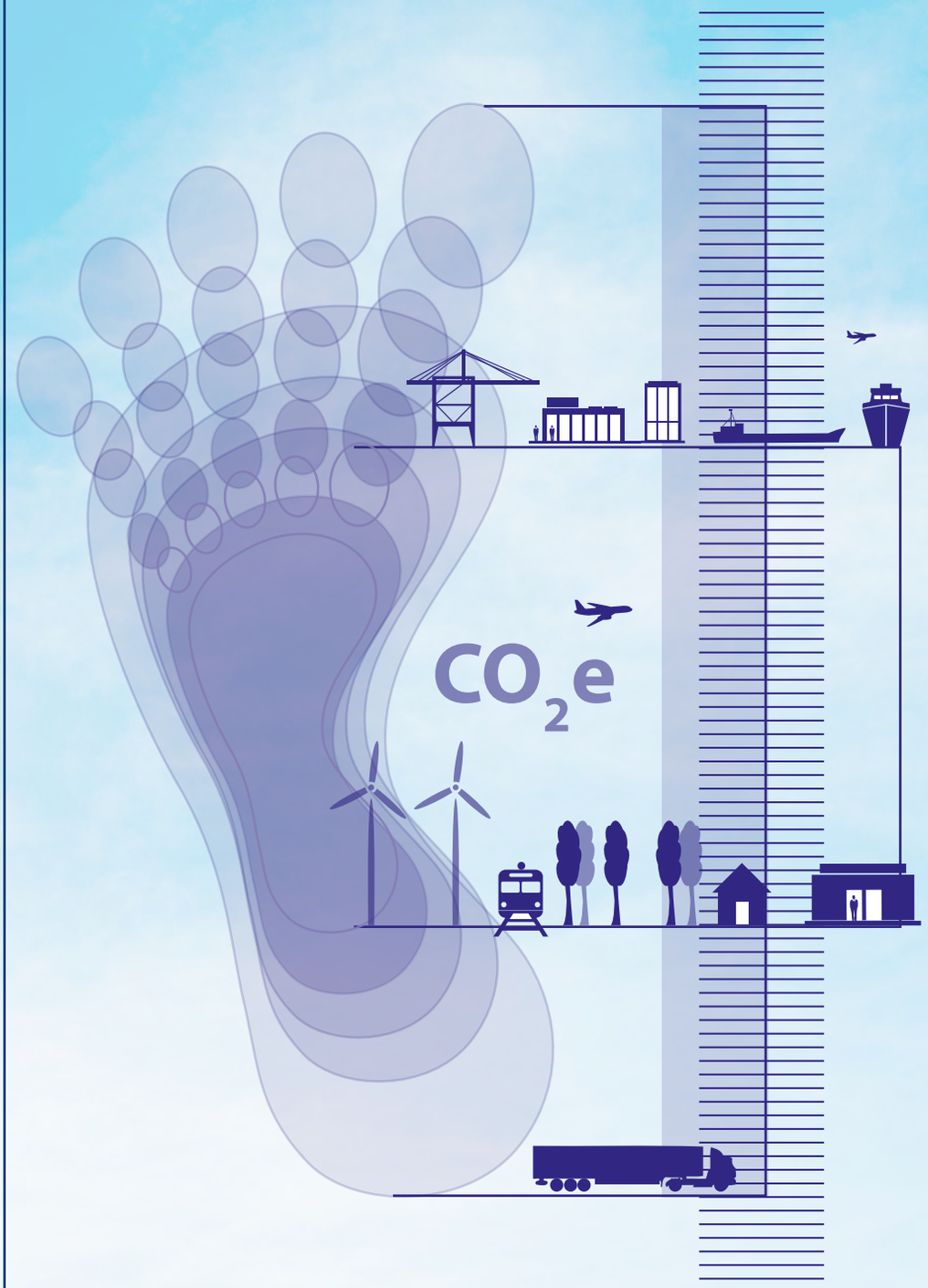
APPLICATION NOTES




# Carbon Footprinting of a Network

*How can a carrier help a shipper define a network footprint*

Connekt

LEAN & GREEN EUROPE

Topsector Logistiek

# Colophon

***Carbon Footprinting of a network***
*How can a carrier help a shipper define a network footprint*

*Application notes*

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**Connekt/Top sector Logistics**
Ezelsveldlaan 59
2611 RV Delft
+31 15 251 65 65
info@connekt.nl
www.connekt.nl

