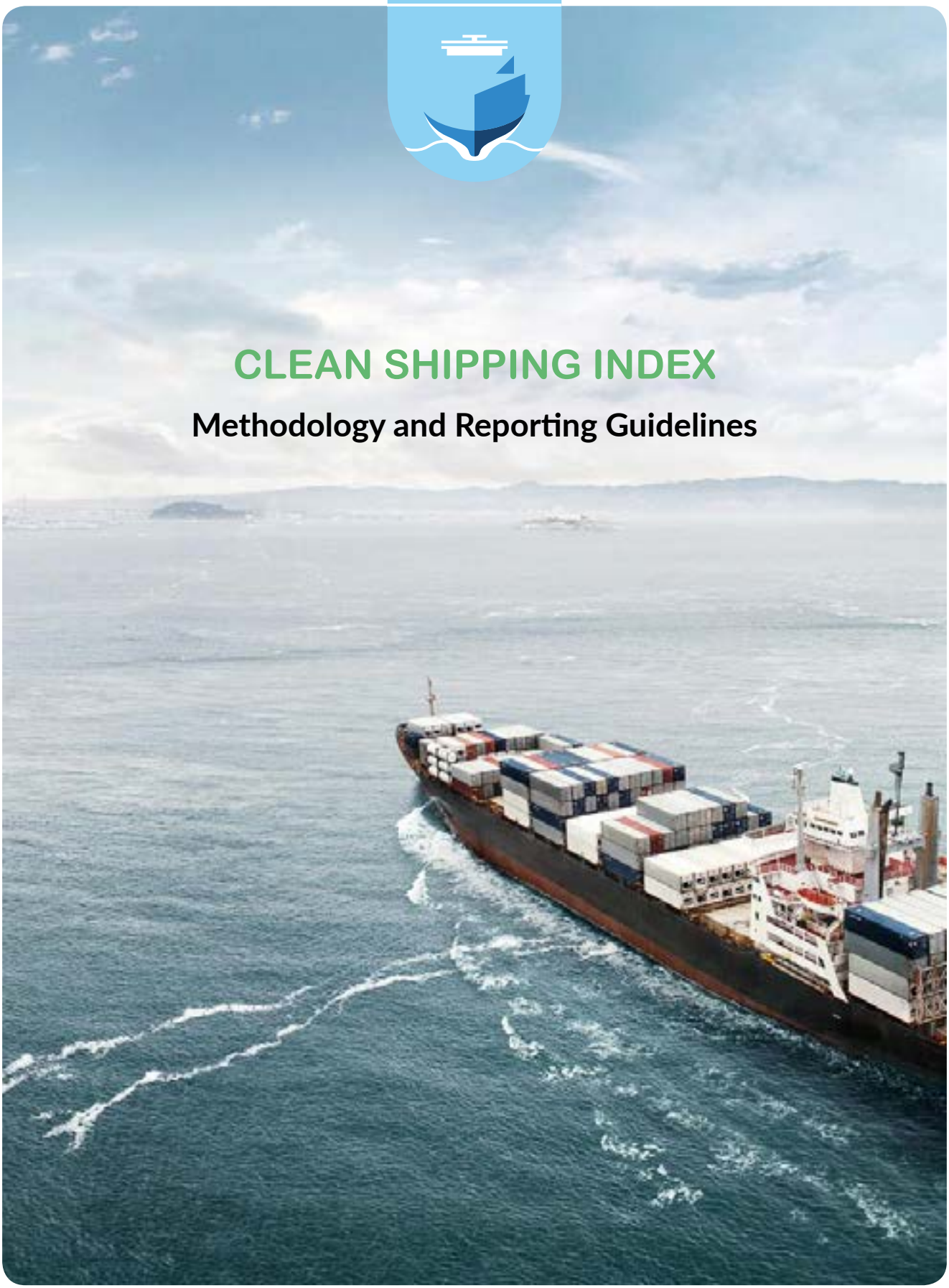

CLEAN SHIPPING INDEX

Methodology and Reporting Guidelines

Publication date: 2018-05-03

About the Clean Shipping Index

The Clean Shipping Index is an independent reporting and labelling system of the environmental performance of ships and shipping companies.

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Citation

Clean Shipping Index, 2018. Methodology and Reporting Guidelines 2018, Clean Shipping Index, Gothenburg, Sweden.

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The methodology and reporting guidelines aim to assist shipping companies with the reporting of environmental data into the Clean Shipping Index database. It also provides an explanation about the criteria used and the scoring of vessels.

This guideline report is the result of a series of workshops with the technical committee of the Clean Shipping Index which were held during 2016 and the beginning of 2017.

Special thanks to the members of the technical committee for sharing their knowledge and experience from working with and/or within the shipping industry.

If you have any questions regarding the methodology and reporting guidelines, do not hesitate to contact the Clean Shipping Index Management Team.

Rickard Lindström
April 3, 2017

1. INTRODUCTION

Shipping is a very energy efficient way to transport goods and people around the world. From this perspective, shipping is an environmentally sound mode of transport.

Despite the global shipping industry's efficiency as a transport mode, there is admittedly room for improvement in numerous areas. Apart from CO_2, ships emit nitrogen oxides, sulphur oxides and particles to the air. These emissions contribute to climate change, eutrophication and acidification of land and sea and have a negative impact on air quality and human health. Intentional and unintentional discharges of oil, chemical cargo residues, garbage, cleaning agents, antifouling paint compounds and non-indigenous species from ballast water have an ongoing adverse impact on life in the world's seas.

Besides rules and regulations there are other ways to drive improvements through market actors. If reasonable but significant environmental demands are coordinated from large cargo owners like export/import industries and companies, a 'win-win' situation can be created. This is beneficial for shipping companies, subcontractors for clean technologies and, last but not least, the environment itself. A network of cargo owners from Sweden, Germany and the Netherlands agreed to use CSI in their procurement process.

Apart from cargo owners, also several ports use CSI for lowering their port dues for clean ships. From 2018 onwards, the Swedish Maritime Administration intends to give a significant tax reduction for well-performing vessels according to the Clean Shipping Index. In this way, the Clean Shipping Index aims to give ship-owners with clean ships a competitive advantage in the market. They pay less fairway dues than their competitors and may have a preferred supplier status with their customers. Also ports are increasingly rewarding ships with lower emissons. The members and supporting companies and organizations of the Clean Shipping Network can be found on our website: www.cleanshippingindex.com.

The Clean Shipping Index focuses on the vessels' operational impact on the environment. The information is collected in the Clean Shipping Index Database. To this database, the members of the Clean Shipping Network have access. By rewarding good environmental performance with economic incentives, the members of the clean shipping network aim to contribute to environmental development of the maritime industry.

Chapter 2 describes a general overview about the Clean Shipping Index and the classification and verification of vessels. In chapter 3, the environmental parameters and methodology is outlined. Detailed guidance on filling in the web-based application is given in the appendices.

2. CLEAN SHIPPING INDEX: HOW DOES IT WORK?

2.1 General overview and environmental parameters

This section provides an overview of how the Clean Shipping Index works. For detailed guidance on the methodology please read chapter 3.

The Clean Shipping Index tool consists of a questionnaire of 25 basic questions on environmental performance of ships. They all go beyond existing rules and regulations and cover existing ships of different types.

Carriers can fill in vessel specific data of environmental parameters through an online questionnaire which is accessible via www.cleanshippingindex.com. Shipping companies obtain a Clean Shipping Index account by contacting the Clean Shipping Index secretariat through info@cleanshippingindex.com. A username and password provide access to the online application.

The Clean Shipping Index questionnaire covers general information about the participating shipping company and its vessel specific data on the following parameters: emissions of CO_2, sulphur oxides, particles, nitrogen oxides, the use of chemicals onboard and water and waste management. These parameters are chosen because they cover the main environmental challenges the shipping industry faces.

Table 1. Clean Shipping Index environmental parameters and a general overview of health and environmental effects.

