Clean Cargo

A Smart Freight Centre Partnership

2021 Global Ocean Container Greenhouse Gas Emission Intensities

Smart Freight Centre. Clean Cargo 2021 Global Ocean Container Greenhouse Gas Emission Intensities. June 2022.

Disclaimer
The information presented in this publication is based on analyses conducted by Smart Freight Centre staff and does not necessarily reflect the views of the Board of Trustees of Smart Freight Centre. Smart Freight Centre does not guarantee the accuracy of the content included in this publication and does not accept any responsibility for consequences of its use.

About Smart Freight Centre

Smart Freight Centre is an international non-profit organization focused on reducing greenhouse gas emissions from freight transportation. Smart Freight Centre's vision is an efficient and zero emission global logistics sector. Smart Freight Centre's mission is to collaborate with the organization's global partners to quantify impacts, identify solutions, and propagate logistics decarbonization strategies. Smart Freight Centre's goal is to guide the global logistics industry in tracking and reducing the industry's greenhouse gas emissions by one billion tonnes by 2030 and to reach zero emissions by 2050 or earlier, consistent with a 1.5°C future.

About Clean Cargo

Clean Cargo is a collaborative initiative between ocean container carriers, freight forwarders, and cargo owners.

Clean Cargo serves as a source of high-quality containership greenhouse gas emission performance information that supports members in their work to decarbonize containerized ocean cargo transportation. Specifically, the Clean Cargo secretariat collects operational and technical data from ocean container carriers to generate containership emission performance information that:

- **Facilitates accurate greenhouse gas emissions inventory calculations for Clean Cargo members.**
- **Guides member companies in making educated ocean freight procurement decisions.**

Clean Cargo also serves as a forum for decarbonization best practice sharing amongst members.

2021 Greenhouse gas emission performance information

The emission performance information presented in this report is calculated according to the Clean Cargo methods for a series of Clean Cargo ocean container transportation trade lanes. The information in Table 1 represents average annual performance[1] across all reporting Clean Cargo ocean container carrier members. For 2021, there were 18 reporting Clean Cargo carriers. These carriers were responsible for approximately 78% of global ocean container freight capacity (by volume).

Clean Cargo emission intensities are based on emission factors that incorporate greenhouse gas emissions resulting from all United Nations Framework Convention on Climate Change Kyoto Protocol greenhouse gases (currently, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6), and nitrogen trifluoride (NF_3)). The emission factors that underly the Clean Cargo emission intensities include emissions associated with the entire life cycle of the production and use of each energy source[2].

Clean Cargo greenhouse gas emission intensities shown in Table 1:

- **Are calculated based on each vessel's nominal capacity, assuming a 70% vessel capacity utilization factor.**
- **Differentiate between emission intensities for refrigerated cargo (refrigerated) and non-refrigerated cargo (dry) based on each vessel's nominal refrigerated container capacity and the vessel's reported number of days of operation.**
- **Reflect emissions associated with the entire life cycle of the fuel consumed in the carriers' vessels (that is, the Table 1 emission intensities are "Well to Wake" intensities).**

Clean Cargo carrier member data used in calculating the emission intensities undergoes third-party verification.

Additional information on the methods behind the emission intensities included in Table 1 is accessible here.

1 Ocean cargo shippers and freight forwarders interested in carrier-specific emission performance information are welcome to contact Smart Freight Centre at info@smartfreightcentre.org to learn more about membership in Clean Cargo.

