30 December 2022

**Calculation of attained AER and CII Rating**

***Short Guidance***

**Preamble**

This guide provides a short guidance for the calculation of the attained Carbon Intensity Indicator (CII) / Annual Efficiency Ratio (AER) value and the ships' CII rating, including the following:

* definitions of terms used for the calculation of the attained CII/AER;
* all relevant correction factors approved by the International Maritime Organization's (IMO's) Marine Environment Protection Committee 78 (MEPC 78) as Resolution MEPC.355(78);
* clarifications of conditions for which these correction factors could be used;
* formulas to calculate such correction factors; and
* various standard values of coefficients used in these calculations.

The guidance provides generic “CII calculators” (version 2.0) developed by INTERTANKO giving the attained annual AER values of ships operated by Members and the corresponding CII rating. INTERTANKO has prepared separate, user friendly “CII calculators” for:

* Chemical Tankers and for Oil Tankers engaged in regular trade;
* Oil Tankers engaged in ship-to-ship (STS) operations;
* Shuttle Tanker with Dynamic Positioning system (DP Shuttle Tankers);
* LNG and Gas Carriers.

**Calculation of the attained CII/AER value**

The general formula for the calculation of the attained CII/AER value is as follows:

$attained $AER = $\frac{\sum\_{i}^{}C\_{Fj }x \left\{FC\_{j }- \left(FC\_{voyage,i}+ TF\_{j}+ \left(0.75-0.03 y\_{i}\right) x \left(FC\_{electrical,j}+ FC\_{boiler,j}+FC\_{others,j}\right)\right)\right\}}{f\_{i} x f\_{m} x f\_{c} x f\_{iVSE} x Capacity x \left(D\_{t}- D\_{x}\right)}$

where:

• 𝑗 is the fuel type;

• 𝐶𝐹𝑗 represents the fuel mass to CO2 mass conversion factor for fuel type 𝑗, in line with those specified in the *2018 Guidelines on the method of calculation of the attained EEDI for new ships* (Resolution MEPC.308(73)), as may be further amended;

Table 1: Conversion factor between fuel consumption and CO2 emission

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Type of fuel** | **Reference** | **Lower calorific value (kJ/kg)** | **Carbon content** | ***CF*****(t-CO2/t- Fuel)** |
| Diesel/Gas Oil | ISO 8217 GradesDMX through DMB | 42,700 | 0.8744 | 3.206 |
| Light Fuel Oil (LFO) | ISO 8217 GradesRMA through RMD | 41,200 | 0.8594 | 3.151 |
| Heavy Fuel Oil (HFO) | ISO 8217 GradesRME through RMK | 40,200 | 0.8493 | 3.114 |
| Liquid Petroleum Gas (LPG) | Propane | 46,300 | 0.8182 | 3.000 |
| Butane | 45,700 | 0.8264 | 3.030 |
| Liquefied Natural Gas (LNG) |  | 48,000 | 0.7500 | 2.750 |
| Methanol |  | 19,900 | 0.3750 | 1.375 |
| Ethanol |  | 26,800 | 0.5217 | 1.913 |

In cases of ships equipped with a dual-fuel main or auxiliary engine, the *CF*-factors for gas fuel and for fuel oil should apply and be multiplied by the amount of type of fuel consumption, respectively.

• 𝐹𝐶𝑗 is the total mass of consumed fuel of type 𝑗 in the calendar year, as reported under IMO Data Collection System (DCS), converted to grams;

• 𝐹𝐶𝑣𝑜𝑦𝑎𝑔𝑒,𝑗 is the mass (in grams) of fuel of type 𝑗, consumed in voyage periods during the calendar year which may be deducted according to paragraph 4.1 of Resolution MEPC 355(78);

Paragraph 4.1 indicates that fuel may be deducted from the calculation of the attained CII in case the ship encounters one of the following situations:

.1 scenarios specified in regulation 3.1 of MARPOL Annex VI, which may endanger safe navigation of a ship;

.2 sailing in ice conditions, which means sailing of an ice-classed ship in a sea area within the ice edge.