Clean Shipping Index environmental parameters	Environmental and health effects
CO_2 emissions	Global warming and climate change
Nitrogen oxides (NO_x) emissions	Smog formation and the formation of tropospheric ozone are harmful for the human respiratory system. Acidic precipitation affects growth of vegetation and has adverse effects on freshwater bodies. NO_x deposition also contributes to eutrophication.
Sulphur oxides (SO_x) emissions	Harmful for the human respiratory system. SO_x reacts with other compounds contributing to particulate matter (PM) pollution. Acidic precipitation affects growth of vegetation and has adverse effects on freshwater bodies.
Particulate matter emissions	Harmful for the human respiratory system and the heart. Fine particles penetrate the lungs deeply when inhaled. Ultra fine particles can enter the blood-stream and may cause damage to the cardiovascular system.
Use of chemicals	Many chemicals used onboard are toxic for the environment, affect reproduction, are persistent and/or bioaccumulate in the marine environment.
Water and waste management	Discharges of waste water and waste pollutes the oceans.

For the scoring of CO_2, the vessel efficiency is compared to a reference vessel of the same type and size, calculated mainly using data published by the International Maritime Organization (IMO). For all the other paramters, points are given for exceeding legal compliance of environmental performance. For NO_x, the level of NO_x emissions defined by Tier I, II and III levels set by the IMO serve as the reference for scoring. The basis for scoring in SO_x and PM is how much sulphur is present in the fuel, or whether the exhaust gases are treated. In the chemicals section, shipping companies are asked to fill in questions about the chemical used in antifouling paint, the type of stern tube oil, hydraulic fluids and gear oils used, the type of boiling cooling water treatment system installed, the chemicals present in cleaning agents used and the type of refrigerants applied. Environmentally adapted solutions give a score. The waste water section covers the treatment of sewage

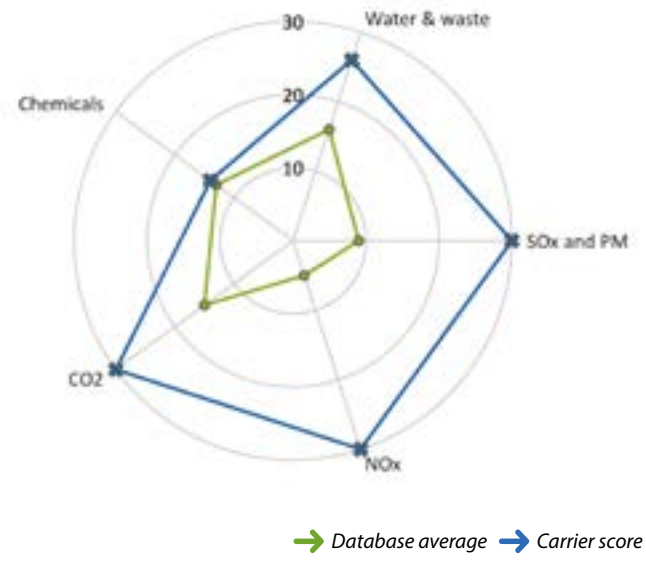


Figure 1. Representation of environmental scores on each of the different environmental parameters.

and grey water, management of solid waste, sludge oil handling and bilge water treatment.

The weighting is based on the input data for the questions about environmental parameters in the questionnaire. Data is entered on a vessel by vessel basis. All vessels in a carrier's fleet add up to a total carrier score. The total carrier score is the average score of all owned vessels. For owned, but unreported, vessels a null score is given. The scoring of a vessel on each of the environmental paramters can be viewed in comparison to the database average for that type of vessel and compared to the carriers average scores, as shown in the spider chart in figure 1.

2.2 Classification and verification

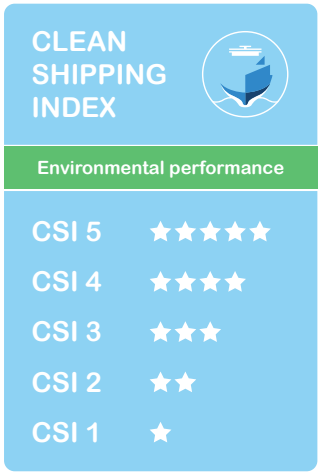


Figure 2. Graphical representation of the new classification scheme.

In 2017, Clean Shipping Index introduced a new classification scheme. The previous three performance categories of Low, Medium and High expire, and are replaced by new environmental classes (Table 2) solely based on a vessel's total scores. The new classes vary from baseline performance, indicated by CSI-class 1 with one star, to top performers indicated by CSI-class 5 with five stars.

In the database the scores are showed both on carrier basis and on vessel basis. In total 150 points can be obtained, 30 points in each of the different parameters. This means 30 points for good performance on CO_2 emissions, 30 on low NO_x emissions etc.

The carrier score is based on the weighted total score of all the carrier's vessels.

Points in CSI	Classification
125-150	CSI 5
100-124	CSI 4
75-99	CSI 3
38-74	CSI 2
0-37	CSI 1

Figure 2. Graphical representation of the new classification scheme.

For the verification of the data entered, Clean Shipping Index has developed a verification protocol. Surveyors are required to follow this protocol. When the data submitted matches the audited data, a certificate is generated through the online application. The logo shown in figure 2 is for a vessel with 75-99 points, CSI class 3. It is the shipping company's responsibility to have the data audited by a classification company that is accredited by the Clean Shipping Index. Most IACS[1] classification companies are accredited to perform audits according to the Clean Shipping Index.

Figure 3. CSI performance label

With regard to the Swedish fairway dues: If shipping companies' self-assessed score deviate from the verified ones, the Swedish Maritime Administration will base CSI class on the lowest score. Therefore, it is important that the self-assessment is aligned with the verification. However, CSI certificates are always based on verifed scores.

2.3 Data sharing

As a ship-owner you can view the scores of your vessels, also in comparison to vessels of other shipping companies. You may thus compare the performance to other vessels of the same type and identify areas for improvement. Contact the Clean Shipping Index secretariat for possibilities of receiving a feedback report with an analysis of the environmental performance of the vessels entered in the database.

Members who have access to the database all sign a letter of intent and a confidentiality agreement. The data can be viewed by the members who wish to provide economic incentives for clean shipping: cargo owners, forwarders, ports, authorities and providers of clean technology. Banks and investors may use the Clean Shipping Index as guidance when investing in new ships. By submitting the data into the database, ship owners approve of sharing the data with the Clean Shipping Network members.

1 IACS is an abbreviation for International Association of Classification Societies.

3. METHODOLOGY

This chapter provides an explanation of the methodology.

3.1 Calculating and reporting CO_2 emissions

3.1.1 Options for calculating and reporting CO_2 emission

Information needed is cargo carried, the distance travelled and the fuel consumption covering a 12-month period.

Option 1. Calculated CO_2 emissions in grams per tonne-nautical mile (tonne-nm). The efficiency must be calculated according to IMO's Energy Efficiency Operational Indicator (EEOI)(3).

Option 2. For Cruise and Passenger ships, the EEOI is calculated as grams CO_2 per passenger-nautical mile (passenger-nm).

Option 3. For RoPax ships; the total CO_2 emissions per year and transport work for freight (in tonne-nm) and passengers (in passenger-nm) for the 12-month period concerned. For RoPax vessels; the actual transport work for both passengers and freight and EEOI by: EEOI = gCO_2 per year /(transport work for freight + 0.7 * transport work for passengers)

Option 4. Calculated CO_2 emissions in grams per TEU-kilome-ter for container vessels, calculated according to Clean Cargo Working Group CO_2 calculation formula (4) (26). This only applies to container ships.

Option 5 (new vessels). The scoring is based on how the vessel's EEDI relates to the EEDI requirement/regulatory limit, yet the figure is reported as an EEOI figure in CSI by following calculation (example): A vessel's EEDI is 20 gram CO2/DwtNm (or any other unit). The regulatory limit is set to 40 gram CO2/DwtNm. This gives a factor of 0,5 (20/40). Let's say CSI's EEOI reference line is set to 50 gram CO2/TonneNm, then your EEOI figure to report in CSI will be 25 gram CO2/TonneNm (0,5 x 50). To view CSI's EEOI reference line you'll need to enter all ship specifications required and enter a temporary fictive value for CO2/TonneNm. (The full method is also applicable for CO2/TEUkm).

The reported CO_2 emissions are compared against a reference value of vessels of the same type and size. The better the vessel performs compared to the reference value, the higher the score in the Clean Shipping Index.

NOTE: Clean Shipping Index applies a carbon factor of zero (0) for renewable fuels when calculating CO2 emissions per TonneNm (EEOI) or TEUkm (CCWG).

