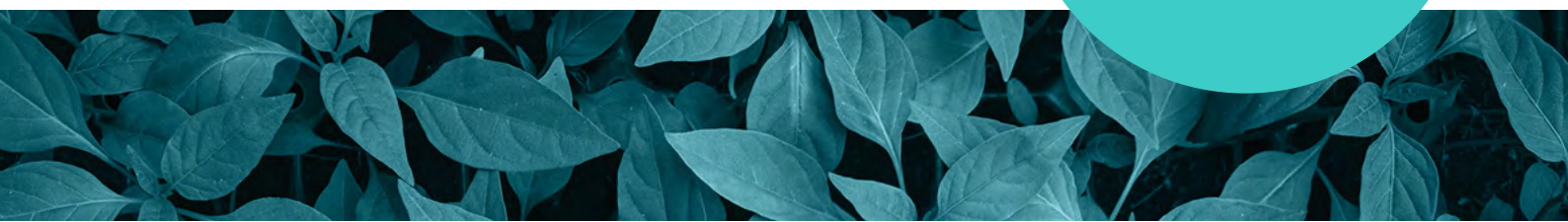
Carbon Emission Calculator

ship-from-store

Measuring the benefits of local sourcing of ecommerce orders

StoreShippers
ship from store

February 2020



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Introduction

Global ecommerce is growing rapidly with no indication of slowing down. In 2019, global retail e-commerce sales amounted to $3.53 trillion and e-retail revenues are projected to grow to $6.54 trillion in 2022. While ecommerce keeps growing, so does our environmental responsibility.

Almost everyone nowadays orders products online. The ease and speed with which this is associated are all the more reason for consumers to continue this buying behaviour. As a result, delivery vans have become a permanent part of the street scene. Vans drive back and forth to the homes of consumers, while trucks supply the distribution centres.

These transport movements cause complex challenges in and for cities. In addition, the transport movement as a result of online orders is accompanied by high carbon emissions, both inside and outside cities. In order to continue to meet the growing demand for online products without burdening the environment, ecommerce deliveries must become more sustainable and efficient. We at StoreShippers believe that ship-from-store is the way forward for global online retail.

With a ship-from-store strategy retailers are able to meet the consumer's demand for fast delivery and improve stock efficiency. Moreover, local sourcing of products is the least harmful to the environment, compared to traditional forms of ecommerce logistics. With a ship-from-store strategy it is possible to shorten the supply chain, improve load capacity and implement sustainable last-mile delivery solutions.

To understand why we believe that ship-from-store is the best way forward for the environment, it is important that the impact of various logistics operations on carbon emission is mapped. Although it is clear to everyone that ecommerce logistics has an impact on the environment, it is not exactly clear how large this impact is and what the differences are between different forms of logistics.

Every distributor works with different figures on the emission of carbon emission. To provide clarity, an indicative figure about the effect on carbon emission reduction of parcels that are shipped from a local store compared with parcels that are shipped from a global distribution centre is needed. This way it is possible to create awareness and respond to opportunities that ship-from-store has to offer.

"Ship-from-store is the way forward for global online retail"

Until now there is no measurement system that offers reliable end-to-end data about carbon emissions for ship-from-store. However, there are several proven measurement systems for specific parts of the supply chain and by combining the best in class measurements systems for each part of the supply chain, StoreShippers has created a ship-from-store Carbon Emission Calculator.

The objective of the ship-from-store carbon calculator is to inform all relevant stakeholders of the benefits of local sourcing of products.

In this white paper we describe sustainability in the supply chain of ecommerce, existing carbon emission measurements, the way we designed the ship-from-store calculator and its most important dimensions.

Sustainability in ecommerce

Sustainability - the ability to meet the needs of the present without compromising the ability of future generations to meet their own needs - is an important theme in all sectors of business. Ecommerce and the associated logistics are certainly no exception to this.

> "73% of consumers would change their consumption habits to reduce their impact on the environment"

Consumers are increasingly aware of their environmental footprint, influencing their purchases.

Research shows that 73% of consumers say they would definitely change their consumption habits to reduce their impact on the environment. Although consumers are increasingly motivated to be more environmentally conscious in their online shopping habits, they feel that companies should help improve the environment too. Moreover, they expect companies to help them make sustainable choices. Companies in all facets of ecommerce adjust their business choices accordingly.

