Outlines of Carbon Intensity Indicator(CII)

Ship Management Systems Department, ClassNK

June 2021

Short-term Measures for GHG Reduction

1. EEXI — Technical Approach

2. SEEMP Update

3. CII Rating

Operational Approach

CII: Carbon Intensity Indicator

Proposals for Operational Approach by the stakeholders in MEPC75

SEEMP Update (periodical Audit)
（Shipowners country, Finland, Japan）

Fuel consumption rating
（China）

Mandatory Speed/FOC limitation
（EU, Environmental Organization, Island countries）

Gentle ⟷ strict

1. Adopted CII related guidelines

1. Guidelines on operational carbon intensity indicators and the calculation methods (CII guidelines, G1)

2. Guidelines on the reference lines for use with operational carbon intensity indicators (CII Reference line guidelines, G2)

3. Guidelines on the operational carbon intensity reduction factors relative to reference lines (CII Reduction factor guidelines, G3)

4. Guidelines on the operational carbon intensity rating of ships (CII Rating Guidelines, G4)

CII Rating（5000GT and above / EEDI applied ship types）

- Rating each vessels by CII from 2023 consumption data (CII Guideline, G1)
- CII and “A” – “E” rating will be added on SOC of IMODCS in accordance with Reference Line (G2), Reduction Factor (G3) and Rating guideline (G4)
- Low rated vessels (“E” or “D” on 3 consecutive years) should develop a plan of corrective actions and the plan should be approved by the Administration or RO

2. Consideration of following guidelines are postponed;

1. Some correction factors and voyage exclusions when calculating CII of each ship

2. Update of SEEMP guidelines

(SEEMP to be updated before 1.Jan.2023)

- Periodical Audit (at ISM audit)
- CII related update

Further information will be updated on ClassNK Technical Information when any development happens

CII Calculation (G1)

Ship types	Calculation method	Note
Bulk carriers, Tankers, Container ships, Gas carriers, LNG carriers, Ro-ro cargo ships, General cargo ships, Refrigerated cargo carrier Combination carriers	$\frac{\mathrm{CO2}\ Emission}{Deadweight \times Distance\ sailed}$	Deadweight: Corresponding to Maximum Summer load draft = the value on IEE Cert supplement
cruise passenger ships Ro-ro cargo ships (vehicle carriers) Ro-ro passenger ships	$\frac{\mathrm{CO2}\ Emission}{Gross\ Tonnage \times Distance\ sailed}$	

CII Reference Line (G2)

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$$CII\ ref = a\ Capacity^{-C}$$

Ship Type		Capacity	a	c
Bulk Carrier	DWT ≥ 279,000	279,000	4745	0.622
	DWT < 279,000	DWT	4745	0.622
Gas Carrier	DWT ≥ 65,000	DWT	14405E+7	2.071
	DWT < 65,000	DWT	8104	0.639
Tanker		DWT	5247	0.610
Container ship		DWT	1984	0.489
General cargo ship	DWT ≥ 20,000	DWT	31948	0.792
	DWT < 20,000	DWT	588	0.389
Refrigerated cargo carrier		DWT	4600	0.557
Combination carrier		DWT	40853	0.812
LNG Carrier	DWT ≥ 100,000	DWT	9.827	0
	100,000 > DWT ≥ 65,000	DWT	14479E+10	2.673
	DWT < 65,000	65,000	14479E+10	2.673
Ro-ro cargo ship (VC)		GT	5739	0.631
Ro-ro cargo ship		DWT	10952	0.637
Ro-ro passenger ship		GT	7540	0.587
Cruise passenger ship		GT	930	0.383

Required CII (G3)

$$Required\ CII = \frac{1 - Z}{100} CII_{Ref}$$

Table 1: Reduction factor (Z%) for the CII relative to the 2019 reference line
Year Reduction factor relative to 2019

Year	Reduction Factor (Z)
2023	5%
2024	7%
2025	9%
2026	11%
2027	**
2028	**
2029	**
2030	**

Reduction factor Z will be starting from 5% in 2023 and 2% will be added yearly

**Z factors for the years of 2027 to 2030 to be further strengthened and developed taking into account the review of the short-term measure.