3.1.2 CO_2 calculation of the reference value following EEOI

The actual reported CO_2 emissions of the vessel are compared to a reference vessel of the same type and size. This section describes how the Clean Shipping Index calculates the value for the reference vessel.

The calculations use the EEDI reference lines from the IMO as a starting point. The following is relevant for options 1-3 mentioned under section 3.1.1.

The Energy Efficiency Operational Indicator ($EEOI_{ref}$) for the reference ship is obtained in two steps. First the Energy Efficiency Design Index reference value ($EEDI_{ref}$) is calculated. This is done using methods outlined by the Greenhouse Gas Working Group of the IMO (24). In an MEPC resolution baselines are defined for the most common ship types, expressing ideal technical circum-stances but not including operational parameters. The baselines are for most ship types presented as functions between dead-weight (dwt) and emitted grams CO_2 per tonne-nm (28).

The $EEDI_{ref}$ gives a typical fuel consumption for a specific ship of a certain type and size. The $EEDI_{ref}$ can be calculated as a function of dwt for different categories of ships, as shown in Table 3 below. The Clean Shipping Index automatically calculates the $EEDI_{ref}$ to be able to compare the efficiency of the reported CO_2 emissions to the reference.

Table 3. $EEDI_{ref}$ formula per ship type derived from the IMO (28)

Type of vessel	Classification
General cargo	$EEDI_{ref} = 107.48 dwt^{-0.216}$
Reefer (gen. Cargo)	$EEDI_{ref} = 227.01 dwt^{-0.244}$
Bulk	$EEDI_{ref} = 961.79 dwt^{-0.477}$
Tanker	$EEDI_{ref} = 1218.8 dwt^{-0.488}$
Gas carrier	$EEDI_{ref} = 1120\ dwt^{-0.456}$
Container	$EEDI_{ref} = 174.22 dwt^{-0.201}$
RoRo	$EEDI'_{ref} = 1405.15 dwt^{-0.498}$
RoPax	$EEDI'_{ref} = 752.16 dwt'^{-0.381}$
Car carrier (RoRo)	$EEDI_{ref} = 11554 dwt^{-0.6565}$

Dwt is the deadweight in tonnes and $EEDI_{ref}$ is the design index value in grams CO_2/ dwt nautical mile. For Car carriers, the IMO uses a correction factor that is not applied here. For RoRo and RoPax ships, the $EEDI'_{ref}$ value should be divided by f_{jRoRo} for each ship to obtain the $EEDI_{ref}$. The calculation of f_{jRoRo} is described in appendix 3. For RoPax ships, the $EEDI'_{ref}$ value is calculated using the parameter $dwt' = f_{cRoPax} * dwt$, where $f_{cRoPax} = 1$ for ships with dwt/GT >0.25 and fcRoPax = ((dwt/GT)/0.25)-0.8 for ships with dwt/GT <0.25.

For RoPax ships, a parameter that describes the combined capacity for freight and passengers has been identified. This parameter, called L, is a linear function of the number of available lanemeters and the passenger capacity so that:

```
L =2*(number of lanemeters) + 0.7*(passenger ca-
pacity).
```

Analysis of RoPax ship data gives that L is proportional to dwt' for RoPax ships so that:

$L = 0.6*dwt'$. Using the IMO EEDI function we then get

RoPax $EEDI'_{ref} = 619.14L^{-0.381}$

An $EEDI_{ref}$ function was developed for Cruise ships using empirical data:

Cruise $EEDI_{ref} = 2279.7PC^{-0.209}$

where PC is the passenger capacity. This function is also used for Passenger ships.

In the second step of calculating the $EEOI_{ref}$ value for the reference ship, operational factors are accounted for. This means that estimated average load factors and estimated payload factors are considered.

The load factors, the ratio of actual load to maximum load on mass basis, assumed for the reference ships are taken according to the Second IMO GHG study (25).

Table 4. Load factors for different types of vessels according to the second IMO GHG study (25)

Type of vessel	Load factor
General cargo	0.6
Reefer	0.5
Bulk dwt > 100000	0.5
Bulk dwt 10000-100000	0.55
Bulk dwt 0-10000	0.6
Product tanker dwt > 20000	0.55
Product tanker dwt 10000-20000	0.50
Product tanker dwt 0-10000	0.45
Gas carrier	0.48
Oil tanker	0.48
Chemical tanker	0.64
Container	0.7
RoRo	0.7
Car carrier	0.7

For Cruise ships the following capacity utilisation is assumed:

Cruise 0.94 (this is a preliminary assumption, it may change during 2018 after more data modelling)

For RoPax ships the capacity utilisation is a combination of passenger and lanemeter utilisation (i.e. "L-utilisation"):

RoPax 0.37 (this is preliminary assumption, it may change during 2018 after more data modelling)

For some types of vessels, the payload ratio (ratio of maximum weight commercial cargo to the deadweight) is an important factor when calculating the $EEOI_{ref}$ for the reference ships. General payload ratios are given for the main type of ships below. The values used here are based on information from ship constructors and ship operators. For tankers, different payload ratio may occur depending on the large differences in the specific weight of the cargo predominantly carried. Gas carriers are assumed to have the same payload ratio as tankers with light products. This assumption is under review in 2018.

Table 5. General payload ratios for main ship type

Type of vessel	Payload ratio
General cargo	0.9
Reefer	0.9
Bulk	0.9
Tanker (>50%) heavy products	0.95
Tanker (>50%) light products	0.8
Gas carrier	0.8
Container	0.8
RoRo	0.5
Car carrier	0.25

Ships carrying products with densities below 0.9 tonne/m3 should use a payload factor of ρ/0.9 where ρ is the average density of the product carried over the year (calculating the average should reflect distance) while for ρ > 0.9 the payload ratio of 0.95 is used as before.

For RoPax ships, this ratio is accounted for when using the relati-onship between dwt' and L (see above).

Cruise ships use significant amounts of fuel while at berth. To account for this the $EEDI_{ref}$ value is multiplied by a 'berth factor' of 1.09 (1.09 is a preliminary assumption, it may change during 2018 after more data modelling).

Using the EEDI baseline functions and considering load factors and payload factors, the calculation for an operational reference value will generally look like this:

for cargo ships: $EEOI_{ref}(dwt) = EEDI_{ref}(dwt) / (load\ factor * payload\ ratio);$

for RoPax vessels:

$EEOI_{ref}(L) = EEDI_{ref}(L) / (L\text{–utilisation factor});$

for Cruise ships:

$EEOI_{ref}(PC) = EEDI_{ref}(PC) * (\text{berth factor}) / (\text{capacity utilisation factor}).$

The actual calculated EEOI for the vessel is compared with the calculated $EEOI_{ref}$ for the vessel. Depending if and how much above or below the reference the actual EEOI is, a scoring is obtained.

For ice-classed ships, the $EEOI_{ref}$ value is increased by multiplying with the factor fi as defined for the calculation of attained EEDI for ice-classed ships. fi is given in appendix 2.

3.1.3 CO_2 calculation of the reference value following the Clean Cargo Working Group methodology

Shipping companies with container vessels can report data according to both the method based on EEOI (Option 1 in 3.1.1) as described above and the Clean Cargo Working Group (CCWG) method (Option 4 in 3.1.1).

The CCWG method only applies to container vessels. The CCWG references are obtained from calculated averages for standardized trade lanes. The use of reefers is not included. The averages are based on CCWG empirical data from the preceding year (26).

Standardized trade lane	CCWG Average (g CO_2/ TEUkm)
Asia – Africa	45,8
Asia – Mediterranean	38,4
Asia – Middle East/India	46,5
Asia – North America EC*	53,8
Asia – North America WC**	48,8
Asia – North Europe	33,7
Asia – Oceania	59,5
Asia – South America (EC/WC)	43,6
Europe (North& Med) – Africa	59
Europe (North& Med) – Middle East/ India	54,8
Europe (North& Med) – Oceania (via Suez/via Panama)	42,6
Europe (North& Med) – Latin America/ South America	54,2
Intra –Americas (Caribbean)	69,6
Intra – Asia	60
Intra – Europe	75,3
Mediterranean – North America EC (incl. Gulf)	52,1
Mediterranean – North America WC	58,8
North America EC – Middle East/ India	66,4
North America – Africa	74,2
North America – Oceania	57,2
North America –South America (EC/WC)	52,9
North Europe – North America EC (incl. Gulf)	60,1
North Europe – North America WC	60,7
South America (EC/WC) – Africa	42,3
Other	64,6

**EC = East Coast*
**WC= West Coast*

The actual calculated CCWG data for the vessel is compared with the CCWG tradelane average (i.e. the reference) for the trade lane the vessel is using. If more than one trade lane is used per year the arithmetic average for the actual trade lanes is the reference value. Depending if and how much below the reference the calculated CCWG value is, a score is obtained.

