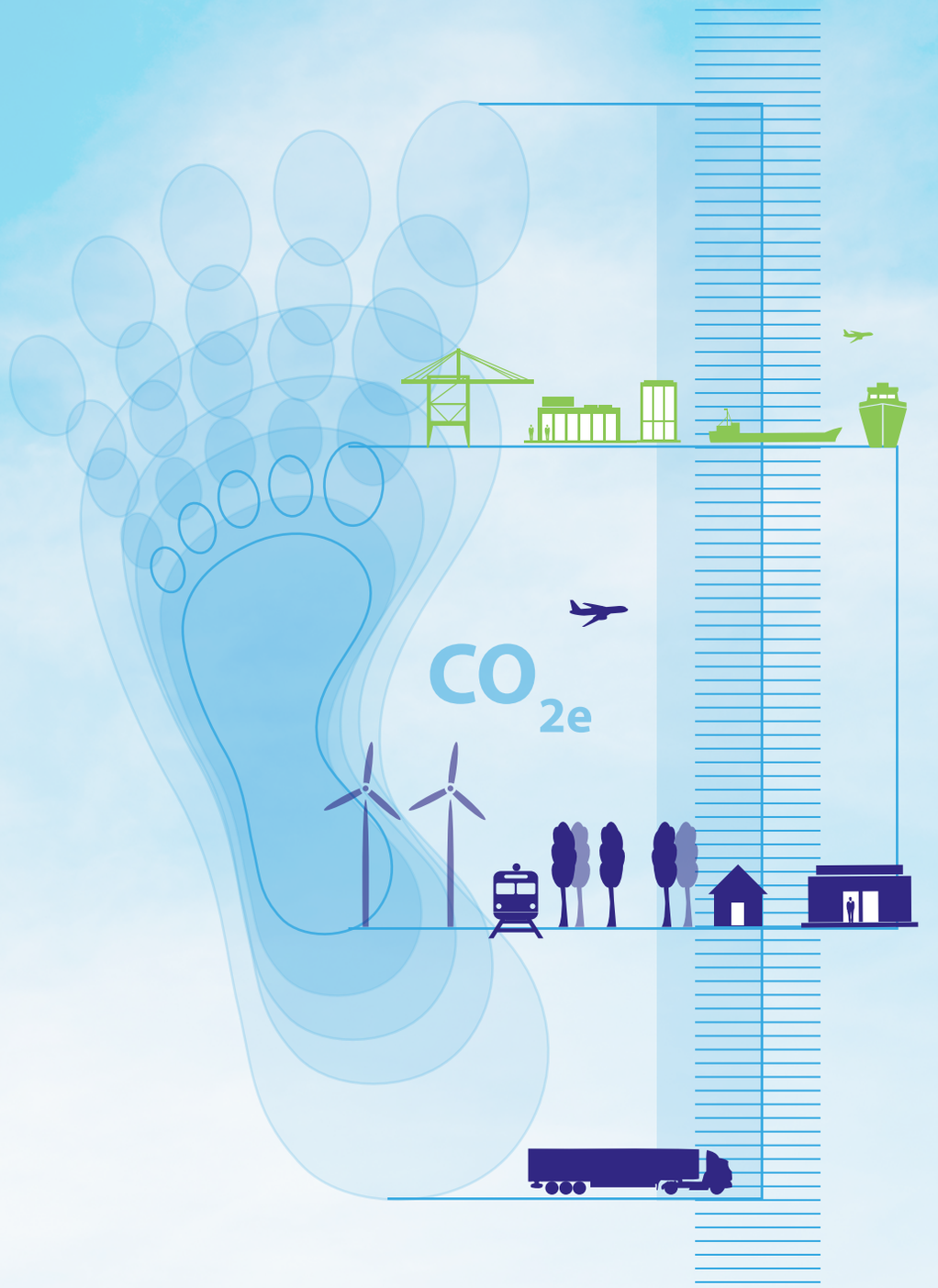
GUIDELINE 1 - CARBON FOOTPRINT IN LOGISTICS



Allocating

Allocating emissions to cargo and customers

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Colophon

Guideline 1 - Allocating
Allocating emissions to cargo and customers

Carbon Footprint in logistics

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Allocating

Allocating emissions to cargo and customers

In guideline 0 'Carbon Footprinting' we explained why calculating CO_{2e} emissions in logistics is such a special case.

