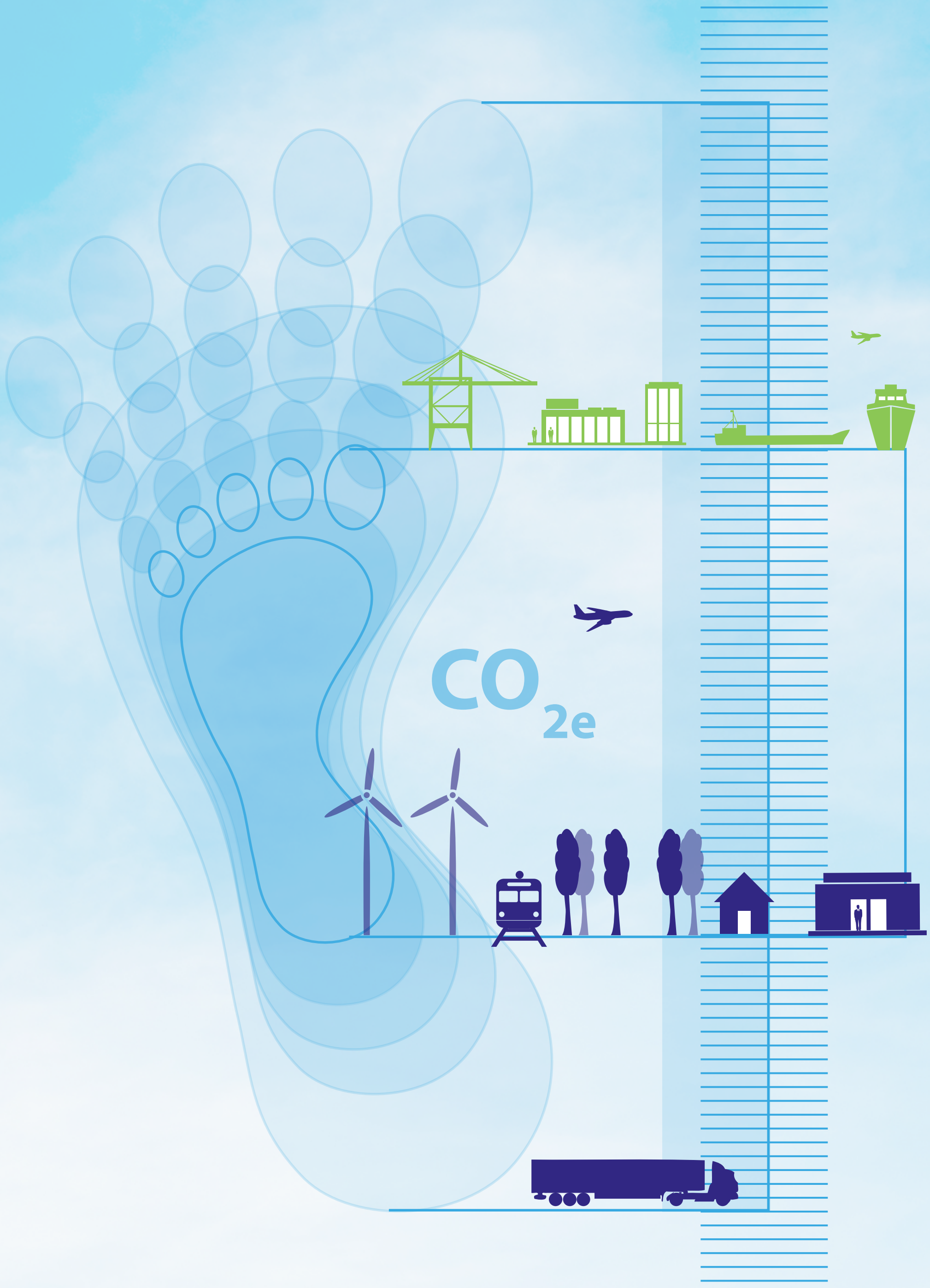
GUIDELINE 6 - CARBON FOOTPRINT IN LOGISTICS



Inland shipping - bulk

Dry and liquid goods

Colophon

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Dry and liquid goods

Carbon Footprint in Logistics

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Inland shipping - bulk

Dry and liquid goods

The bulk inland shipping sector transports dry or liquid goods in bulk.

Common dry bulk goods include:
- Sand;
- Coal;
- Ore;
- Agricultural goods.

