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# LCA study Executive summary

CRDC EXPERTS AND SOLUTIONS IN SUSTAINABLE DEVELOPMENT rdcenvironment.be - contact@rdcenvironment.be





# **Executive summary**

- 1. Through the **vPOOL open pooling exchange system**, customers can **prevent significant emissions and streamline container management**, so that they can focus on their core business
- 2. To attain **external validation of the environmental impact**, vPOOL commissioned RDC Environment to conduct a **Life Cycle Assessment (LCA) comparison** between inhouse and open pooled containers
- 3. The LCA study finds that open pooling containers generate **20% less CO<sub>2</sub>eq compared to inhouse pooling** per usage. Compared to **one-way carton boxes; savings are even higher (25%)**
- 4. Key driver behind the sustainability impact is that **open pool logistic movements are more optimal.** In addition; **production, transport to customer and end-of-life processing are spread over many uses**
- 5. The study was performed in **compliance with the international guidelines** set forth in ISO 14044:2006 and it is undergoing evaluation by an independent panel of experts





CO<sub>2</sub>eq emission reduction vs. inhouse pooling



CO<sub>2</sub>eq emission reduction vs. oneway carton boxes

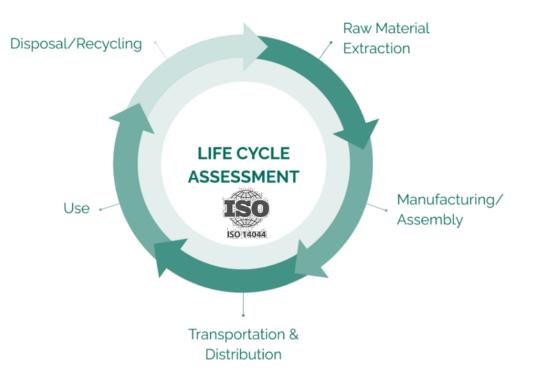
Through the vPOOL open pooling exchange system, customers can prevent significant emissions and streamline load-carrier management

Note: Comparison between systems displayed with rounded numbers; based on 'average' customer circumstances (e.g. logistics) and 600x400x200mm crates & boxes | Source: RDC LCA



# **External validation**

- LCA supplier: vPOOL commissioned RDC to conduct a Life Cycle Assessment (LCA). RDC is an expert with a 20yr trackrecord and experience in packaging / pooling
- **Objective:** To attain external validation of the impact of container open-pooling, and to do an objective comparison
- **Methodology:** The study was performed in compliance with international ISO 14044:2006 guidelines. Moreover; it is undergoing evaluation by a critical independent panel
- **Scope:** Lifecycle coverage includes material extraction, manufacturing, transport, use and disposal/recycling
- **Data:** Credible data is sourced from EcoInvent and calculations are made through RDC's RangeLCA software





# LCA inputs & methodology

Raw materials	Manufacturing	Transport	Use, repair	End-of-life	t I
<ul> <li>Polyethylene chemical production</li> <li>Extraction of timber from woods</li> <li>Recycled content</li> </ul>	<ul> <li>Plastic used for production of crates</li> <li>Corrugated carton, linerboard &amp; kraftliner used for production of boxes</li> <li>Recycled content</li> </ul>	• N/a	• Clean water used to wash crates	<ul> <li>Re-use, loss &amp; scrap rates across different types of containers</li> <li>Virgin material avoidance of HDPE plastic and cardboard</li> </ul>	
<ul> <li>Extraction and processing of input materials energy use</li> <li>Upstream transport of raw materials</li> </ul>	<ul> <li>Crate manufacturing energy use; including injection moulding</li> <li>Corrugated box manufacturing energy use</li> <li>Country electricity mixes</li> </ul>	<ul> <li>Transport to customer</li> <li>Transport between customers fuel use</li> <li>Transport to depot/ washing fuel use</li> <li>Return transport from depot to new customer</li> <li>Transport for relocation</li> </ul>	<ul> <li>Washing, inspection and reconditioning energy use</li> <li>Lighting and heating of the depot energy use</li> <li>Country electricity mixes</li> </ul>	<ul> <li>Energy generated from cardboard fuel use</li> <li>Emissions from landfilling and incineration</li> <li>Country electricity mixes</li> </ul>	

'Functional Use' represents a er use for t of goods a sender eceiver



CRDC

Calculations are made with RDC's RangeLCA software using the Ecoinvent 3.9.1 database

ecoinvent



# How does vPOOL reduce impact?



Robust high-quality containers and the circular pooling system allow for longer lifetime and re-use



