carbone4

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Carbon footprint results for the sailing boat and modal comparison

Vela

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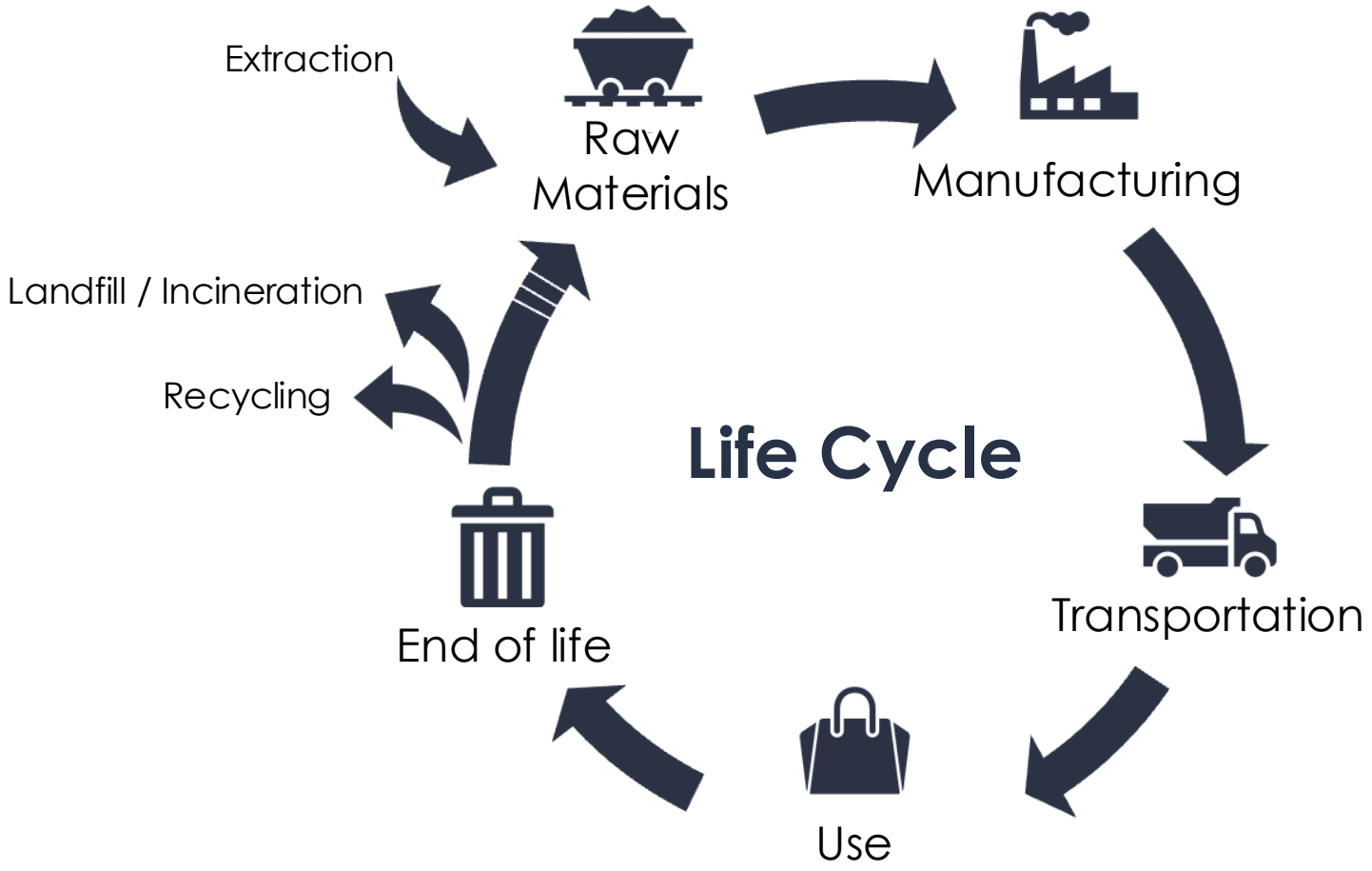
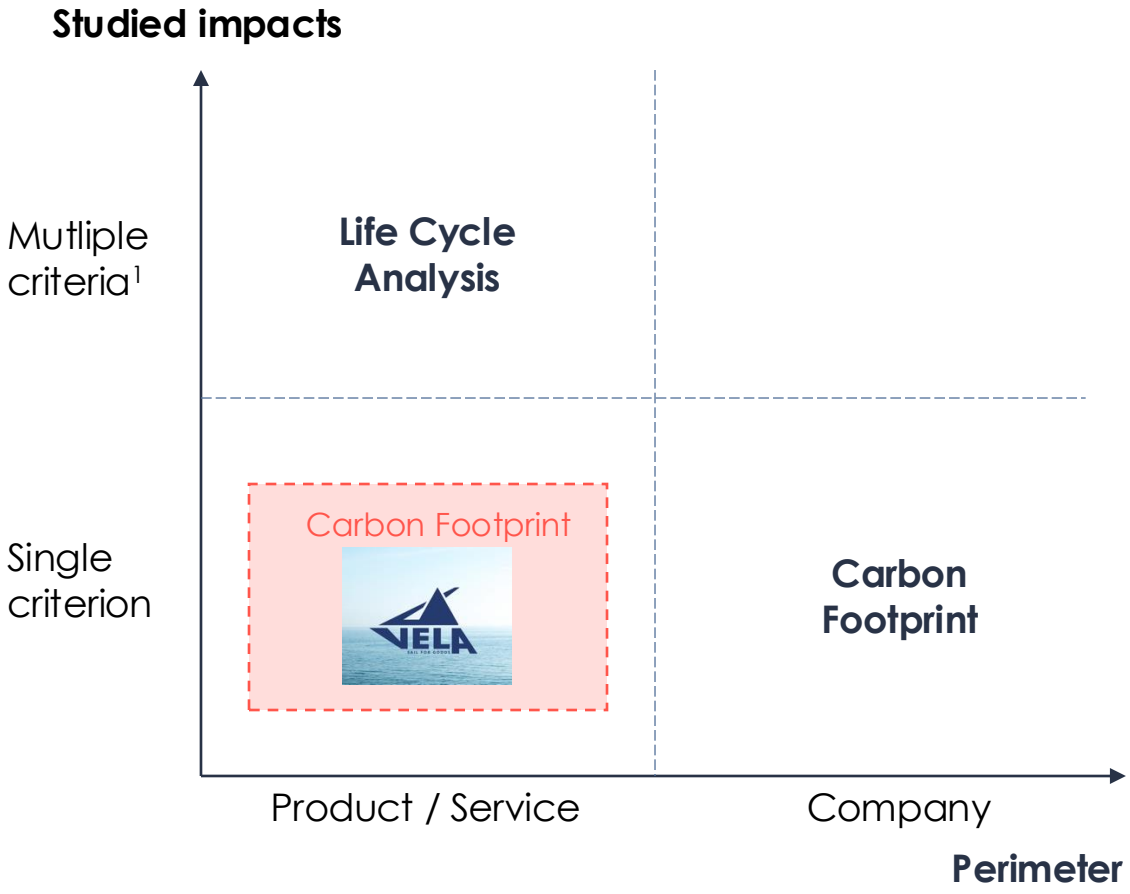
Carbon footprint of Vela 's sailing boat

