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

Alliance for Logistics Innovation through Collaboration in Europe

SUSTAINABILITY AND GHG PERFORMANCE AT LOGISTICS HUBS

Joint webinar of the GILA project and ETP ALICE
12 October 2023 | 15:30 – 17:00 CET

- GHG emissions quantification of logistics sites aligned with ISO 14083
  Jan-Philipp Jarmer, Fraunhofer IML
- Annual market studies & overall GHG performance indicators for logistics hubs
  Andrea Fossa, GreenRouter & Kerstin Dobers, Fraunhofer IML
- Possible solutions for decarbonising logistics hubs
  Sara Perotti, Politecnico di Milano
- Sustainability of hubs: a key driver for maintaining value over time
  Scarlet Romano, Arcadis Germany

Data base for the elaboration of average key performance indicators

based on three GILA market studies(1) consolidated

Info on sample size

843 hubs

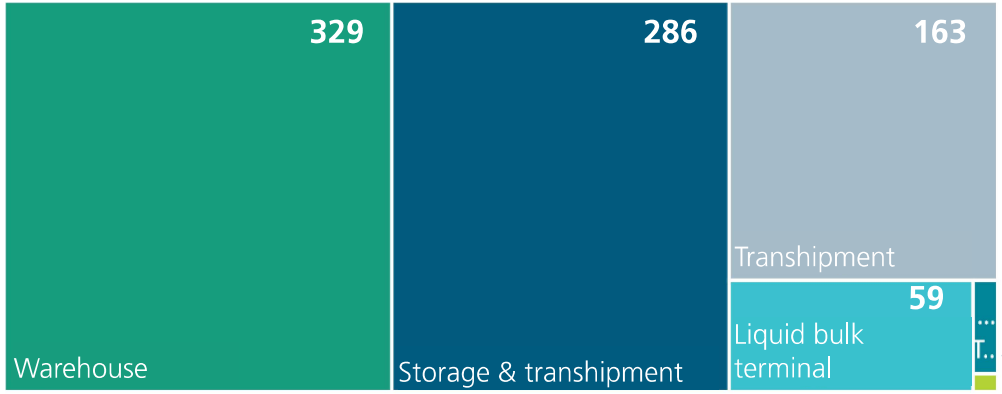
51 countries worldwide

> 15.48 Mio. m² logistical area (indoors)(2) — 696

Real estates(2): > 5.1 bill. tons (outbound) — 334

Terminals(3): > 2.4 bill. tons (outbound) — 60

Countries with >50 hubs: Germany, Italy, Czech Republic, Spain, France, USA



5 Container terminals & 1 RoRo terminal

(1) conducted in 2021, 2022 and 2023
(2) Hubs with storage and/or transhipment
(3) Terminals (container, liquid bulk)

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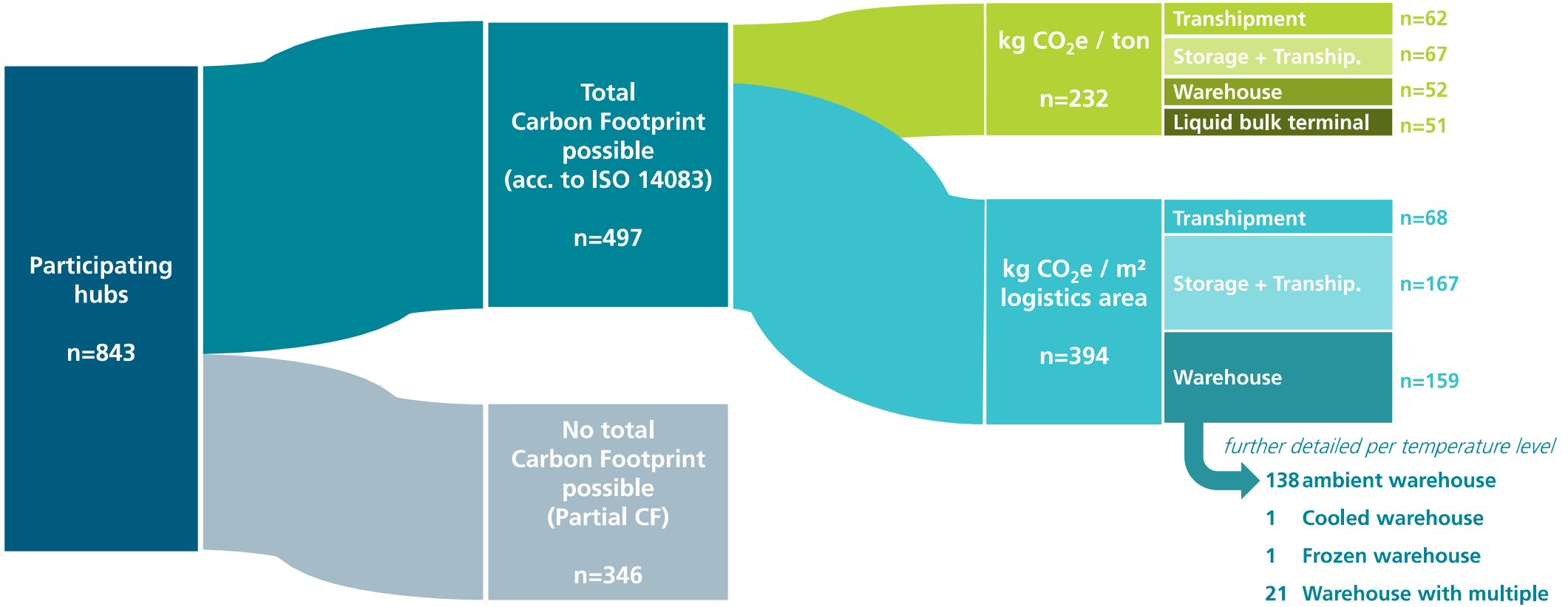
Completeness of provided data