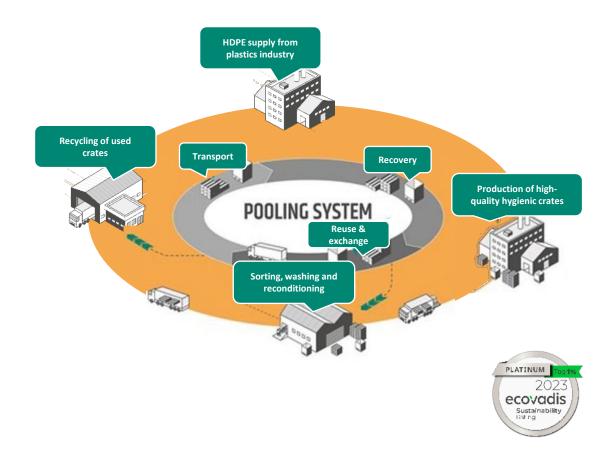
Open pooling model minimizes and simplifies logistic movements (e.g. no empty runs or reloading of goods)



Comprehensive end-of-life processing involves recycling to save virgin plastics



Optimal linking of demand and excess supply of containers leads to less containers needed in the system





# **Open pooling minimizes impact from logistics compared to close pooling**

Europe-wide ordering, delivery & collection Full flexibility in time, place and quality Approximately 50 employees in 9 languages

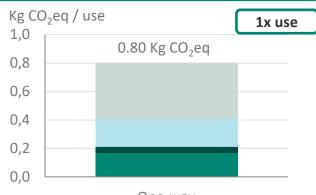
- Empty runs and time-consuming reloading no longer required
- Shorter distances through efficient network of EU-wide exchange spots
- Optimal linking of demand and excess supply of containers leads to less containers needed in the system





## LCA results: Comparison across different container systems

#### **One-way cardboard box**



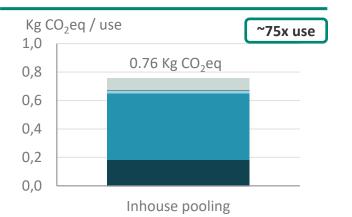
#### One-way

Cardboard boxes are **used only once** for transportation and storage of goods. They have a **100% loss rate** 

#### Highest environmental impact since

production, transport to the customer and end-of-life processing are fully allocated across a single use

#### Inhouse pooling



Plastic containers are **rent to supply chain customers**. The renting company manages the supply, collection and repair of containers

**2<sup>nd</sup> lowest impact** since the plastic crate is reused many times. This outweighs the additional impact from plastic production, returning, reconditioning and EoL processing. Logistics are suboptimal for inhouse pooling

#### Open pooling **VPOOL**

	D <sub>2</sub> eq / use		~75x use
1,0			
0,8	0	60 Kg CO <sub>2</sub> eq	
0,6	0.	oo kg co <sub>2</sub> eq	
0,4			
0,2			
0,0			

Open pooling

Plastic containers are **ordered and returned by customers anywhere** in the EU. vPOOL handles supply, collection, washing and relocation

**Lowest impact** since logistic movements are fully optimized (e.g. no empty runs) whilst production, transport to the customer and end-of-life processing are spread over many uses

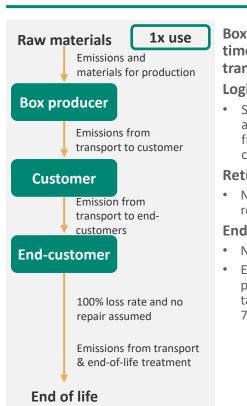


Note: Cardboard boxes may be used more than 1x, but not as part of a 'controlled process'; 75x use for vPOOL is based on a sample of a controlled process | Source: RDC Comparative Life Cycle Assessment of container systems 2024



**One-way cardboard box** 

### Through re-use from pooling, emissions are spread over more uses



Box designed for onetime use in storage / transport Logistics Standard diesel trucks

are used to transport from producer to customer

**Return & recondition** 

 No collection and reconditioning

End-of-life & re-use

- No re-use takes place
- EOL processing takes place for every use; taking into account 75% recycle

~75x use **Raw materials** Emissions and materials for production Crate supplier Emissions from transport to customer Inhouse pool customer Emission from transport between customers

**Inhouse pooling** 

**End-customer** Emissions from return transp. collection Washing Emissions from washing Emissions from transport & end-of-life treatment

End of life

#### **Plastic crates are rent** to customers with an inhouse pool Production

 More emissions & materials from production vs. carton

#### Logistics

 Inhouse pooling has suboptimal logistics

#### Washing

 Crates may be washed and returned

#### Re-use

- Production, transport to the customer and EoL are spread over 75x average uses
- 80% HDPE recycle

