

For [Company Name]

ClassNK Fleet Cost Simulation Cost Estimation Report (Sample)

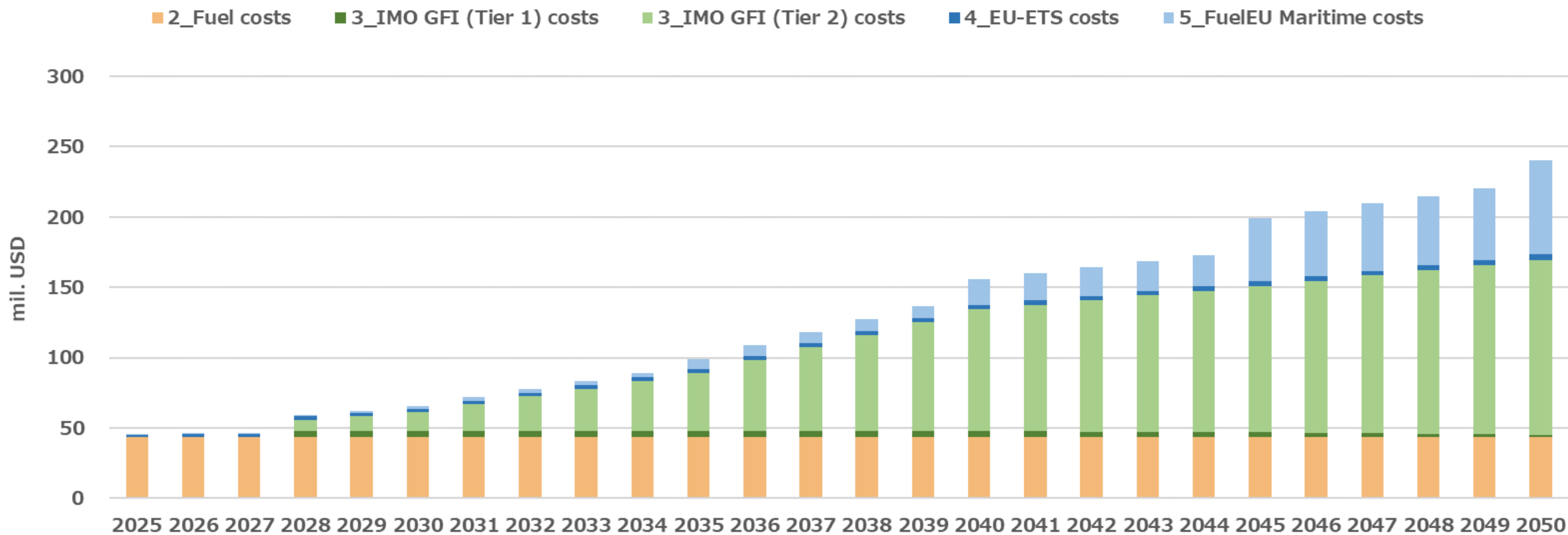
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Nippon Kaiji Kyokai (ClassNK)
Green Transformation Center