2 Except in selected instances, where the emission intensities will be clearly marked "Tank to Wake," or "TTW."

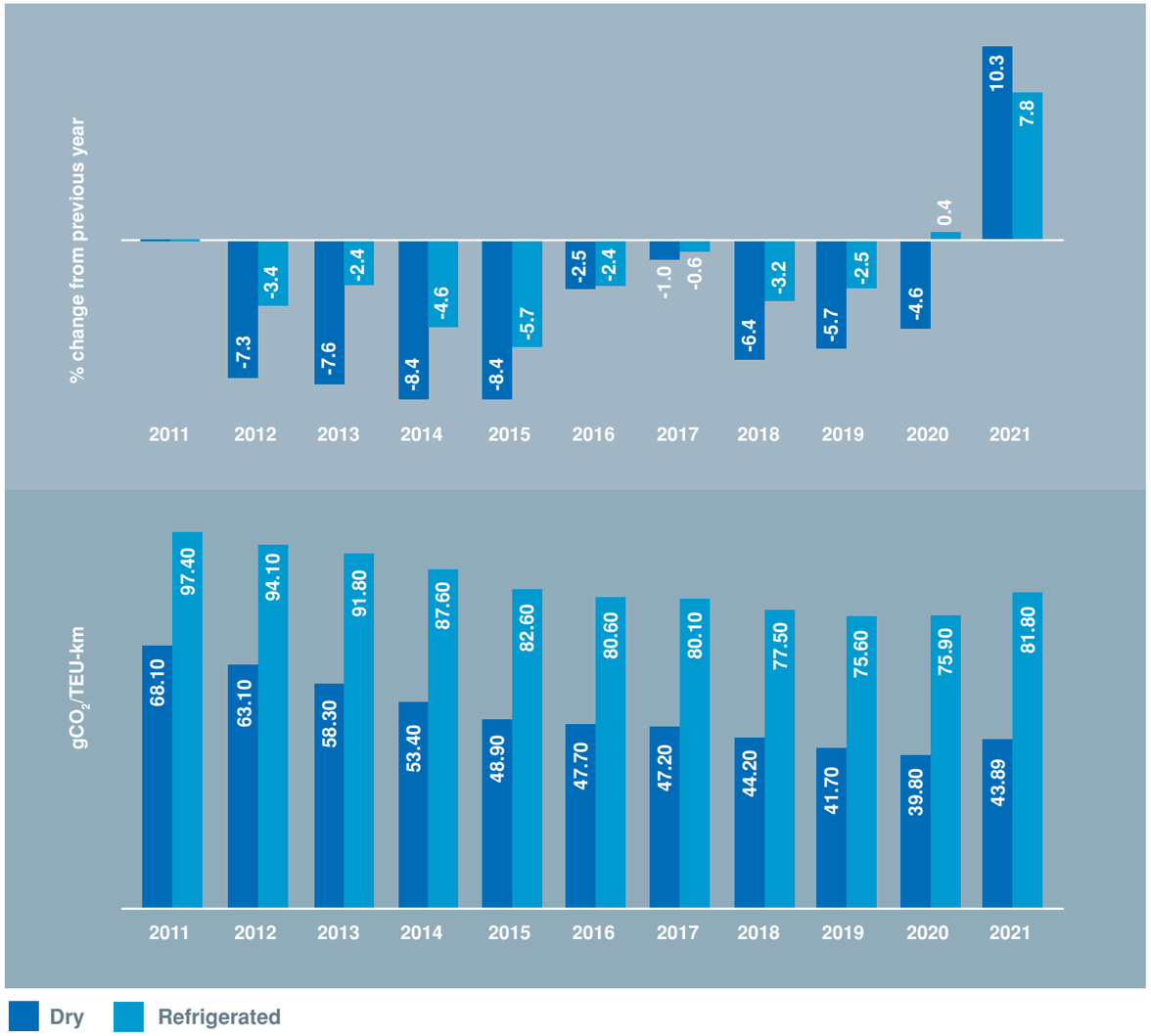
Table 1 Average carrier dry and refrigerated container emission intensities in grams of carbon dioxide equivalent per twenty foot equivalent unit-kilometer (gCO_2e/TEU-km). Intensities reflect Well to Wake emission factors and assume 70% vessel capacity utilization.