In cases where 𝐹𝐶𝑣𝑜𝑦𝑎𝑔𝑒,𝑗 is used:

• any associated distance travelled must also be deducted using 𝐷𝑥 otherwise ships will benefit from distance travelled without any associated CO2 emission.

• the ship should report data for the deductions associated with voyage adjustments to the Administration in accordance with Appendix 2 of Resolution MEPC 355(78).

• 𝑇𝐹𝑗 = (1 − 𝐴𝐹𝑇𝑎𝑛𝑘𝑒𝑟) x 𝐹𝐶𝑆,𝑗 - represents the quantity of fuel *j* removed for STS or shuttle tanker operations, where

* 𝐹𝐶𝑆,𝑗 = 𝐹𝐶𝑗 for shuttle tankers (paragraph 2.9 of Resolution MEPC 355(78)) and
* 𝐹𝐶𝑆,𝑗 is the total quantity of fuel *j* used on STS voyages by STS vessels. (paragraph 2.8 of Resolution MEPC 355(78))

If 𝑇𝐹𝑗 > 0 then 𝐹𝐶𝑒𝑙𝑒𝑐𝑡𝑟𝑖𝑐𝑎𝑙,𝑗 = 𝐹𝐶𝑏𝑜𝑖𝑙𝑒𝑟,𝑗 = 𝐹𝐶𝑜𝑡ℎ𝑒𝑟𝑠,𝑗 = 0;

Paragraph 2.8 - A tanker should be considered in Ship-to-Ship (STS) operation when operating in accordance with regulation 41.2 of MARPOL Annex I and applying the best practices in accordance with the OCIMF Ship to Ship Transfer Guide for Petroleum, Chemical and Liquefied Gases. For the purpose of these guidelines, a tanker is engaged in an STS voyage if a voyage between cargo loading and cargo discharging locations, or a voyage between cargo discharging and cargo loading locations does not exceed 600 nautical miles and the time for each of these voyages (which does not include port or discharge time) is limited to 72 hours.

Paragraph 2.9 - A shuttle tanker is a tanker which is equipped with dynamic positioning and specialized cargo handling equipment making it capable of loading crude oil at offshore installations.

• 𝐴𝐹𝑇𝑎𝑛𝑘𝑒𝑟 represents the correction factor to be applied to Shuttle tankers or STS voyages according to paragraph 4.2 of Resolution MEPC 355(78);

Paragraph 4.2 - 𝑨𝑭𝑻𝒂𝒏𝒌𝒆𝒓 for corrections to STS voyages on tankers - Tankers engaged in STS voyages as defined above in paragraph 2.8 may apply the correction factor AFTanker,STS to all fuel consumption relating to STS voyages, including cargo transfer at offshore location, voyage, cargo discharge and waiting periods at anchor or drifting during which the ship reports being part of an STS operation and voyage. The STS operation includes fuel consumption in port where the transferred cargo is discharged after such a voyage. The correction is calculated as:

*𝐴𝐹𝑇𝑎𝑛𝑘𝑒𝑟,𝑆𝑇𝑆 = 6.1742×𝐷𝑊𝑇−0.246*

Where AFTanker,STS is applied, FCelectrical, FCboiler and FCothers should not be used.

Paragraph 4.2 - 𝑨𝑭𝑻𝒂𝒏𝒌𝒆𝒓 for corrections to shuttle tankers

Shuttle tankers equipped with dynamic positioning as defined above in paragraph 2.9 may apply the correction factor AFTanker,Shuttle to total fuel consumption. The correction factor is calculated as:

*𝐴𝐹𝑇𝑎𝑛𝑘𝑒𝑟,𝑆ℎ𝑢𝑡𝑡𝑙𝑒 = 5.6805 𝑥 𝐷𝑊𝑇−0.208*

Where AFTanker,Shuttle is applied, FCelectrical, FCboiler, FCothers and AFTanker,STS should not be used.

