not be feasible for short sea shipping as these ships generally sail in areas with high traffic densities or in restricted waterways. Another aspect is that the world's oceans and seas each have characteristic conditions and so ships designed for specific routes and trades may not obtain the same benefit by adopting the same measures or combination of measures as other ships. It is also likely that some measures will have a greater or lesser effect in different sailing areas.

4.44 The trade a ship is engaged in will also determine the feasibility of some of the measures. Ships that perform services at sea (pipe laying, seismic survey, OSVs, dredgers, etc.) are likely to choose different methods of carbon reductions when compared to conventional cargo carriers. The length of voyage will also be an important parameter as will safety considerations imposed upon some vessels. As a result, it is likely that the pathway to the most efficient combination of measures will be unique to each vessel within each shipping company.

A sample form of a SEEMP is presented in the appendix for illustrative purposes.

APPENDIX

SHIP EFFICIENCY ENERGY MANAGEMENT PLAN

Name of Vessel:		GT:	
Vessel Type:		Capacity:	

Date of Development:		Developed by:	
Implementation Period:	From: Until:	Implemented by:	
Planned Date of Next Evaluation:			

1 MEASURES

Energy Efficiency Measures	**Implementation** (including the starting date)	**Responsible Personnel**
Weather Routeing	<Example> Contracted with [Service providers] to use their weather routeing system and start using on-trial basis as of 1 July 2012.	<Example> The master is responsible for selecting the optimum route based on the information provided by [Service providers].
Speed Optimization	While the design speed (85% MCR) is 19.0 kt, the maximum speed is set at 17.0 kt as of 1 July 2012.	The master is responsible for keeping the ship's speed. The log-book entry should be checked every day.

2 MONITORING

- Description of monitoring tools

3 GOAL

- Measurable goals

4 EVALUATION

- Procedures of evaluation

ANNEX 4

MEPC.1/Circ.684
17 August 2009

GUIDELINES FOR VOLUNTARY USE OF THE SHIP ENERGY EFFICIENCY OPERATIONAL INDICATOR (EEOI)

1 The Marine Environment Protection Committee, at its fifty-ninth session (13 to 17 July 2009), agreed to circulate the Guidelines for voluntary use of the Ship Energy Efficiency Operational Indicator (EEOI) as set out in the annex.

2 Member Governments are invited to bring the Guidelines to the attention of all parties concerned and recommend them to use the Guidelines on a voluntary basis.

3 Member Governments and observer organizations are also invited to provide information on the outcome and experiences in applying the Guidelines to future sessions of the Committee.

ANNEX

GUIDELINES FOR VOLUNTARY USE OF THE SHIP ENERGY EFFICIENCY OPERATIONAL INDICATOR (EEOI)

1 The Conference of Parties to the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto, held from 15 to 26 September 1997 in conjunction with the Marine Environment Protection Committee's fortieth session, adopted Conference resolution 8, on CO_2 emissions from ships.

2 IMO Assembly resolution A.963(23) on IMO policies and practices related to the reduction of greenhouse gas emissions from ships urged the Marine Environment Protection Committee (MEPC) to identify and develop the mechanism or mechanisms needed to achieve the limitation or reduction of Greenhouse Gas (GHG) emissions from international shipping and, in doing so, to give priority to the establishment of a GHG baseline; and the development of a methodology to describe the GHG efficiency of a ship in terms of GHG emission indicator for that ship.

3 As urged by the Assembly, MEPC 53 approved Interim Guidelines for Voluntary Ship CO_2 Emission Index for Use in Trials.

4 These Guidelines can be used to establish a consistent approach for voluntary use of an EEOI, which will assist shipowners, ship operators and parties concerned in the evaluation of the performance of their fleet with regard to CO_2 emissions. As the amount of CO_2 emitted from a ship is directly related to the consumption of bunker fuel oil, the EEOI can also provide useful information on a ship's performance with regard to fuel efficiency.

5 These Guidelines may be updated periodically, to take account of:

- Operational experiences from use of the indicator for different ship types, as reported to MEPC by industry organizations and Administrations; and

- Any other relevant developments.

6 Industry organizations and interested Administrations are invited to promote the use of the attached Guidelines or equivalent approaches and their incorporation in company and ship environmental management plans. In addition, they are invited to report their experience in applying the EEOI concept back to MEPC.