3.2 NO_x emissions

The NO_x emission levels Clean Shipping Index uses as reference for scoring are the same levels as defined in the Tier I, II and III in MARPOL Annex VI, with one exception.
Between Tier II and III there are two levels included to reward different NO_x reduction techniques.

Data should be presented for both the main engine as well as the auxiliary engines. For ships without auxiliary engines, the scoring for the main engines is increased to get the same possible points. In case shore-side electricity is installed and used in all applicable harbours, the maximum score for auxiliary engines applies.

In cases where a NO_x reducing device is fitted but not part of an engine's NO_x-certification, such systems are to be covered by verification procedures required by the NO_x Technical Code 2008, demonstrating that the claimed application cycle value is being achieved (6).

Measurements performed in accordance with the NO_x Technical Code 2008 that show low NO_x emissions also score (75% load factor is approved on installations done before 2018). This might be the case for LNG-powered vessels with Tier II certificated engines. Measurements done by accredited institutions are also accepted.

The same applies when performance of a pre-2000 engine has the appropriate application cycle weighted value within either the Tier I or Tier II limit.

Measurements of NO_x emissions according to the regulations by the Swedish Maritime Administration , are also accepted (7). Note: last certificates were issued 2017-11-14.

If Selective Catalytic Reduction (SCR) is installed as a post-combustion reduction technique there must not be an ammonia-slip (NH3) above 20 ppm, following the Swedish Maritime Administration regulations (7).

If none of these options are at hand, NO_x data should be calculated by default factors found in Section 3-19-9 in the Tax on emissions of NO_x in Norway (8). See also Table 1, 2 and 3 of appendix 4: NO_x factors and emission conversion factors for main and auxiliary engines.

If there is more than one main engine or more than one auxiliary engine installed, the power weighted emission value should be presented. The principal calculation of this will be:

```
Engine 1:   x g/kWh * y kW = xy;
Engine 2:   z g/kWh * a kW = za
Power weighted average: (xy+za)/(y+a);
where x and z are the NOx emission values; y and a
are the engine powers.
```

When Plug-in battery power is claimed, its required utilization must be 90% of the operational time at minimum, or non-utilization must have been caused by external factors that can be proven. A 12- months rolling period is considered with an exemption for new ships and retrofits.

3.3 SO_x and PM emissions

The basis for scoring in SO_x and PM is how much sulphur is used in the fuel, or whether the exhaust gases are treated. Total average of sulphur in all fuel used on board as percentage by weight, over a 12-month rolling period are considered. Main engines and auxiliary engines are scored. A distinction in the scoring is made between the sulphur emitted in and outside Emission Control Areas (ECAs). For new vessels, the calculation is based on any fuel order basis.

Sulphur testing should follow the Revised MARPOL Annex VI (6).

Extra points are granted for using low sulphur fuel in main engines/auxiliary engines/boilers when navigating in harbour or port areas outside ECAs. The port area is defined as the point from where you require pilot assistance.

Highest points are given for operation with 'minimum sulphur fuels' with a weighted average of < 50 ppm. Minimum sulphur fuels refer to fuels such as LNG and methanol.

The use of abatement technology is accepted when compliant with MARPOL Annex VI. I.e. the corresponding total emission weight of sulphur dioxides should not exceed 6.0 g SOx/kWh when a fuel sulphur content of 1.5% is claimed or required. Additionally 4.0 g SOx/kWh corresponds to 1% Sulphur and 2.0 g SOx/kWh to 0.5% Sulphur etc (see MARPOL Annex VI).

Since the amount of sulphur emissions and particulate matter emissions correlate, the basis for scoring in the PM section is the average sulphur content in fuels for main and auxiliary engines used during 12-month rolling period.

In addition, measured PM emissions are also accepted. Points are given for low PM emissions if the emission factors for the engines are measured using ISO 8178 and the weighted average of the engines is calculated.

When Plug-in battery power is claimed, same requirements as for NO_x applies.

3.4 Chemicals

In the chemicals section, Clean Shipping Index rewards points to environmentally adapted solutions used. The criteria Clean Shipping Index applies are from an environmental point of view. The functional features are the producers´ responsibility.

3.4.1 Antifouling

The basis for scoring relies on what type of biocide and what type of binder is included in the antifouling coating.

A low-leaching but effective binder, as for example hydrolysing SPC (self-polishing coating) together with acceptable biocides, gets scores. A more traditional controlled depletion polymer (CDP) does not. A general definition of an SPC may be that it is a binder which chemically reacts in sea water by hydrolysis and which segregate components inhibits fouling. Only biocides accepted according to the EU Biocide Directive 98/8/EG Annex 1 (10) are allowed in the binders in order to get a CSI score. See Table 6 below.

Non-toxic Fouling Release coatings, i.e. coatings without chemical or biological activity and exempted from approval according to the Biocide Directive, get the highest scores.

The data on antifouling of the vessel is found in the antifouling system (AFS) certificate supplemented by the coating manufacturers, in the Materials Safety Data Sheet (MSDS) and in the Technical Data Sheet (TDS). In certain cases, a direct contact with the antifouling paint producer is needed.

Table 6. Antifouling biocides included in Annex 1 to the EU Biocide Directive.

Name	CAS nr
Tolylfluanid	731-27-1
Copper thiocyanate	1111-67-7
Dicopper oxide	1317-39-1
Copper	7440-50-8
Zineb	12122-67-7
Bis(1-hydroxy-1H-pyridine-2-thiona-to-O,S)copper	14915-37-8
4,5-dichloro-2-octyl-2H-isothiazol-3-one	64359-81-5
Tralopyril	122454-29-9
Medetomidine	86347-14-0
Dichlofluanid	1085-98-9

3.4.2 Stern tube oils

Traditionally, engine oils or gear oils based on mineral oil containing additives are used. Operational spillage occurs due to over-pressure of lubricants in the stern tube.

Alternatives such as lubricants based on biodegradable oil, water lubrication, or systems with technically advanced sealing systems ('air seal') have less impact on the marine environment and score in the Clean Shipping Index.

The definition of a biodegradable oil is that each main component (>5% by weight) should have a biodegradation >60% within 28 days. Testing should be according to ISO 9439 (11) or ISO 10708 (12), but ISO 9408 (13) may be accepted if the theoretical oxygen demand (ThOD) and a period of maximum 28 days are chosen in the method.

The option 'Not applicable' may be chosen if the vessel does not have a stern tube, for example if the propulsion is dependent on azimuth thrusters only.

3.4.3 External hydraulic fluids

In general, hydraulic fluids based on mineral oil are used. In external applications leakages may occur. There are several options for minimizing the risk for leakage. Biodegradable hydraulic fluids, the use of electrical power instead of hydraulic power or external hydraulic systems capped so that leakages will not reach the sea. These solutions score in the Clean Shipping Index. The definition of a biodegradable hydraulic fluid is the same as for stern tube oils as described above.

3.4.4 Gear oils for thrusters and/or controllable pitch propellers

The use of biodegradable gear oils score in the Clean Shipping Index. The definition of biodegradable gear oil is the same as for stern tube oils (see above). The option 'Not applicable' also scores and should be selected when no thrusters and no CP propellers are installed.

3.4.5 Boiler-/ cooling water treatment

The basis for scoring is the avoidance of the use of chemical products, or components in the products, classified as carcinogenic, mutagenic or toxic to reproduction (CMR), according to the EU Dangerous Substance Directive (DSD)(14). Additionally, the use of chemical products classified as sensitizing, toxic or dangerous for the environment according to the DSD directive should be avoided, with the exclusion of nitrite. Nitrite is toxic, but is not bioaccumulating or persistent.

Information on the features mentioned above are stated in the Material Safety Data Sheets (MSDS) for the chemical products in question.