One of the components of ecommerce that has the greatest environmental impact is logistics. Common logic may suggest that ecommerce ensures fewer car trips by consumers, because they no longer have to go to physical stores for their desired products. And fewer car trips means fewer carbon emissions. However, this does not appear to be entirely true in reality.

Although online shopping can reduce these trips to the stores, research shows that instead of including one-off purchases in other shopping trips, like grocery shopping, consumers are making more one-off online purchases while the number of shopping trips remains unchanged. In addition, according to the same research, online shopping has put more delivery trucks on the road without a similar reduction in consumers' cars. This can partly be explained by the increase in delivery options, such as same-day and two-hour delivery, as a result of higher consumer demands.

Consequence is that more delivery trucks drive more often between distribution centres and the homes of consumers. On the other hand, nowadays there are several distributors, and even a few retailers such as Amazon and Coolblue, who deliver packages. In the past, every country had one postal operator that carried out all the last-mile deliveries of mail items as a universal service, while nowadays ecommerce is delivered in free competition by multiple carriers.

The increase in the number of car trips and delivery trucks on the road leads to an increase in carbon emissions, congestion, slower and

a decrease in the accessibility of cities. These negative consequences of ecommerce logistics influence public opinion and government policies, which in turn pushes retailers and distributors to think about their own actions and to adjust their operations accordingly.

The goal of many ecommerce retailers and distributors is therefore to reduce their carbon footprint. To counter the problems related to the environment, many developments are taking place within ecommerce logistics. This includes green gas cars, electric vehicles, water transport, pick-up point delivery, bundling packages and sustainable packaging. Various distributors also offer consumers and retailers the opportunity to offset their carbon emissions. They do this by charging extra costs with which carbon credit is purchased on a carbon emission trading market (such as Climex).

Although there are many developments taking place within the sector to make it more sustainable, many ecommerce logistics companies are mainly focused on the last mile. This can be explained by the fact that the last mile is the most visible part of the supply chain. After all, consumers only have direct contact with the distributor who delivers the package at their home. The focus of many companies is therefore on the part of the supply chain that catches the eye to the outside world, while it is necessary to look at the elements in the supply chain that are the most polluting.

Little initiative is shown to change the supply chain as a whole, in order to structurally reduce carbon emissions per package. A development that actually does this, is ship-from-store. With ship-from-store, products are sourced locally which makes it a fast and sustainable alternative to traditional ecommerce logistics.

"Ship-from-store is a fast and sustainable alternative to traditional ecommerce logistics"

What is ship-from-store?

Ship-from-store is a fulfilment process where retailers use stock from their brick-and-mortar store estate to fulfil (online) orders. Instead of using centralized distribution centres, the physical store is used as a small distribution centre, to support the digital platform.

With ship-from-store retailers can ship an online order straight from their local store instead of having to ship the order all across the world from a central warehouse. Fulfilling orders this way turns the store into a virtual hub and ensures that orders are sent smoothly and quickly to the consumer.

In practice, ship-from-store works as follows: customers visit the online store and place their order online. The online store gets notified that the order is placed, checks store inventory and searches for the store closest to the consumer.

The store staff then collects the products for the orders - sometimes by shipment, sometimes in bulk. The store staff packs the items and prepares the order to be handed to the carrier. Finally, the carrier collects the package from the store and delivers it to the consumer.

"Ship-from-store turns the store into a virtual hub"

Ship-from-store reduces carbon emissions

Implementing a ship-from-store fulfilment strategy offers several benefits. Retailers benefit by higher sales, faster deliveries, optimized inventory forecasting, higher margins and lower costs. The environment benefits by reduced carbon emission because products only travel the last mile in the form of a parcel. Also, ship-from-store uses more eco-friendly modes of transport and it sources products closer to consumers. We distinguish the following reasons:

1. Reduction in cargo load

Products can travel in bulk to the store before they are packed for delivery to the final consumer, while parcels travel thousands or at least hundreds of miles when shipped from a distribution centre. With the latter method, a lot of air is transported, so that fewer products can be transported in one load.

Ship-from-store transports cargo in a more efficient way, which reduces transport movements. Our research shows that when products can travel in bulk to the store before they are packed for delivery to the consumer, a factor five in volumetric is saved. Carbon emissions are reduced as a result, which in turn is positive for the environment.