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Estimation Results

Estimation Results: Annual Total Costs



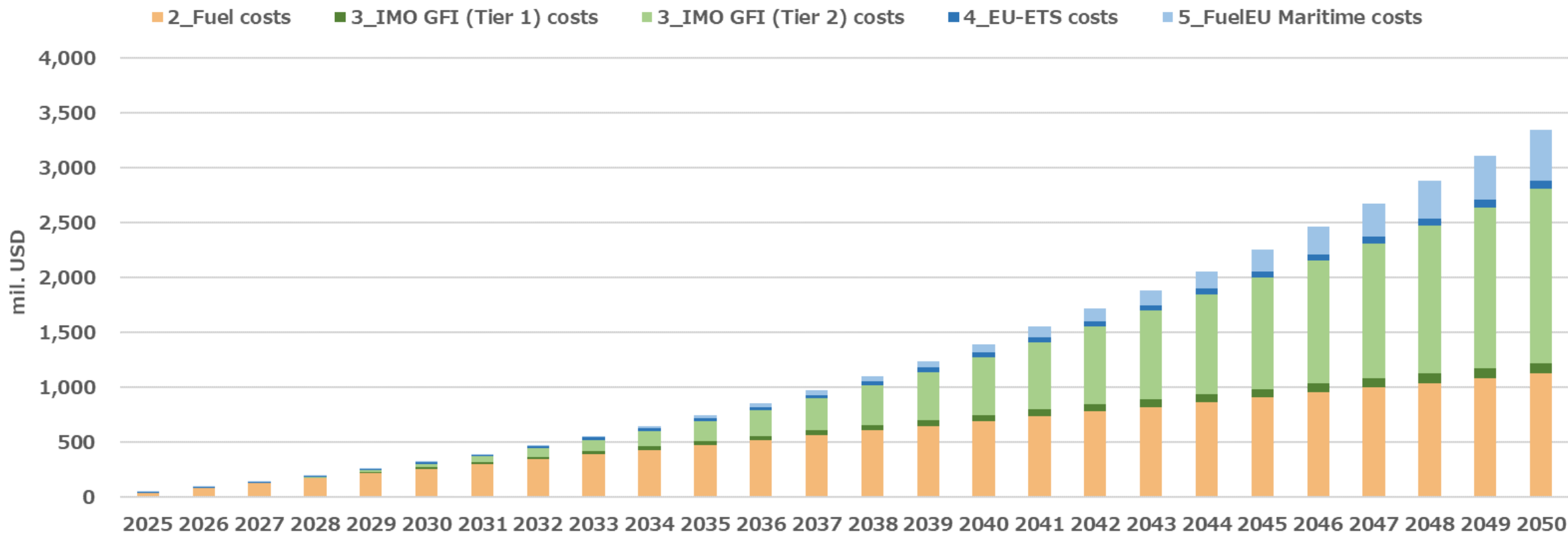
- In 2028, the total cost for the entire fleet (7 vessels) is USD 59,131,833, representing a 27.2% increase from 2027's total cost.
- If conventional fuel oil use continues, the fleet's total regulatory costs (IMO GFI, EU-ETS, FuelEU Maritime) will increase to a level comparable to fuel costs by 2033.
- If conventional fuel oil use continues, the fleet's total regulatory costs will increase to 4.5 times the fuel costs by 2050.

Estimation Results: Annual Total Costs (Details)

Unit: USD

Year	Fuel costs	IMO GFI (Tier 1) costs	IMO GFI (Tier 2) costs	EU-ETS costs	FuelEU Maritime costs	Total costs
2025	42,454,000	0	0	2,367,200	425,270	43,246,470
2026	42,454,000	0	0	2,385,600	455,900	45,295,500
2027	42,454,000	0	0	2,404,000	486,530	47,344,530
2028	42,454,000	6,388,270	6,375,000	2,422,400	517,160	58,146,830
2029	42,454,000	6,388,270	10,695,270	2,440,800	547,790	64,615,330
2030	42,454,000	6,388,270	15,010,500	2,459,200	578,420	71,940,390
2031	42,454,000	6,388,270	19,325,730	2,477,600	609,050	79,694,580
2032	42,454,000	6,388,270	23,640,960	2,496,000	639,680	87,448,780
2033	42,454,000	6,388,270	27,956,190	2,514,400	670,310	95,202,970
2034	42,454,000	6,388,270	32,271,420	2,532,800	700,940	102,957,160
2035	42,454,000	6,388,270	36,586,650	2,551,200	731,570	110,711,350
2036	42,454,000	6,388,270	40,901,880	2,569,600	762,200	118,465,540
2037	42,454,000	6,379,730	45,217,110	2,588,000	792,830	126,219,730
2038	42,454,000	6,388,270	49,532,340	2,606,400	823,460	133,973,920
2039	42,454,000	6,382,267	53,847,570	2,624,800	854,090	141,728,110
2040	42,454,000	6,379,730	58,162,800	2,643,200	884,720	149,482,300
2041	42,454,000	6,379,730	62,478,030	2,661,600	915,350	157,236,490
2042	42,454,000	6,382,267	66,793,260	2,680,000	945,980	164,990,680
2043	42,454,000	5,888,400	71,108,490	2,698,400	976,610	172,744,870
2044	42,454,000	5,775,407	75,423,720	2,716,800	1,007,240	180,499,060
2045	42,454,000	5,576,130	79,738,950	2,735,200	1,037,870	188,253,250
2046	42,454,000	5,227,000	84,054,180	2,753,600	1,068,500	196,007,440
2047	42,454,000	5,075,000	88,369,410	2,772,000	1,099,130	203,761,630
2048	42,454,000	5,026,000	92,684,640	2,790,400	1,129,760	211,515,820
2049	42,454,000	5,075,000	96,999,870	2,808,800	1,160,390	219,270,010
2050	42,454,000	5,026,000	101,315,100	2,827,200	1,191,020	227,024,200