3.4.6 Cleaning agents

As with boiler cooling water treatment, the basis for scoring on the use of cleaning agents is the avoidance of the use of chemical products **or** components in the products, classified as carcinogenic, mutagenic or toxic to reproduction (CMR), according to the EU Dangerous Substance Directive (DSD)(14). Additionally, the use of detergents classified as dangerous for the environment according to the DSD directive or with limitations in the EU Regulation on detergents (15) should be avoided. Organic solvents classified and with risk phrases on health and environmental danger according to DSD directive, should also be avoided. The above information can be found in the Material Safety Data Sheets (MSDS) for the products in question.

Detergents, surfactants or other components that disturb the installed bilge water treatment should be avoided. Information on approved surfactants is usually found on the website of the bilge water cleaning equipment manufacturer.

3.4.7 Refrigerants

Clean Shipping Index considers the type of refrigerants that are used in cargo refrigerant plants, centralised air-conditioning and refrigeration systems installed on board. A score is given when all refrigerants applied comply with the Clean Shipping Index standard. Reefer refrigerants are not included. The focus is put on ozone layer depletion potential (ODP) and global warming

potential (GWP) as defined by the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer (16).

For scoring, the refrigerants should be natural (NH3, CO_2) or HFC (Hydro Fluoro Carbon) with ODP number = 0 and the GWP number < 3500. Additional points are achieved if the GWP is below 1850. The information should be found in the Material Safety Data Sheet (MSDS) and Technical Data Sheet (TDS) for the refrigerants in question.

3.5 Water and waste control

The waste water section covers the treatment of sewage and grey water, management of solid waste, sludge oil handling and bilge water treatment.

3.5.1 Sewage

The options that score are either 1) an approved sewage treatment plant according to MEPC (20) – Certificate of Type Approval for Sewage Treatment Plant – and a control of its usage and function through a maintenance record, or 2) that no sewage discharge in Particularly Sensitive Sea Areas (PSSAs) can be shown through operation manuals. In Table 7 below the PSSAs are listed.

Table 7. Particularly Sensitive Sea Areas. The year of the designation as PSSA is given in parenthesis

The Great Barrier Reef, Australia (1990)
The Sabana-Camagüey Archipelago in Cuba (1997)
Malpelo Island, Colombia (2002)
The sea around the Florida Keys, United States (2002)
The Wadden Sea, Denmark, Germany, Netherlands (2002)
Paracas National Reserve, Peru (2003)
Western European Waters (2004)
Extension of the existing Great Barrier Reef PSSA to include the Torres Strait (proposed by Australia and Papua New Guinea) (2005)
Canary Islands, Spain (2005)
The Galapagos Archipelago, Ecuador (2005)
The Baltic Sea area, Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland and Sweden (2005)
The Papahānaumokuākea Marine National Monument, United States (2007)

3.5.2 Grey water

The options that score are either treating the grey water with the black water in an approved sewage treatment plant according to MEPC (20) – Certificate of Type Approval for Sewage Treatment Plant – and a control of its usage and function through a maintenance record. An alternative option is that no grey water discharge in PSSAs can be shown through operation manuals.

3.5.3 Garbage handling

For a score in CSI, there should be no incinerator on board or documentation of no incineration of garbage. Additionally, there should be no waste overboard – food waste excluded – and separate garbage handling for reuse, recycling and discharge. This information should be found in the Garbage Record Book on board and the Garbage Management Plan according to Annex V in MARPOL 73/78 (21).

3.5.4 Sludge oil handling

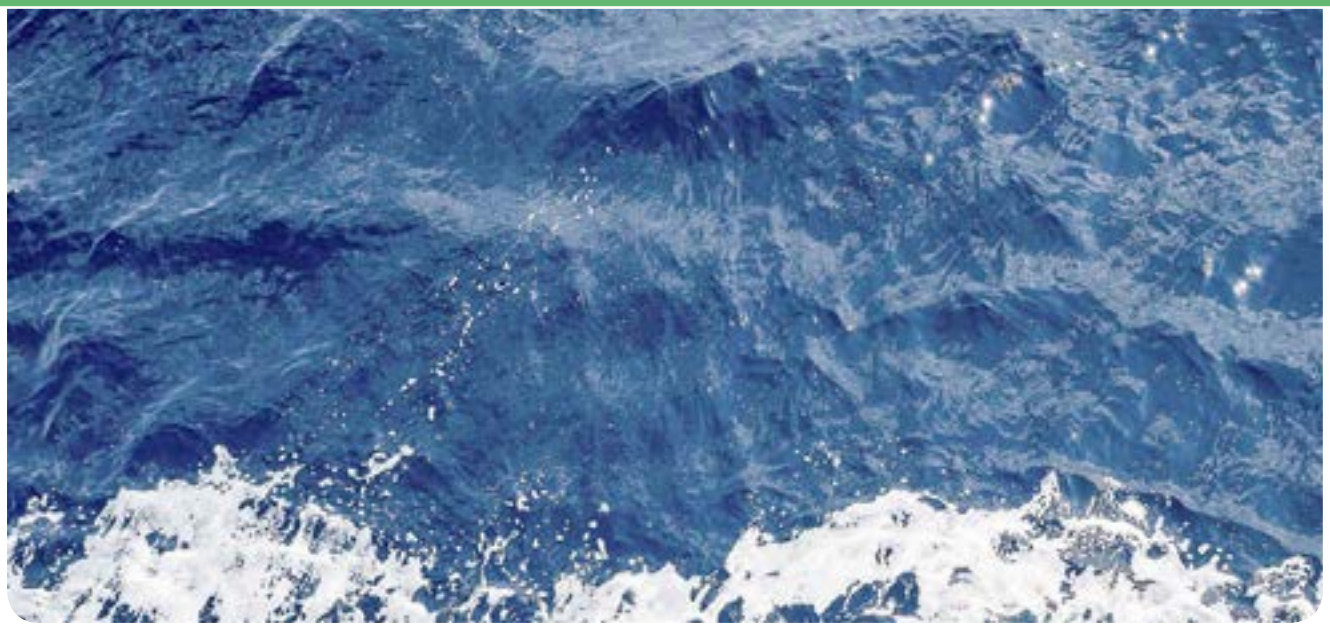
As with garbage, there should be no incinerator on board or documentation of no incineration of sludge oil for a CSI score. Additionally, there should be documented disposal of sludge oil to treatment facilities on shore. This information should partly be found in the IOPP (International Oil Pollution Prevention) Certificate according to MARPOL Annex I (22), or found in operating manuals on board.

3.5.5 Bilge water treatment

The basis for scoring is how the bilge water is treated on board or whether it is discharged to an onshore facility. The complexity of bilge water mixtures today often results in stable oil/water emulsions, hard to be broken down in traditional gravimetric separators. Scoring is received only if active treatment equipment is installed, calibrated and a documented emission of <5ppm oil in the disposed bilge water. This information should partly be found in the IOPP Certificate according to MARPOL Annex I (22), or found in operating manuals on board. Additional scoring can be received if an emission control box is installed. The box ensures that no oily water discharge occurs and will continuously register position and time.

3.5.6 Crew awareness

The basis for scoring is education for all crew on board with special emphasis on engine room personnel and handling of heavy fuel oil.



3.6 Other issues

The environmental paramaters described in section 3.1 to 3.6 are used to calculate a total CSI score. The parameters all concern operational emissions and leakages that occur during the normal use of a vessel. Apart from the operational questions, the Clean Shipping Index also requires shipping companies to report about end of life vessel handling on a company policy level. The European Shiprecycling Regulation serves as the reference. It is not included in the CSI scores.

The Clean Shipping Index is a dynamic index. When regulations change, or when new techniques or solutions enter the shipping market, the criteria may need to change or be removed. During 2017, the question on ballast water management was removed from the CSI questionnaire due to the implementation of the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention).

The parameters are reviewed annually by a technical committee with experts on air emissions, ecotoxicology, ship construction, policy and environmental science.

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APPENDIX 1. CALCULATIONS FOR RORO VESSELS

Following MEPC 64/4/14 and MEPC 64/4/4, f_{jRoRo} is calculated as follows:

$$f_{jRoRo} = \frac{1}{Fn_L^{\alpha} \times \left(\frac{L_{pp}}{B_S}\right)^{\beta} \times \left(\frac{B_S}{d_S}\right)^{\gamma} \times \left(\frac{L_{pp}}{\sqrt[3]{\nabla}}\right)^{\delta}};$$

where Fn_L is the Froude's number:

$$Fn_L = \frac{0.5144 \times v_{ref}}{\sqrt{L_{pp} \times g}};$$

g is the gravitational acceleration:
L_{pp} is the Length between perpendiculars in m;
v_{ref} is the ship's reference Speed in knots;
B_S is the Breadth in m;
d_S is the Draught (at summer load) in m;
∇ is the Volumetric displacement in m3 (multiply by 1.025 to get Δ in tonnes).