• 𝑦𝑖 is a consecutive numbering system starting at 𝑦2023 = 0, 𝑦2024 = 1, 𝑦2025 = 2, 𝑦2026 = 3;

• 𝐹𝐶𝑒𝑙𝑒𝑐𝑡𝑟𝑖𝑐𝑎𝑙,𝑗 is the mass (in grams) of fuel type 𝑗, consumed for production of electrical power which can be deducted according to paragraph 4.3 of Resolution MEPC 355(78) and paragraph 2 of its Appendix 1;

For Gas Carriers and LNG Carriers with electrical cargo cooling systems or reliquefication plants, the correction factor FCelectrical may be applied as follows:

𝐹𝐶𝑒𝑙𝑒𝑐𝑡𝑟𝑖𝑐𝑎𝑙\_𝑐𝑜𝑜𝑙𝑖𝑛𝑔,𝑗 = 𝐶𝑜𝑜𝑙𝑖𝑛𝑔 𝑘𝑊ℎ × 𝑆𝐹𝑂𝐶

where:

• 𝐹𝐶𝑒𝑙𝑒𝑐𝑡𝑟𝑖𝑐𝑎𝑙\_𝑐𝑜𝑜𝑙𝑖𝑛𝑔,𝑗 (cargo cooling fuel oil consumption) represents the estimated fuel consumption attributed to cooling of gas cargoes.

• 𝐶𝑜𝑜𝑙𝑖𝑛𝑔 𝑘𝑊ℎ is measured on the vessel by the kWh meter counter on the vessel.

• 𝑆𝐹𝑂𝐶 represents the specific fuel consumption in g/kWh associated with the relevant source of electrical power as per the EEDI/EEXI Technical File or NOx Technical File. In the case of ships without a Technical File, a default value of 175 g/kWh for two-stroke engines and 200 g/kWh for four-stroke engines may be applied. In the case of waste heat recovery systems as defined under Category C1 in MEPC.1/Circ.896 the SFOC to be used will be at the discretion of the Administration.

Alternatives such as derivation of fuel consumption or kWh from auto-logged data may be used subject to approval by the Administration.

Note that cargo cooling kWh consumption should not include consumption during voyage adjustment periods.

• 𝐹𝐶𝑏𝑜𝑖𝑙𝑒𝑟,𝑗 is the mass (in grams) of fuel type 𝑗, consumed by the boiler which may be deducted according to paragraph 4.4 of Resolution MEPC 355(78) and paragraph 2 in Part B of its Appendix 1;

FCBoiler correction relating to cargo heating - For tankers with fuel fired boilers used for cargo heating or steam driven cargo pumps, the following correction factor may be applied for the period that the cargo heating or discharge pumps are in operation:

.1 In the case of boilers used for cargo heating, the amount of fuel used by the boiler (𝐹𝐶𝐵𝑜𝑖𝑙𝑒𝑟) should be measured by accepted means, e.g. tank soundings, flow meters.

.2 For tankers which use steam driven cargo pumps, the amount of fuel used by the boiler (𝐹𝐶𝐵𝑜𝑖𝑙𝑒𝑟) should be measured by accepted means, e.g. tank soundings, flow meters. Some amount of fuel consumed by the boiler during cargo heating or discharge operations may be attributed to other purposes, e.g. calorifiers. It is not necessary to split these out from reporting.

Note that boiler consumption should not include consumption during voyage adjustment periods.

• 𝐹𝐶𝑜𝑡ℎ𝑒𝑟𝑠,𝑗 is the mass (in grams) of fuel type 𝑗, consumed by other related fuel consumption devices according to paragraph 4.5 of Resolution MEPC 355(78) and paragraph 2 in Part B of its Appendix 1;

FCOthers is for correction relating to discharge pumps on tankers powered by their own generator. The amount of fuel used for the period that the discharge pumps are in operation (𝐹𝐶𝑂𝑡ℎ𝑒𝑟𝑠) should be measured by accepted means, e.g. tank soundings, flow meters. Note that fuel deducted under FCOthers should not include consumption during voyage adjustment periods.