Estimation Results: Cumulative Total Costs



• The cumulative total cost of the entire fleet (7 vessels) up to each year is as follows.

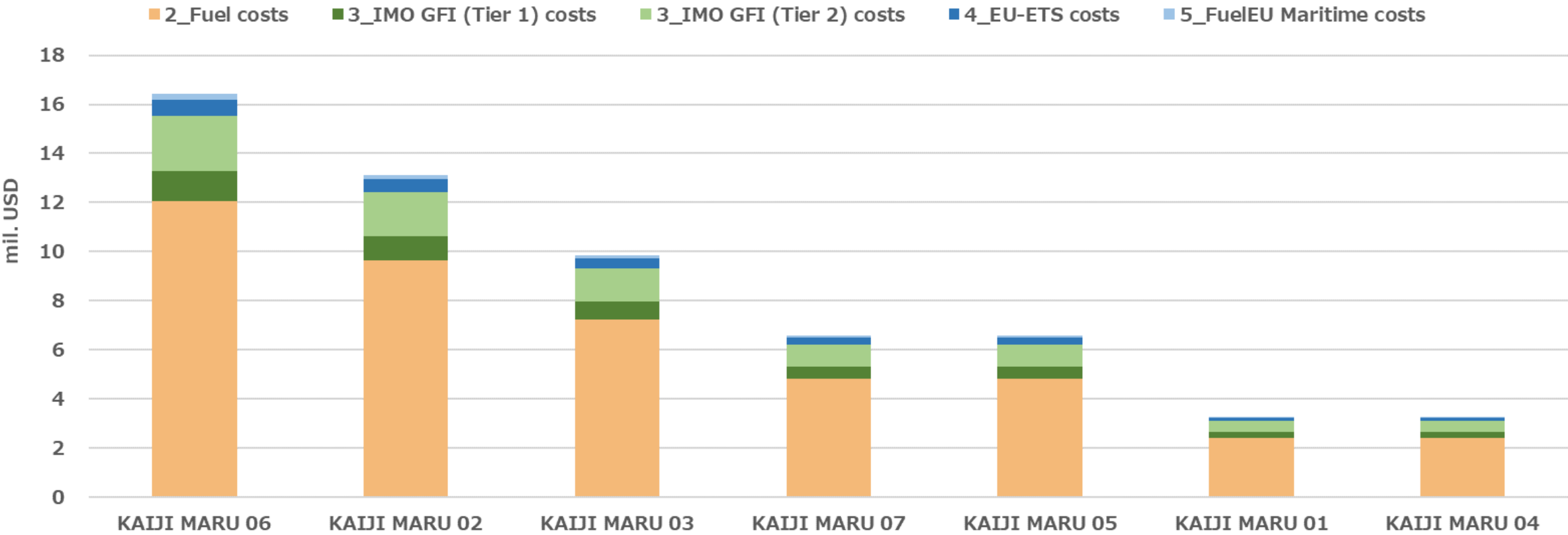
- ✓ 2030: USD 325,357,982
- ✓ 2040: USD 1,393,591,261
- ✓ 2050: USD 3,347,295,974

Estimation Results: Cumulative Total Costs (Details)