The exponents α, β, γ and δ are 2.00, 0.50, 0.75 and 1.00, respectively, for RoRo ships; and 2.50, 0.75, 0.75 and 1.00, respectively, for RoPax ships.

APPENDIX 2. ICE-CLASS CORRECTION FACTORS

f_i values for ice-classed ships adopted by the IMO. Note that the minimum value is 1.

Ship type	f_i	Limits depending on the ice class			
		IA Super	IA	IB	IC
Tanker	$\frac{0.00138 L_{pp}^{3.331}}{capacity}$	$\begin{cases} \max 2.10 L_{pp}^{-0.11} \\ \min 1.0 \end{cases}$	$\begin{cases} \max 1.71 L_{pp}^{-0.08} \\ \min 1.0 \end{cases}$	$\begin{cases} \max 1.47 L_{pp}^{-0.06} \\ \min 1.0 \end{cases}$	$\begin{cases} \max 1.27 L_{pp}^{-0.04} \\ \min 1.0 \end{cases}$
Bulk carrier	$\frac{0.00403 \cdot L_{pp}^{3.123}}{capacity}$	$\begin{cases} max 2.10 L_{pp}^{-0.11} \\ min 1.0 \end{cases}$	$\begin{cases} max 1.80 L_{pp}^{-0.09} \\ min 1.0 \end{cases}$	$\begin{cases} max 1.54 L_{pp}^{-0.07} \\ min 1.0 \end{cases}$	$\begin{cases} max 1.31 L_{pp}^{-0.05} \\ min 1.0 \end{cases}$
General cargo ship	$\frac{0.0377 \cdot L_{pp}^{2.625}}{capacity}$	$\begin{cases} \max 2.18 L_{pp}^{-0.11} \\ \min 1.0 \end{cases}$	$\begin{cases} \max 1.77 L_{pp}^{-0.08} \\ \min 1.0 \end{cases}$	$\begin{cases} \max 1.51 L_{pp}^{-0.06} \\ \min 1.0 \end{cases}$	$\begin{cases} \max 1.28 L_{pp}^{-0.04} \\ \min 1.0 \end{cases}$
Containership	$\frac{0.1033 \cdot L_{pp}^{2.329}}{capacity}$	$\begin{cases} \max 2.10 L_{pp}^{-0.11} \\ \min 1.0 \end{cases}$	$\begin{cases} \max 1.71 L_{pp}^{-0.08} \\ \min 1.0 \end{cases}$	$\begin{cases} \max 1.47 L_{pp}^{-0.06} \\ \min 1.0 \end{cases}$	$\begin{cases} \max 1.27 L_{pp}^{-0.04} \\ \min 1.0 \end{cases}$
Gas carrier	$\frac{0.0474 \cdot L_{pp}^{2.590}}{capacity}$	$\begin{cases} \max 1.25 \\ \min 1.0 \end{cases}$	$\begin{cases} max 2.10 L_{pp}^{-0.12} \\ min 1.0 \end{cases}$	$\begin{cases} max 1.60 L_{pp}^{-0.05} \\ min 1.0 \end{cases}$	$\begin{cases} max 1.25 L_{pp}^{-0.04} \\ min 1.0 \end{cases}$

Note: containership capacity is defined as 70% of the *DWT*.

APPENDIX 3. THE CLEAN SHIPPING INDEX QUESTIONNAIRE

A total of 150 points can be obtained, 30 points in each of the different environmental areas. This means 30 points for good performance on CO_2 emissions, 30 on low NO_x emissions etc. Points are granted only for exceeding legal compliance performance on SO_x, PM, NO_x, chemicals and water and waste management. For CO_2 emissions, there are no binding regulations yet for the existing fleet. CO_2 therefore scores for good performance compared to a calculated reference vessel of the same type and size. The number of points that can be earned are set by the Clean Shipping Index secretariat and the Technical Committee.

The overall score indicates how well a vessel is performing compared to legislative requirements and compared to other vessels of the same type and size.

SO_x

Main engines	No data	0
Operations in non-ECAs	Operation only in ECAs*	0
(total yearly average)	Fuel quality > 2.3% S	0
	Fuel quality < 2.3% S	1
	Fuel quality < 1.5% S	2
	Fuel quality < 1.0% S	3
	Fuel quality < 0.5% S	4
	'Minimum Sulphur fuels' (<50 ppm)	5
	Plug-in battery power	5

*When answering Operation only in ECAs, the score doubles for the questions on operation in ECAs. Otherwise the vessel cannot reach the same score as vessels operating in- and outside ECAs.

Operations in ECAs	No data/compliance	0
(yearly average)	Operation only in non-ECAs*	0
	<500 ppm S	2
	'Minimum Sulphur fuels' (<50 ppm)	5
	Plug-in battery power	5

*When answering Operation only in non-ECAs, the score doubles for the questions on operation in non-ECAs. Otherwise the vessel cannot reach the same score as vessels operating in- and outside ECAs.

Harbour Bonus:	No data/compliance	0
main/aux engines, boilers	Fuel quality > 0.1% S in harbour areas	0
	Fuel quality < 0.1% S in harbour areas	1
	'Minimum Sulphur fuels' (<50 ppm)	2
	Plug-in battery power	2
Aux. engines:	No auxiliary engines*	0
	No data/compliance	0
	Fuel quality > 0.1% S	0
	Fuel quality < 0.1% S outside SECAs	1
	Shore-side electricity	3
	'Minimum Sulphur fuels' (<50 ppm)	3
	Plug-in battery power	3

*If no auxiliary engine, report the fuel quality used in main engine when in non-propulsion mode.

PM	No data	0
Main engines	Operation only in ECAs	0
Operations in non-ECAs	Fuel quality > 2.3% S	0
	Fuel quality < 2.3% S	1
	Fuel quality < 1.5% S	2
	Fuel quality < 1.0% S	3
	Fuel quality < 0.5% S	4
	'Minimum Sulphur fuels' (<50 ppm)	5
	PM < 0.3 g/kWh	4
	Plug-in battery power	5
PM Main engines	No data/comliance	0
Operations in ECAs	Operation only in non-ECAs	0
(yearly average)	<500 ppm S	1
	'Minimum Sulphur fuels' (<50 ppm)	5
	PM < 0.2 g/kWh	3
	PM < 0.1 g/kWh	5
	Plug-in battery power	5
Harbour Bonus	No data/compliance	0
Main/aux engines, boilers	PM < 0.1 g/kWh	1
	'Minimum Sulphur fuels' in harbour areas	2
	Plug-in battery power	2
PM Aux. engines:	No auxiliary engines*	0
	No data/compliance	0
	PM <0.2 g/kWh	1
	PM < 0.1 g/kWh	2
	Shore-side electricity	3
	'Minimum Sulphur fuels' (<50 ppm)	3
	Plug-in battery power	3

*If no auxiliary engine, report the fuel quality used (or specific PM emission value) in main engine when in non-propulsion mode.

NO_x		
Main engines:	No data	0
	Engines 2000-2011, above or within Tier 1	0
	levels Engines prior year 2000, Tier I levels	6
	Engines prior year 2011, Tier II levels	9
	30% below Tier I levels	12
	40% below Tier I levels	15
	Tier III levels	21
	Plug-in battery power	21
Aux. engines:	No auxiliary engines*	0
	No data	0
	Engines 2000-2011, above or within Tier 1	0
	levels Engines prior year 2000, Tier I levels	2

Engines prior year 2011, Tier II levels	3
30% below Tier II levels	4
40% below Tier II levels	6
Tier III levels or when shore-side electricity is installed and used	9
Plug-in battery power	9

*When the vessel does not have auxiliary engines, the points will automatically be allocated to the question on main engines.