7 In addition to these Guidelines, due account should be taken of the pertinent clauses within the ISM Code in voluntary basis along with reference to relevant industry guidance on the management and reduction of CO_2 emissions.

ANNEX

GUIDELINES FOR VOLUNTARY USE OF THE SHIP ENERGY EFFICIENCY OPERATIONAL INDICATOR (EEOI)

Contents

1 INTRODUCTION

In 1997 IMO adopted a resolution on CO_2 emissions from ships①.

IMO Assembly further adopted resolution A.963(23) on IMO policies and practices related to the reduction of greenhouse gas emissions from ships, which requests the MEPC to develop a greenhouse gas emission index for ships, and guidelines for use of that index.

This document constitutes the Guidelines for the use of an Energy Efficiency Operational Indicator (EEOI) for ships. It sets out:

- what the objectives of the IMO CO_2 emissions indicator are;
- how a ship's CO_2 performance should be measured; and
- how the index could be used to promote low-emission shipping, in order to help limit the impact of shipping on global climate change.

2 OBJECTIVES

The objective of these Guidelines is to provide the users with assistance in the process of establishing a mechanism to achieve the limitation or reduction of greenhouse gas emissions from ships in operation.

These Guidelines present the concept of an indicator for the energy efficiency of a ship in operation, as an expression of efficiency expressed in the form of CO_2 emitted per unit of transport work. The Guidelines are intended to provide an example of a calculation method which could be used as an objective, performance-based approach to monitoring the efficiency of a ship's operation.

These Guidelines are recommendatory in nature and present a possible use of an operational indicator. However, shipowners, ship operators and parties concerned are invited to implement either these Guidelines or an equivalent method in their environmental management systems and consider adoption of the principles herein when developing plans for performance monitoring.

3 DEFINITIONS

3.1 Indicator definition

In its most simple form *the Energy Efficiency Operational Indicator* is defined as the ratio of mass of CO_2 (M) emitted per unit of transport work:

Indicator = M_{CO_2}/(transport work)

For more details of indicator calculation, see 3.2 to 3.4 and Appendix 1.

3.2 Fuel consumption

Fuel consumption, FC, is defined as all fuel consumed at sea and in port or for a voyage or period in question, e.g., a day, by main and auxiliary engines including boilers and incinerators.

3.3 Distance sailed

Distance sailed means the actual distance sailed in nautical miles (deck log-book data) for the voyage or period in question.

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① Resolution 8 of the 1997 International Conference of Parties to MARPOL 73/78.

3.4 Ship and cargo types

The Guidelines are applicable for all ships performing transport work.

.1 Ships:

- dry cargo carriers
- tankers
- gas tankers
- containerships
- ro-ro cargo ships
- general cargo ships
- passenger ships including ro-ro passenger ships

.2 Cargo:

Cargo includes but not limited to:
all gas, liquid and solid bulk cargo, general cargo, containerized cargo (including the return of empty units), break bulk, heavy lifts, frozen and chilled goods, timber and forest products, cargo carried on freight vehicles, cars and freight vehicles on ro-ro ferries and passengers (for passenger and ro-ro passenger ships)

3.5 Cargo Mass Carried or Work Done

In general, cargo mass carries or work done is expressed as follows:

.1 for dry cargo carriers, liquid tankers, gas tankers, ro-ro cargo ships and general cargo ships, metric tonnes (*t*) of the cargo carried should be used;

.2 for containerships carrying solely containers, number of containers (TEU) or metric tons (*t*) of the total mass of cargo and containers should be used;

.3 for ships carrying a combination of containers and other cargoes, a TEU massof 10 t could be applied for loaded TEUs and 2 t for empty TEUs; and

.4 for passenger ships, including ro-ro passenger ships, number of passengers or gross tonnes of the ship should be used;

In some particular cases, work done can be expressed as follows:

.5 for car ferries and car carriers, number of car units or occupied lane metres;

.6 for containerships, number of TEUs (empty or full); and

.7 for railway and ro-ro vessels, number of railway cars and freight vehicles, or occupied lane metres.

For vessels such as, for example, certain ro-ro vessels, which carry a mixture of passengers in cars, foot passengers and freight, operators may wish to consider some form of weighted average based on the relative significance of these trades for their particular service or the use of other parameters or indicators as appropriate.