• 𝑓𝑖 is the capacity correction factor for ice-classed ships as specified in *the 2018 Guidelines on the method of calculation of the attained EEDI for new ships* (Resolution MEPC.308(73));

Capacity correction factor for ice-classed ships

The capacity correction factor, 𝑓𝑖, for ice-classed ships having DWT as the measure of capacity should be calculated as follows:

𝑓𝑖=𝑓𝑖(𝑖𝑐𝑒 𝑐𝑙𝑎𝑠𝑠) x 𝑓𝑖𝐶𝑏,

where 𝑓𝑖(𝑖𝑐𝑒 𝑐𝑙𝑎𝑠𝑠) is the capacity correction factor for ice-strengthening of the ship, which can be obtained from Table 2 and 𝑓𝑖𝐶𝑏 is the capacity correction factor for improved ice-going capability, which should not be less than 1.0 and which should be calculated as follows:

$ f\_{iCb}= \frac{C\_{b reference design}}{C\_{b}}$

where 𝐶𝑏 𝑟𝑒𝑓𝑒𝑟𝑒𝑛𝑐𝑒 𝑑𝑒𝑠𝑖𝑔𝑛 is the average block coefficient for the ship type, which can be obtained from Table 3 for bulk carriers, tankers and general cargo ships, and 𝐶𝑏 is the block coefficient of the ship. For ship types other than bulk carriers, tankers and general cargo ships, 𝑓𝑖𝐶𝑏=1.0.

Table 2: Capacity correction factor for ice-strengthening of the hull

|  |  |
| --- | --- |
| Ice class*\** | 𝑓𝑖(𝑖𝑐𝑒 𝑐𝑙𝑎𝑠𝑠) |
| IC | *f*i(IC) = 1.0041 + 58.5/*DWT* |
| IB | *f*i(IB) = 1.0067 + 62.7/*DWT* |
| IA | *f*i(IA) = 1.0099 + 95.1/*DWT* |
| IA Super | *f*i(IAS) = 1.0151 + 228.7/*DWT* |

*\* For further information on approximate correspondence between ice classes, see HELCOM Recommendation 25/7, which can be found at http://www.helcom.fi*

Table 3: Average *Cb reference design* for bulk carriers, tankers and general cargo ships

|  |  |
| --- | --- |
|  | **Size categories DWT** |
| **Ship type** | <10,000 | 10,000–25,000 | 25,000–55,000 | 55,000–75,000 | >75,000 |
| Tanker | 0.78 | 0.78 | 0.80 | 0.83 | 0.83 |

• 𝑓𝑚 is the factor for ice-classed ships having IA Super and IA as specified in the *2018 Guidelines on the method of calculation of the attained EEDI for new ships* (Resolution MEPC.308(73)); *fm* = 1.05

• 𝑓𝑐 represents the cubic capacity correction factor for chemical tankers as specified in paragraph 2.2.12 of Resolution MEPC.308(73);

Cubic capacity correction factor *fc* applies to chemical tankers, as defined in regulation 1.16.1 of MARPOL Annex II

*fc* = *R*-0.7─0.014, if *R* < 0.98

or

*fc* = 1.00, if *R* = 0.98 and above

$$R= \frac{DWT}{total cargo tanks capacity (m^{3})}$$

• 𝑓𝑖,𝑉𝑆𝐸 represents the correction factor for ship specific voluntary structural enhancement as specified in paragraph 2.2.11.2 of the 2018 Guidelines on the method of calculation of the attained EEDI for new ships Resolution MEPC.308(73), to be applied **only** to self-unloading bulk carriers;

• 𝐶𝑎𝑝𝑎𝑐𝑖𝑡𝑦 is summer load line DWT;

• 𝐷𝑡 represents the total distance travelled (in nautical miles), as reported under IMO DCS; and

• 𝐷𝑥 represents distance travelled (in nautical miles) for voyage periods which may be deducted from CII calculation according to paragraph 4.1 of Resolution MEPC 355(78).