# Carbon Footprinting of a network

## How can a carrier help a shipper define a network footprint

For both the logistics manager and the CFO of a company, it is very interesting to make a good carbon footprint of their supply chain, at least for the part where they make the decisions. Financial analyses have quite a few limitations: on the basis of cost alone it is hard to say something about effectiveness, whether improvements and savings can be achieved by organizing logistics differently.
A carbon footprint analysis shows how much energy (translated into $CO_2e$ emissions) was put into the transportation of goods: with shipping documents in hand, that information gives a lot of new insights as you can easily get into the details. Per part of the chain, per trip or per day or week or month, per customer, you can see the indicator change: that says a lot a lot about the operation.

But how does a logistics manager create a footprint of the entire chain, which has both collection and distribution, dozens of service providers, each of which sometimes hires charters? So, what data will you ask from the service providers, and how difficult or easy or threatening is that for those service providers? What do you do with charters about which little is known?

This guideline addresses this issue, and especially the information that service providers provide to the shipper.

For a service provider there are 6 different ways to provide information that the logistics manager can further calculate. From very precise and detailed, to standard performance indicators that fit the type of carrier. The more detail given, the better the analysis of the chain. But a pretty good chain-footprint can also be made with the 6$^{th}$ variant.

So, it is up to each individual service provider how the customer is served, and each service provider may make a different choice for each customer. Even then the computational method works.

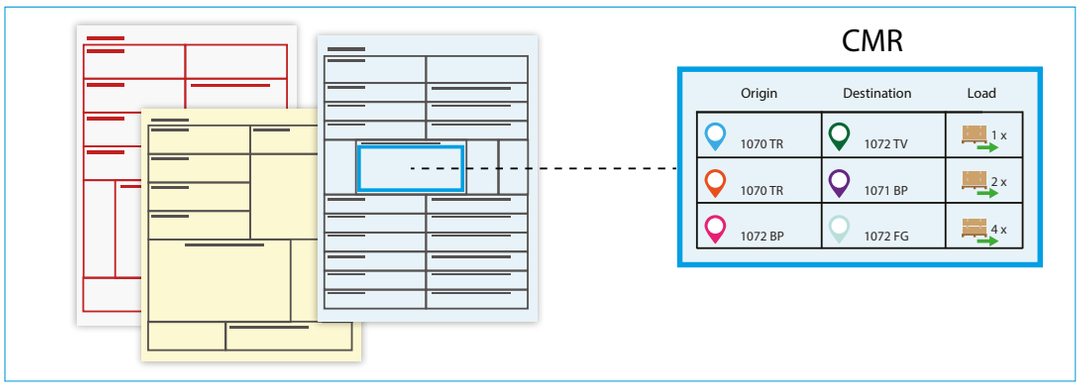
The 6 different possibilities are shown in the following picture: from emissions per shipment, measured per trip, to using a CPI default value from public tables.

| | |
|---|---|
| A | **Share emissions per shipment** |
| B | **CPI per-trip sharing** |
| C | **Sharing carrier average CPI for this type of trip** |
| D | **Sharing carrier average CPI** |
| E | **Average CPI per transport (sub)segement** |
| F | **Use CPI from standard value tables** |

How can a shipper use that data to calculate a chain? And how can the service provider help?

## $CO_2$e emissions per shipment in a network

Each time, a shipper issues transportation orders to its carriers: collect this shipment at the address of origin and deliver it to the specified destination. The chain is formed by stringing together the transportation, transshipment and storage steps.