This unique situation led to the development of a special standard (EN16258) and a recommendation from the EU COFRET project on how this should be handled. Methods such as GLEC and Objectif CO_{2e} have added a number of calculation rules and agreements to this, which are particularly relevant if you want to estimate total emissions. TNO has examined these methods and concluded that all variants fall within the EN16258 standard. Preference is given to the COFRET approach, but if the basic data are recorded well, the results can be easily converted to each of these methods.

In this guideline we explain how allocation works under the COFRET approach. For people with a lot of experience in the logistics sector this way of thinking does not come naturally at first, but it has significant practical benefits.

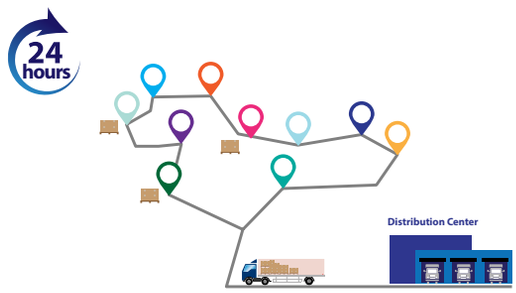
First of all, we explain what is important when it comes to allocation and why simple methods have so many disadvantages.

The COFRET approach is then explained, followed by an example.

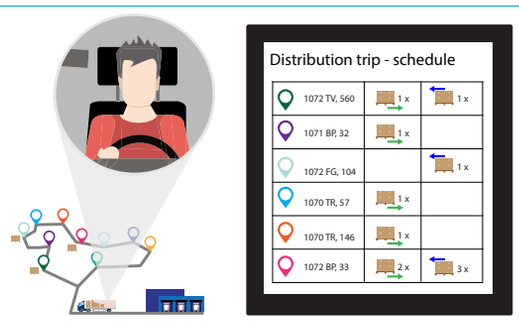
The result allows customers to be given precise information on the quantity of emissions generated by the transport of a particular order. Just as importantly, the transporter can see how efficiently the company is operating.

Allocating emissions to cargo: what is important?

A frequently asked question is: how can you allocate emissions to each stop on a distribution trip.

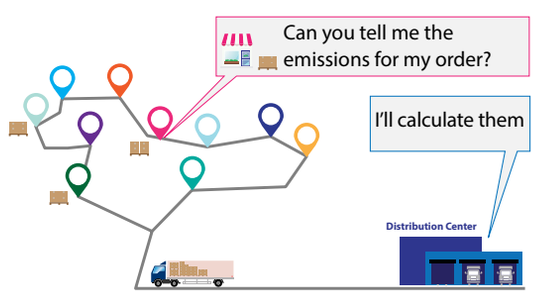


The example is based on a distribution trip undertaken over 1 day.



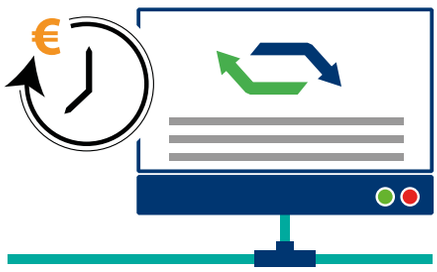
During the distribution trip the driver transports cargoes from different customers to various addresses. On the way he also picks up cargoes and takes them back to the warehouse.

At the end of the day the collected cargo is unloaded into the warehouse.

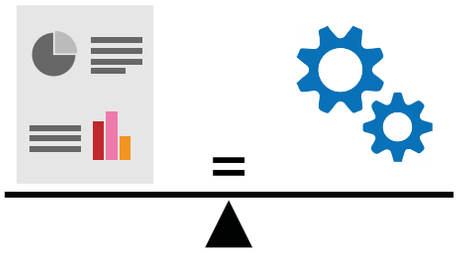


One of the customers asks for details of the (allocated) emissions for his particular order. The transporter wants to calculate this information.