CO_2

Emission information:

No data	0
CO_2 per TEU-km according to CCWG	3
CO_2 per tonne-nm according to MEPC (EEOI)	3

Emission performance EEOI:

No data	0
20% above reference or more	0
<20% above reference	3
<15% above reference	6
<10% above reference	9
<5% above reference	12
Reference value or below	15
>5% below reference	18
>10% below reference	21
>15% below reference	24
>20% below reference	27

Emission performance according to CCWG:

No data	0
Reference value or above	0
< Reference value	3
> 5% below reference	6
> 10% below reference	9
> 15% below reference	12
> 20% below reference	15
> 25% below reference	18
> 30% below reference	21
> 35% below reference	24
> 40% below reference	27

Chemicals

Antifouling:	No data	0
	Other	0
	Controlled depletion polymer (CDP)	0
	Self-polishing coating (SPC), only accept. Biocides)	5
	Non-toxic	7

Stern tube oil:	No data	0
	Mineral oil based	0
	Air seal	3
	Based on biodegradable oil	5
	Water lubrication	7
	Not applicable	7
External hydraulic fluids:	No data	0
	Mineral oil based	0
	External hydraulics exchanged to electrical power	3
	Based on biodegradable oil	3
	External hydraulic system capped	3
Gear oils for thrusters and Controllable pitch propellers:	No data	0
	Mineral oil based	0
	Based on biodegradable oil	5
	Not applicable	5
Boiler/ cooling water treatment:	No data	0
	Classified as CMR, toxic, sensitizing or dangerous to the environment	0
	Not classified as above (nitrite exclusive)	2
Cleaning agents:	No data	0
	Classified as CMR, dangerous to the environment or toxic	0
	Not classified as above	3
Refrigerants:	No data	0
	Non-natural (excluding the HFCs below)	0
	HFCs complying with GWP < 3500 and ODI = 0	1
	Natural (NH3, CO_2) or HFCs complying with GWP < 1850 and ODI = 0	3

Water and waste control

Grey water:	No data	0
	No treatment	0
	No discharge in sensitive areas (PSSA) or treatment in sewage plant onboard	4
Sewage/ black water:	No data	0
	No treatment	0
	No discharge in sensitive areas (PSSA) or sewage treatment plant onboard	4

Garbage handling:	No data	0
	Incinerator used on board	0
	No incinerator onboard or documented no incineration of garbage and separate garbage handling for reuse, recycling and disposal	6
Sludge handling:	No data	0
	Incinerator used onboard	0
	No incinerator onboard or documentation of no incineration of sludge and disposal of sludge to treatment on shore	5
Bilge water treatment:	No data	0
	Gravimetric separation	0
	Active treatment installed and < 15ppm oil in outgoing water	4
	Active treatment installed and < 5ppm oil in outgoing water	6
	Active treatment installed and < 5ppm oil in outgoing water ***and*** emission control box in place	8
	Discharge to onshore facility	8
Crew awareness:	No data	0
	Education of personnel on environmental awareness, health risks and adequate protective equipment	3

APPENDIX 4. NO_x FACTORS AND EMISSION CONVERSION FACTORS FOR MAIN AND AUXILIARY ENGINES

Table 1. NO_x factors for ship engines, derived from the Norwegian Tax on NO_x emissions (8)

Engines	kg NO_x per tonne of fuel
Rpm less than 200	100
200 rpm to 1,000 rpm	53 (54 for engines constructed prior 2000)
1,000 rpm to 1,500 rpm	50
1,500 rpm upwards	44 (45 for engines constructed prior 2000)

For converting the emission factors 1 kg NO_x/tonne bunkers into specific NO_x emissions in g/kWh, Table 7 and 8 in MEPC 58/INF. 6 (9) should be applied:

Table 2. NO_x emission conversion factors for main engines (9)

Main engine specific fuel consumption values (g/kWh) for different engine ages and different maximum rated power			
Engine age	Above 15,000kW	15,000 – 5,000 kW	Below 5,000 kW
<1983	205	215	225
1984-2000	185	195	205
2001-present	175	185	195

Table 3. NO_x emission conversion factors for auxiliary engines (9)

Auxiliary engine fuel consumption values (g/kWh) for different maximum rated power		
Engine age	Above 800 kW	Below 800 kW
Any	220	230

APPENDIX 5. GUIDELINES FOR FILLING IN THE ONLINE QUESTIONNAIRE

This appendix provides a step-by-step explanation for filling in the web-based Clean Shipping Index questionnaire. It is also possible to make a batch data upload, where you upload vessel data for several vessels at once. Under Carrier-Export/Import on the lefthand side of the webpage you can find more details about the format of the csv-file which can be uploaded to the Clean Shipping Index database.

Go to www.cleanshippingindex.com and log in with your username and password. If you do not have a user account please send an email to info@cleanshippingindex.com for assistance. After entering the login details you will be redirected to the welcome page with background information and instructions.

Click Carrier/ Home in the left column. You can start submitting data by clicking edit information on the top of the page. If this is the first time you enter the database, fill in the general questions as listed below. Otherwise check whether the information is correct and edit if needed.

Carrier information

Shipping line:	Who owns, manages or operates the reported vessels.
Website:	The website address to the shipping line.

Contact

Responsible person:	The name of the contact person who is responsible for all the information presented.
Phone number:	The international telephone number of the responsible person.
E-mail address:	The email address of the responsible person.

Vessel count

Operated vessels:	The total operated vessels by the carrier.
Owned/managed:	The total owned or managed vessels by the carrier.

CO_2

CO_2 reduction goal:	Yes or no.
Target (%):	The target figure in %.
Target year:	The year when the target shall be reached.
Baseline year:	The year from which the target is set.
Reduction type:	Is the target absolute or per transported unit?

Scrapping policy

Does your company have a policy for safe and environmentally sound recycling of vessels?
Yes or no.

The answer is 'yes' if criteria 1 and 2 of below are met as a minimum.
1) We sell end-of-life vessels ensuring demolition in a modern ship recycling facility not located on a beach (once published, the European Commission's list of Ship Recycling Facility's will serve as the reference).
2) We have a high-quality and updated Inventory of Hazardous Materials (IHM), in accordance with the EU Ship Recycling Regulation's requirements for IHMs.

Criteria 3) to 5) are additional recommendations to ensure that ship recycling is clean and safe.
3) We ensure that the entire recycling process is documented (including amounts of hazardous wastes removed and their disposal) and make reports examinable.
4) We allow for an independent auditing and/or monitoring of the process by ship recycling experts in order to make sure the highest standards are fulfilled.
5) We do not involve business partners in their ship recycling processes that do not support and act upon criteria 1) and 2).

When you have filled in the questions above click on the update button on the bottom right and the information will be submitted into the database. You will then automatically return to the home page again.

Vessel information

Add Vessel/ Edit Vessel
For adding a new vessel to the database, click Carrier/ Add vessel in the left column of the home page. If you want to complete or change information on a vessel already in the database you enter list of vessels in the top of the home page and click on the IMO number of the concerned vessel in the vessel ranking list. You will then come to Vessel information where you click edit vessel on the top of the page. From here the questionnaire looks the same for both Add vessel and Edit vessel.

IMO number:
The three letters IMO directly followed by the unique and permanent seven-digit number (eg. IMO1234567). The database does not accept a space between the O and the first number.
Name of vessel:
The current name of the ship.
Prepared by:
The person responsible for submitting the information of this specific ship.
Year:
The year the vessel was built or had a major conversion.
Maximum payload:
The total weight of commercial cargo in tonnes or TEUs that the vessel can carry.
Deadweight tonnage:
Deadweight tonnage (DWT) is a measure of how much weight a ship can safely carry. It is the sum of the weights of cargo, fuel, fresh water, ballast water, provisions, passengers and crew.
Passenger Capacity:
Fill in the capacity in number of persons for cruise and passenger vessels.
Type of vessel:
Select from the drop-down menu. In case of oil tankers there will appear two options,'light' products referring to predominantly (>50%) products with low specific weight like gasoline, jet fuel, diesel, LNG/LPG etc. and 'heavy' products referring to predominantly (>50%) heavy products like HFO, crude oil, asphalt etc.
Ice class:
Fill in the specific ice class of the vessel.
For ice-classed ships:
Length between perpendiculars in m.
For RoRo vessels:
Length between perpendiculars in m.
The ship's reference Speed in knots.
The breadth in m
The Draught (at summer load) in m
The Volumetric displacement in m^3

Owned/chartered vessels:
Select from drop down menu. Note that time-chartered refers to vessels chartered for use for a period of 6 months or more and spot-chartered for periods less than 6 months.
Index verified by:
Select from drop down menu. The verifier must be a member of the International Association of Classification Societies (IACS), but also accredited according to ISO/IEC Guide 65 (EN 45011) or under ISO 14065:2007 for a verification service. The verifier should also be approved by the Clean Shipping Network.