This shipper wants to know the assigned $CO_2$e emissions from its entire network, from all the carriers engaged, per shipment, for each shipment separately. Of both collection and distribution transportation.

Assignment is especially necessary for combined shipments (groupage, LTL, distribution, containers, etc.). Carriers plan as efficiently as possible and combine multiple shipments from multiple customers in one trip. Then the emissions from the round trip are distributed among the cargo in the shipments: this is called assignment. The so-called COFRET method tells you how to calculate it.

The essence of the method is that the so-called 'transport performance' is the measure of things. The transport performance is the amount of cargo times the distance (as the crow flies) between origin and destination of the shipment. The larger the load the more performance. The greater the distance between origin and destination, the greater the performance.

The difference with transportation performance is that the distance driven or sailed does not count. So if in a distribution trip the last pallet is unloaded 10 km (as the crow flies) from the warehouse, after a 200 km round trip, the transport performance is 1 pallet over 10 km. This approach fits with the way prices are calculated, and with common sense.

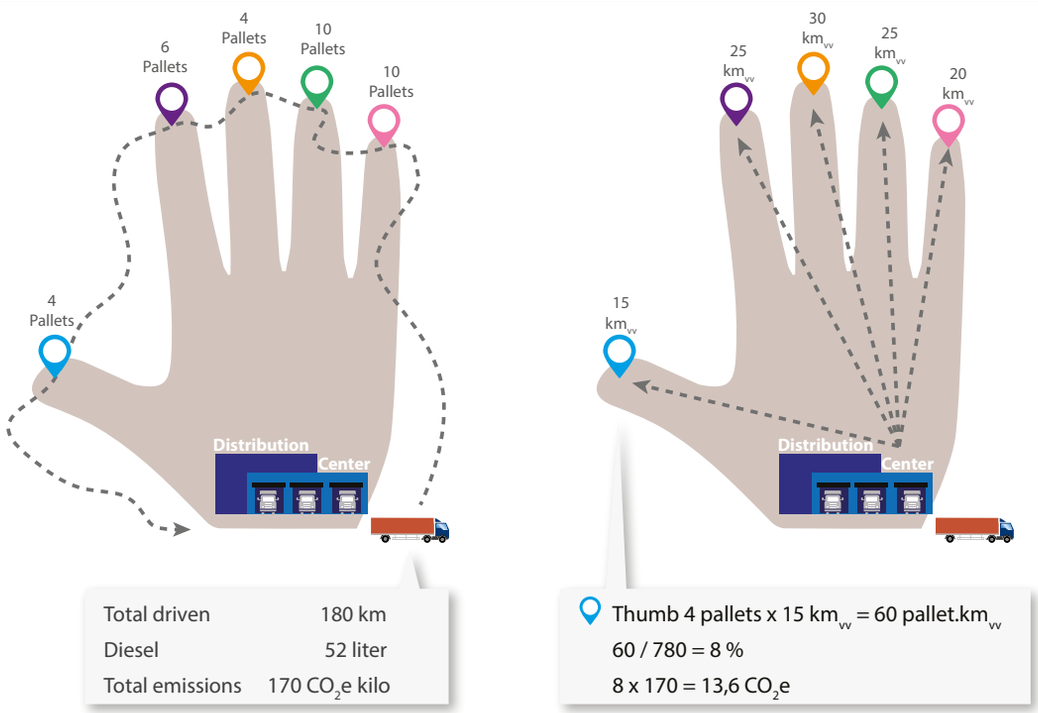
The emissions from a round trip are distributed over the total trip performance: the sum of all orders performed in that trip. This is called assigning emissions to shipment orders.

## Brief explanation COFRET method of assigning $CO_2e$ to cargo (shipments)

In the example, a carrier takes 34 pallets to 5 locations, delivering pallets to each location.

- The amount of fuel for the trip is easy to measure.
- The number of pallets to be delivered per location is known.
- The addresses of the warehouse and delivery locations are also known.