Number of participating hubs & sample size for KPIs



Conclusion: Further market studies necessary

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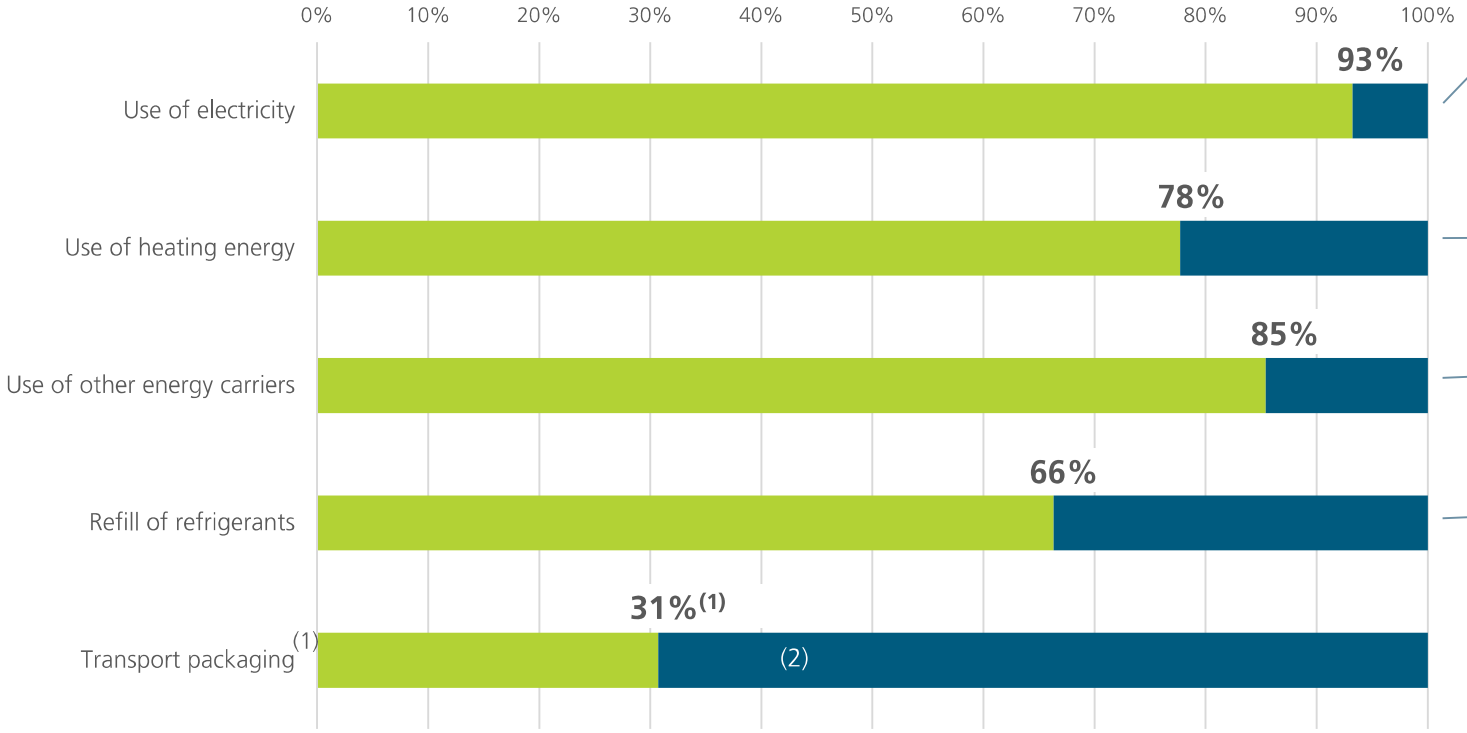
Where do data gaps exist?