**Calculation of attained AER value and CII Rating for**

**Chemical Tankers (CH) and for Oil Tankers (OT) engaged in regular trade**

This guide provides a simplified formula for the calculation of the attained AER with factors which apply to Chemical Tankers and Oil Tankers engaged in regular trade. It should be used in connection with the generic “CII calculator” developed by INTERTANKO giving the value of the attained annual CII/AER and the corresponding CII rating. The “CII Calculator” is included in this guidance.

The formula below retains only factors applicable to the calculation of the attained AER for chemical tankers and oil tankers engaged in regular trade

$attained $AER = $\frac{\sum\_{i}^{}C\_{Fj }x \left\{FC\_{j }- \left(FC\_{voyage,i}+ \left(0.75-0.03 y\_{i}\right) x \left(FC\_{electrical,j}+ FC\_{boiler,j}+FC\_{others,j}\right)\right)\right\}}{f\_{i} x f\_{m} x f\_{c} x DWT x \left(D\_{t}- D\_{x}\right)}$

Users of the calculator should be aware of the following required ship’s data:

* DWT (tons);
* for chemical tankers, include the total volume of cargo tanks (m3);
* if the ship has ice class, include the ship’s block coefficient (Cb) as appropriate;
* total annual fuel consumption for each type of fuel used (in tons);
* aggregated fuel consumptions qualified for various corrections for each type of fuel used (in tons);
* the total distance (in nm);
* aggregated distance for voyages through ice and voyages related to safety of navigation.

Note that the calculator includes further guidance and explanation as well as values entered for the year 2023 as a measure to check the correctness of the formula.

The user should fill in data in the blue cells only. Table 3 of the worksheet gives the CII rating.



**Calculation of attained AER value and CII Rating for**

**Oil Tankers (OT) engaged in Ship-to-Ship (STS) operations**

**Preamble**

This guide provides a formula for the calculation of the attained AER for Oil Tankers engaged in ship-to-ship (STS) operations. It should be used in connection with the generic “CII calculator” developed by INTERTANKO giving the value of the attained annual AER value and the corresponding CII rating. The “CII Calculator” for OT engaged in STS operations (version 2.0) is included in this guidance.

**Definition of an STS voyage**

*Paragraph 2.8 - A tanker should be considered in Ship-to-Ship (STS) operation when operating in accordance with Regulation 41.2 of MARPOL Annex I and applying the best practices in accordance with the OCIMF Ship to Ship Transfer Guide for Petroleum, Chemical and Liquefied Gases. For the purpose of these guidelines, a tanker is engaged in an STS voyage if a voyage between cargo loading and cargo discharging locations, or a voyage between cargo discharging and cargo loading locations does not exceed 600 nautical miles and the time for each of these voyages (which does not include port or discharge time) is limited to 72 hours.*

Paragraph 2.8 of Resolution MEPC.355(78) provides definition of an “STS voyage” and the limits for distance and time of an STS voyage are set to avoid misuse of the correction factor:

* each leg/voyage up to 600 nm – mileage ship covers
	+ from the STS loading position to the unloading terminal; or
	+ from the terminal to the position of the next STS loading operation
	+ but it does NOT include small distances when tanker is waiting adrift
* each leg/voyage up to 72 hours – time during the ship moves, but it does NOT include time for:
	+ loading
	+ discharge
	+ waiting at anchor and
	+ waiting adrift

The distance of 600nm relates to a specific STS location with the offloaded cargo being delivered at two different shore terminals. The 72 hours limit was chosen based on the following criteria:

* at a speed of 10 kn/12 kn, the 600 nm can be covered in some 58/52 hours, respectively
* since IMO defines time as fixed number of days, 3 days or 72 hours have been agreed
* therefore, the 72 hours do **only** include time ship is moving from the STS loading position to the unloading terminal(s) or from the unloading terminal to the next STS loading position
* the choice of 72 hours was also made to allow slower steaming if appropriate.

