Beyond the Miles: Measuring Green Credentials

Haier Biomedical
Intelligent Protection of Life Science

Laboratories are under increasing pressure to **improve sustainability and reduce carbon emissions**, putting every new instrument and its supply chain in the spotlight. As part of the procurement process, some UK organisations are assessing the sustainability of an instrument according to the distance from its manufacturing site to the purchasing lab. Unfortunately, this is often an over-simplified view of a highly complex matter, with many variables – including an instrument's operational energy efficiency, supply chains of parts during manufacture, and type of freight for transport once assembled – ultimately **contributing more to environmental impact**.

Transportation method

CO_2 emissions vary significantly between the different types of freight used to transport goods around the world. **Sea freight is by far the most efficient in terms of CO_2 emitted per tonne of cargo transported per kilometre**. It has the highest trade volume of all freight methods - 90 per cent of everything we consume arrives by sea – yet accounts for only two per cent of total global CO_2 emissions, clearly demonstrating its efficiency.[1] In stark contrast, air freight is highly inefficient, and land transport falls somewhere in the middle. The advantages and limitations of the three methods for long distance commercial freight are summarised below, as well as their CO_2 emissions.

Air

\+
- Fast
- Global reach

−
- Expensive
- Not eco-friendly

CO2 per tonne per km (g)
602 (range 570-1925)[2]

Land

\+
- Flexible routing
- Quick, especially for short routes

−
- Labour intensive
- Limited capacity for large items

CO2 per tonne per km (g)
62 (range 39.7-151.1)[2]

Sea

\+
- Highly efficient
- Cost effective

−
- Slow
- Limited accessibility (ports)

CO_2 per tonne per km (g)
8.0 (range 5.7-36.3)[2]

Sea freight is therefore **~71 times more efficient** than air, and **~7 times more efficient** than land freight.

To determine how this translates in a real-world scenario, we compared the CO_2 emitted when transporting equipment to London in the **UK** from a manufacturing site located either in **China** or **Germany**, considering the various forms of freight required.

700 litre ULT freezer

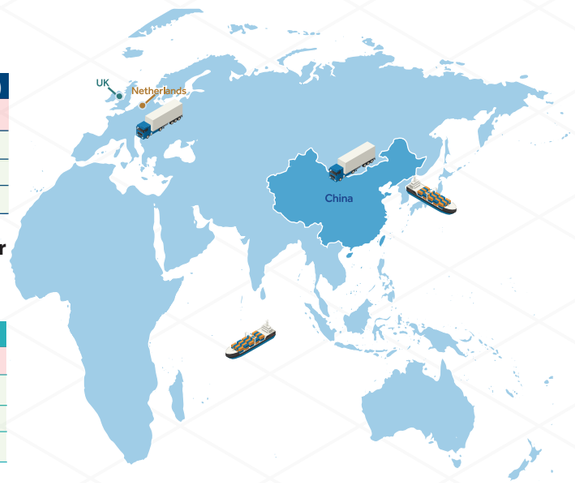
Origin	Destination	Freight	CO_2 emissions (kg)
Germany	London	Land	57*
China	London	Land: factory to port	1.34*
		Sea: port to port	50.19**
		Land: port to London	3.91*

TOTAL CO EMISSIONS (kg) SAVED 1.6 per freezer

Mid-sized centrifuge

Origin	Destination	Freight	CO_2 emissions (kg)
Germany	London	Land	16*
China	London	Land: factory to port	0.12*
		Sea: port to port	5.43**
		Land: port to London	0.37*

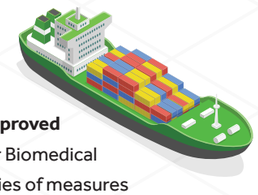
TOTAL CO EMISSIONS (kg) SAVED 10.08 per freezer



* Calculated in accordance with CSN EN 16258
** Calculated using Evergreen Marine data for an actual Haier Biomedical shipment in 2024

Evidently, not every kilometre is equal when debating the energy efficiency of transporting an instrument from where it is made.