3.6 Voyage

Voyage generally means the period between a departure from a port to the departure from the next port. Alternative definitions of a voyage could also be acceptable.

4 ESTABLISHING AN ENERGY EFFICIENCY OPERATIONAL INDICATOR (EEOI)

The EEOI should be a representative value of the energy efficiency of the ship operation over a consistent period which represents the overall trading pattern of the vessel. Guidance on a basic calculation procedure for a generic EEOI is provided in the Appendix.

In order to establish the EEOI, the following main steps will generally be needed:

.1 define the period for which the EEOI is calculated*;

.2 define data sources for data collection;

.3 collect data;

.4 convert data to appropriate format; and

.5 calculate EEOI.

* Ballast voyages, as well as voyages which are not used for transport of cargo, such as voyage for docking service, should also be included. Voyages for the purpose of securing the safety of a ship or saving life at sea should be excluded.

5 GENERAL DATA RECORDING AND DOCUMENTATION PROCEDURES

Ideally, the data recording method used should be uniform so that information can be easily collated and analysed to facilitate the extraction of the required information. The collection of data from ships should include the distance travelled, the quantity and type of fuel used, and all fuel information that may affect the amount of carbon dioxide emitted. For example, fuel information is provided on the bunker delivery notes that are required under regulation 18 of MARPOL Annex VI.

If the example formula given in the Appendix is used, then the unit used for distance travelled and quantity of fuel should be expressed in nautical miles and metric tonnes. The work done can be expressed using units appropriate for the ship type in paragraph 3.5.

It is important that sufficient information is collected on the ship with regard to fuel type and quantity, distance travelled and cargo type so that a realistic assessment can be generated.

The distance travelled should be calculated by actual distance travelled, as contained in the ship's log-book.

Amount and type of fuel used (bunker delivery notes) and distance travelled (according to the ship's log-book) could be documented by the ship based either on the example described in the Appendix or on an equivalent company procedure.

6 MONITORING AND VERIFICATION

6.1 General

Documented procedures to monitor and measure, on a regular basis, should be developed and maintained. Elements to be considered when establishing procedures for monitoring could include:

- identification of operations/activities with impact on the performance;
- identification of data sources and measurements that are necessary, and specification of the format;
- identification of frequency and personnel performing measurements; and

- maintenance of quality control procedures for verification procedures.

The results of this type of self-assessment could be reviewed and used as indicators of the System's success and reliability, as well as identifying those areas in need of corrective action or improvement.

It is important that the source of figures established are properly recorded, the basis on which figures have been calculated and any decisions on difficult or grey areas of data. This will provide assistance on areas for improvement and be helpful for any later analysis.

In order to avoid unnecessary administrative burdens on ships' staff, it is recommended that monitoring of an EEOI should be carried out by shore staff, utilizing data obtained from existing required records such as the official and engineering log-books and oil record books, etc. The necessary data could be obtained during internal audits under the ISM Code, routine visits by superintendents, etc.

6.2 Rolling average indicator

As a ship energy efficiency management tool, the rolling average indicator, when used, should be calculated by use of a methodology whereby the minimum period of time or a number of voyages that is statistically relevant is used as appropriate. "Statistically relevant" means that the period set as standard for each individual ship should remain constant and be wide enough so the accumulated data mass reflects a reasonable mean value for operation of the ship in question over the selected period.

7 USE OF GUIDELINES

Methodology and use of EEOI, as described in these Guidelines, provide an example of a transparent and recognized approach for assessment of the GHG efficiency of a ship with respect to CO_2 emissions. The Guidelines are considered to be suitable for implementation within a company environmental management system.

Implementation of the EEOI in an established environmental management system should be performed in line with the implementation of any other chosen indicator and follow the main elements of the recognized standards (planning, implementation and operation, checking and corrective action, management review).

When using the EEOI as a performance indicator, the indicator could provide a basis for consideration of both current performance and trends over time.

One approach could be to set internal performance criteria and targets based on the EEOI data.

APPENDIX

CALCULATION OF ENERGY EFFICIENCY OPERATIONAL INDICATOR (EEOI) BASED ON OPERATIONAL DATA

1 General

The objective of the Appendix is to provide guidance on calculation of the Energy Efficiency Operational Indicator (EEOI) based on data from the operation of the ship.