What is important when it comes to the principle of allocating emissions to cargo?



Collecting and recording data costs time and money. Being able to reuse data that you have already recorded is an advantage. If additional management information can be extracted from these data, that is desirable.

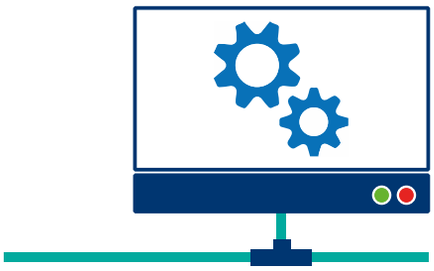


Calculated figures need to be realistic and consistent with the situation in practice: if you are performing better they need to reflect this. Figures should tell the same story as practice.

If a transporter shares the emission figures with its customer, these figures must also fit in with the financial agreements made.

The allocation method must be transparent and standardizable to avoid any discussions about the interpretation of the figures.

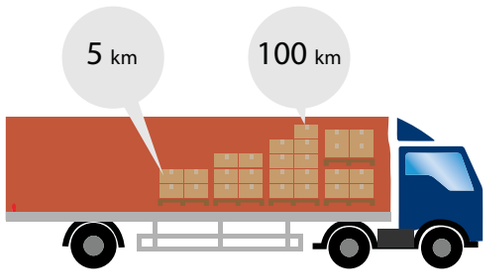
The allocation must be easy for auditors to verify.



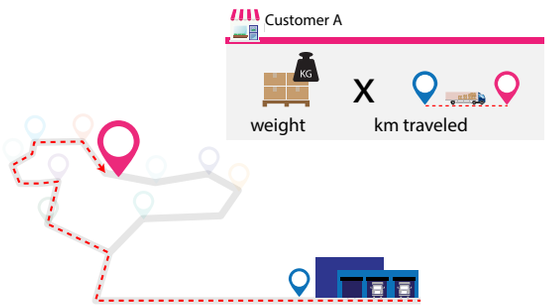
The recording and allocation process is easy to automate.

The emissions for a trip can be calculated easily if it is known how much fuel has been consumed.

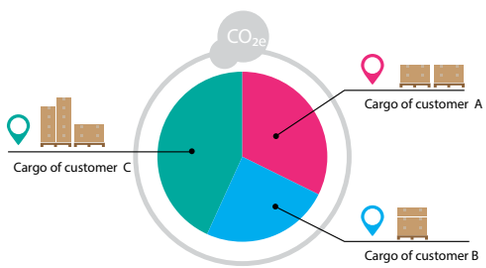
But how can you allocate these emissions to a particular cargo? And what are the advantages and disadvantages?



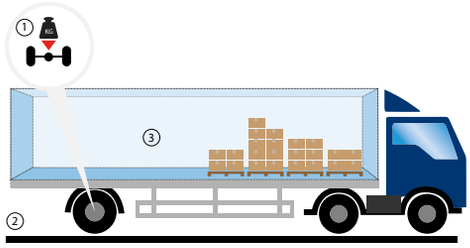
Loading factor
The loading factor at the time of departure is often known. However, this figure says nothing about what happens afterwards. A pallet that is transported 5 km ends up being allocated the same amount as one transported 100 km as part of the same trip. That is not easy to justify.



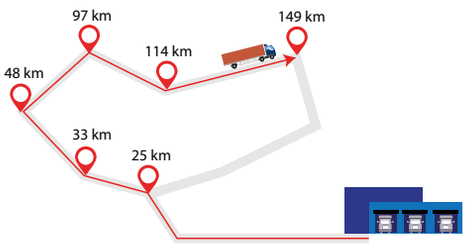
Total weight and kilometers traveled
This combination results in emissions per ton.$_{km}$. If you multiply this by the number of tons in an order and the distance to the destination you obtain the emissions for each cargo. The disadvantage is that, relatively speaking, far too much CO_{2e} is allocated to the last drops made on a trip, which means the allocation does not correspond to the actual transport activity: the net transportation of the cargo.