Availability of data



60% of hubs use national electricity mix
32% purchase „green“ tariff, though do not now the underlying mix

esp. natural gas (83% of hubs), district heating and heating oil

esp. diesel/biodiesel (91%), petrol/ethanol and propane

esp. R-410A, R-717 (ammoniac), R-404A, R-134a, R-448a and R-744

843

(1) optional information in market study
(2) no information or explicitly stated that no information available

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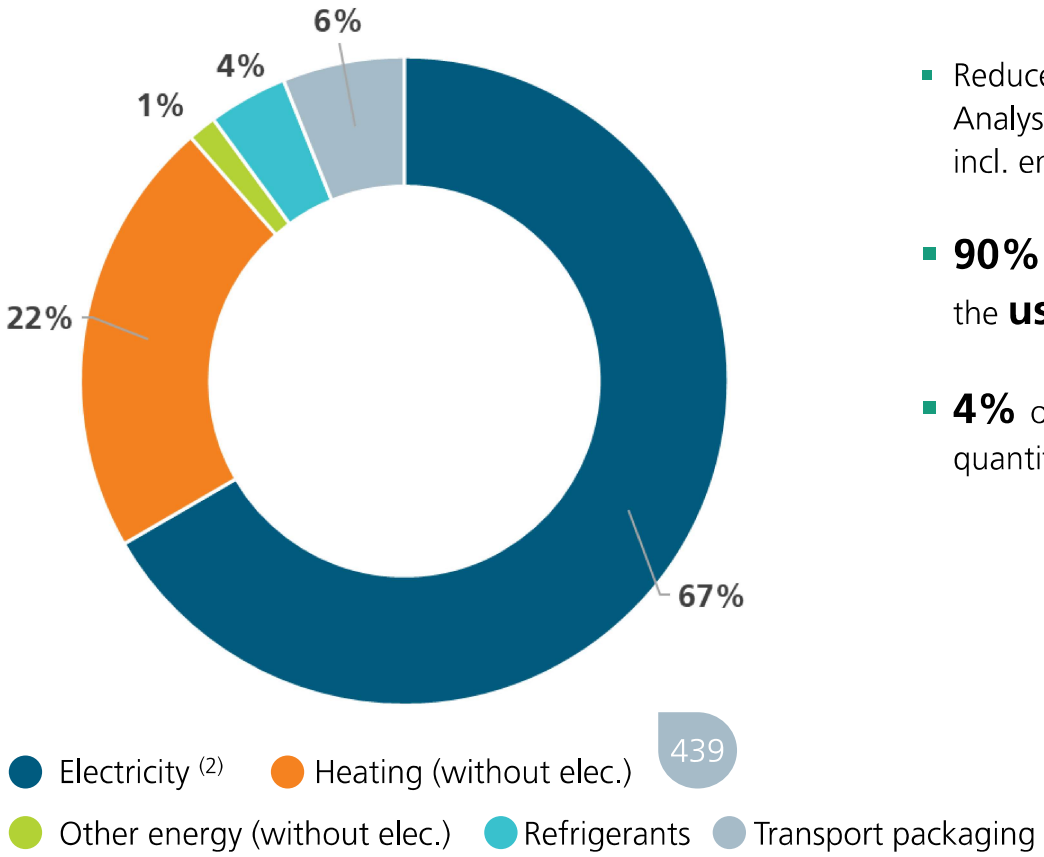
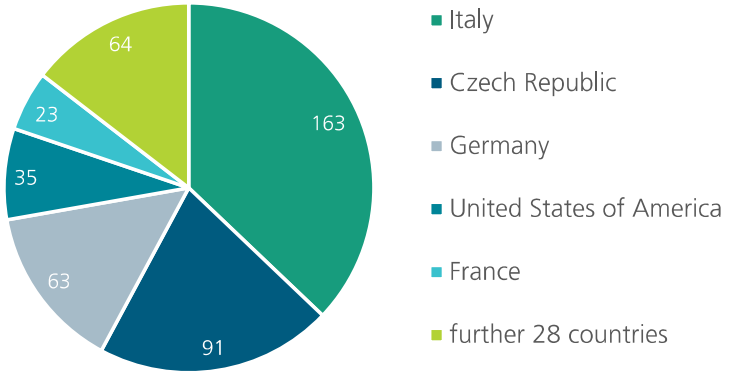
Sources of GHG emissions at logistics hubs

Focus logistics real estates[1]