2 Data sources

Primary data sources selected could be the ship's log-book (bridge log-book, engine log-book, deck log-book and other official records).

3 Fuel mass to CO_2 mass conversion factors (C_F)

C_F is a non-dimensional conversion factor between fuel consumption measured in g and CO_2 emission also measured in g based on carbon content. The value of C_F is as follows:

Type of fuel	Reference	Carbon content	C_F (t-CO_2/t-Fuel)
1. Diesel/Gas Oil	ISO 8217 Grades DMX through DMC	0.875	3.206000
2. Light Fuel Oil (LFO)	ISO 8217 Grades RMA through RMD	0.86	3.151040
3. Heavy Fuel Oil (HFO)	ISO 8217 Grades RME through RMK	0.85	3.114400
4. Liquified Petroleum Gas (LPG)	Propane Butane	0.819 0.827	3.000000 3.030000
5. Liquified Natural Gas (LNG)		0.75	2.750000

4 Calculation of EEOI

$$\text{EEOI} = \frac{\sum_j FC_j \times C_{Fj}}{m_{cargo} \times D} \qquad \text{Equation 1}$$

Where average of the indicator for a period or for a number of voyages is obtained, the Indicator is calculated as:

$$\text{Average EEOI} = \frac{\sum_i \sum_j (FC_{ij} \times C_{Fj})}{\sum_i (m_{cargo,i} \times D_i)} \qquad \text{Equation 2}$$

Where:

- j is the fuel type;
- i is the voyage number;
- FC_{ij} is the mass of consumed fuel j at voyage i;

- CF_j is the fuel mass to CO_2 mass conversion factor for fuel j;
- m_{cargo} is cargo carried (tonnes) or work done (number of TEU or passengers) or gross tonnes for passenger ships; and
- D is the distance in nautical miles corresponding to the cargo carried or work done.

The unit of EEOI depends on the measurement of cargo carried or work done, e.g., tonnes CO_2/(tonnes • nautical miles), tonnes CO_2/(TEU • nautical miles), tonnes CO_2/(person • nautical miles), etc.

It should be noted that Equation 2 does not give a simple average of EEOI among number of voyage i.

5 Rolling average

Rolling average, when used, can be calculated in a suitable time period, for example one year closest to the end of a voyage for that period, or number of voyages, for example six or ten voyages, which are agreed as statistically relevant to the initial averaging period. The Rolling Average EEOI is then calculated for this period or number of voyages by Equation 2 above.

6 Data

For a voyage or period, e.g., a day, data on fuel consumption/cargo carried and distance sailed in a continuous sailing pattern could be collected as shown in the reporting sheet below.

CO_2 Indicator reporting sheet

NAME AND TYPE OF SHIP						
Voyage or day (i)	Fuel consumption (FC) at sea and in port in tonnes				Voyage or time period data	
	Fuel type ( )	Fuel type ( )	Fuel type ( )		Cargo (m) (tonnes or units)	Distance (D) (NM)
1						
2						
3						

NOTE: For voyages with $m_{cargo} = 0$, it is still necessary to include the fuel used during this voyage in the summation above the line.

7 Conversion from g/tonne-mile to g/tonne-km

The CO_2 indicator may be converted from g/tonne-mile to g/tonne-km by multiplication by 0.54.

8 Example:

A simple example including one ballast voyage, for illustration purpose only, is provided below. The example illustrates the application of the formula based on the data reporting sheet.

NAME AND TYPE OF SHIP						
Voyage or day (i)	Fuel consumption (FC) at sea and in port in tonnes				Voyage or time period data	
	Fuel type (HFO)	Fuel type (LFO)	Fuel type ( )		Cargo (m) (tonnes or units)	Distance (D) (NM)
1	20	5			25,000	300
2	20	5			0	300
3	50	10			25,000	750
	10	3			15,000	150

$$EEOI = \frac{100 \times 3.114 + 23 \times 3.151}{(25{,}000 \times 300) + (0 \times 300) + (25{,}000 \times 750) + (15{,}000 \times 150)} = 13.47 \times 10^{-6}$$

unit: tonnes CO_2/(tons • nautical miles)