The carbon footprint of Vela's sailing boat has been calculated over the entire life cycle of the boat.



The Analysis of Vela's transportation solution is a product scale carbone footprint based on LCA's framework



Perimeter

- **The approach is based on a Life Cycle Assessment (LCA)** covering all stages of the **product life cycle**, from "cradle-to-grave". It does not include impacts that are not directly linked to the product but considered in a company carbon footprint (ex: employee commuting).
- **Only greenhouse gas emissions** were considered. Other environmental impact categories (acidification, eutrophication, toxicity, etc.) were not assessed.
- **All greenhouse gases (GHGs) listed by the IPCC[2] were taken into account** and converted into **CO_2 equivalents (CO_2e)** using their 100-year Global Warming Potentials (GWPs): CO_2, CH_4, N_2O, SF_6, PFCs, and HFCs emissions to, and removals from, the atmosphere.

(1) multi-criteria: the various criteria studied may include ecotoxicity, land use, water consumption and GHG emissions. This contrasts with single-criteria analysis, where only one impact is studied (in this case, GHG emissions).
(2) Intergovernmental Panel on Climate Change

Details on the approach

Approach

- **Carbone 4's approach is inspired by the GHG Product Standard** (itself built on ISO 14040:2006, ISO 14044:2006, and PAS2050), reflecting its key concepts without implying strict compliance, as some procedural steps were adapted to fit Vela's constraints.
- Data sources include primary data collected from **Vela**, complemented by recognized databases (e.g. **Ecoinvent, ADEME Base Carbone, etc.**) and emission factors calculated by **Carbone 4**.
- The results provided represent an estimate of the total carbon footprint of the product: the Vela sailboat, including manufacturing, use, maintenance, and end of life, as described by the Vela teams at Carbone 4 in 2023 and 2025. They make it possible to identify the main emission hotspots and potential levers for reduction.

Limitations and exclusions

- **Uncertainties:** as in any LCA, some data are associated with uncertainties (variability in inventory data, approximations in databases, end-of-life assumptions). Furthermore, some assumptions (specified in the study deliverables) are particularly sensitive, these must be carefully and regularly monitored to ensure that the conclusions of this study remain valid.
- **Critical review:** The assessment has not been subject to an external critical review as defined in the standard.
- **Certification :** The results are intended to provide a robust and transparent estimate of the carbon footprint of the product, but should not be interpreted as a formal certification under the GHG Protocol Product Standard.
- **Other environmental impacts:** only greenhouse gas emissions were considered. Other environmental impact categories (acidification, eutrophication, toxicity, etc.) were not assessed.

(1) multi-criteria: the various criteria studied may include ecotoxicity, land use, water consumption and GHG emissions. This contrasts with single-criteria analysis, where only one impact is studied (in this case, GHG emissions).
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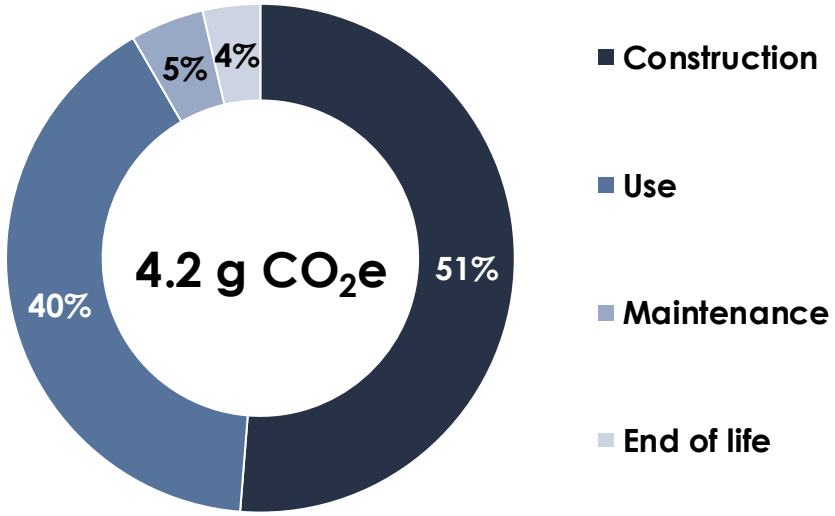
Calculating a carbon footprint involves multiplying activity data by emission factors

	Business activity data		Emission factors		GHG emissions
	Physical or monetary indicators reflecting an « activity »		Average emissions ratio for a given activity		Direct or indirect emissions linked to an activity
Diesel fuel consumption for vehicle fleet	**1 700** litres	×	**3,16** $kgCO_2e$ / litre	=	**5 370** $kgCO_2e$
Total cost of road transport contracts for freight	**289** k€	×	**560** $kgCO_2e$ / k€ spent	=	**161 840** $kgCO_2e$

Vela sailing boat's carbon footprint is 4.2 g CO_2e per t.km transported emitted from construction to the end of the boat's life

Breakdown of emissions from the Vela sailing ship according to the stages of its life cycle (g CO_2e / t.km)