This is all the data needed for the calculation.




x = / 780 x 170

| Location | Cargo (pallets) | Distance ($km_{vv}$) | pallets x km (Pallet.$km_{vv}$) | Allocation (%) | Emissions $CO_2e$ kilo |
|---|---|---|---|---|---|
| Thumb | 22 | 15 | 60 | 8 | 13,6 |
| Index finger | 2 | 25 | 150 | 19 | 32,3 |
| Middle finger | 2 | 30 | 120 | 15 | 25,5 |
| Ring finger | 3 | 25 | 250 | 32 | 54,4 |
| Little finger | 5 | 20 | 200 | 26 | 44,2 |
| **Total** | **34** | **180** | **780** | **100%** | **170** |

CPI = 170 kg $CO_2e$ / 780 pallet.$km_{vv}$ = **0,218 kg $CO_2e$ per pallet.$km_{vv}$**

KPI = 170 kg $CO_2e$ / 34 pallets = **5,0 kg $CO_2e$ per pallet**

The figure shows the calculation: the displacement distance (as-the-crow-flies kilometers between origin and destination) is calculated from the addresses, the performance is the number of pallets times the displacement distance. The rest is simple multiplication, addition and division.

The calculation will determine a so-called COFRET Performance Indicator (CPI). The CPI is the measure of $CO_2e$ effectiveness: the lower the CPI the less $CO_2e$ it took to move all the cargo from origin to destination. As well as a measure of effectiveness, the CPI is also a very easy way to do calculations by subtask. More on that later.

## Combining client orders

What happens if the carrier cleverly combines orders from different customers into one trip? How to calculate the information per customer, per shipment, per part of that shipment (partial order)?

The assignment calculation provides how much $CO_2e$ is assigned to each specific subcontract. The carrier that performs the calculation can then calculate the orders of one customer, and provide only the specific information to the specific customer.

The customer (shipper) loads the emissions by partial order into his analysis system, and can then view and analyze the chain.

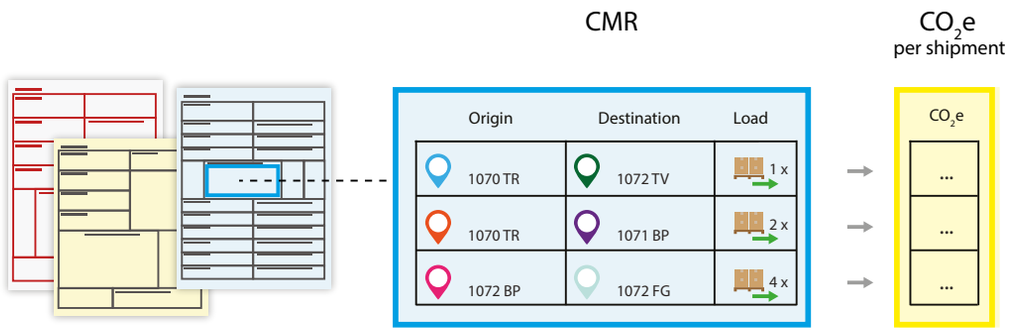
In practice, not every carrier is able or willing to perform this calculation.

So how does this work in practice? How can a carrier still help its client?

There are 6 possible ways for a carrier to provide the client with data: the difference is to what extent the result is an average, and how it contributes to the analysis.

Below they are shown in order of accuracy.

## A Share emissions per shipment



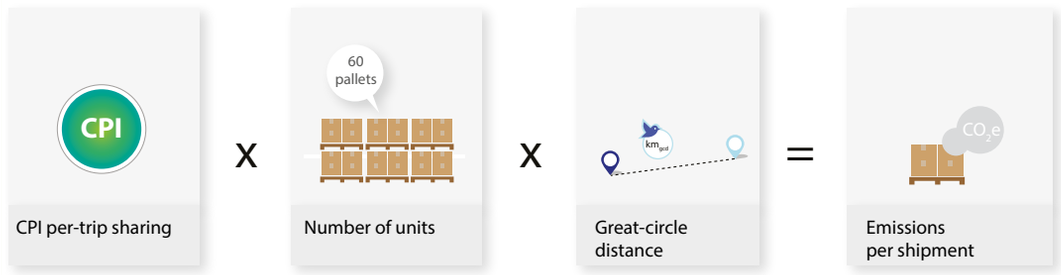

*In this case, the carrier has all the tools to perform its own assignment calculation per shipment for each trip according to the COFRET method. The result of the calculation is the emissions per shipment, of all shipments from all clients in that trip.*