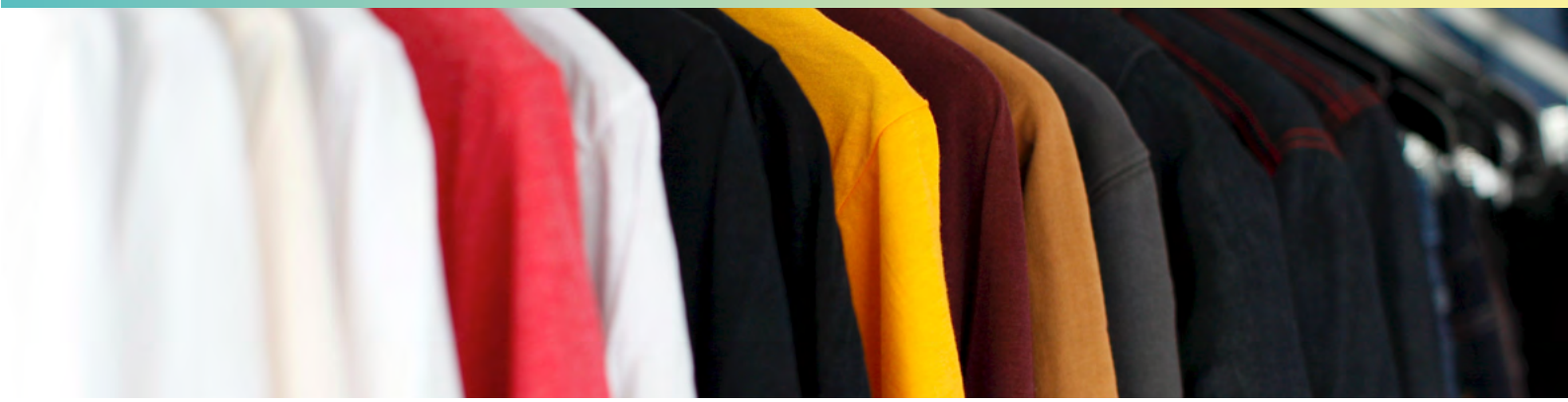
2. More environmentally-friendly modes of transport

Because products are sourced from a store and delivered to consumers in just a few hours, it is not needed to use fast and polluting transport means like planes and/or vans. Products can travel the longest part in the supply chain by boat, train, and truck to supply stores, which have a significant lower impact on carbon emission than planes and vans.

3. Shorter last mile

In traditional ecommerce logistics parcels travel hundreds, or at least tens, of miles before they are delivered to the end consumer. With ship-from-store, on the other hand, this can be reduced till only a few miles. Because ship-from-store introduces a different logistics model than traditional ecommerce logistics, its impact on the environment not only positively influences the last-mile, but also the entire supply chain.

"Higher sales, faster deliveries, optimized inventory forecasting, higher margins and lower costs"



Measuring carbon emission

Making ecommerce logistics more sustainable is an ambition of many companies in the sector. As we mentioned earlier, this is not least because consumers are becoming increasingly aware of the impact of their buying behaviour, which has an effect on the actions of retailers. In addition, global reduction targets set retailers in motion to focus on the sustainability theme. Sustainability is therefore a challenge faced by many retailers, distributors and other companies in the sector.

Because of the emphasis placed on the importance of sustainability within the sector, many companies want to show their environmental performance. However, measuring the effect on carbon emissions in ecommerce logistics is complicated. There is inconsistency among existing emission factors. The emission factor indicates how many pollutants a vehicle emits per kilometre. This is expressed in kilograms of CO_2 per tonne-kilometre. The total greenhouse gas emissions in freight transport are preferably subsequently calculated by multiplying the amount of fuel used in the transport options used by the various CO_2 emission factors.

1. Distributors' calculation methods

Various distributors have developed calculation methods to calculate their carbon emissions per package. For example, DHL has developed the 'DHL Carbon Calculator'. With the Calculator, DHL allows customers to calculate transport-related emissions. DHL uses the sender's and receiver's locations to calculate emissions, as well as the weight and volume of the shipment. DHL distinguishes four transport modes, namely plane, boat, rail and truck.

For each scenario (route plus volume plus weight) the carbon emissions can be calculated per transport mode, making it clear which mode produces the least emissions. This shows that delivering the package by plane in most cases produces the highest carbon emissions.