Divide the emissions by the quantity of cargo?
In this case a pallet transported over a long distance is allocated the same amount as one delivered nearby. This distorts the picture.



Allocate everything on the basis of weight
In practice, tons, m^3, volumetric weight, pallets and roll cages are frequently encountered as the unit of measurement for the cargo and for invoicing. Trucks are often full before they reach their maximum weight. In such cases it is much better to take the natural unit as the basis for allocation instead of weight.



Allocation based on kilometers traveled from the warehouse
The disadvantage of this method is that the sequence of addresses now has a significant influence: the last address is allocated the most emissions, while this is likely to be close to the DC. In such a case all customers will want to be the first address in the sequence.

Allocation: the COFRET project

The EU COFRET project focused on questions including how emissions can be allocated fairly. There are many conceivable ways to perform such a calculation.

The solution that COFRET proposes takes the company's basic data as a starting point, is well-balanced, works in all circumstances and can be calculated with precision retrospectively on the basis of the records kept, making it practicable for auditors.

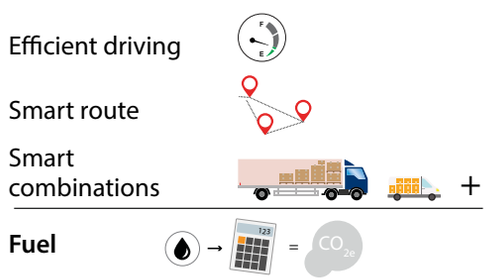
The downside of the COFRET method is that it incorporates a calculation that is difficult for people to perform:

- Calculating the great-circle distance between the origin and destination;
- Determining the percentage of the loading capacity taken up by each portion of the cargo (tons or m^3);
- And then performing a weighted allocation of the total emissions to each portion of the cargo.

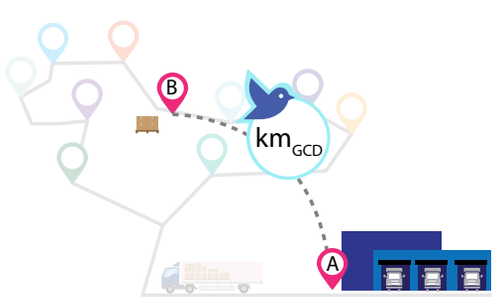
However, this calculation can be easily automated.

COFRET approach to allocation

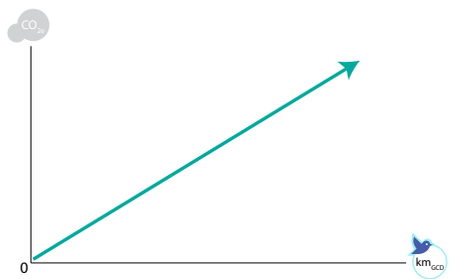
The starting points are summarized below.



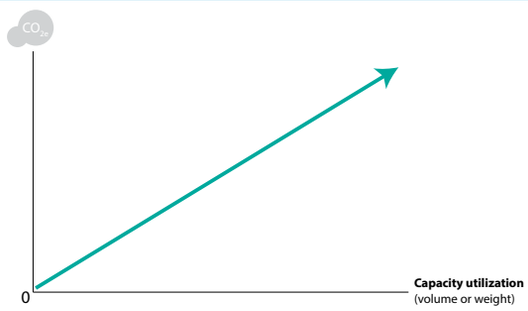
The more efficient the transporter's planning and driving are, the less fuel (or energy) is needed to carry out the combined orders. The fuel (or energy) is also a measure of the deployment of people and vehicles, which is useful for performing subsequent operational analyses. The total amount of fuel consumed can be easily converted to the total CO_{2e} emissions for the trip. These now have to be allocated to each order.