Unit: USD

Year	Fuel costs	IMO GFI (Tier 1) costs	IMO GFI (Tier 2) costs	EU-ETS costs	FuelEU Maritime costs	Total costs
2025	45,450,000	0	0	1,367,100	400,000	46,817,100
2026	46,450,000	0	0	1,460,000	1,300,000	47,810,000
2027	126,240,000	0	0	4,100,000	1,470,000	131,810,000
2028	177,660,000	6,980,170	6,170,000	6,700,700	1,860,700	193,371,570
2029	217,080,000	6,770,000	16,850,170	10,980,300	1,770,000	253,450,170
2030	260,490,000	11,000,000	10,000,000	11,450,470	6,100,000	301,040,870
2031	301,450,000	17,200,000	10,000,000	11,070,000	6,470,000	346,190,000
2032	347,100,000	11,000,000	70,000,000	16,000,000	11,000,000	455,100,000
2033	390,740,000	16,100,000	100,700,000	11,000,000	16,100,100	624,640,100
2034	436,000,000	16,700,000	100,000,000	11,000,000	17,100,700	670,800,700
2035	477,170,000	16,100,170	100,000,000	16,170,000	16,000,000	715,440,170
2036	516,000,000	16,000,000	110,000,000	16,000,000	16,000,000	768,000,000
2037	554,400,000	41,000,000	100,000,000	11,000,000	16,000,000	822,400,000
2038	597,800,000	46,200,000	100,000,000	11,000,000	46,200,000	8,000,700,000
2039	651,240,000	11,000,000	416,000,000	16,000,000	16,000,000	1,037,240,000
2040	696,000,000	16,000,000	110,000,000	41,000,000	70,700,000	1,033,700,000
2041	736,070,000	41,000,000	110,000,000	46,100,000	16,100,000	1,035,270,000
2042	780,400,000	46,000,000	706,000,000	47,100,000	110,000,000	1,719,500,000
2043	824,800,000	46,100,000	800,000,000	16,000,000	116,700,000	1,809,600,000
2044	866,100,000	70,000,000	800,000,000	11,700,000	116,000,000	1,863,800,000
2045	911,700,000	76,000,000	1,000,000,000	17,000,000	100,000,000	2,104,700,000
2046	950,700,000	70,000,000	1,117,000,000	46,000,000	100,000,000	2,283,700,000
2047	100,000,000	46,000,000	1,110,000,000	46,000,000	100,000,000	2,412,000,000
2048	1,000,000,000	46,000,000	1,000,000,000	47,000,000	100,000,000	2,093,000,000
2049	1,000,000,000	47,000,000	1,000,770,000	70,000,000	100,000,000	2,118,770,000
2050	1,100,000,000	46,000,000	1,000,100,000	70,000,000	46,000,000	2,362,200,000

Estimation Results: Total Costs In 2028 (By Vessel)



