German, Italian and Latin American consortium for resource efficient logistics hubs & transport

Emission intensity factors for logistics hubs

by Kerstin Dobers (Fraunhofer IML)[1], Sara Perotti (Politecnico di Milano) and Andrea Fossa (GreenRouter)
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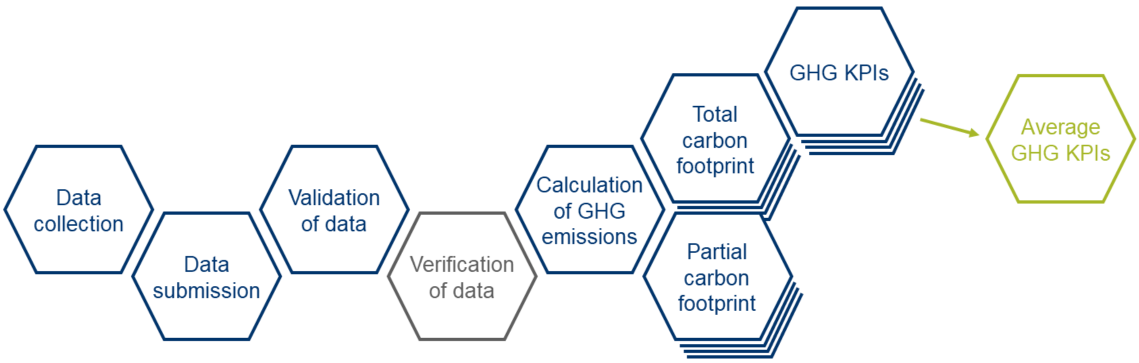
To overcome the data gap on operational greenhouse gas (GHG) emissions of logistics hubs, the international partners of the GILA project[i] – Fraunhofer IML, Politecnico di Milano, GreenRouter and Universidad de los Andes – organized market studies to update their initial data base on carbon emission intensity values of logistics sites. This document summarizes the approach and outcomes of the 2022 market study[ii] with the focus on logistics sites offering storage and/or transhipment as well as liquid bulk terminals.

Data collected by each institution were processed, anonymised and finally merged into one database that allowed to elaborate the collected information. The method adopted for the first 2021 market study[iii] was replicated and further refined for the 2022 market study. As a result, the 2022 database covers 605 logistics hubs and terminals from 44 countries worldwide, 82% of them located in Europe. Their operators have provided annual information on energy consumption, refill of refrigerants, as well as throughput and logistical area indoors. The assessment scope used for calculating average emission intensity values is in accordance with the "Guide for Greenhouse Gas Emissions Accounting at Logistics Sites"[iv] and considers requirements of the ISO/FDIS 14083[v]. As shown in the following process chart, the collected data was validated as regards to completeness and outliers; a detailed verification of each individual site is not included. For the elaboration of average GHG KPIs, only sites establishing a total carbon footprint calculation were considered.



Due to varying data availability and quality (e.g. completeness of consumption data according to assessment scope, provision of base units throughput and size), a reduced number of 310 sites has been used to calculate emission intensity values per site. This database differentiates four site types, i.e.

(1) Sites where transhipment is the main service (>80 % of volume)

(2) Sites where both transhipment and warehousing are relevant services

(3) Sites where warehousing is the main service (>80 % of volume), and

(4) Liquid bulk terminals.

[1] Contact: Dr. Kerstin Dobers, Fraunhofer Institute for Material Flow and Logistics IML (Germany), kerstin.dobers@iml.fraunhofer.de

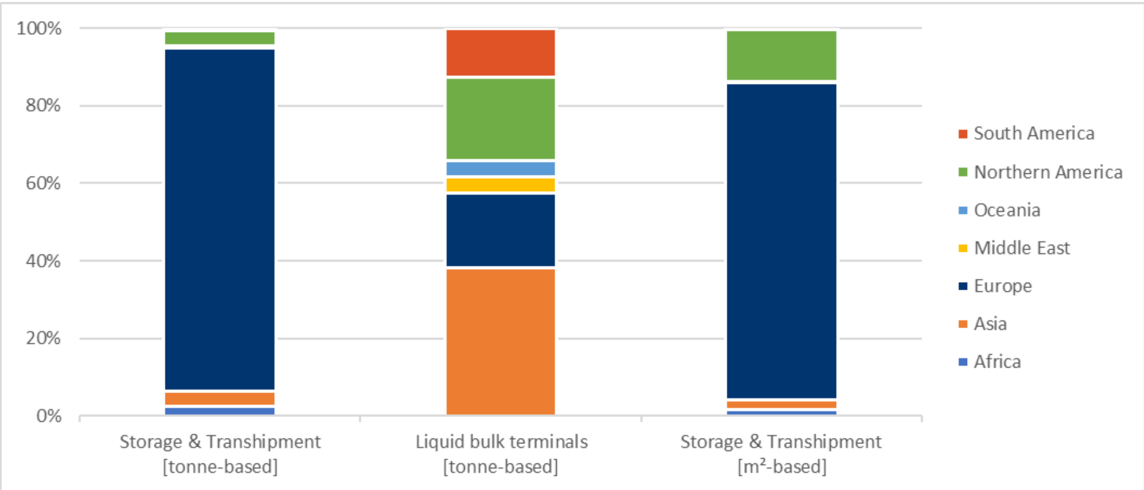
As an additional categorization, the site conditions have been used by differentiation between ambient, chilled, frozen, or mixed sites.