The first starting point for allocation is that the service provided is determined not by the route driven, but by the transportation of the cargo. The customer is interested in the net transportation (=great-circle distance) of his cargo to the destination. That determines the added value and what he is willing to pay. The kilometers traveled and the route are in themselves unimportant: if the route of a distribution trip is reversed and a pallet is unloaded last instead of first, the net service does not change.



When the emissions are distributed each sub-order (cargo) is allocated a larger or smaller share. The greater the distance between the point where the cargo is collected and the destination, the more emissions are allocated to this cargo.



That is not the only thing that counts, however. The more of the truck's capacity a specific cargo takes up, the greater the emissions allocated to this cargo.

The starting point for COFRET is: the further the cargo is transported and the more capacity that is taken up, the greater the percentage of emissions allocated to the order in question.

The weighting factor (%) for the transport order for this cargo is therefore:

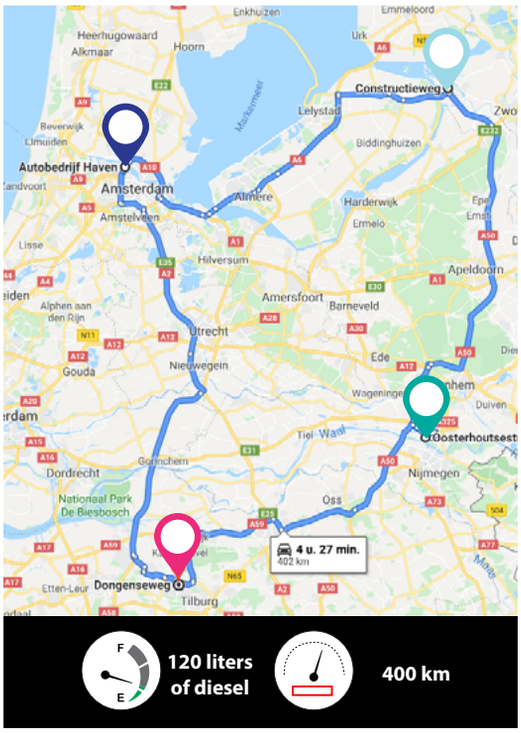
$$\frac{\text{capacity utilization} \times km_{GCD}}{\text{sum total of cargo (capacity utilization} \times km_{GCD})}$$

All weighting factors together therefore add up to 100%.
The weighting factor per sub-order indicates what percentage of the total emissions is allocated to this cargo/order.
A simple example calculation is provided below.

Weighting factor (%)

Order	Capacity utilization		Distance km_{GCD}				
1	5 tons	x	10	=	50	/250 =	20%
2	5 tons	x	20	=	100	/250 =	40%
3	10 tons	x	10	=	100	/250 =	40%
					+		+
Total					250	=	100%

Example: a round trip in the Netherlands

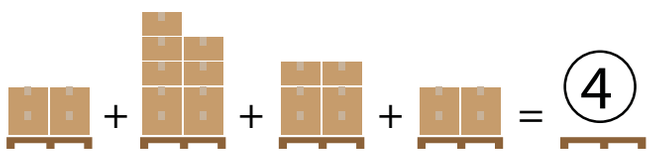


	Einladen	Ausladen
Start DC in Tilburg	+ 30	
Westpoort Amsterdam		- 18
Kampen	+ 24	- 12
Oosterhout		- 24
End point DC Tilburg		

A truck makes a round trip from the Vossenberg industrial estate in Tilburg. Thirty pallets are loaded onto the truck. Eighteen pallets go to an address in Westpoort Amsterdam and 12 pallets to an address in Kampen. Here 24 pallets are then loaded onto the truck and taken to Oosterhout near Nijmegen. The truck then returns to Tilburg empty.
The round trip covers over 400 km and the truck consumes 120 liters of diesel on that day.