Common liquid bulk goods include:
- Oil;
- Chemicals.

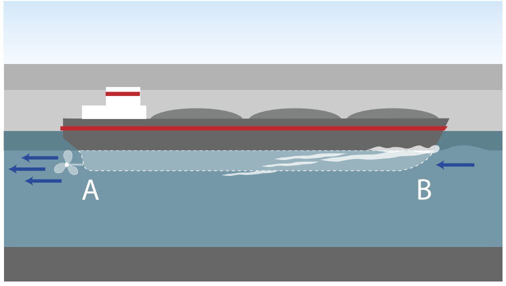
The quantities are usually expressed in tons.

Origin and destination

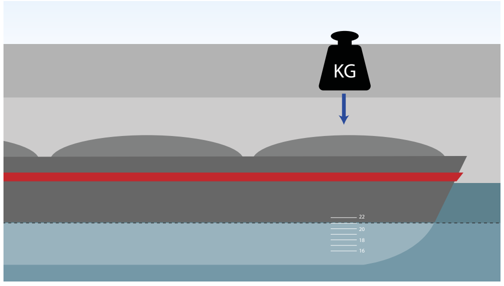
The standardization of terminal codes for bulk goods is less advanced than it is for inland container shipping. A list of bulk terminals with geocoordinates is being developed to allow distances to be calculated easily using software.

Fuel consumption

An inland vessel's fuel consumption is dependent on a large number of factors:

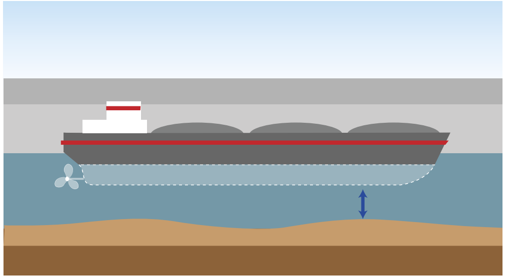


The speed (A) at which the vessel sails and the resistance of the hull as it moves through the water (B[1]).

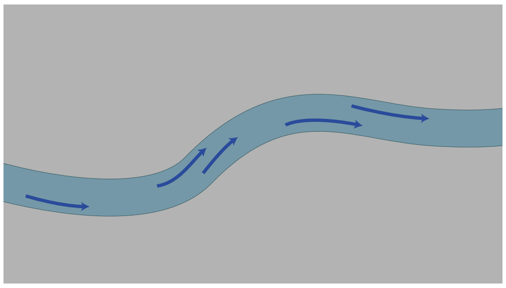


The draft of the loaded vessel: the greater the weight being carried, the lower the vessel will sit in the water.

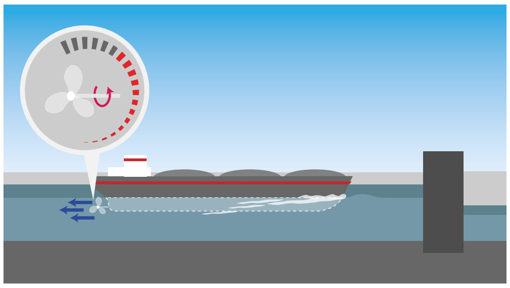
1 *hydrodynamic resistance*



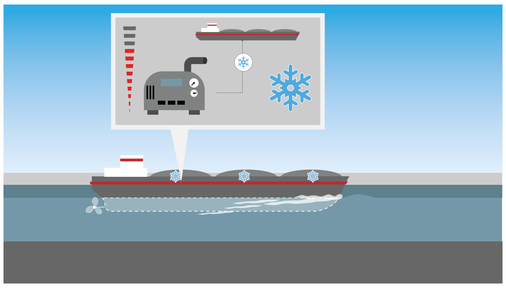
How much water lies between the keel and the bed of the inland waterway, and whether the bed is muddy or hard.



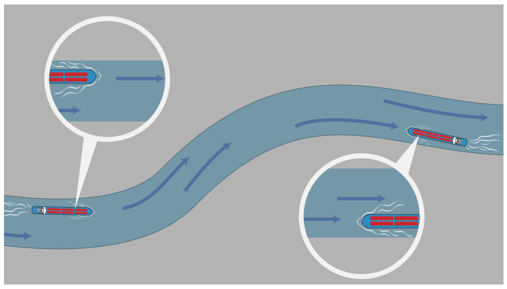
How fast the rivers are flowing.