The next step (the software can do this) is to break down this table to each client, and send separate results to the client: this is your CMR, so to speak, supplemented by $CO_2e$ emissions for each partial order.

The shipper receives the correct emissions per order line, for the work performed by the carrier. This data can be combined with other data from the rest of the chain without further processing. The shipper can immediately see all details and analyse his entire chain.

This is the most direct and accurate method.

## B CPI per-trip sharing




*In this case, the carrier has all the tools to do its own assignment calculation for each trip per shipment according to the COFRET method.*

In this per-trip calculation, a so-called CPI is calculated which you need as shown in the example.

The CPI is defined emissions per unit.$km_{vv}$ in this calculation example the unit is pallet. The '$km_{vv}$' is the displacement distance. For a specific shipment, that is equal to the as-the-crow-flies distance between origin and destination of that shipment.

Instead of the details ($CO_2e$ per shipment), the carrier can also share the CPI with the client.

This is because the shipper knows the rest of the data per shipment: the amount of cargo (number of units), the origin location and the destination. After all, that is his job.

Given the origin and destination location, it is quite easy for the shipper to use the data to calculate the as-the-crow-flies distance between origin and destination per shipment, and then apply the formula:

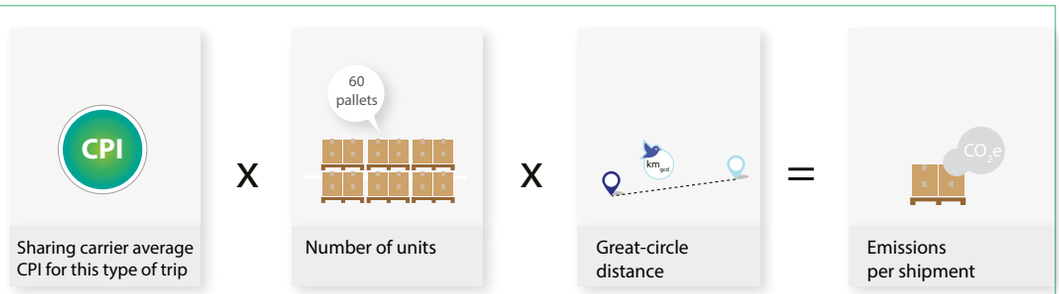
***CPI x number of units x as-the-crow-flies distance = $CO_{2e}$ for that shipment.***

This calculation of the as-the-crow-flies distance is easy to automate in software.

This is as accurate as Method A, but a bit more indirect.

This, too, will give the shipper the correct emissions per order line, for the work performed by the carrier. This data can be combined with other data from the rest of the chain without further processing. The shipper can immediately see all details and analyse his entire chain.