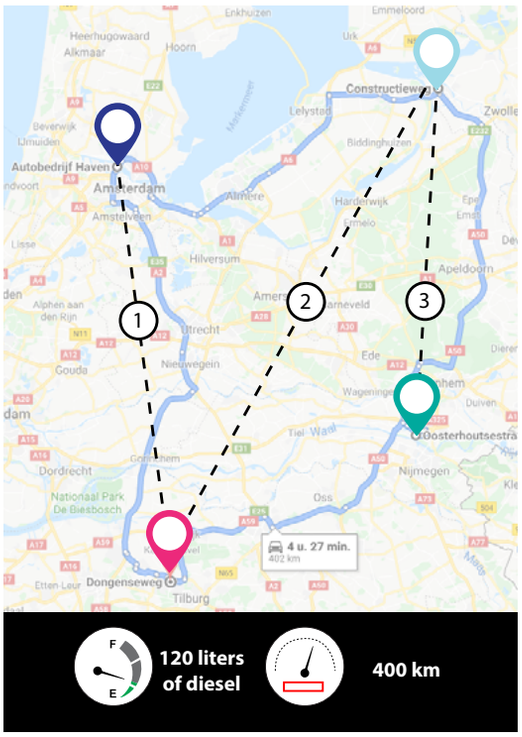
Consumption	Emission factor	Kg CO_{2e}
120 L	**3.23**	**387.6**

According to www.CO2emissiefactoren.nl, the Well-to-Wheel (WTW) emission factor for diesel is 3.23 kg CO_{2e} per liter. 120 liters therefore correspond to 387.6 kg CO_{2e}. How do we allocate this?



The cargo is not particularly heavy and the capacity is not limited by the weight of the cargo, which means we can count the cargo in pallets.

Example calculation



1	89 km_{GCD}	18
2	124 km_{GCD}	12
3	77 km_{GCD}	24

- *The first 18 pallets are transported from the starting location in Tilburg to the destination in Amsterdam. The great-circle distance between these two points is 89 km_{GCD}.*
- *The second order is transported from Tilburg to Kampen. The great-circle distance between Tilburg and Kampen is 124 km_{GCD}.*
- *The third order is to transport 24 pallets from Kampen to Oosterhout. The great-circle distance between Kampen and Oosterhout is 77 km_{GCD}.*

To calculate this retrospectively, use can be made of planners such as Google Maps that indicate the coordinates of a location directly. The great-circle distance can be obtained via the website www.nhc.noaa.gov/gccalc.shtml. Further automation is a good solution for longer lists.

Allocation

Route	Pallets	km_{GCD}	Pallets.km_{GCD}	%	Kg CO2e	Kg CO2e per pallet	Customer
DC Amsterdam	18	89	1602	32.4%	125.7*	6.99	→ A
DC Kampen	12	124	1488	30.2%	116.8**	9.73	→ B
Kampen Oosterhout	24	77	1848	37.4%	145.1***	6.04	→ C
total			**4938**	**100%**	**387.6******		

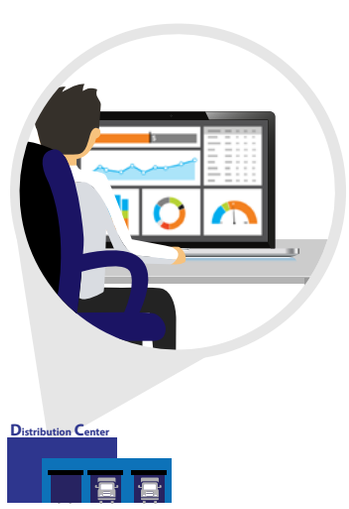
** 32.4% x 387.6 kg CO_{2e} = 125.7*
*** 30.2% x 387.6 kg CO_{2e} = 116.8*
**** 37.4% x 387.6 kg CO_{2e} = 145.1*
***** 120 liters of diesel x 3.23 kg CO_{2e}/liter WTW = 387.6 kg CO_{2e} total*

The calculation in the table shows how the total quantity of CO_{2e} for the trip is allocated to individual orders. This is information for a customer.

Efficiency

A different figure is important for the transporter, namely the average emissions per km_{GCD}: in this example 78.5 grams per pallet.km_{GCD}.