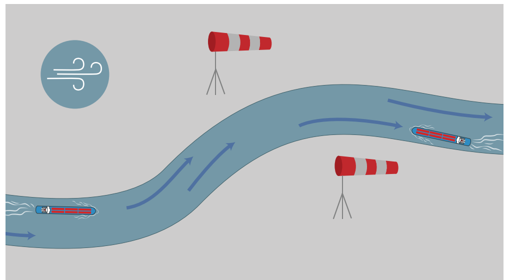
Whether the bow thrusters have to be used a lot, e.g. at locks.



Whether the generator has to deliver a lot of power, e.g. to power refrigerated containers during the trip.



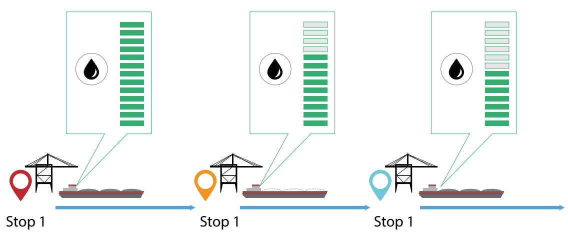
Whether the vessel is sailing against or with the current.



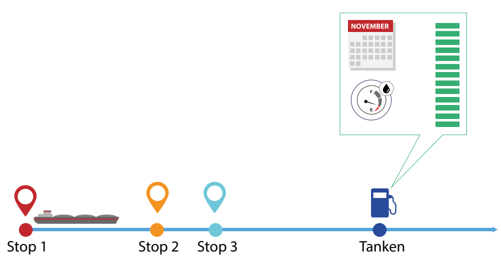
Whether there is a strong tailwind or headwind.

There are models that try to predict fuel consumption by taking all these factors into account. The alternative is to measure consumption in practice on an ongoing basis and apply so-called regression analysis to the measured data. This statistical analysis shows which influencing factors appear to have a major impact on the result. In this way the data from practice provide a wealth of information about these influences.

Measuring consumption



Some vessels can measure their consumption precisely between two stops at terminals. For allocation purposes the intention is to determine the consumption for a round trip: the sum of the fuel consumption measured at each stop. This allows emissions to be allocated to individual orders as precisely as possible.

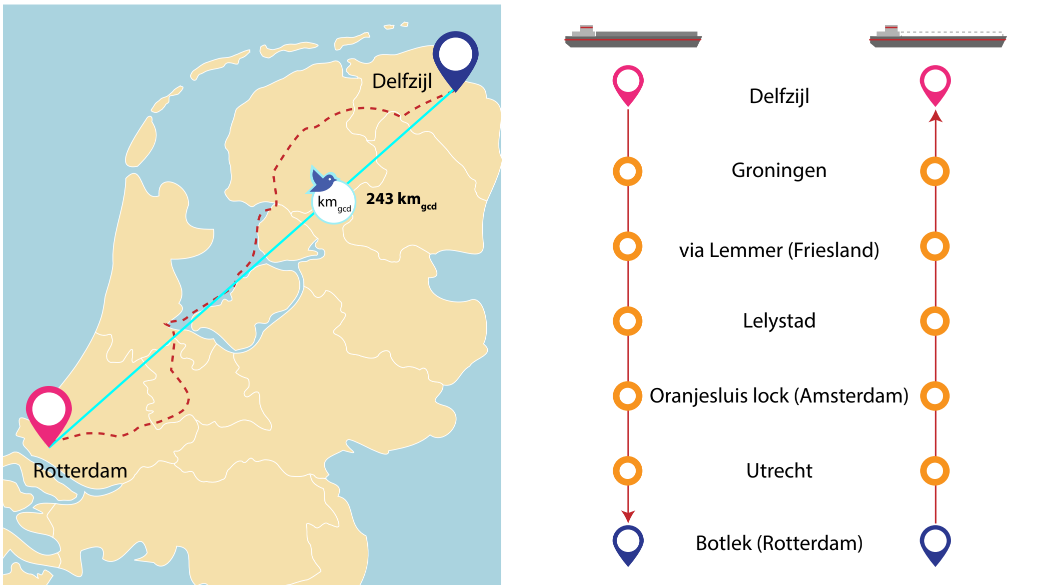


Other vessels determine how much fuel has been consumed over a certain period during bunkering/refueling. This results in emissions being allocated to orders more on the basis of averages. While the total is still correct, the differences are less visible in this case.