Sustainable shipping

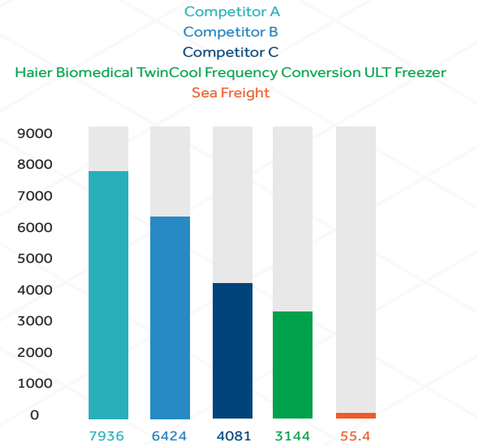


In recent years, commercial cargo ships have undergone huge advancements in engine efficiency and hull design – as well as **increasing their capacity and reducing installed engine power – which has significantly improved fuel efficiency and reduced emissions.**[1] The choice of shipping company therefore matters, which is why Haier Biomedical uses Evergreen Marine for transportation between China and the UK. Evergreen Marine has implemented a series of measures to **improve sustainability** – including investing in newly-built ships – resulting in a **68 per cent reduction in its fleet's CO_2 emissions** between 2008 and 2023.[3] Haier Biomedical also chooses **40-foot containers, which hold two per cent more volume** compared to two 20-foot containers, plus they fit perfectly on a truck, **optimising land freight to and from the port**.

Operational energy efficiency

The transportation of laboratory equipment from the site of manufacture to the lab represents only a small fraction (typically 1-3%) of its overall environmental impact, regardless of where it is shipped from. Procurement decisions should therefore first look at **operational energy use throughout an instrument's lifetime – as this is where the bulk of emissions are produced** – which can vary significantly depending on the supplier (**Figure 1**). For example, the Haier Biomedical TwinCool Frequency Conversion ULT Freezer **emits approximately 4,562 kg of CO_2 over a 10-year period** (based on 4.16 kWh/day consumption), with transportation from China – at 55.44 kg of CO_2 – **representing a mere 1.22 percent of its total output over 10 years**.

Equivalent CO2 emissions over 10 years (kg)



Some third-party sustainability impact scores and government institutional tenders give transportation and lifetime energy use almost equal weighting. However, this is contradictory to our data, which clearly shows that the emissions impact of transportation can be up to 125 times less than the impact of energy use during its lifetime.

Supply chains

Claims of 'Made in the UK' or equivalent should also be taken with caution when considering environmental impact, as an instrument's components are almost always sourced from all over the globe and assembled at one site. For example, a freezer might be comprised of a compressor from Italy, steel from India and electronics from China. **Transporting these components to one place involves highly complex supply chains that are many layers deep; suppliers themselves are sourcing their parts from various locations**. These considerations are increasingly being factored in when discussing a lab's green credentials, however, it is often difficult to uncover Scope 3 emission with all the underlying aspects relating to supply chains.

Buyer beware

When considering an instrument's environmental impact, where it is made may seem important, but its supply chain during manufacture, and how it is transported to your lab, are even more vital. **Sea freight is by far the most energy-efficient method, but the CO_2 saved at this stage is completely overshadowed by how an instrument performs once it's in operation**. The energy efficiency of an instrument once installed should therefore be the decisive factor, and can help to boost your lab's green credentials.

References

1. European Community Shipowners' Associations. (2020) How shipping, including short sea shipping, compares favourably to other modes of transport on CO_2 emissions 2020. https://www.ecsa.eu/sites/default/files/publications/2020%20CO2%20Performance%20of%20Shipping.pdf. Accessed August 6, 2024.
2. European Chemical Transport Association. (2021) Guidelines for Measuring and Managing CO_2 Emission from Freight Transport Operations. https://ecsa.eu/wp-content/uploads/-publications/1f429e3660c68b60d33bd38f989e14c4.pdf. Accessed October 10, 2024.
3. Evergreen Marine. (2023) Energy and Greenhouse Gas Management. https://www.ecta.com/wp-content/uploads/2021/03/ECTA-CEF-IC-GUIDELINE-FOR-MEASURING-AND-MANAGING-CO2-ISSUE-1.pdf. Accessed August 6, 2024.