CII Rating (G4)

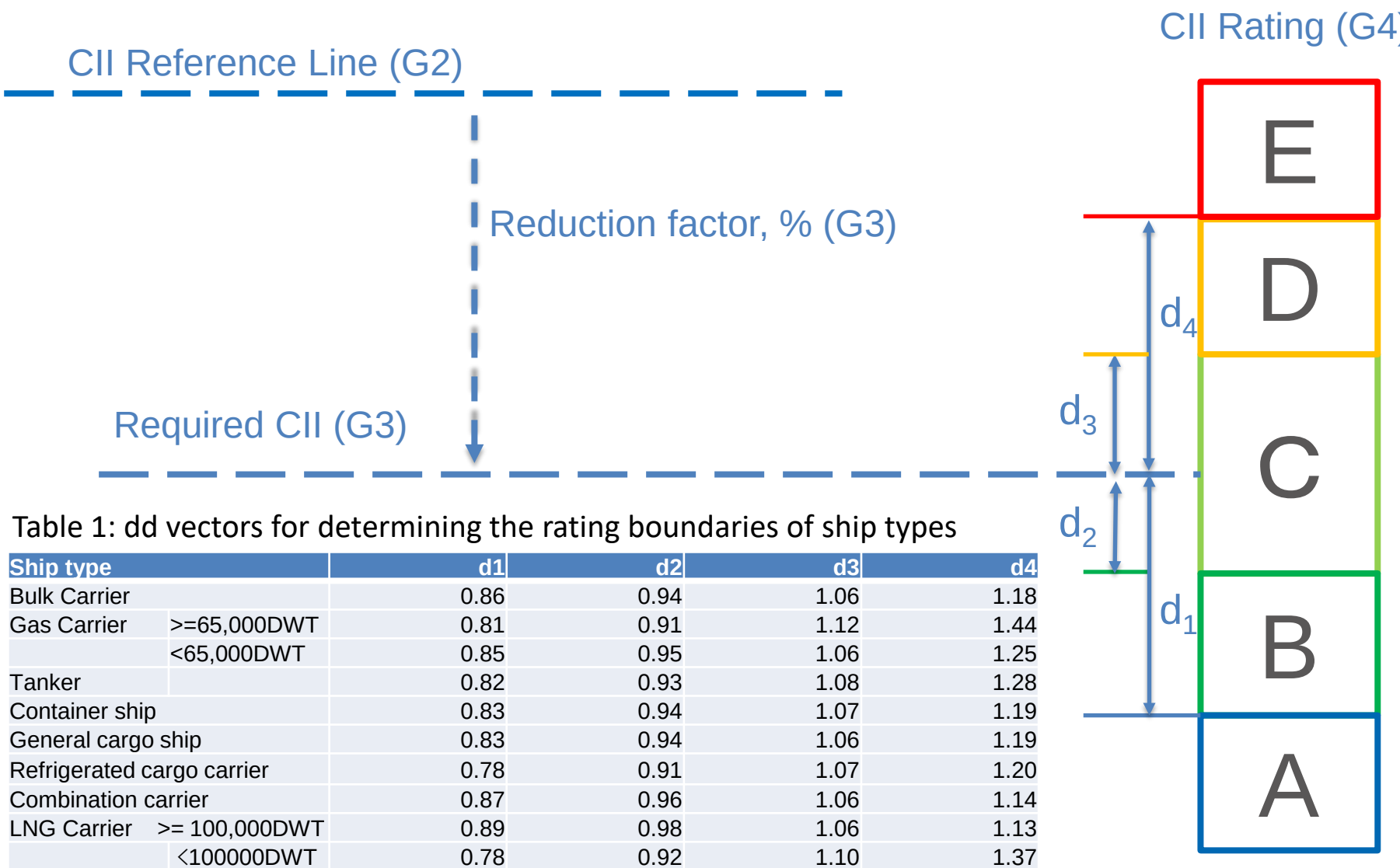

Table 1: dd vectors for determining the rating boundaries of ship types

Ship type		d1	d2	d3	d4
Bulk Carrier		0.86	0.94	1.06	1.18
Gas Carrier	>=65,000DWT	0.81	0.91	1.12	1.44
	<65,000DWT	0.85	0.95	1.06	1.25
Tanker		0.82	0.93	1.08	1.28
Container ship		0.83	0.94	1.07	1.19
General cargo ship		0.83	0.94	1.06	1.19
Refrigerated cargo carrier		0.78	0.91	1.07	1.20
Combination carrier		0.87	0.96	1.06	1.14
LNG Carrier	>= 100,000DWT	0.89	0.98	1.06	1.13
	<100000DWT	0.78	0.92	1.10	1.37
Ro-ro cargo ship (VC)		0.86	0.94	1.06	1.16
Ro-ro cargo ship		0.66	0.9	1.11	1.37
Ro-ro passenger ship		0.72	0.90	1.12	1.41
Cruise passenger ship		0.87	0.95	1.06	1.16

CII Calculation example

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Items	
Ship type	Bulk Carrier
Deadweight	62000
Gross tonnage	33255
Distance Travelled (NM)	60045
CO2 emissions (ton)	17477
Attained CII (G1)	4.69
a (G2)	4745
c (G2)	0.622
CII ref (G2)	4.96
Required CII (G3, 2023)	4.71
Attained CII / Required CII	1.00
Rating (2023)	**C**

Data source from IMODCS fuel reporting (started from emission of 2023)

Attained CII (g/ton mile)

$$= \frac{17447\ (ton)}{62000 \times 60045\ (ton\ mile)} \times 10^6 = 4.69$$

CII ref = $4977 \times 62000^{-0.626} = 4.96$

Rating (on 2023 reduction factor)

Required CII $= 4.96 \times \frac{100-5}{100} = 4.71\ (2023)$

$$\frac{Attained\ CII}{Required\ CII} = 1.00 < d2\ (1.06)$$

Effect of reduction factor