Allocation

The COFRET methodology distributes the emissions resulting from all fuel consumed in a period across all transport orders. This means that all repositioning kilometers over this period are distributed across all orders. It is interesting to note that consumption is usually considerably lower if the ship is empty. As these guidelines are developed in the future, consideration will be given to this effect and to the allocation of repositioning kilometers.

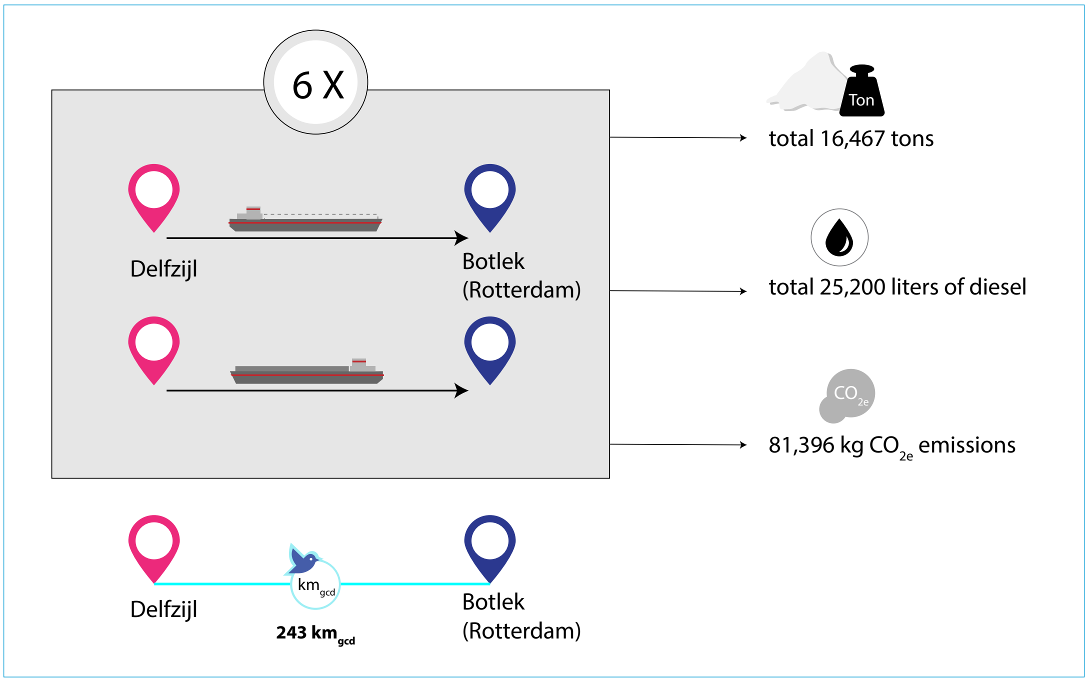
Example calculations



The route from Delfzijl to Rotterdam is as follows:

From Delfzijl the vessel sails via Groningen to Lemmer. From Lemmer it crosses the IJsselmeer, via Lelystad, to the Oranjesluis lock in Amsterdam. After passing through the lock it continues to the Botlek in Rotterdam, via Utrecht. The return journey to Delfzijl is the same route in reverse.

Example calculation



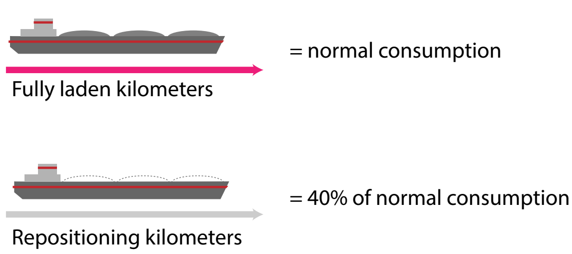
The following is known about 6 return trips:

- In total 16,467 tons were transported from Delfzijl to Rotterdam.
- A total of 25,200 liters of diesel were consumed, which equates to 81,396 kg of CO_{2e} emissions.
- The great-circle distance between the two locations is 243 km_{gcd}.

If all the emissions are allocated to the cargo, the result is as follows:

- Total 81,396 kg CO_{2e}.
- 4.94 kg CO_{2e} per ton.
- 20.6 grams CO_{2e} per $ton.km_{gcd}$.