Another distributor that has developed a calculation method for carbon emissions is PostNL. This calculator looks at the annual number of parcel shipments in the interior (the Netherlands), within Europe and outside Europe. Based on these numbers, the calculator calculates the carbon emissions for these shipments in total. As with DHL, this shows that the greater the distance, the greater the carbon emissions.

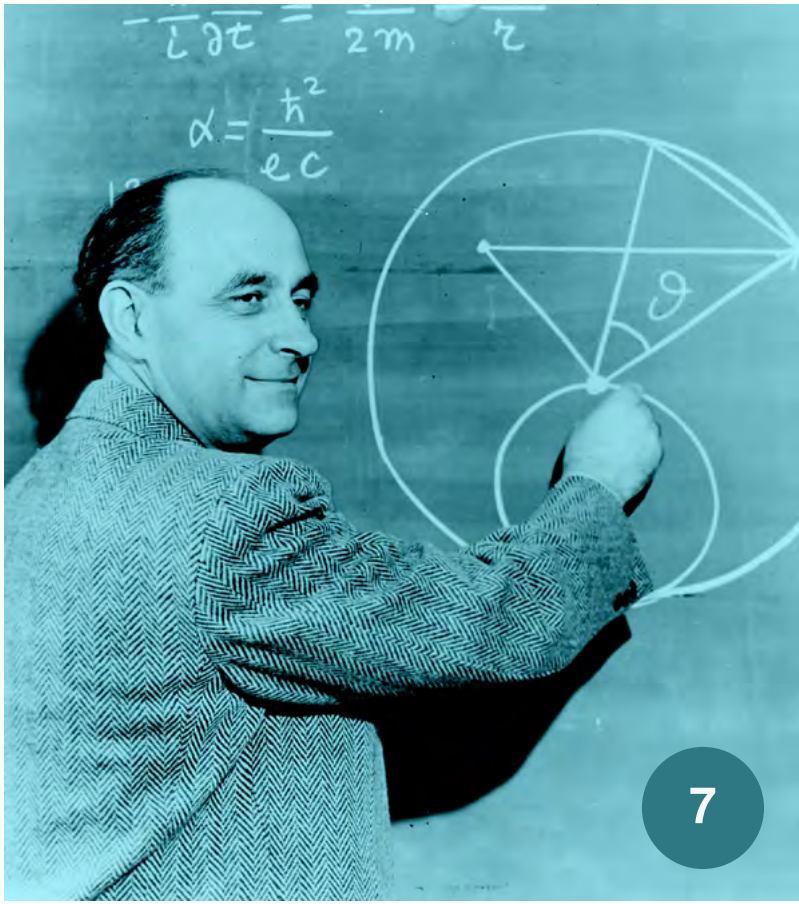
In addition, other distributors, such as UPS, GLS and Hermes, focus on creating sustainability awareness in relation to logistics and on reducing their own carbon emissions. Figures about their own footprint are therefore shown in white papers and reports, but without the calculation method used. There is a lack of openness about the calculation method and underlying figures.

This lack of openness about the calculation methods and underlying figures applies to almost all the aforementioned distributors. DHL is the most open and gives a clear explanation of how the carbon emissions have been calculated and which sources have been used, but it is not clear what the exact used emission factors are per transport mode.

The other distributors provide little or no insight into their used calculation method, figures and calculations. This data is often invisible to the user of the calculation tool, which gives the impression that the measurements can be subjective and distorted. This makes it difficult to assess the actual impact on the environment. Moreover, openness about the calculation method and figures is needed to convince consumers and to make them embrace the brand or company. Trust is a crucial element to convince customers and change customer behaviour.

In addition to the lack of openness, also a standard uniform calculation method that every distributor uses is missing. This uniformity is necessary to be able to compare the environmental performance of different companies and their shipping methods.

Finally, distributors are either focused on the last mile or on other parts of the supply chain. In the latter case, only the delivery to the city - city centre or city border - of the consumer is considered and not the delivery to the exact address of consumers, which means that the delivery by van or bicycle is nearly or not included.



2. Calculation methods of research institutes

In addition to distributors, various research institutes have also conducted research into carbon emissions in freight transport (table 1). This concerns independent scientific studies in which there is no direct interest in the outcome of the studies.

These institutes have developed calculation methods to measure carbon emissions. They do this, among other things, on the basis of the emission factor per transport mode. These emission factors are shown below in kilograms CO2 per tonne-kilometre.