Paragraph 4.2 of Resolution MEPC.355(78) defines the application of the STS correction factor. It indicates that the correction formula is applied to the entire fuel consumption during an STS voyage.

*Paragraph 4.2 -* 𝑨𝑭𝑻𝒂𝒏𝒌𝒆𝒓 *for corrections to STS voyages on tankers - Tankers engaged in STS voyages as defined above in paragraph 2.8 may apply the correction factor AFTanker,STS to all fuel consumption relating to STS voyages, including cargo transfer at offshore location, voyage, cargo discharge and waiting periods at anchor or drifting during which the ship reports being part of an STS operation and voyage. The STS operation includes fuel consumption in port where the transferred cargo is discharged after such a voyage. The correction is calculated as:*

*AFTanker,STS = 6.1742 x DWT-0.246*

*Where AFTanker,Shuttle is applied, FCelectrical, FCboiler, FCothers and AFTanker,STS should not be used.*

The correction factor applies to ALL fuel consumption during an STS voyage, for all ship’s operations:

* during cargo transfer at offshore location (i.e. offloading),
* during voyage (steaming from offshore location to the shore terminal, between two shore terminals in case of multiple terminals discharge),
* during cargo discharges,
* during waiting periods, both with the ship waiting at anchor and/or drifting, and
* during delivery port stay (if next voyage is also an STS voyage and ship’s departure is delayed).

**Correction Factor applicable to oil tankers engaged in STS operations**

It is assumed that oil tankers can be involved in regular trade and, sometimes in STS voyages. According to Resolution MEPC 355(78), calculation of the annual attained CII/AER value applies a correction factor $ TF\_{j} $to the fuel consumed during the STS voyages, as defined above.

• 𝑇𝐹𝑗 = (1 − 𝐴𝐹𝑇𝑎𝑛𝑘𝑒𝑟, *STS*) *x* 𝐹𝐶𝑆,𝑗 - represents the quantity of fuel *j* removed for tankers engaged in STS operations, where 𝐹𝐶𝑆,𝑗 is the total quantity of fuel *j* used on STS voyages.

• 𝐴𝐹𝑇𝑎𝑛𝑘𝑒𝑟, *STS* - represents the correction factor to be applied to STS voyages:

$$AF\_{Tanker, STS}=6.1742 x DWT^{-246}$$

Data recording for STS voyages should be clearly identified to facilitate verification of such voyages. The correction factor applies to fuel consumption during STS voyages only. The formula for calculating the annual attained AER value for oil tankers engaged in STS voyages is:

$attained $AER$= \frac{\sum\_{i}^{}C\_{Fj }x \left\{FC\_{j }- \left(FC\_{voyage,i}+ TF\_{j}+ \left(0.75-0.03 y\_{i}\right) x \left(FC\_{electrical,j}+ FC\_{boiler,j}+FC\_{others,j}\right)\right)\right\}}{f\_{i} x f\_{m} x DWT x \left(D\_{t}- D\_{x}\right)}$

If 𝑇𝐹𝑗 > 0 (meaning for STS voyages), 𝐹𝐶𝑒𝑙𝑒𝑐𝑡𝑟𝑖𝑐𝑎𝑙,𝑗 = 𝐹𝐶𝑏𝑜𝑖𝑙𝑒𝑟,𝑗 = 𝐹𝐶𝑜𝑡ℎ𝑒𝑟𝑠,𝑗 = 0.

The correction for $FC\_{voyage,i}$ and for ice class ($f\_{i}, f\_{m})$ apply to STS voyages, if appropriate.