Total for 6 trips

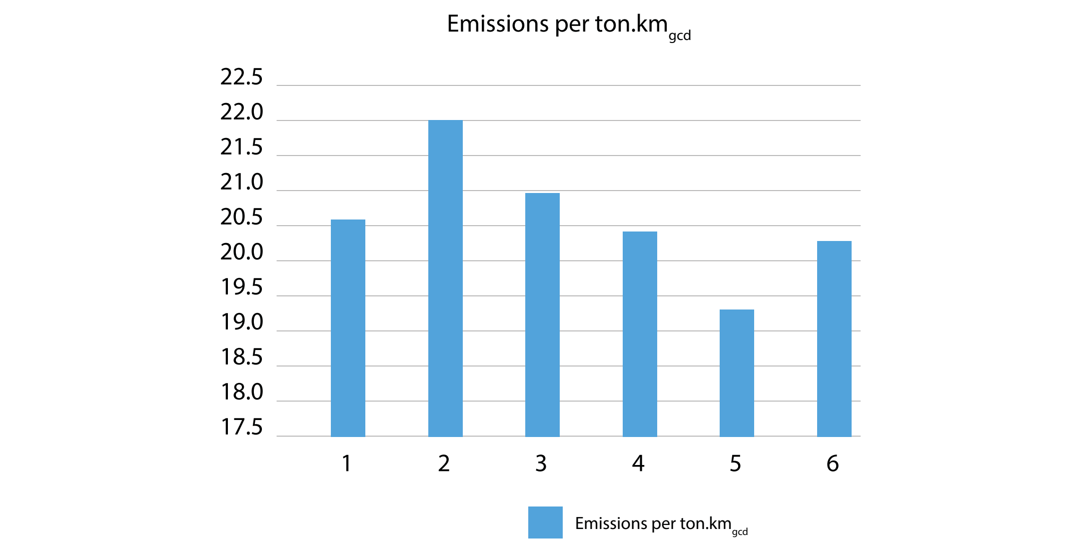


Empty outward trip	40%	7,200 liters
Full return trip	100%	18,000 liters
Total	140%	25,200 liters

Better data delivers more information

If the data for each trip are known, differences become visible and offer interesting insights.

Trip no.	Tonnage transported Tons	Fuel Liters	CO_{2e} kg	CO_{2e} kg per ton	CO_{2e} grams per ton.km$_{gcd}$
1	2,743	4,200	13,566	4.95	20.6
2	2,753	4,500	14,535	5.28	22.0
3	2,731	4,250	13,727.5	5.03	20.9
4	2,737	4,150	13,404.5	4.90	20.4
5	2,752	3,950	12,758.5	4.64	19.3
6	2,751	4,150	13,404.5	4.87	20.3



Trip 2 and trip 5 deviate significantly from the average. Upon inquiry it emerges that there was a substantial delay during loading on trip 2 and this lost time had to be made up. On trip 5 it was possible to load earlier, so the vessel was able to sail at a more leisurely pace.

This analysis reveals that Carbon Footprinting can serve two purposes. Firstly, it can provide governments and other parties with information on average performance, by means of annual averages, for example. Secondly, it allows a company to derive all kinds of operational insights from the detailed analyses.

Carbon Footprint guidelines

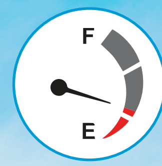
0. Measuring, calculating, allocating and reducing

1. Allocating

2. Cargo

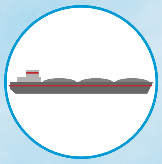
3. Origin and destination

4. Fuel

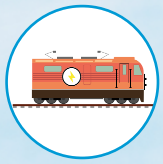


5. Inland shipping - containers

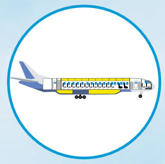
6. Inland shipping - bulk



7. Freight transport by rail



8. Air freight



9. Maritime and short sea shipping

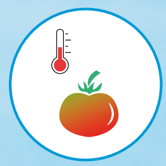
10. Transshipment

11. Storage

12. Parcel transport and post

13. General road transport

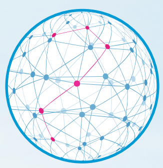
14. Perishable and temperature controlled



15. Outsourced transport

16. Repositioning and empty kilometers

17. (Inter)national supply chains



18. Benchmarking

19. Intermediaries and platforms

20. Auditors and accountants

21. Data quality

22. The relationship between social goals and corporate goals

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