Unlike the distributors, the research institutes are transparent in the underlying figures and calculation method that they use. However, here too, uniformity is missing. If the figures from the different research institutes are compared, it can be seen that the emission factors per vehicle in freight transport differ per institute. This again shows that measuring the effect on carbon emissions in ecommerce logistics is complicated and inconsistent.

However, while there are different conditions in each context, what is consistent is the higher impact of plane travel over other transport modes.

Because the research institutes are transparent in their calculation methods, their direct self-interest is missing and because they release figures for the entire supply chain, we have chosen to use the figures from the research institutes for the development of the StoreShippers Carbon Emission Calculator. To develop the carbon emission calculator, which is introduced in this white paper, we use the median of the available emission factors per transport mode, being:

Plane short-haul:	1,47 kg per tonne kilometre
Plane long-haul:	0,61 kg per tonne kilometre
Boat:	0,02 kg per tonne kilometre
Truck:	0,11 kg per tonne kilometre
Van:	0,69 kg per tonne kilometre
Cargo bike:	0,00 kg per tonne kilometre

CO2 Emissions, kg per tonne-kilometer								
Source	Plane short haul	Plane long haul	Boat	Short sea	Barge	Rail	Truck (semi trailer)	Van
1	1,47389	0,61324	0,048			0,0252	0,297	0,297
1	1,47389	0,61324	0,019055			0,0285	0,24695	0,75492
1	1,527	1,527	0,048			0,0252	0,297	
2	Avg. Plane: 0,602			0,016	0,031	0,022	0,062	
3				0,015		0,018	0,082	1,153
4	1,24621	0,59268	0,01305			0,03299	0,10797	0,61547
5	0,14964		0,02215			0,0228	0,07988	
6	Avg. Plane: 0,75		0,0175					
7			0,0472					
Median	1,47389	0,61324	0,02215	0,0155	0,031	0,02520	0,10797	0,6852
Average	1,17413	0,83654	0,03071	0,0155	0,031	0,02496	0,18513	0,7051
Std. Deviation	0,58	0,46	0,02	0,00	N/A	0,00	0,11	0,35

Table 1: emission factors per institute and transport mode

Sources:

1. GHG Protocol - “Other” region
2. ECTA / Cefic
3. CE Delft
4. UK Department for Business, Energy & Industrial Strategy
5. Spain (Llano et al.)
6. CLECAT
7. BSR CCWG

Carbon emissions in the supply chain of ecommerce

The impact of ecommerce parcels on carbon emissions very much depends on the length and speed of the supply chain. The farther and the faster parcels have to travel from the distribution centre to the end consumer, the more impact on the environment. Therefore the total carbon reduction of a ship-from-store strategy differs very much per retailer and how they have organized the ecommerce supply chain.

Below we compare the supply chain from traditional ecommerce logistics to ship-from-store. We distinguish four legs of the ecommerce supply chain, namely international, continental, national and local. The following transport modes apply per leg of the supply chain: long haul by plane, continental transport by plane, national transport by truck and local delivery by van.

"Carbon emissions depend on the length and speed of the supply chain"

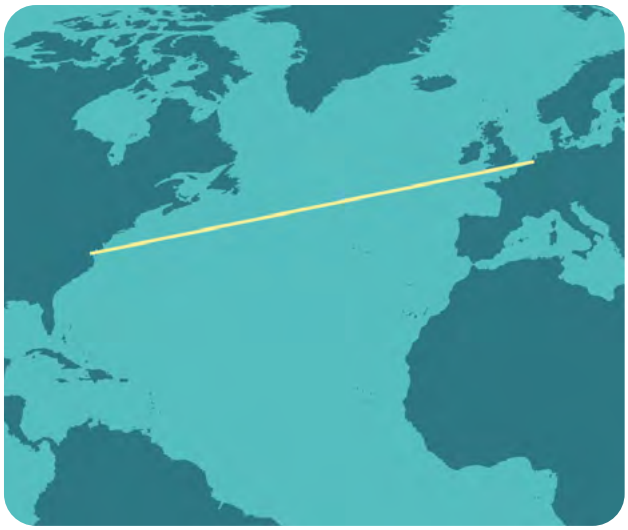
1. Intercontinental

Parcels are sourced from one global distribution centre for global delivery.