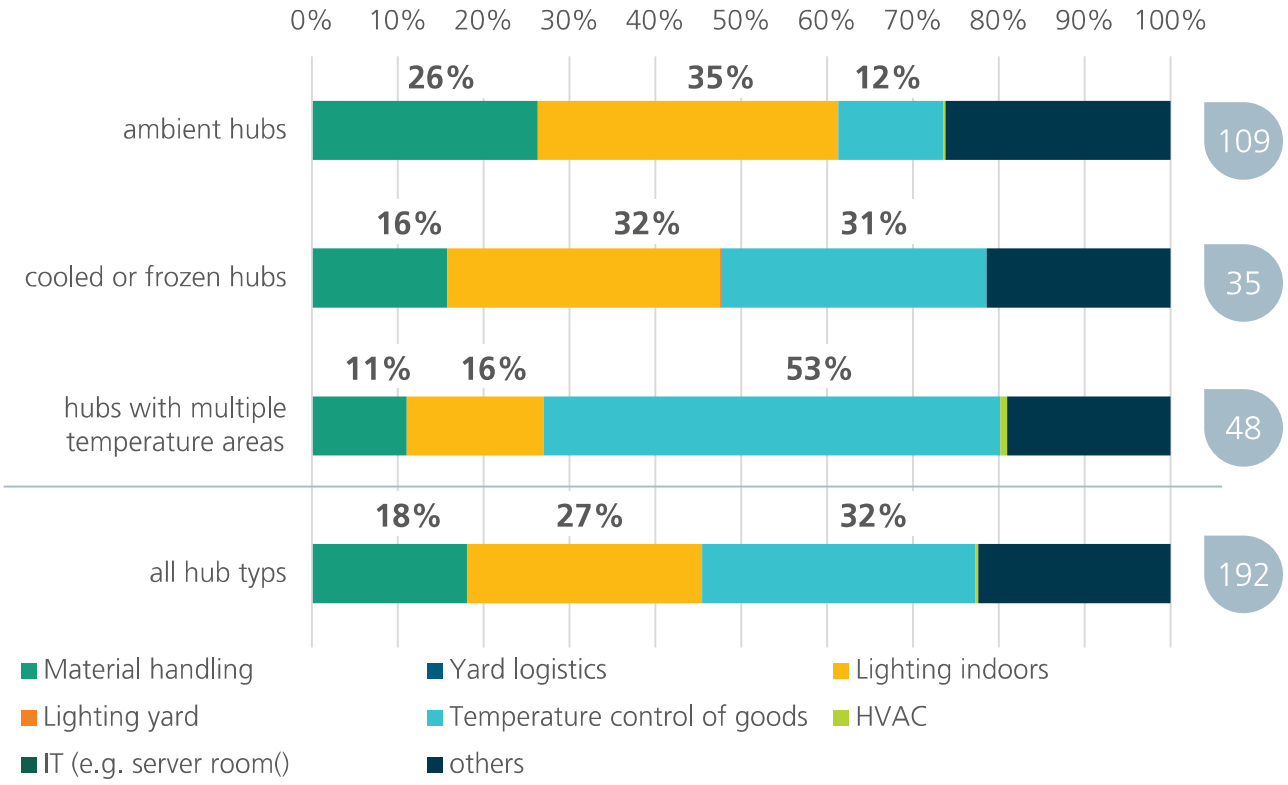
- Reduced data base:
  Analysis of hubs with an ISO aligned GHG emissions quantification (n=439); incl. emissions related to storage and use of transport packaging
- **90% of GHG emissions** of logistics real estates origin from the **use of energy**: 67% electricity, 22% heating, 1% other energy
- **4%** of GHG emissions relate to **refrigerant leakage** (estimated by the quantity of refill)



(1) Hubs offering storage and/or transhipment (no terminals)
National electricity mix (so-called »location based«)

What is the electricity used for?

Allocation to predefined activity clusters



- **25% of hubs**(1) have further detailed their electricity consumption.
- Theses hubs consume 43% of total electricity consumption of the study.
- 70% of hubs specified explicitly, that they do not have any transparency on detailed electricity use.

- Almost 80% of the electricity consumption has been allocated to pre-defined activity clusters.

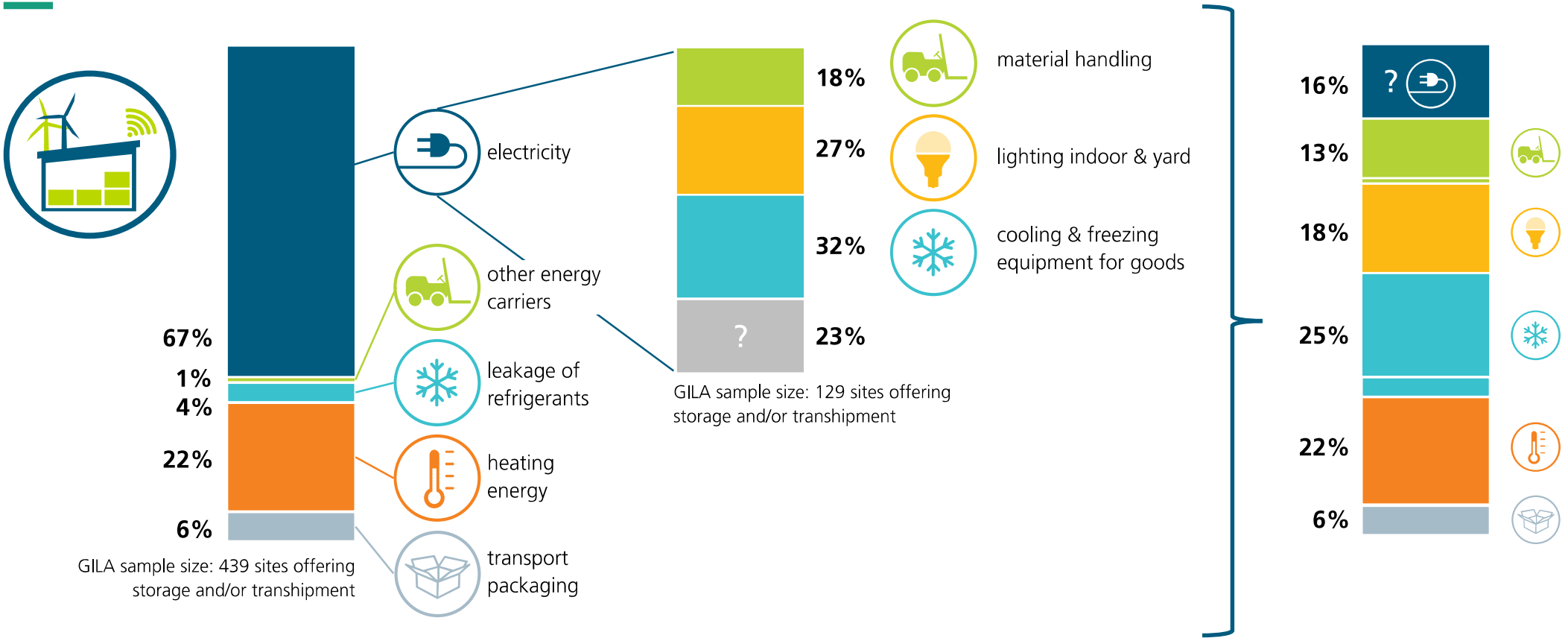
Overall allocation of electricity:

- 32% for temperature control of goods
- 27% for lighting indoors
- 18% for material handling

(1) Focus logistics real estates (without terminals)

GHG emissions arising at logistics sites

Shares derived by GILA market studies (2021-2023)



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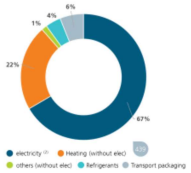
Emission intensity values for logistics hubs

- Work in progress -



Carbon Footprint (CF)

- Total CF of hubs

  kg CO_2e / a

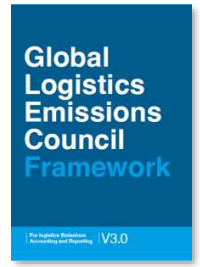
Emission intensity

- based on throughput

  kg CO_2e / tonne

- ISO 14083:
  kg CO_2e / tonne

- Use as default value
  - if e.g., no primary data is available
  - in tools in combination with transport emissions
  - in GLEC Framework (version 3.0)
- option for the future: use as benchmark



Work in progress!!	ambient		mixed	
Transhipment	0.6 kg CO_2e / t	n=65	2.2 kg CO_2e / t	n=6
Storage + transhipment	2.1 kg CO_2e / t	n=58	4.0 kg CO_2e / t	n=9
Warehouse	17.5 kg CO_2e / t	n=49	33.0 kg CO_2e / t	n=3
Liquid bulk terminal	3.1 kg CO_2e / t	n=22	8.1 kg CO_2e / t	n=29

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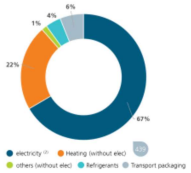
Emission intensity values for logistics hubs

- Work in progress -



Carbon Footprint (CF)

- Total CF of hubs

  kg CO_2e / a

Emission intensity

- based on logistical area (indoors)

  kg CO_2e / m²

Work in progress!!	ambient		mixed	
Transhipment	16.7 kg CO_2e / m²	n=61	19.5 kg CO_2e / m²	n=7
Storage + transhipment	28.0 kg CO_2e / m²	n=124	64.4 kg CO_2e / m²	n=43
Warehouse	23.6 kg CO_2e / m²	n=138	22.8 kg CO_2e / m²	n=21

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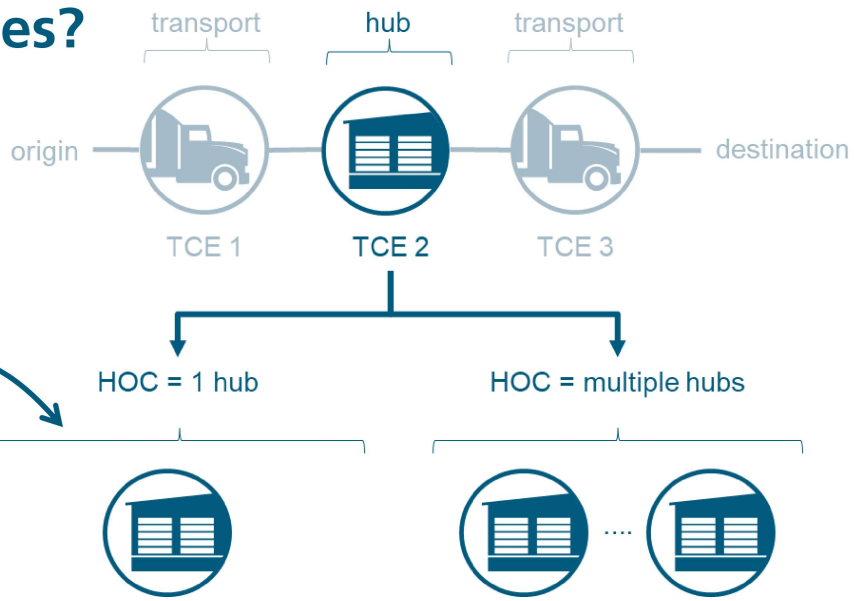
Why participating in the market studies?