Items	
Ship type	Bulk Carrier
Deadweight	62000
Gross tonnage	33255
Distance Travelled (NM)	60045
CO2 emissions (ton)	17447
Attained CII (G1)	**4.69**
a (G2)	4745
c (G2)	0.622
CII ref (G2)	4.96

If the vessel keep their emission score same, the rating will be slightly worse year by year

Reporting Year	Reduction factor (%)	Required CII	Rating
2023	5	4.71	C
2024	7	4.61	C
2025	9	4.51	C
2026	11	4.41	**D**

Integration of CII on ClassNK MRV Portal

- CII rating will be added to IMODCS annual report

IMODCS annual report

Reporting period

Start date	2020/02/13	End date	2020/12/31

Ship Particulars

Name of ship *		
IMO No. *		
Company *		
FLAG / PORT *		Singapore / Singapore
Distinctive number or letters * (Call sign / Official Number)		[illegible]
Ship type *		Gas Carrier
Gross tonnage *		48122
Net tonnage *		14437
Deadweight *		54823
EEDI (gCO2/t.nm) *		5.85
Ice class (if applicable)		
Power output (rated power)(kW)	Main Power Propulsion *	13000
	Auxiliary Engine(s) *	4110 (Please input the total output of all the Auxiliary Engines. e.g

Consumption Data

		Actual reported value
Distance Travelled (nm)		79536
Hours underway (h)		5281
Fuel oil consumption (t)	Diesel/Gas Oil (Cf:3.206)	631
	LFO (Cf:3.151)	0
	HFO (Cf:3.114)	7987
	LPG(Propane) (Cf:3.000)	
	LPG(Butane) (Cf:3.030)	
	LNG (Cf:2.750)	
	Methanol (Cf:1.375)	
	Ethanol (Cf:1.913)	
Method used to measure fuel oil consumption		method using Bunker Fuel Oil Tank Monitoring