The site sizes vary from 18 tonnes to 1.3 million tonnes outbound with 70 000 tonnes as median value for storage and transhipment sites and 500 to 108 Mio tonnes with a median value of 700 000 tonnes for liquid bulk terminals. A third of the operators specified a site-specific electricity mix. However, only an average national emission factor for the relevant year was used for calculating the average emission intensity value as specified in the table below. Natural gas is the main heating energy source, liquid bulk terminals also use steam for heating purposes. Energy sources for non-electrified material handling are diesel, biodiesel, LNG, or LPG. The refrigerant types R-717, R-404A and R-410A are the most frequently used ones as specified by the participating sites.

The following tables summarize the results of average GHG emission intensity values of the sample size, allocated to one of the defined site types. The relevant sample size per site type is outlined in brackets. The underlying regional coverage of the sample size is provided as well.

Logistics site emission intensity values for different types (tonne-based)

	Ambient		Mixed	
Transhipment	0.5 kg CO_2e / t	(55)	3.6 kg CO_2e / t	(4)
Storage + transhipment	2.1 kg CO_2e / t	(45)	11.1 kg CO_2e / t	(7)
Warehouse	27.8 kg CO_2e / t	(36)	26.8 kg CO_2e / t	(8)
Liquid bulk terminals	3.7 kg CO_2e / t	(21)	6.4 kg CO_2e / t	(26)



Regional coverage of elaborated emission intensity values

Logistics site emission intensity values for different types (square meter-based)

	Ambient		Mixed	
Transhipment	10.2 kg CO_2e / m^2	(58)	55.3 kg CO_2e / m^2	(7)
Storage + transhipment	14.4 kg CO_2e / m^2	(79)	22.6 kg CO_2e / m^2	(18)
Warehouse	12.6 kg CO_2e / m^2	(60)	14.9 kg CO_2e / m^2	(20)

	Chilled		Frozen	
Storage + transhipment	58.8 kg CO_2e / m^2	(13)	61.9 kg CO_2e / m^2	(4)

Considering the constrained sample size, further interpreting the data at this point looks inappropriate. It is crucial to emphasize the relevance for further research to establish useful average emission intensity values for logistics sites in the future, instead.

In **March 2023** we start the **next market study** for extending the sample size, data collection ends on May 31st. A consolidated analysis and elaboration of updated KPIs is planned for summer 2023, which combines all data sets from the international market studies performed until then.

For participating in this work, please contact us!
Updates are published on https://reff.iml.fraunhofer.de/.

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[i] Project information available at https://www.iml.fraunhofer.de/en/fields_of_activity/logistics--traffic--environment/environment_and_resource_logistics/project--gila---german--italian---latin-american-consortium-for-.html

[ii] Dobers, K.; Fossa, A.; Perotti, S.; Jarmer, J.P. Energy efficiency and GHG emission intensity values for logistics sites. GILA webinar. 02.02.2023. https://reff.iml.fraunhofer.de/

[iii] Dobers, K.; Fossa, A.; Perotti, S.; Jarmer, J.P. Energy efficiency and GHG emission intensity values for logistics sites. GILA webinar. 03.02.2022.

[iv] Dobers, K.; Rüdiger, D.; Jarmer, J.P. Guide for Greenhouse Gas Emissions Accounting at Logistics Sites. 2018. ISBN 978-3-8396-1434-1. http://publica.fraunhofer.de/documents/N-532019.html

[v] ISO/DIS 14083. Greenhouse gases – Quantification and reporting of greenhouse gas emissions arising from transport chain operations. https://www.iso.org/standard/78864.html