Open pooling	vPOOL
Raw materials Emissions and materials for production	Crates are ordered and returned by customers anywhere
Crate supplier Emissions from transport to customer	<ul> <li>Production</li> <li>More emissions &amp; materials from production vs. carton</li> </ul>
Customer Emission from	<ul> <li>Open pooling has the most optimal logistics</li> </ul>
transport between customers End-customer / collection Emissions from Emissions from	<ul> <li>Washing</li> <li>Crates are washed at depots</li> <li>Add'l return transport after washing</li> </ul>
transport to depot / recycler Depot / washing From washing	after washing <b>Re-use</b> • Production, transport to the customer and
Emissions from transport	EoL are spread over 75x average uses

End of life

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Note: Cardboard boxes may be used more than 1x, but not as part of a 'controlled process'; 75x use for vPOOL is based on a sample of a controlled process | Source: RDC Comparative Life Cycle Assessment of container systems 2024



#### **Container system comparison**

CARRYING IMPACT

vPOOL

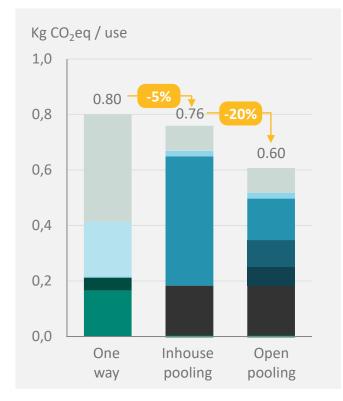
1,000 vPOOL crates instead of one-way cardboard boxes



200 Kg CO<sub>2</sub>eq emissions prevented



980 passenger car kilometers avoided



Category



(kgCO2/use)	One-way	Inhouse pool	Open pool	Key assumptions
Production	0.39	0.09	0.09	<ul> <li>600x400x200mm container dimensions with 2kg non-recycled plastic (HDPE) crates and 0.54kg 88% recycled corrugated board boxes</li> <li>Incl. emissions from inputs (e.g. polyethylene), processing and upstream logistics</li> </ul>
First delivery to customer	0.20	0.00	0.00	<ul> <li>Fuel use estimated for low-sulfur diesel trucks with a blend of EURO III, IV, V, VI and blend of rural, urban and highway roads</li> <li>187km avg. distance for open pooling, 200-230km for other systems</li> </ul>
Goods delivery	0.01	0.02	0.02	<ul> <li>Same truck type as 'transport to customer'</li> <li>535km avg. distance at customer for all systems</li> </ul>
Direct reuse	0.00	0.47	0.15	<ul> <li>No direct re-use for one-way; full direct re-use for inhouse pooling (w/o collection)</li> <li>261km avg. distance for open pooling, 535km for inhouse pooling</li> </ul>
Container collection	0.00	0.00	0.10	<ul> <li>No collection for one-way boxes and inhouse pooling</li> <li>For open pooling; 34% of flow is collected, rest flows to direct re-use; 276km distance</li> </ul>
Container redelivery	0.00	0.00	0.07	<ul> <li>No re-delivery for one-way boxes and inhouse pooling</li> <li>For open pooling; 98% of crates sent to depot is re-delivered; 187km avg. distance</li> <li>For open pooling; 1% of crates sent to depot is relocated; 259 avg. distance</li> </ul>
Reconditioning	0.00	0.18	0.18	<ul> <li>No reconditioning for one-way boxes</li> <li>For inhouse pooling; 99% of the crates are washed</li> <li>For open pooling; 37% of the crates are washed</li> </ul>
Disposal transport	0.05	0.01	0.01	• 399km avg. distance for open pooling and inhouse pooling; 50km for one way
End of life treatment	0.17	0.00	0.00	<ul> <li>For plastic crates 80% recycling, 11% incineration and 9% landfill</li> <li>For cardboard boxes 75% recycling, 14% incineration and 11% landfill</li> <li>75x re-use for plastic crates. 1x use for one way based on 100% loss rate</li> </ul>

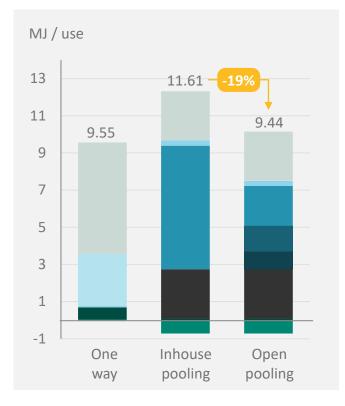
• 75x re-use for plastic crates, 1x use for one way based on 100% loss rate