CO_2 / unit of transport work
Add the calculated CO_2 emissions of a 12-month period. Either in grams CO_2/tonne-nm, grams CO_2/TEU-km, or grams CO_2/passenger-nm.

A click on the Submit button will give you the scores according to your data. The vessel is compared to a calculated reference value and a scoring is obtained. Note that if you change or edit some CO_2 information you must click the Submit button again.

Environmental Management System:
Select from drop down menu which certification applies to the vessel.

NO_x main/auxiliary engines:
For engines larger than 130 kW, NO_x emission data in g/kWh, along with engine revolutions per minute (rpm), should be presented. Several options for finding this data are at hand. Clean Shipping Index follows the Norwegian Maritime Directorates guidelines on NO_x taxation (5).
Year:
This should reflect the applicable NO_x certification date for an engine as defined by Revised MARPOL Annex VI (6), considering the relevant requirements related to 'major conversions'.
Total power:
The total installed power of all main or all auxiliary engines.
NO_x emissions (g/kWh):
If the engine is installed on a ship constructed on or after 1 January 2000, the data will be found in the EIAPP certificate (6).

Calculated NO_x emissions in grams/tonne-nm:
This is voluntary information and is not used for the ranking in Clean Shipping Index. However, some users have an interest in these figures. A way of calculating this emission by using the CO_2 emission data is the following:
If you divide the CO_2 emission value (in g CO_2 per tonne-nm) with the factor giving the emitted mass of CO_2 per mass of fuel consumed (3.114 for HFO and 3.206 for diesel/gasoil)) you will get the fuel consumption per transport work (in gram fuel/tonne-nm).
With the knowledge of the engines' age and power you will find the specific fuel consumption (g fuel per kWh engine work) values both for main engines and auxiliary engines in the Tables in appendix 4.
By dividing the fuel consumption per transport work (in gfuel/tonne-nm) with the specific fuel consumption value you will get the engine work needed per transport work which will have the unit kWh/tonne-nm. By multiplying this with the NO_x emission factor (in g/kWh) for your engine you will get the emission of NOX per transport work in grams/tonne-nm. The values for auxiliary engines should be calculated in a similar way and added.

Calculated NO_x emissions in grams/TEU-km: The calculation may be done accordingly and corrected for TEU-Km's.

Sulphur in fuel: Total average of sulphur in all fuel used on board as percentage by weight, over a 12-month rolling period.

Calculated SO_2 emissions in grams/ tonne-nm: This is voluntary information and is not used for the ranking in Clean Shipping Index. However, some users have an interest in these figures.

The CO_2 emission data can be used by calculating the fuel consumption per transport work, as described under calculating NO_x emissions in grams/tonne-nm.

To get the emission of SO_2, the fuel consumption should be multiplied with the average sulphur content in the fuel and then multiplied by 2. The factor 2 comes from the conversion from S (atomic mass 32) in the fuel to SO_2 (molecular mass 64) in the exhaust.

Calculated SO_2 emissions in grams/ TEU-km: The calculation may be done accordingly and corrected for TEU-Km's.

Trade lanes/ Routes:
Trade lanes are to be reported for container carriers only and are are limited to 25 predetermined options. If the ship operates on more than one route during the year, you may just mark the other ones also.

Vessel performance

SO_x and PM in main engines/auxiliary engines: fill in the average sulphur content in fuels for main and auxiliary engines used during a 12-month period. The averages should reflect the tonnage weighted sulphur content.

Four options can be selected:

Operations in non-ECAs: the yearly average of sulphur in fuel for the total consumption in the main engines.
Operations in ECAs: the yearly average of sulphur in fuel exclusively used in ECAs for main engines.
Harbour bonus: extra points are granted for using low sulphur fuel in main engines/auxiliary engines/boilers when navigating in harbour or port areas outside ECAs. The port area is defined as the point from where you require pilot assistance.
Auxiliary engines: the yearly average of sulphur used in fuel for auxiliary engines. Highest points are given for operation with 'minimum sulphur fuels' with a weighted average of < 50 ppm. Minimum sulphur fuels refer to fuels such as LNG and methanol.

NO_x main engines/auxiliary engines: Actual figures should be declared under the NO_x field above.

Chemicals

Antifouling: fill in the type of antifouling applied.

Stern tube oils: fill in the type of lubrication applied in the stern tube.

External hydraulic fluids: fill in the type of external hydraulic system applied on board.

Gear oils for thrusters and/or controllable pitch (CP) propellers: fill in the type of gear oil used in thrusters and/or CP propellers.

Boiler-/ cooling water treatment: fill in the type of chemicals in boiler-/cooling water treatment.

Cleaning agents: fill in the type of chemicals in cleaning agents.

Refrigerants: fill in the type of refrigerants that are used in cargo refrigerant plants, centralised air-conditioning and refrigeration systems installed on board.

Water and waste control

Sewage/ black water: fill in how sewage water is treated in PSSAs.

Grey water: fill in how grey water is treated in PSSAs.

Garbage handling: fill in whether an incinerator is used.

Sludge oil handling: fill in whether an incinerator is used.

Bilge water treatment: fill in how bilge water is treated.

Crew awareness: fill In whether crew is educated on environmental risks.

Vessel information results

Submit: after filling in the questionnaire, click the submit button at the bottom of the page. The information will be added to the database. However, if there is some compulsory information missing, nothing will be submitted to the database and the errors will show on the top of the page. The information must be completed and another Submit click must be done to get the information in the database.

After successful submission, you may now automatically see **Vessel information** on the vessel you just added.

You may continue to add or edit other vessels. If you have vessels with identical performance data you can use the function **use as template** on the top of the page which only erases IMO number and ship name of the vessel showing.

If you sell or anchor up your vessel for a long period you may also delete all info by enter **delete vessel**. This will erase the vessel from the database.

The vessel information page will present a spider diagram of the five different environmental areas and the scores for this specific ship. Putting the pointer on the different breaking points in the diagram will show the score percentage you have reached in these different areas for the ship.

Under Routes at the bottom of the page you may enter **view in chart**. In the spider diagram an orange line now will show the mean values for all vessels of the same type in the database on that specific route. Your ship is not included in these mean values.

To see all the detailed information you have entered for your ship you may enter **view questionnaire** at the bottom of the page.

Carrier results

When all vessels are added, or edited you may view the result under **Carrier/ Home.**
If you enter **list of vessels** on the top of the page you will see a ranking of all ships you have added. If you have different types of vessels in your fleet you may select only one type and rank them towards each other.

If you want to rank your vessels according to some specific environmental field you may click on some of the orange headlines on the top of the Table like **CO_2** or **Chemicals**.

If you want to go back to Vessel Information for any of your ships you may click on the orange **IMO number** in the Table.

If you want to change anything concerning carrier information you just click on **edit information** as described in the beginning of this document.

A chart is visible at the top of the page. This presents the **total weighed carrier ranking** in the database with your company represented as a red star. The weighed ranking means that the percentage of reported ships of the totally owned fleet is multiplied with the total score. By putting the pointer on the different (unnamed) carriers you will see their total weighed score.

If you go down the page to Ranking and enter the orange ranking figures by the type of ship, the top chart will update to show the weighed ranking for that type of carrier. This is the most adequate comparison as the same types of carriers are compared.

Under Vessel Count and reported vessels you may enter **view vessel ranking**. This is the same page as **list of vessels** mentioned above.

When comparing carriers and vessels, the application emphasizes the verified carriers and vessels. The verification document is published on www.cleanshippingindex.com.

Statistics

Under the **Statistics/ Search** function you may search the database for your own ships by adding search criteria such as routes, type of vessel, owned / chartered, verified and environmental management systems.

Under the **Statistics/ Mean** Comparison function you can compare the mean values for all your vessels compared to all other vessels in the database of the same type and on the same route. Your vessel is in that case not included in the mean values of the database.

Under the **Statistics/ Vessel** ranking you enter the same page as **list of vessel** and **view vessel ranking** mentioned above.