This figure immediately provides an insight into planning and driving efficiency. A higher figure means that more energy and time have been invested by the transporter for the same customer performance (what is paid for).[1] Analyzing this figure allows inefficient trips/orders to be identified.



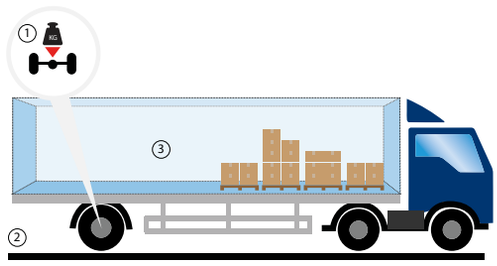
Total pallet.km_{GCD} 4938

CO_{2e} emissions per pallet.km_{GCD} **78.5 grams**

1 *This is one of the reasons for calculating in great-circle-distance kilometers instead of kilometers traveled.*

A few things stand out in this example

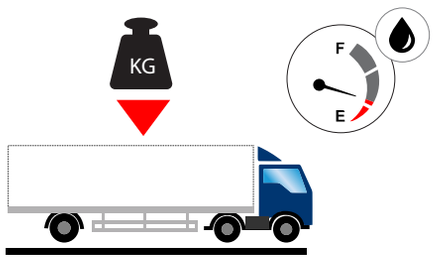
In the allocation no consideration is given to the weight of a pallet and the cargo. This can be easily converted into tons later, but it is not the basis for allocation. In other words, it is perfectly possible to ultimately report in tons, while performing allocation on the basis of pallet spaces taken up. However, this is on condition that the average cargo weight per pallet is roughly the same.



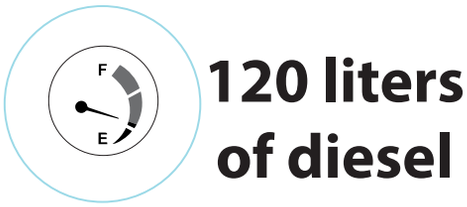
In this example we remain below the:
1 Maximum weight/load per axle;
2 Maximum/total weight of the vehicle and cargo;
3 Maximum available floor area.

The number of pallet spaces used is a good measure.

More weight = higher consumption



But does weight have no impact on total consumption? Actually, it does: a higher train weight results in higher consumption. Should you not then perform allocation on the basis of weight instead of floor area?

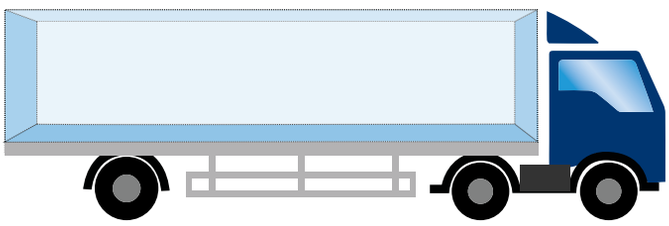


120 liters of diesel

consumption

In theory, that is correct, but in practice these data are often not known and the net effect on the outcome is not significant. That means there is a lot of extra work for little extra information. Furthermore, it only has an impact on the allocation: the sum total of all emissions remains the same. This is determined by the total quantity of diesel.

If it is necessary to calculate emissions per ton or kg, the conversion is simple: divide the emissions per pallet by the number of kg.



The empty kilometers for returning back to base are allocated to all customers. This is customary for distribution trips and delivers good insights. In some cases it gives rise to discussion, particularly in the case of FTL orders: how do you allocate these? Who is responsible? This is examined in more detail in guideline 16 'Repositioning and empty kilometers'.

Carbon Footprint guidelines

0. Measuring, calculating, allocating and reducing

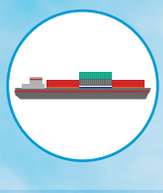
1. Allocating

2. Cargo

3. Origin and destination

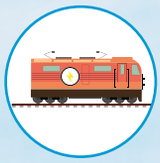
4. Fuel

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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