Source: RDC Comparative Life Cycle Assessment of container systems 2024; CO2emissifactoren.nl Note: based on 'average' customer circumstances (e.g. logistics) and 600x400x200mm crates & boxes



## LCA results: 19% less fossil resource use vs. inhouse pooling

#### **Container system comparison**

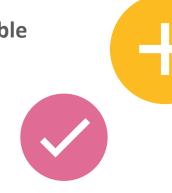


Category (MJ/use)	One-way	Inhouse pool	Open pool	Key assumptions
Production	5.99	2.62	2.62	<ul> <li>600x400x200mm container dimensions with 2kg non-recycled plastic (HDPE) crates and 0.54kg 88% recycled corrugated board boxes</li> <li>Incl. emissions from inputs (e.g. polyethylene), processing and upstream logistics</li> </ul>
First delivery to customer	2.80	0.03	0.03	<ul> <li>Fuel use estimated for low-sulfur diesel trucks with a blend of EURO III, IV, V, VI and blend of rural, urban and highway roads</li> <li>187km avg. distance for open pooling, 200-230km for other systems</li> </ul>
Goods delivery	0.08	0.28	0.28	<ul> <li>Same truck type as 'transport to customer'</li> <li>535km avg. distance at customer for all systems</li> </ul>
Direct reuse	0.00	6.65	2.14	<ul> <li>No direct re-use for one-way; full direct re-use for inhouse pooling (w/o collection)</li> <li>261km avg. distance for open pooling, 535km for inhouse pooling</li> </ul>
Container collection	0.00	0.00	1.39	<ul> <li>No collection for one-way boxes and inhouse pooling</li> <li>For open pooling; 34% of flow is collected, rest flows to direct re-use; 276km distance</li> </ul>
Container re- delivery	0.00	0.00	0.94	<ul> <li>No re-delivery for one-way boxes and inhouse pooling</li> <li>For open pooling; 98% of crates sent to depot is re-delivered; 187km avg. distance</li> <li>For open pooling; 1% of crates sent to depot is relocated; 259 avg. distance</li> </ul>
Reconditioning	0.00	2.67	2.67	<ul> <li>No reconditioning for one-way boxes</li> <li>For inhouse pooling; 99% of the crates are washed</li> <li>For open pooling; 37% of the crates are washed</li> </ul>
Disposal transport	0.66	0.07	0.07	<ul> <li>399km avg. distance for open pooling and inhouse pooling; 50km for one way</li> </ul>
End of life treatment	0.03	-0.72	-0.72	<ul> <li>For plastic crates 80% recycling, 11% incineration and 9% landfill</li> <li>For cardboard boxes 75% recycling, 14% incineration and 11% landfill</li> <li>75x re-use for plastic crates, 1x use for one way based on 100% loss rate</li> </ul>



# Apart from improved sustainability - vPOOL load carriers offer many advantages:

- Food safe materials (HPDE) and DIN 55423 conformity
- Hygienic standards in European food industry
- In-Mould label / traceability in Performance range
- Quality assurance through recurring lab tests
- High and consistent product quality
- Easy to clean and highly durable







# **Product portfolio pooling**





H1 Hygienic pallet



## ...and much more!





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We feel we have a duty to our clients and to future generations to offer highquality, reusable and sustainable services. The reusability of load carriers like plastic crates has helped our clients and us to significantly reduce our use of resources. The availability of all types and quantities of load carriers across the EU helps to avoid empty runs and therefore markedly reduces CO<sub>2</sub> emissions.

# **VPOOL** CARRYING IMPACT

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### **Appendix: Container system comparison across impact categories**

Impact category	Unit / functional use	One-way	Open pooling
Climate change	kg CO <sub>2</sub> eq	0.800	0.603
Resource use, fossils	MJ	9.55	9.44
Ozone depletion	kg CFC-11 eq	1.82E-08	1.15E-08
Particulate matter	disease incidence	4.11E-08	1.50E-08
Ionising radiation, human health	kBq U <sup>235</sup> eq	0.037	0.023
Photochemical ozone formation	kg NMVOC eq	3.08E-03	1.90E-03
Acidification	mol H+ eq	2.72E-03	1.46E-03
Eutrophication, terrestrial	mol N eq	8.90E-03	3.76E-03
Eutrophication, freshwater	kg P eq	3.72E-04	9.49E-05
Eutrophication, marine	kg N eq	1.52E-03	3.75E-04
Land use	Dimensionless (pt)	48.21	4.19
Water use	m <sup>3</sup> world eq	0.274	0.089
Resource use, minerals & metals	g Sb eq	2.71E-06	2.34E-06