Transparency & own values



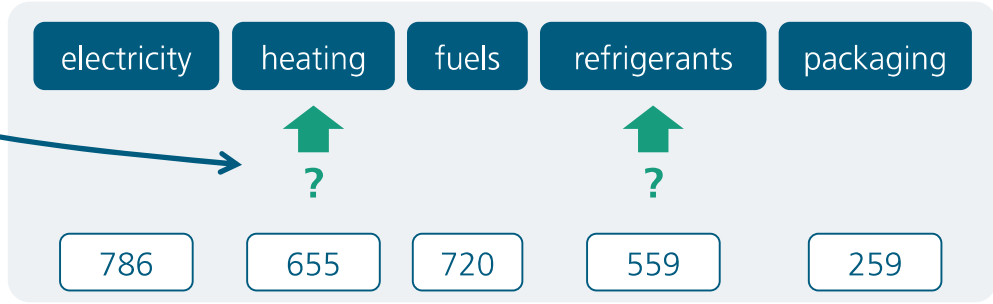
Participating companies receive their individual GHG emission intensity values

- aligned with ISO 14083
- one hub = 1 HOC (hub operation category)

Use of the REff Tool® prepares for calculating total CF & elaborating more specific KPIs, e.g.

- elaboration of emission intensity values covering a number of comparable hubs (= HOC with multiple hubs)
- allocation at activity level, e.g., two KPIs per hub
- support in case of data gaps using KPIs of anonymised data base

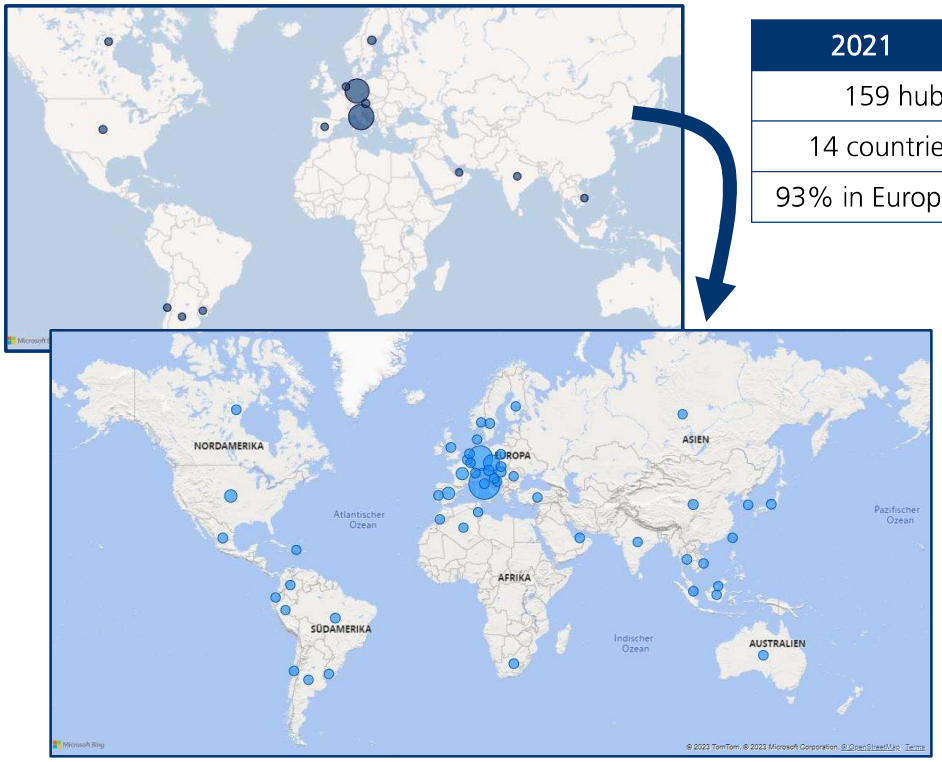
Support of overall research on sustainability of logistics hubs & elaboration of average emission intensity values



Market studies in GILA project

Extension of global coverage

1st study (2021)



after 3rd study (2023)

2021	2023
159 hubs	843 hubs
14 countries	33 countries
93% in Europe	85% in Europe

Annual market studies will continue!

Timeline

- Collection of annual data continuously possible
- Deadline: May 31st
- Start of analysis: June 1st
- Publication of values: August
  online: https://reff.iml.fhg.de/

Participation via

- Osservatorio Contract Logistics "Gino Marchet" of Politecnico di Milano
- REff Tool® of Fraunhofer IML

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Support our annual market studies

It is more than just receiving a single KPI

ISO 14083 (normative scope)

- Transhipment sites
- Energy & refrigerant related GHG emissions
- For electricity: location-based approach

ISO 14083 (optional scope)

- Warehouses
- Energy & refrigerant & (re)packing related GHG emissions

- GHG emissions per tonne
- GHG emissions per m², …

Individual electricity mix at hubs

- Market-based emission factors
- Self-generation of power on-site

Allocation of consumption

- Transparency for identifying fields of action & elaborating decarbonisation roadmap

- Decarbonised KPIs
- Estimates for decarbonisation potentials & successes

GHG assessment of logistics networks

- Direct use of provided data
- Import of individual KPIs in other tools
- Publishing of average KPIs in standards and other tools
- Quantitative basis for cost vs. CO2e redesign

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Support our annual market studies