CII result

CII	
Attained CII	6.17
Required CII	7.23
CII Rating (2023)	B

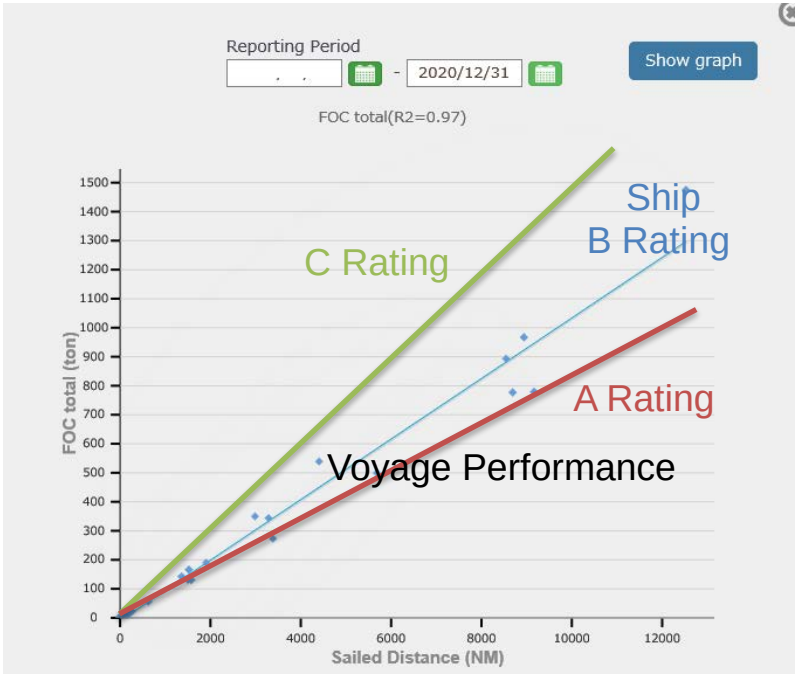
Corrective action plan
(if rating is “E” or “D” for three years in a row)

- Tick corrective actions to be made
- Document will be Automatically generated on the system

Integration of CII on ClassNK MRV Portal

- CII rating estimation function will be implemented

Error Mark	V/No.	Departure Dep.Time(UTC)	Departure Port	Arrival Arr.Time(UTC)	Arrival Dep.Time(UTC)	Arrival Port
☑	80	2018/08/09 13:42	El dekheila	2018/08/11 20:12	2018/08/17 03:52	GREEK
☑	81	2018/08/17 03:52	GREEK	2018/08/27 13:54	2018/08/30 23:18	Schiedam
☑	81	2018/08/30 23:18	Schiedam	2018/08/31 12:42	2018/09/25 14:24	Calais
☑	82	2018/09/25 14:24	Calais		2018/10/20 18:12	



CII rating estimation

Users can easily understand the ship's estimated rating on-demand

Integration of CII on ClassNK MRV Portal

ClassNK

- CII rating fleet / historical analysis

Vessel	Attained CII (Required CII) 2019	Attained CII (Required CII) 2020	Attained CII (Required CII) 2021	Attained CII (Required CII) 2022
NK Bulker	3.47 (3.22)	3.52 (3.15)	3.43 (3.09)	3.22 (3.05)
NK Maru	…			
…	…			
…	…			
…	…			
…	…			
…	…			

Users can understand the CII result for all vessels
User also can download the detailed data set and use it for further analysis

ClassNK Action for the time being

- CII calculation excel sheet will be available on ClassNK Homepage as a tentative manner until ClassNK MRV Portal update
- Support for SEEMP Revision will be announced when further updates are made by IMO

CII calculation sheet

	A	B	C
	CII Calculation *Please input blue cells		ClassNK Version 0.1 June 2021
2	Ship Particular	IMO Number	1111111
3		Ship Name	NK LNG
4		Ship Type	Gas carrier
5		Deadweight	54823
6		Gross Tonnage	48122
7	Fuel Consumption (ton)	Diesel/Gas Oil	631
8		LFO	0
9		HFO	7987
10		LPG(Propane)	
11		LPG(Butane)	
12		LNG	
13		Methanol	
14		Ethanol	
15	Distance Travelled (nm)		79536
16	CO2 Emission		26895
17	Attained CII		6.17
18	CII ref		7.61
19	Rating Year		2023
20	Required CII		7.23
21	Attained CII / Required CII		0.853
22	CII Rating		B

IMODCS / SEEMP information

https://www.classnk.or.jp/hp/en/activities/statutory/seemp/index.html

Contact

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