For example: The consumer lives in New York City and buys jeans online from a fashion retailer in The Netherlands. She chooses the fastest delivery option available. The fashion retailer has a warehouse on the edge of Amsterdam with the jeans. The jeans will travel by plane from Amsterdam to New York (Intercontinental, ~5800km), and then last-mile by van to the consumer's doorstep in Queens (Local, ~100km total delivery round).

Intercontinental using: plane, truck and van.
Ship-from-Store using: boat, truck and bike.
Carbon emissions savings with ship-from-store: 17.998kg CO2 per tonne.

For a package of approximately 1 kilogram the carbon emissions savings with ship-from-store are 18,0 kilogram CO2.



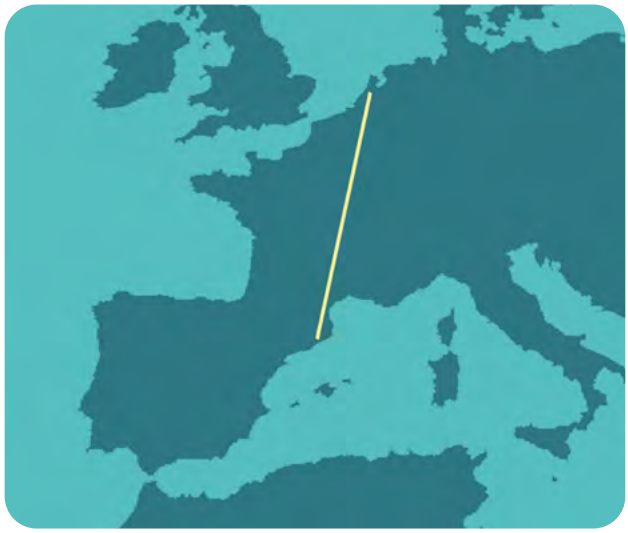
2. Continental

Parcels are sourced from a continental distribution centre for continental distribution.

For example: The consumer lives in Amsterdam and buys a jacket online from a fashion retailer in Spain. She chooses the fastest delivery option available. The fashion retailer has a warehouse in Barcelona with the jacket. The jacket will travel by plane from Barcelona to Amsterdam (Continental, ~1215km), and then last-mile by van to the consumer's doorstep in South Amsterdam (Local, ~100km total delivery round).

Continental shipping using: plane, truck and van.
Ship-from-Store using truck and bike.
Carbon emissions savings with ship-from-store: 9.167kg CO2 per tonne.

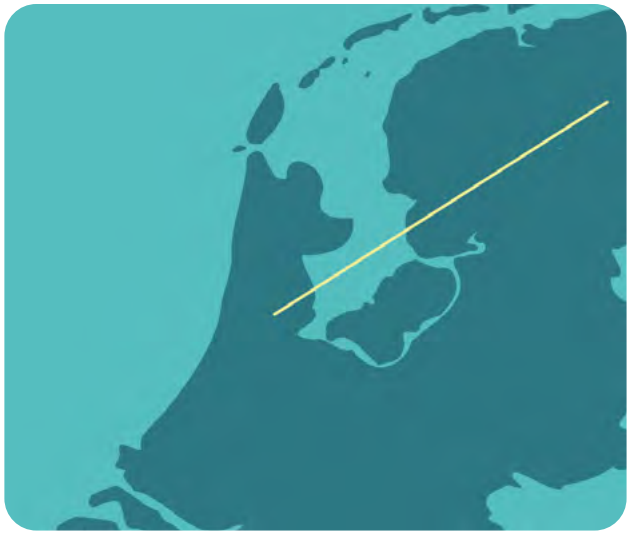
For a package of approximately 1 kilogram the carbon emissions savings with ship-from-store are 9,2 kilogram CO2.



3. National

Parcels are sourced from a national distribution centre for national delivery.

For example: The consumer lives in Groningen and buys jeans online from a fashion retailer in the Netherlands. She chooses the fastest delivery option available. The fashion retailer has a warehouse in Amsterdam with the jeans. The jeans will travel by truck to Groningen (National,~195km) and then last-mile by van to the consumer's door (Local, ~100km total delivery round).



National shipping using truck and van.
Ship-from-Store using truck and bike.
Carbon emissions savings with Ship-from-store: 426kg CO2 per tonne

For a package of approximately 1 kilogram the carbon emissions savings with ship-from-store are 0,4 kilogram CO2.