## C Sharing carrier average CPI for this type of trip

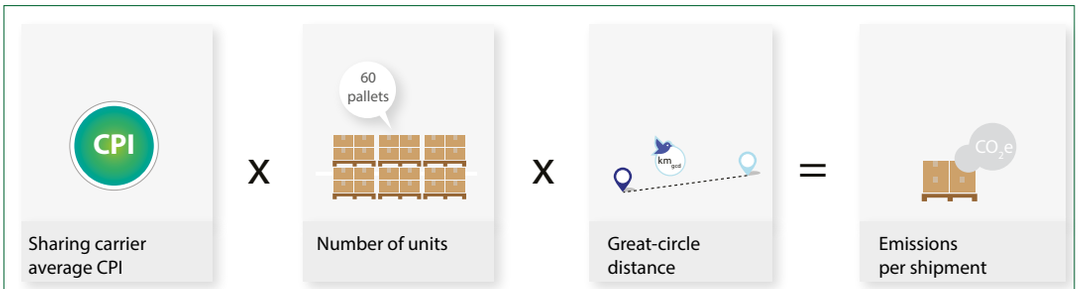



*Every so often, the carrier calculates its CPI for a particular type of customer and trips using samples.*
*The carrier shares the CPI with its clients monthly or otherwise.*
*The shipper can do the same calculation as in B: per trip.*

This calculation in turn produces the list that can be combined with other data for analysis.

It will give more average results (based on the sample). This is because the difference between trips is no longer visible in the analysis.

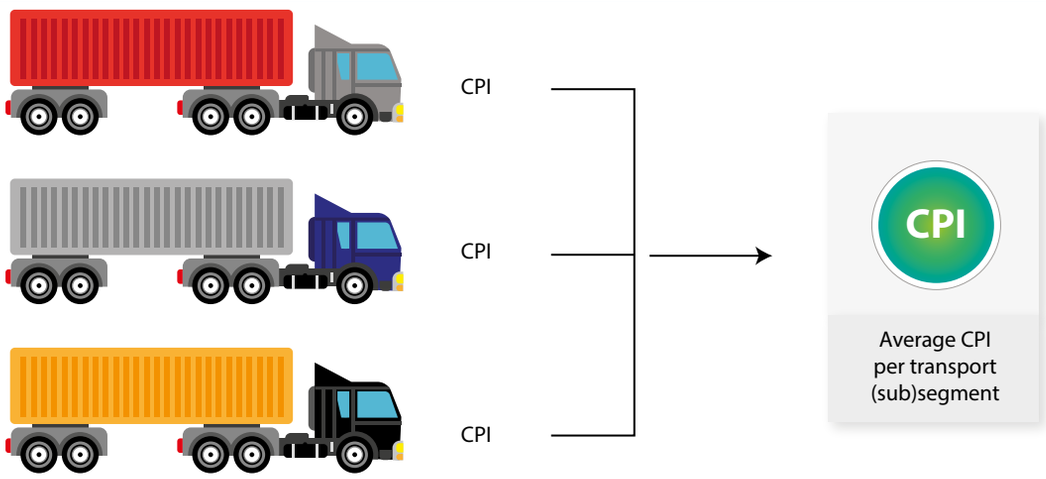
## D Sharing carrier average CPI




*The carrier calculates its CPI for all types of trips and clients every so often by sampling.*
*The carrier shares the CPI with its clients annually or otherwise.*
*The shipper can do the same calculation as in B: per shipment.*

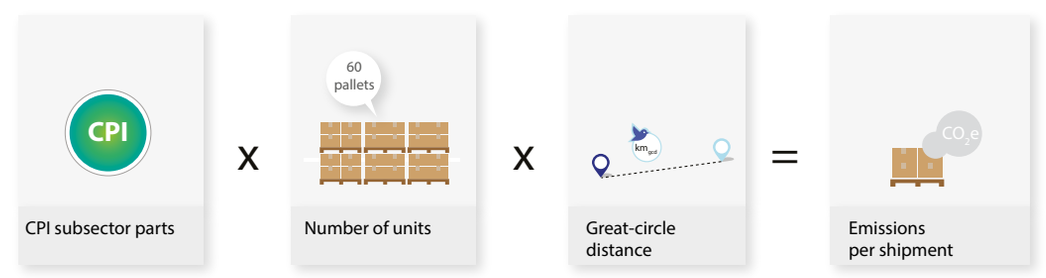
Again, this produces a list that can be immediately combined for further analysis by the shipper. The disadvantage of this variant is that the outcome is even more average, with differences between types of customers and types of trips lost in the averaging.