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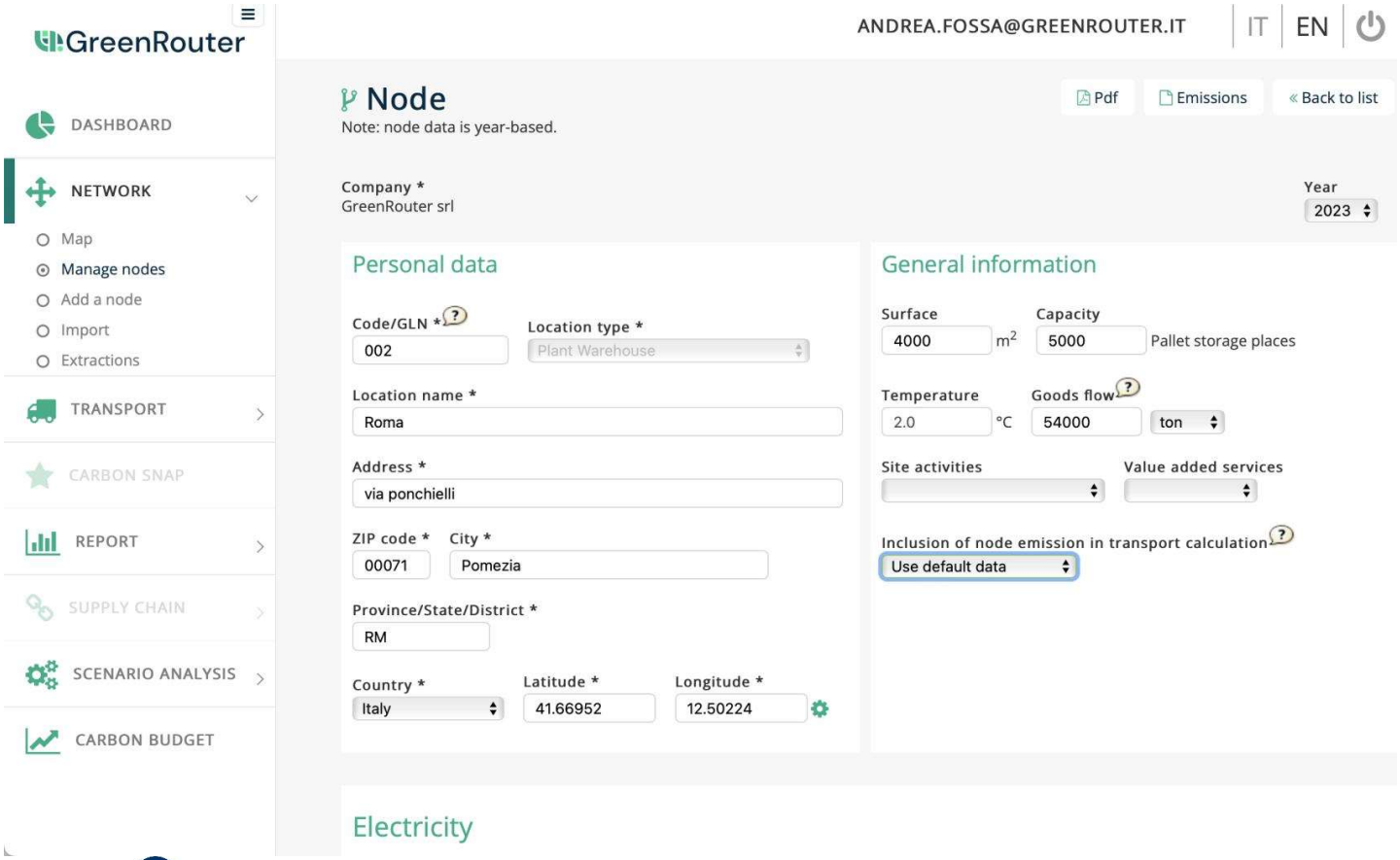

Structuring data over time allows for further outcomes

- GILA growing database will allow for segmentation + YoY analysis
- Internal benchmarks on specific activities enriched by GILA values
- Quantitative support while defining priorities of action