4. Local

Parcels are sourced from a store or urban depot for local delivery. For example: The consumer lives in Amsterdam and buys a jacket online from a fashion retailer in the Netherlands. She chooses the fastest delivery option available. The fashion retailer has a warehouse in Amsterdam with the jacket. The jacket is picked up from the warehouse and then last-mile delivered by van to the customers door(Local, ~100km total delivery round).

Local shipping using van.
Ship-from-Store using bike.
Carbon emissions savings with Ship-from-store: 343kg CO2 per tonne
For a package of approximately 1 kilogram the carbon emissions savings with ship-from-store are 0,3 kilogram CO2.

If we look at the aforementioned advantages for ecommerce it can be seen that the benefits of ship-from-store have an effect on each leg of the supply chain.

The StoreShippers ship-from-store Carbon Emission Calculator

For the StoreShippers Carbon Emission Calculator we distinguish four legs in the supply chain. Depending on the way the supply chain of the online retailer is organised, the calculator will take into account one, two, three or four legs of the supply chain.

Moreover, the volumetric of the parcel is very important for the required transport capacity per leg. Therefor the calculator asks to enter the distance that the parcel travels per leg and secondly, the calculator asks for the volumetric factor of the parcel. The calculator can be found on the StoreShippers website.

Calculator for CO2 emission savings with ship from store				
	1. Intercontinental	2. Continental	3. National	4. Local
Traditional e-commerce	0,61324	1,47389	0,10797	0,6852
	Plane long-haul	Plane short-haul	Truck	Van
Ship from store	0,02215	0,10797	0,10797	0
	Boat	Truck	Truck	Bike
Volumetric factor of Parcel	5	5	5	5
Distance				
Traditional e-commerce emissions	0	0	0	0
Ship from store emissions	0	0	0	0
Emissions saved per leg (Kg of CO2 per tonne transported)	0	0	0	0
Total emissions saved (Kg of CO2 per tonne transported)	0			
*To calculate: 1) choose which legs/categories apply to your shipment, 2) enter the distance in km of package for each leg of the trip				

Conclusion

The future of ecommerce depends on its sustainability and efficiency. One of the components of ecommerce that has the greatest environmental impact is logistics. It is therefore not a question if ecommerce logistics should become more sustainable, but how.

Although there are many developments taking place within the sector to make it more sustainable, many initiatives mainly relate to the supply chain as we have traditionally known it. Little initiative is shown to change the supply chain as a whole, in order to structurally reduce carbon emissions per package.

We believe that ship-from-store is the way forward for global online retail. Ship-from-store reduces carbon emission because products only travel the last mile in the form of a parcel, it makes it possible - due to the short distance to the consumer - to use more eco-friendly modes of transport and it sources products closer to consumers.

With ship-from-store, products are sourced locally and this makes it a fast and sustainable alternative to traditional ecommerce logistics. With the StoreShippers Carbon Emission Calculator we want to inform all relevant stakeholders of the benefits of local sourcing of products.

"The future of ecommerce depends on its sustainability and efficiency"

Methodology

In October 2019, StoreShippers carried out desk research to understand the impact of ecommerce logistics on the environment and to develop the StoreShippers Carbon Emission Calculator.

The objective of the research and the corresponding ship-from-store carbon calculator is to inform all relevant stakeholders of the benefits of local sourcing of products.

The research was conducted by Trey Hahn, MSc. Urban and Regional Planning from the University of Amsterdam.

Meet StoreShippers

StoreShippers provides sustainable urban collection services and sustainable same-day delivery in cooperation with bicycle couriers and other eco-friendly couriers around the world. It is the mission of StoreShippers to build a global sustainable ship-from-store network to connect global online visibility with local offline presence.

Any questions?

About the white paper please contact:
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Want to learn more?
Check out our global network and services, at
www.storeshippers.com

or contact our sales team, at
hello@storeshippers.com

Let's connect

We ask bicycle couriers around the world to connect with our platform. Together we can boost sustainable delivery. We invite omnichannel retailers and pure players with an urban footprint to contact us. Let's boost ship-from-store!

Find and follow us at LinkedIn

Disclaimer

The data in this whitepaper are gathered from public sources. The purpose of this white paper is to give a general impression of the environmental benefits of a ship-from-store strategy. Statistics are gathered by StoreShippers to improve and develop the ship-from-store carbon calculator.