**CII Calculator for Oil Tankers engaged in STS operations**

Users of the calculator should be aware of the following required ship’s data:

* DWT (tons);
* the ship’s block coefficient (Cb) at the ship’s correct ice class, if appropriate;
* total annual fuel consumption for each type of fuel used (in tons);
* total annual fuel consumption during STS voyages for each type of fuel used (in tons);
* fuel consumptions qualified for other various corrections for each type of fuel used (in tons);
* the total distance (in nm);
* aggregated distance for STS voyages;
* aggregated distance for voyages through ice and voyages related to safety of navigation.

Note that the calculator includes further guidance and explanation as well as values entered for the year 2023 as a measure to check the correctness of the formula. The user should fill in data in the blue cells only. Table 3 of the worksheet gives the CII rating.



**Calculation of the annual attained AER value and CII Rating for**

**Shuttle Tankers with Dynamic Propulsion systems**

**Preamble**

This guide provides a formula for the calculation of the attained Carbon Intensity Indicator (CII) / Annual Efficiency Ratio (AER) value for Shuttle Tankers with Dynamic Propulsion systems (DP Shuttle Tankers). It should be used in connection with the generic “CII calculator” developed by INTERTANKO for checking the attained annual CII/AER values of ships operated by Members and the corresponding CII rating. The “CII Calculator” for DP Shuttle Tankers (version 2.0) is included in this guidance.

**Definition of a DP Shuttle Tanker**

The definition of a shuttle tanker to which this calculation applies is given in paragraph 2.9 of Resolution MEPC 355(78).

*Paragraph 2.9 A Shuttle Tanker is a tanker which is equipped with Dynamic Positioning and specialized cargo handling equipment making them capable of loading crude oil at offshore installations.*

**Correction Factor applicable to Shuttle Tankers with Dynamic Position systems**

$attained $AER$= \frac{\sum\_{i}^{}C\_{Fj }x \left\{FC\_{j }- \left(FC\_{voyage,i}+ TF\_{j} \right)\right\}}{f\_{i} x f\_{m} x DWT x \left(D\_{t}- D\_{x}\right)}$

• 𝑇𝐹𝑗 = (1 − 𝐴𝐹𝑇𝑎𝑛𝑘𝑒𝑟) x 𝐹𝐶𝑆,𝑗

where 𝐹𝐶𝑆,𝑗 = 𝐹𝐶𝑗 as the total mass of consumed fuel by shuttle tanker of type 𝑗 in the calendar year, as reported under the International Maritime Organization’s Data Collection System (DCS);

• 𝐴𝐹𝑇𝑎𝑛𝑘𝑒𝑟 represents the correction factor to be applied to Shuttle Tankers according to paragraph 4.2 of Resolution MEPC 355(78).

*Paragraph 4.2 Shuttle tankers equipped with Dynamic Positioning as defined above in paragraph 2.9 may apply the correction factor AFTanker,Shuttle to total fuel consumption. The correction is calculated as:*

𝐴𝐹𝑇𝑎𝑛𝑘𝑒𝑟,𝑆ℎ𝑢𝑡𝑡𝑙𝑒 = 5.6805 𝑥 𝐷𝑊𝑇−0.208

*Where AFTanker,Shuttle is applied, FCelectrical, FCboiler, FCothers and AFTanker,STS should not be used.*

Based on the above, the simplified formula is

$attained $AER$= \frac{\sum\_{i}^{}C\_{Fj }x \left\{FC\_{j }- \left(FC\_{voyage,i}+\left(1-5.6805 x DWT^{-0.208}\right) x FC\_{j} \right)\right\}}{f\_{i} x f\_{m} x DWT x \left(D\_{t}- D\_{x}\right)}$

which can also be further simplified to

$attained $AER$= \frac{\sum\_{i}^{}C\_{Fj }x FC\_{j }x \left\{5.6805 x DWT^{-0.208}- FC\_{voyage,i}\right\}}{f\_{i} x f\_{m} x DWT x \left(D\_{t}- D\_{x}\right)}$

**CII Calculator for Shuttle Tankers with Dynamic Position systems**

Users of the calculator should be aware of the following required ship’s data:

* DWT (tons);
* the ship’s block coefficient (Cb) at the ship’s correct ice class, if appropriate;
* total annual fuel consumption for each type of fuel used (in tons);
* total annual fuel consumption if voyage through ice or voyages in which safety of navigation mattered in tons);
* the total distance (in nm);
* aggregated distance for voyages through ice and voyages related to safety of navigation.