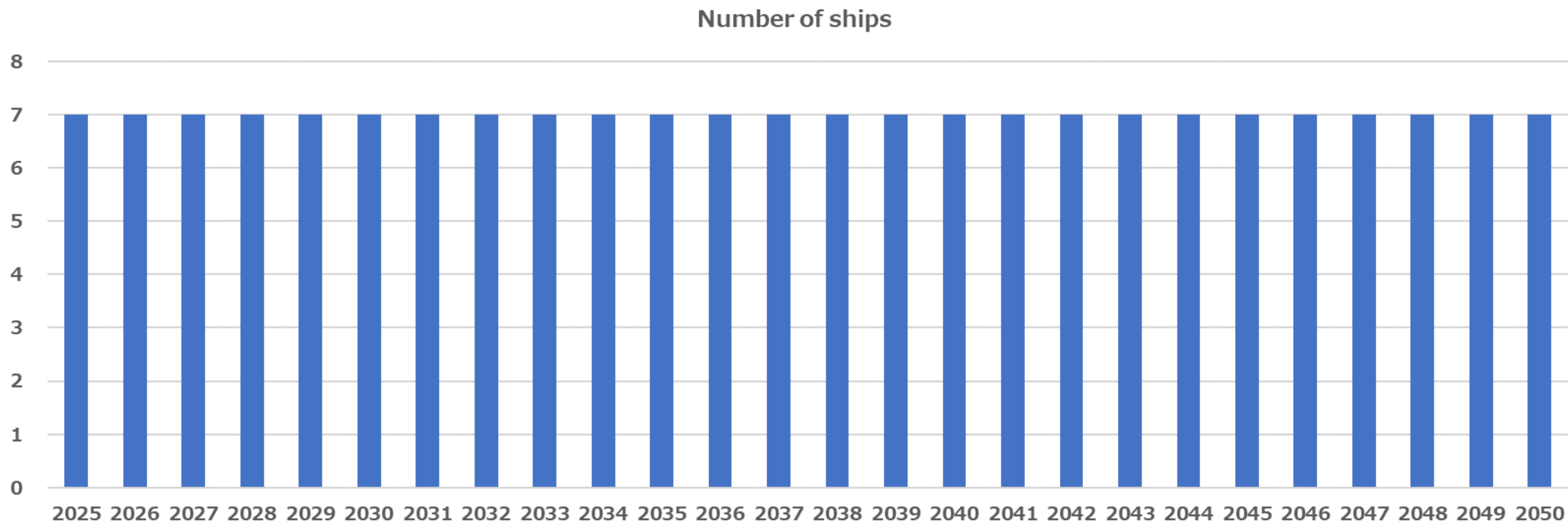
- MV "KAIJI MARU 06," which has the highest annual fuel consumption in the entire fleet, incurs the largest total cost.
- By reducing MV "KAIJI MARU 06V" annual GHG intensity through fuel conversion, it's possible to generate a greater surplus in compliance balance for IMO GFI and FuelEU Maritime.

Estimation Results: Total Costs In 2028 (By Vessel)

Unit: USD

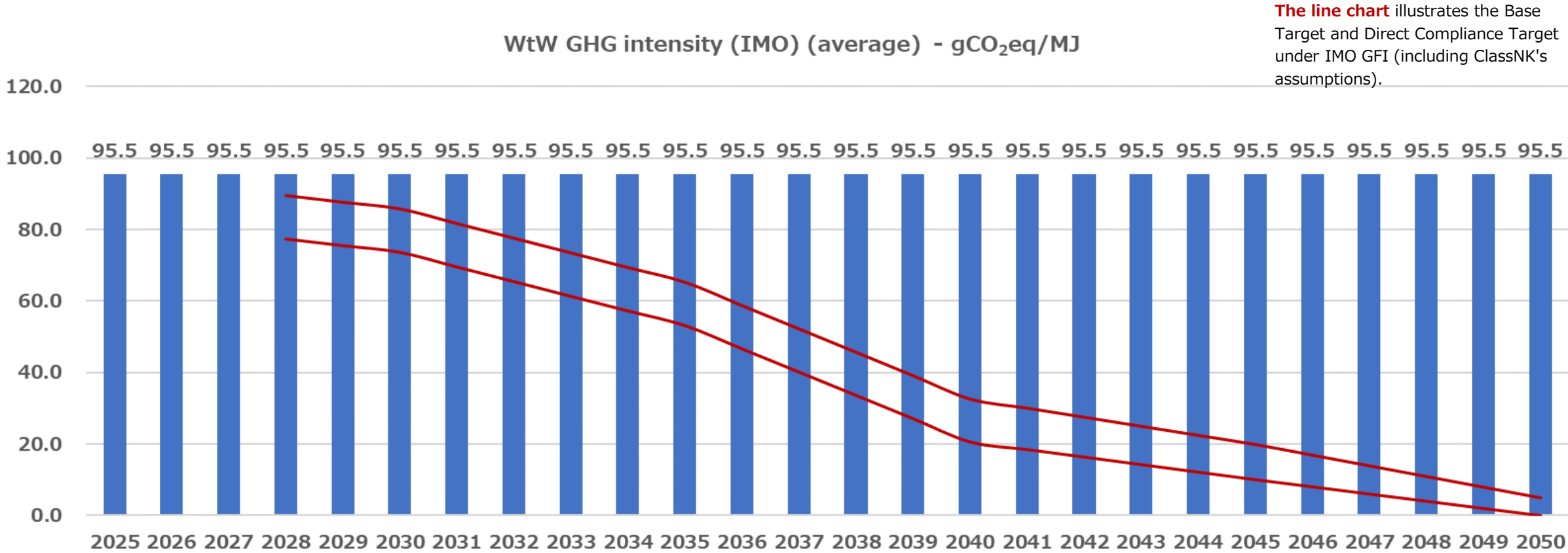
Ship name	Fuel costs	IMO GFI (Tier 1) costs	IMO GFI (Tier 2) costs	EU-ETS costs	FuelEU Maritime costs	Total costs
KAIJI MARU 06	1,000,000	1,000,000	1,000,000	1,000,000	100,000	5,000,000
KAIJI MARU 02	1,000,000	1,000,000	1,000,000	1,000,000	100,000	5,000,000
KAIJI MARU 03	1,000,000	1,000,000	1,000,000	1,000,000	100,000	5,000,000
KAIJI MARU 07	1,000,000	1,000,000	1,000,000	1,000,000	100,000	5,000,000
KAIJI MARU 05	1,000,000	1,000,000	1,000,000	1,000,000	100,000	5,000,000
KAIJI MARU 04	1,000,000	1,000,000	1,000,000	1,000,000	100,000	5,000,000
KAIJI MARU 01	1,000,000	1,000,000	1,000,000	1,000,000	100,000	5,000,000