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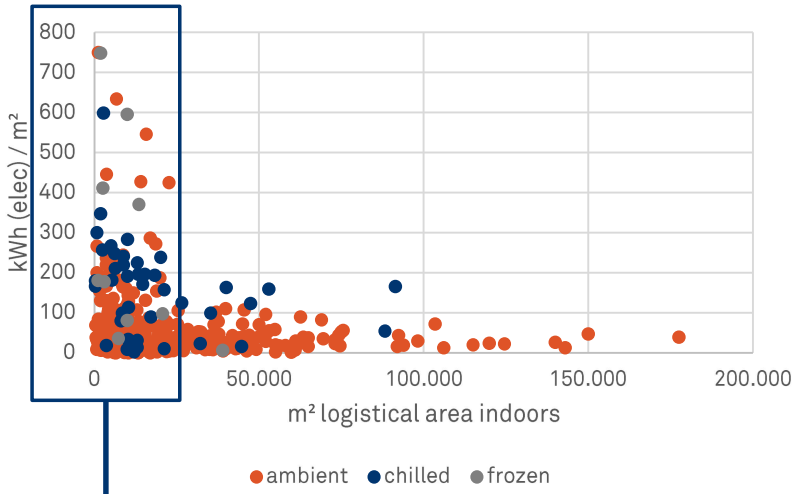
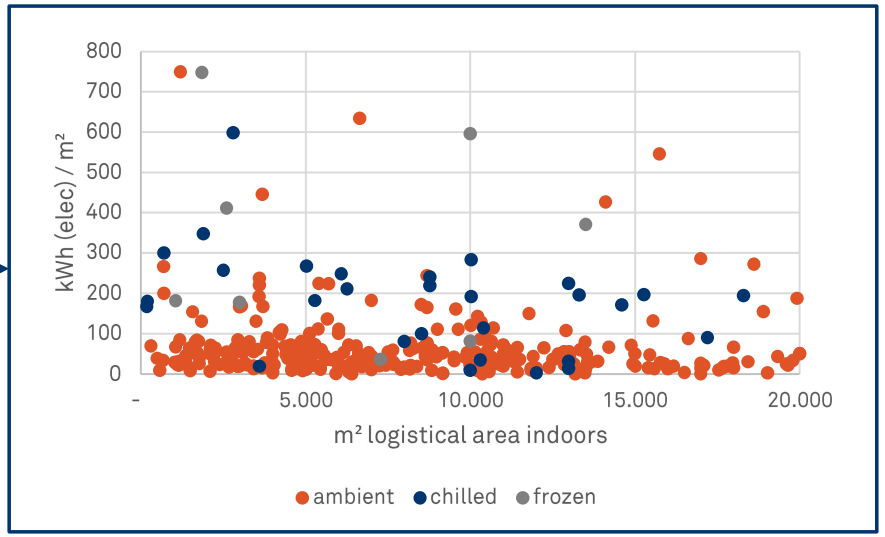
GreenRouter

Electricity consumption per logistical area indoors or logistical real estates



- ambient real estates, n=433
- chilled real estates, n=42
- frozen real estates, n=11

- **Performance of (partial) sample shows pattern**
- **Segmentation based upon internal activity or automation level might be very useful**
  - **we need a larger sample !**



Which share do logistics sites contribute to the total of GHG emissions?

- Still difficult to say: Not addressed by national statistics

- Some assumptions published
  - 13% of logistics emissions related to logistics buildings (global) WEF 2009
  - 11 - 20% of transport emissions related to warehouses (UK, US) McKinnon 2018
  - 15% of logistics emissions related to logistics nodes (Germany) Rüdiger et al. 2017

Use of initial KPIs elaborated in GILA for new estimates

Work in progress!!	ambient		mixed	
Transhipment	16.7 kg CO_2e / m²	n=61	19.5 kg CO_2e / m²	n=7
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on average ~ 25 kg CO_2e/m²

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Decarbonising logistics hubs

GERMANY

- A very rough estimate…

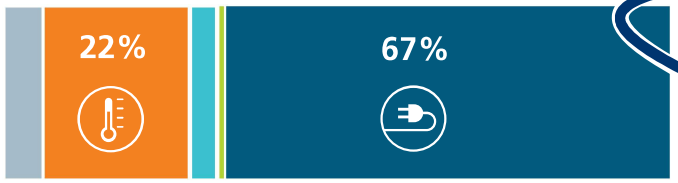
Footprint of logistics sites [m²]	x	Average GHG-KPI [kg CO_2e/m²]
~ 300 Mio m²	x	~ 25 kg CO_2e/m²
	=	~ 7.4 Mio t CO_2e

GILA average value for all logistics real estates

…
Der Footprint an Logistikflächen in Deutschlan
300 Mio. m², wovon aber aufgrund von Bausub
Eigentumsverhältnissen ein Großteil dem Nutze
dürfte. Der auch unter immobilienwirtschaftlichen Aspekten interessante
…
DVZ Deutsche Verkehrs-Zeitung
[dvz 2019]

in comparison German road transport:
145 Mio t CO_2e (2022) [UBA 2023]
→ 40% ≅ 60 Mio t CO_2e in freight transport

~ 11% of logistics emissions



GILA sample size: 439 sites offering storage and/or transhipment

- 90% of the operational carbon footprint(1) of logistics sites result from energy use; **67% from electricity**
- The **transfer towards** electricity basing on **renewable energy sources** will impact carbon footprint decisively.

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(1) location based approach

Decarbonising logistics hubs

ITALY

- A second, very rough estimate...

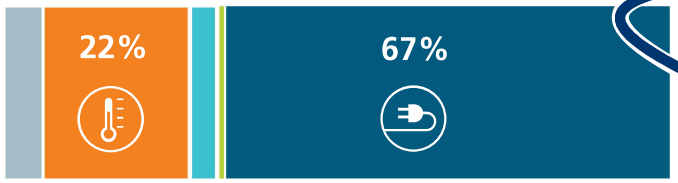
Footprint of logistics sites [m²]	x	Average GHG-KPI [kg CO_2e/m²]
~ 60+ Mio m²	x	~ 25 kg CO_2e/m²
	=	~ 1.5 Mio t CO_2e

Source: World Capital/OSIL, Guizzo.eu

GILA average value for all logistics real estates

in comparison Italian road transport:
109 Mio t CO_2e [2022 ISPRA]
→ 27% road freight ≅ 30 Mio t CO_2e

~ 4,8% of logistics emissions



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