Note that the calculator includes further guidance and explanation as well as values entered for the year 2023 as a measure to check the correctness of the formula.

The user should fill in data in the blue cells only. Table 3 of the worksheet gives the CII rating.



**Calculation of attained AER and CII rating for Gas Carriers and LNG carriers**

**Preamble**

This guide provides formula for the calculation of the attained Carbon Intensity Indicator (CII) / Annual Efficiency Ratio (AER) value and CII rating for Gas and LNG Carriers.

**Calculation of the attained CII/AER value**

$attained $AER$= \frac{\sum\_{i}^{}C\_{Fj }x \left\{FC\_{j }- \left(FC\_{voyage,j }- \left(0.75- 0.03 y\_{i}\right) x FC\_{electrical,j}\right)\right\}}{f\_{i} x f\_{m} x Capacity x \left(D\_{t}- D\_{x}\right)}$

**Correction Factor applicable to Gas and LNG carriers**

The main correction factor applying to these types of ships is *FCelectricalj* - Electrical consumption of cargo cooling/reliquefication systems.

𝐹𝐶𝑒𝑙𝑒𝑐𝑡𝑟𝑖𝑐𝑎𝑙\_𝑐𝑜𝑜𝑙𝑖𝑛𝑔,𝑗 = 𝐶𝑜𝑜𝑙𝑖𝑛𝑔 𝑘𝑊ℎ × 𝑆𝐹𝑂𝐶

where:

• 𝐶𝑜𝑜𝑙𝑖𝑛𝑔 𝑘𝑊ℎ is measured on the vessel by the kWh meter counter on the vessel.

• 𝑆𝐹𝑂𝐶 represents the specific fuel consumption in g/kWh associated with the relevant source of electrical power as per the EEDI/EEXI Technical File or NOx Technical File. In the case of ships without a Technical File, a default value of 175 g/kWh for two-stroke engines and 200 g/kWh for four-stroke engines may be applied. In the case of waste heat recovery systems as defined under Category C1 in MEPC.1/Circ.896 the SFOC to be used will be at the discretion of the Administration.

Alternatives such as derivation of fuel consumption or kWh from auto-logged data may be used subject to approval by the Administration.

Note that cargo cooling kWh consumption should not include consumption during voyage adjustment periods.

These ships also would benefit from the use of:

• 𝑓𝑖 is the capacity correction factor for ice-classed ships as specified in *the 2018 Guidelines on the method of calculation of the attained EEDI for new ships* (resolution MEPC.308(73));

• 𝑓𝑚 is the factor for ice-classed ships having IA Super and IA as specified in the *2018 Guidelines on the method of calculation of the attained EEDI for new ships* (resolution MEPC.308(73)) as amended at MEPC 74; *fm* = 1.05

• 𝐹𝐶𝑣𝑜𝑦𝑎𝑔𝑒,𝑗 is the mass (in grams) of fuel of type 𝑗, consumed in voyage periods during the calendar year which may be deducted according to paragraph 4.1 of this Resolution;

**CII Calculators for Gas Carriers and LNG Carriers**

Users of the calculator should be aware of the following required ship’s data:

* DWT (tons);
* the ship’s block coefficient (Cb) at the ship’s correct ice class, if appropriate;
* total annual fuel consumption for each type of fuel used (in tons);
* total annual fuel consumption if voyage through ice or voyages in which safety of navigation mattered in tons);
* the total distance (in nm);
* aggregated distance for voyages through ice and voyages related to safety of navigation.

Note that the calculator includes further guidance and explanation as well as values entered for the year 2023 as a measure to check the correctness of the formula.

The user should fill in data in the blue cells only. Table 3 of the worksheet gives the CII rating.

 