For Reference



- The number of ships was 7 at the time of the cost simulation.
- The number of ships is assumed to be maintained until 2050 for the estimation.
- Each vessel's lifespan is assumed to be 20 years, and vessels exceeding this lifespan are assumed to be replaced with new vessels of the same type, size, and fuel engine, with no energy efficiency improvement.

For Reference: Fleet GHG Intensity (IMO GFI)

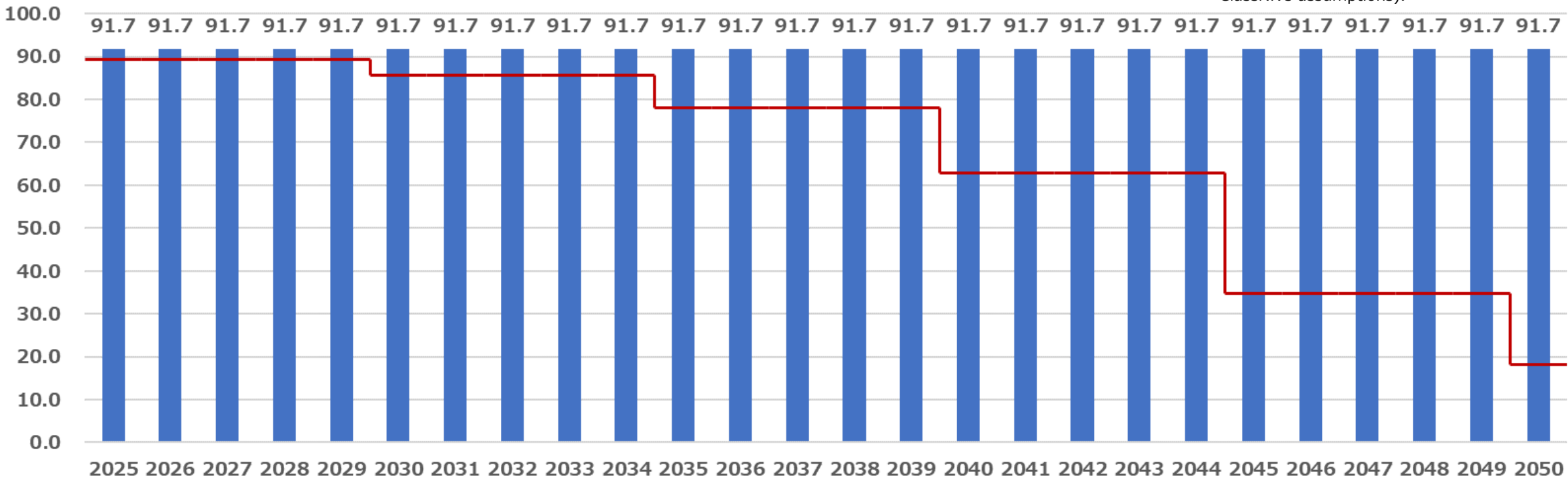


- The fleet's average GHG intensity was estimated based on each vessel's 2024 fuel consumption data (using conventional fuel oil only), assuming all vessels exclusively use HFO (Heavy Fuel Oil) with a sulfur content of 0.5% or less.
- If all vessels exclusively use HFO (with a sulfur content of 0.5% or less), the fleet's average GHG intensity under IMO GFI will be 95.48408 gCO₂eq/MJ.
- By 2028, when IMO GFI is introduced, the fleet's average GHG intensity resulted in exceeding IMO GFI's limit.

For Reference: Fleet GHG Intensity (FuelEU Maritime)

WtW GHG intensity (FuelEU Maritime) (average) - gCO₂eq/MJ

The line chart illustrates the GHG intensity limit under FuelEU Maritime (including ClassNK's assumptions).



- The fleet's average GHG intensity was estimated based on each vessel's 2024 fuel consumption data (using conventional fuel oil only), assuming all vessels exclusively use HFO.
- If all vessels exclusively use HFO, the fleet's average GHG intensity under FuelEU Maritime will be 91.74420 gCO₂eq/MJ.
- This results in the fleet's average GHG intensity exceeding FuelEU Maritime's limits by 2025, when FuelEU Maritime enter into force.

Assumptions

Assumptions: Fleet Data

No.	IMO No.	Ship name	Ship type	GT	DWT	Year built	Main engine	Fuel consumptions [tonne HFOeq]
1	1000001	KAIJI MARU 01	Bulk carrier	36,000	64,000	2015	Conventional fuel oil	5,000
2	1000002	KAIJI MARU 02	Containership	130,000	150,000	2018	Conventional fuel oil	20,000
3	1000003	KAIJI MARU 03	Crude oil tanker	150,000	300,000	2020	Conventional fuel oil	15,000
4	1000004	KAIJI MARU 04	Product/Chemical tanker	30,000	50,000	2020	Conventional fuel oil	5,000
5	1000005	KAIJI MARU 05	LPG carrier	53,000	60,000	2022	Conventional fuel oil	10,000
6	1000006	KAIJI MARU 06	LNG carrier	110,000	100,000	2025	Conventional fuel oil	25,000
7	1000007	KAIJI MARU 07	Vehicle carrier	80,000	30,000	2025	Conventional fuel oil	10,000

Simulation period	2025 – 2050
Vessel's lifetime	Until 2050
Fuel type and consumption	Based on 2024 fuel consumption data: <ul style="list-style-type: none">✓ Fuel type: same as 2024✓ Fuel consumption volume: same as 2024 (HFO base)
Annual energy efficiency improvement	Not considered
Use of pilot fuel	Not considered
IMO GFI	<ul style="list-style-type: none">✓ Contribution unit price (Tier 2): Constant at 380 USD/tonneCO₂eq until 2050✓ Contribution unit price (Tier 1): Constant at 100 USD/tonneCO₂eq until 2050✓ Unit price for transferring Surplus Units to other vessels: 380 USD/tonneCO₂eq✓ Reward: Not considered
Share subject to EU Regulations	10% of all voyages
EUA price (EU-ETS)	Starting at 70.0 EUR/tonneCO ₂ eq (2025), increasing by 2.0% year-over-year
Exchange rate	Constant at 0.89 EUR/USD