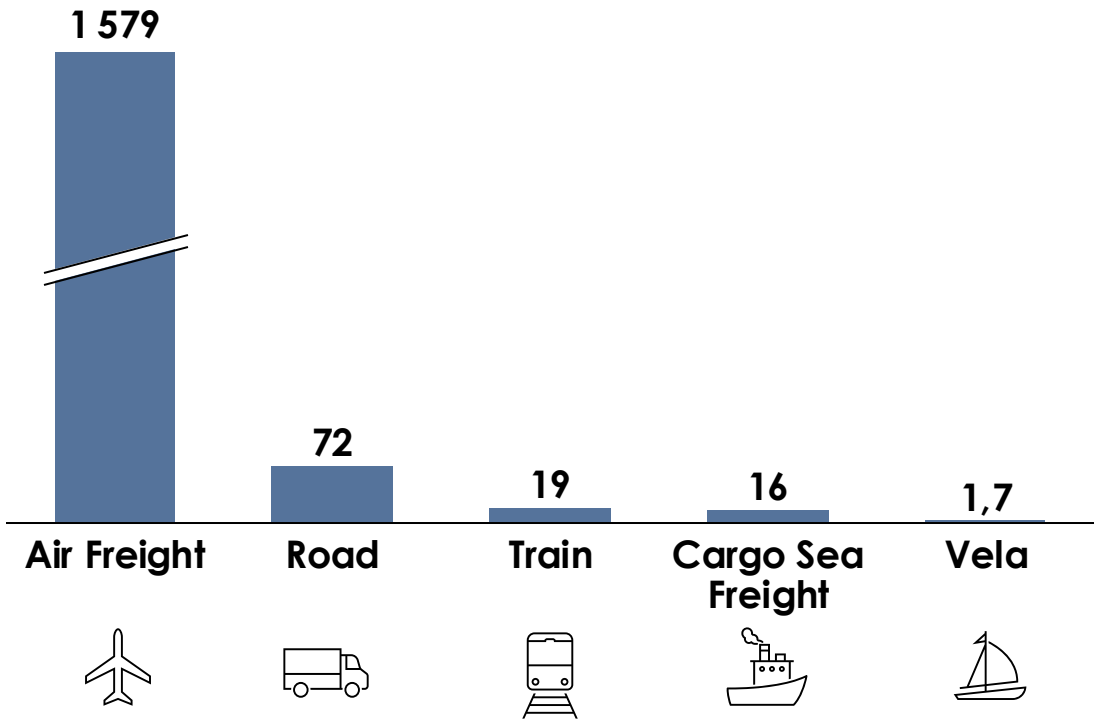
Comments

- **Construction and use are the stages of the life cycle that have the greatest impact** on the sailing boat's contribution to climate change
- Use of the sailing ship accounts for the majority of emissions, **linked to diesel consumption for hotel loads, which is five times greater than for navigation**
- About construction:
  - **The materials needed to build the boat are the main contributors to construction stage's impact**. Among these materials, aluminum accounts for most of the impact, followed by carbon fiber, electrical cabinets, computers, sails, etc.
  - **Equipment accounts for less than 10% of this impact**

Comparison to different transportation modes

Switching from air freight to sea freight reduces emissions by 100 to 200 times. Wind-powered freight via Vela offers a further reduction of ≃90%

Emissions from different modes of freight transport compared during the use phase ($gCO_2e/t.km$)



Comments

- **Carbone 4 and Vela chose to compare the impacts of different modes of freight transport solely during the use phase** in order to provide an iso-perimeter comparison with other means of transport and to align to current reporting practices under the GLEC[1] for instance. Vela is significantly less emissive than other modes of transport, including reefers transported via conventional ships.

- Given the significant economies of scale, the construction phase has a relatively small impact on container ship transport. However, if we include the construction phase of the Vela solution, it has an impact of 3.8 g CO_2e / t.km transported, **which is still four times less than container ships during their use phase alone.**

(1) Global Logistics Emissions Council (GLEC)

Note : The comparison is made only for the usage phase. For maritime transport in refrigerated containers, fuel upstream value chain and combustion emissions from the ADEME's 'Porte-conteneur/Reefer/Trans-Atlantique' factor were taken into account. Air freight emission factor is the factor 'Avion cargo/Plus de 100 tonnes, 1000 - 2000 kms, 2023/SANS trainées' from ADEME's database, the value however for aircraft transportation does not include refrigeration. For road transport, the energy/fuel consumption component of the ADEME factor 'Articulé/40 à 44 tonnes/Diesel routier, incorporation 7 % de biodiesel – France' was used and for train transport, the factor 'EU average (where traction energy type unknown*)' from GLEC was used.

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