## E Average CPI per transport (sub)segment




*A group of carriers under an industry association or otherwise, calculate their average CPI for all types of trips and clients every so often using random sampling. They work in the same industry, for the same types of clients and types of cargo.*

This CPI is published and can be used by their clients to perform the calculation.

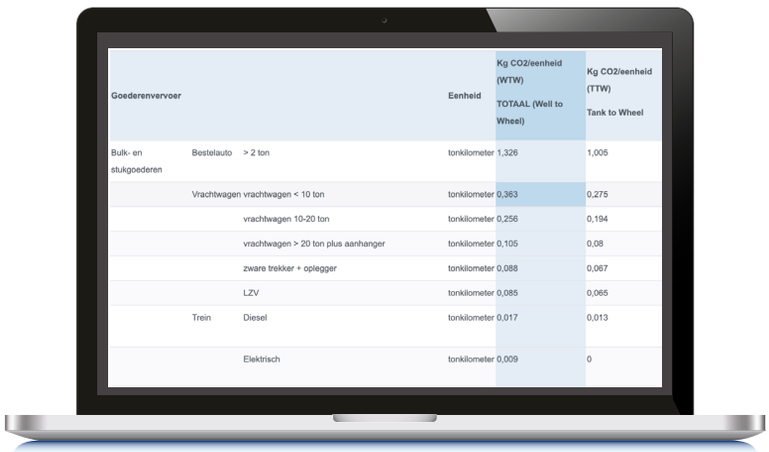



*The shipper can do the same calculation as in B: per shipment.*

The result is a realistic approximation of emissions.

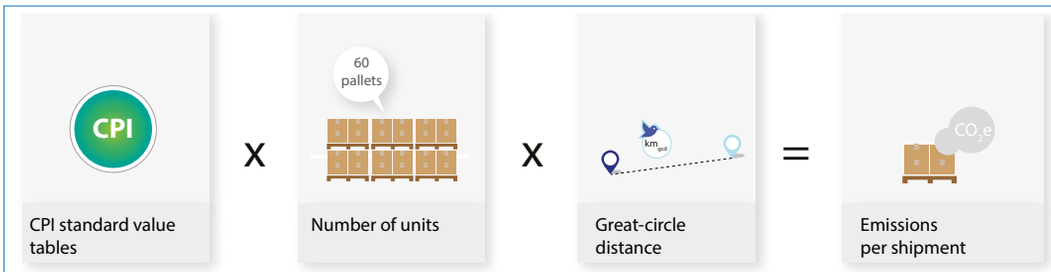
Again, this produces a list that can be immediately combined for further analysis by the shipper. The disadvantage of this variant is that the outcome says nothing about the carrier's impact on the outcome, it only shows the industry average.

## F Use CPI from standard value tables



| Goederenvervoer | | | Eenheid | Kg CO2/eenheid (WTW) TOTAAL (Well to Wheel) | Kg CO2/eenheid (TTW) Tank to Wheel |
|---|---|---|---|---|---|
| Bulk- en stukgoederen | Bestelauto | > 2 ton | tonkilometer | 1,326 | 1,005 |
| | Vrachtwagen | vrachtwagen < 10 ton | tonkilometer | 0,363 | 0,275 |
| | | vrachtwagen 10-20 ton | tonkilometer | 0,256 | 0,194 |
| | | vrachtwagen > 20 ton plus aanhanger | tonkilometer | 0,105 | 0,08 |
| | | zware trekker + oplegger | tonkilometer | 0,088 | 0,067 |
| | | LZV | tonkilometer | 0,085 | 0,065 |
| | Trein | Diesel | tonkilometer | 0,017 | 0,013 |
| | | Elektrisch | tonkilometer | 0,009 | 0 |

*The shipper chooses the most appropriate CPI from standard value tables.*




*The shipper can do the same calculation as in B: per shipment.*

The result is a realistic estimate of emissions.

The list is immediately combinable for further analysis by the shipper.

The analysis and reporting do provide insight into the relative differences in the chain (customer, region, period and more), but not on the influence of carriers on the outcome.

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