	2025	2030	2035	2040	2045	2050	備考
HFO	12 USD/MT (+40% +100%+)	12 USD/MT	12 USD/MT	12 USD/MT	12 USD/MT	12 USD/MT	燃料費40%
Biodiesel (B30)	28.0	24.2	20.9	20.9	20.4	24.2	+3%
Biodiesel (B100)	30.0	26.2	22.9	22.4	21.6	25.8	+3%
LNG	15.0	15.0	15.0	15.0	15.0	15.0	+0%
bio-methane	25.0	27.6	30.9	33.6	37.1	41.0	+3%
e-methane	75.0	60.1	51.6	44.2	38.1	32.7	-3%
Gray methanol	18.0	18.0	18.0	18.0	18.0	18.0	+0%
bio-methanol	40.0	34.2	29.0	24.2	20.1	16.2	-3%
e-methanol	40.0	31.5	24.2	18.0	12.6	8.0	-3%
Gray ammonia	26.0	26.0	26.0	26.0	26.0	26.0	+0%
e-ammonia	75.0	58.0	44.9	34.7	26.9	20.8	-3%

- The fuel prices are reference values based on ClassNK's research and do not guarantee the accuracy of the fuel prices.
- Biodiesel prices are expected to rise significantly due to demand competition among conventional fuel vessels.
- Similarly, bio-methane and bio-methanol are unlikely to see substantial price drops.
- For e-fuels (e-methane, e-methanol, e-ammonia), a price decline is anticipated with the wider adoption of green hydrogen as a raw material, with this trend expected to be particularly pronounced for e-ammonia, given its abundant production projects.

	IMO GFI	FuelEU Maritime
HFO	95.48408 gCO ₂ eq/MJ	91.74420 gCO ₂ eq/MJ
Biodiesel (B30)	75.92110	70.67229
Biodiesel (B100)	22.11989	16.38352
LNG (Otto dual fuel slow speed)	85.33134	82.86808
bio-methane (Otto dual fuel slow speed)	28.70968	27.37945
e-methane (Otto dual fuel slow speed)	19.53968	18.16808
Gray methanol	102.86281	103.15377
bio-methanol	12.86734	13.14450
e-methanol	12.46734	12.95377
Gray ammonia	123.63978	123.95108
e-ammonia	12.63978	12.95108

Note: The Well-to-Wake GHG intensity values for each fuel are assumed to remain constant until 2050. The difference in Well-to-Wake GHG intensity values between IMO GFI and FuelEU Maritime is due to variations in the emission factors, calorific values, and Global Warming Potential (GWP) values applied during calculation. Regarding GWP values, IMO GFI uses IPCC AR5 values based on IMO LCA Guidelines, while FuelEU Maritime uses IPCC AR4 values based on FuelEU Maritime regulations.

Assumptions: Well-to-Wake GHG Intensity Limits

Year	IMO GFI				FuelEU Maritime	
	Base target	Reduction rate from baseline	Direct compliance target	Reduction rate from baseline	GHG intensity limits	Reduction rate from baseline
2028	89.56800 gCO ₂ eq/MJ	4.0 %	77.43900 gCO ₂ eq/MJ	17.0 %	89.33680 gCO ₂ eq/MJ	2.0 %
2029	87.70200	6.0	75.57300	19.0	89.33680	2.0
2030	85.83600	8.0	73.70700	21.0	85.69040	6.0
2031	81.73080	12.4	69.60180	25.4	85.69040	6.0
2032	77.62560	16.8	65.49660	29.8	85.69040	6.0
2033	73.52040	21.2	61.39140	34.2	85.69040	6.0
2034	69.41520	25.6	57.28620	38.6	85.69040	6.0
2035	65.31000	30.0	53.18100	43.0	77.94180	14.5
...
2040	32.65500	65.0	20.61930	77.9	62.90040	31.0
...
2045	19.96620	78.6	10.07640	89.2	34.64080	62.0
...
2050	5.03820	94.6	0.00000	100.0	18.23200	80.0

Note: The figures in red are ClassNK's assumptions (not yet decided by the IMO). For the values of the Base target and Direct compliance target in the IMO GFI for 2035 and beyond, linear interpolation is used based on ClassNK's assumptions.

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A person wearing a white lab coat is pointing their right index finger at a map on a desk. The map shows various colored lines and shapes. Overlaid on the image is the text 'THANK YOU' in a bold, blue, sans-serif font. The word 'THANK' is on the left, 'YOU' is on the right, and a large blue circle is positioned between them, centered over the person's hand. A horizontal blue line passes through the center of the circle, separating the 'N' from the 'K'.

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