	2021 Number of vessels: 3,737		2020 Number of vessels: 3,740		2019 Number of vessels: 3,493		2018 Number of vessels: 3,275	
TRADE LANE	Dry	Refrigerated	Dry	Refrigerated	Dry	Refrigerated	Dry	Refrigerated
Asia to-from Africa	87.7	155.4	75.3	143.5	74.3	133.1	72.9	128.4
Asia to-from Mediterranean/Black Sea	48.0	111.4	46.6	104.7	50.3	104.8	56.9	108.9
Asia to-from Middle East/India	73.7	137.5	60.5	121.3	56.2	111.1	64.0	116.9
Asia to-from North America East Coast/Gulf	64.7	120.4	57.8	111.6	60.2	107.4	63.7	111.1
Asia to-from North America West Coast	71.3	138.2	64.1	121.7	67.1	116.5	71.0	120.1
Asia to-from North Europe	42.3	102.0	44.1	100.5	42.3	93.1	43.4	92.1
Asia to-from Oceania	100.7	168.6	88.4	149.2	86.4	138.6	89.4	141.5
Asia to-from South America (Including Central America)	71.5	125.9	63.1	118.2	60.5	109.9	63.4	111.7
Europe (North and Mediterranean) to-from Africa	102.2	174.0	100.2	171.3	100.9	164.9	91.6	151.8
Europe (North and Mediterranean) to-from South America (Including Central America)	79.6	139.7	68.8	126.2	67.4	121.2	77.5	132.5
Europe (North and Mediterranean) to-from Middle East/India	68.5	132.6	58.9	119.2	55.8	108.3	58.5	111.5
Europe (North and Med) to-from Oceania (via Suez/via Panama)	82.8	139.5	81.9	138.7	80.0	131.2	94.5	146.5
Mediterranean/Black Sea to-from North America East Coast/Gulf	88.4	154.0	77.1	139.2	80.1	136.6	89.1	143.9
Mediterranean/Black Sea to-from North America West Coast	62.3	131.1	71.9	129.9	77.8	134.4	96.5	153.9
North America East Coast/Gulf/West Coast to-from Africa	134.2	193.5	124.3	201.1	138.9	190.7	53.4	133.4
North America East Coast/Gulf/West Coast to-from Oceania	109.7	173.7	103.5	156.	106.4	156.7	111.0	158.9
North America East Coast/Gulf/West Coast to-from South America (Including Central America)	91.6	156.5	82.5	143.2	82.3	134.7	89.8	141.7
North America East Coast/Gulf/ West Coast to-from Middle East/India	79.9	137.7	70.9	125.9	66.0	115.9	74.0	121.1
North Europe to-from North America East Coast/Gulf	92.2	159.5	84.5	144.4	86.9	141.1	88.8	141.1
North Europe to-from North America West Coast	88.6	170.0	75.9	134.2	64.0	117.5	70.6	122.9
South America (Including Central America) to-from Africa	110.6	186.8	122.4	200.0	115.9	174.0	68.6	118.5
Intra Africa	135.2	233.0	127.1	219.0	118.3	201.2	115.7	186.9
Intra North America East Coast/Gulf/West Coast	171.5	233.7	177.6	241.8	143.2	203.3	118.2	175.8
Intra South America (Including Central America)	108.4	176.0	103.9	177.0	103.1	169.9	112.2	181.3
South East Asia to-from North East Asia	98.1	168.3	84.0	148.4	91.3	150.6	94.5	154.5
Intra North East Asia	118.9	187.8	103.5	182.8	101.7	173.7	72.5	129.2
Intra South East Asia	117.4	193.2	112.5	194.2	102.6	176.8	109.3	178.9
North Europe to-from Mediterranean/Black Sea	104.2	173.9	95.8	160.1	98.8	158.0	103.3	163.0
Intra Mediterranean/Black Sea	148.2	250.2	134.3	239.4	128.3	220.6	100.2	174.3
Intra North Europe	143.3	233.2	138.4	221.6	139.8	221.4	98.3	162.7
Intra Middle East/India	126.1	233.2	108.9	197.1	95.9	171.6	96.7	169.5
Other	106.7	179.2	110.9	182.5	78.3	139.9	68.2	120.5
Average Across all Trade Lanes	74.4	138.3	66.4	126.5	66.2	120.1	70.6	123.5

Figure 1 2011-2021 trend in global average Clean Cargo carrier emission intensities. Intensities reflect Tank to Wake emission factors and assume 100% vessel capacity utilization.

Emission intensity trends

Clean Cargo carrier carbon dioxide emission intensities for 2021, when averaged across all reporting carriers across all trade lanes, were approximately 10% (dry) and 8% (refrigerated) higher than the 2020 emission intensities.[3]



3 For most of the years between 2011 and 2021, Clean Cargo emission intensities were reported based on CO_2 (versus CO_2e), Tank to Wake emission factors, assuming 100% vessel capacity utilization. As such, the percent change information discussed here – and the information shown in Figure 1 – reflects Tank to Wake CO_2 emissions and a 100% vessel capacity utilization factor.

Potential drivers of the intensity changes

The increased fleetwide average greenhouse gas emission intensity for 2021 is likely the result of numerous overlapping factors. It is difficult to determine the contribution of each factor to the increased intensity without conducting a detailed analysis of global container fleet activities in 2021. However, some contributing factors could include:

- **An increase in average containership speed from 2020-2021. Increases in vessel speeds above a certain threshold can be associated with decreases in the energy efficiency (per transport activity) of a vessel.**
- **An increased use of low sulfur (liquid) fuels by reporting companies from 2020-2021. Low sulfur liquid fuels, in general, are associated with higher greenhouse gas emission factors than the heavy fuel oils that were more widely used before entry into force of a global sulfur cap in early 2020[4].**
- **Port delays. Vessels sitting at anchor awaiting a berth may consume fuel (e.g., to power refrigerated containers and to serve vessel hotel loads) while not conducting transport activity (i.e., not physically moving cargo). Increasing fuel consumption without increasing transport activity could increase a vessel's greenhouse gas emission intensity.**

Using the 2021 emission performance intensities

For further information on how to apply the 2021 Clean Cargo greenhouse gas emission intensities in greenhouse gas emission footprint calculations, please see the Global Logistics Emissions Council Framework.

4 Heavy fuel oil represented approximately 44% of the total fuel consumption by reporting carriers in 2020. In 2021, heavy fuel oil represented approximately 27% of the total fuel consumption by reporting carriers. The reduced consumption of heavy fuel oil in 2021 was associated with an increase in consumption of lower sulfur liquid fuels in 2021 (liquid natural gas consumption represented approximately 1% of the fuel consumed by reporting carriers in both 2020 and 2021).

Clean Cargo

Information

For more information on Smart Freight Centre or Clean Cargo, please visit our website at www.smartfreightcentre.org.

You can also contact Smart Freight Centre directly by email at info@smartfreightcentre.org, or by phone at +31 6 4695 4405.