

Life cycle analysis of finished product Chalibria - carbon neutral steel by AFV Beltrame Group



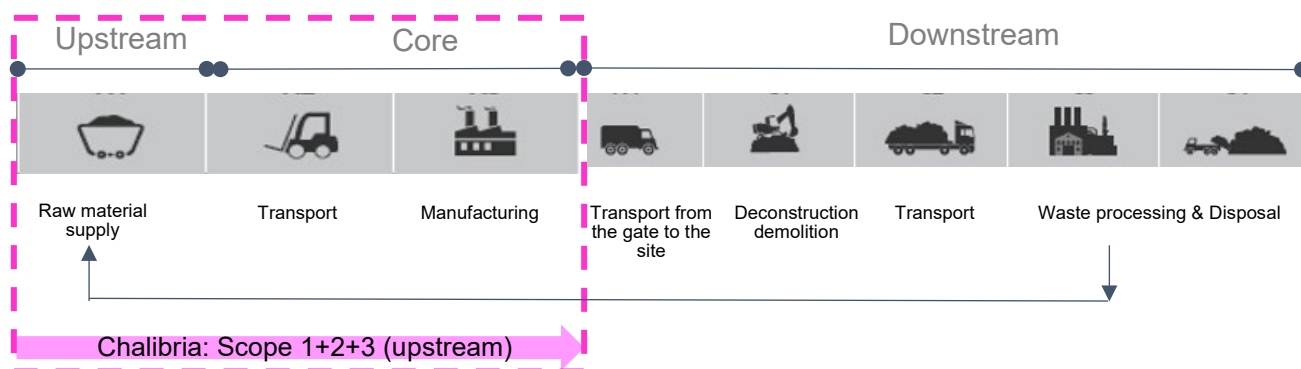
Edition	Date	Edited	Verified	Approved
1	10/02/2023	Andrea Costa	Francesco Campara	AFV Beltrame

PREMISE

With reference to Decree n°539, 13/04/2022 (*Décret n°2022-539 du 13 avril 2022 relatif à la compensation carbone et aux allégations de neutralité carbone dans la publicité*), this document illustrates the incidence of CO₂eq emissions of a Chalibria finished product, carbon neutral steel by AFV Beltrame Group, on CO₂eq emissions from all life cycle stages. Scope 1+2+3 (upstream) emissions, on which the project is based, have been verified by RINA, accredited certification body, in accordance with ISO14064-1.

LIFE CYCLE ANALYSIS

Life cycle phases of a Chalibria finished product are illustrated as follows:



According to the Chalibria project, specific product emissions have been measured using the “cradle to gate” approach, that is, from the raw material extraction stage to the gates of AFV Beltrame Group production plant: the average value at Group level amounts at 0,57 tCO₂eq/t finished steel product.

- **Upstream & Core activities (0,57 tCO₂eq/t)**
 - Measurement of CO₂eq emissions: quantified according to ISO14064-1 and verified by third party.

The remaining life cycle emissions have necessarily been estimated, as the company has neither control nor visibility over the downstream processes of product delivery (e.g., transport to the final customer, demolition, and end of life).

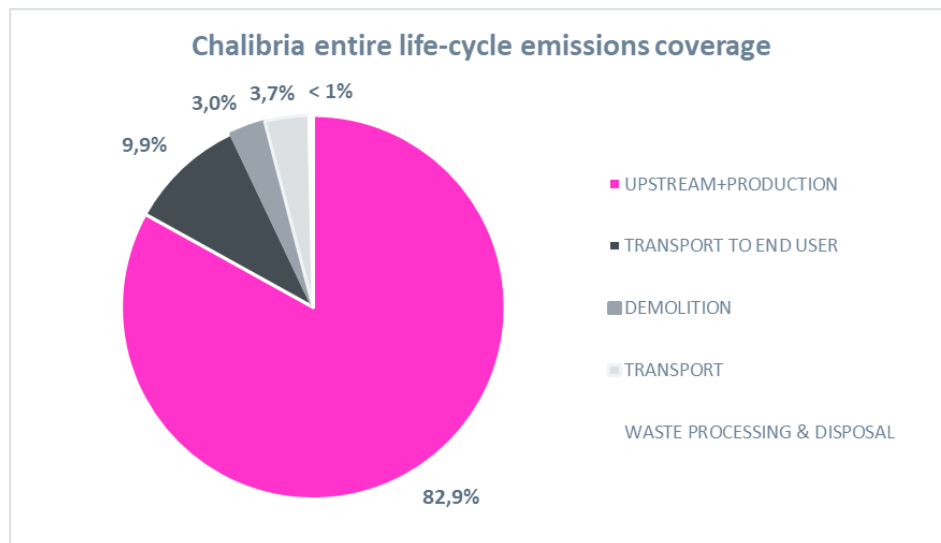
The assumptions underlying the estimates are summarised below.

- **Transport from the gate to end-user (0,068 tCO₂eq/t)**
 - This step is divided into:
 - Distance of delivery from AFV Beltrame Group to customer: measured accordingly to ISO 14064-1 inventory
 - Distance from AFV Beltrame Group customer to end-user or site of use: 100 km
 - Emission factor: Ecoinvent (EURO 4 truck, average type between 16-32 t and >32 t GVW)
- **Deconstruction & demolition (0,0205 tCO₂eq/t)**
 - This phase includes all demolition and dismantling operations, and the reordering of steel from buildings and/or other manufactured products
 - Gervasio, H. & Dimova, S. - JRC (2018): Model for Life Cycle Assessment (LCA) of buildings
- **Transport (26 kgCO₂eq/t)**
 - Distance from demolition and/or dismantling site to generic treatment or disposal site: 200 km
 - Emission factor: Ecoinvent (EURO 4 freight, GVW average between 16-32 t and >32 t)
- **Waste processing & Disposal (0,004 tCO₂eq/t)**

- Material destination hypothesis: 90% recovery and 10% waste disposal
- 90% of the material destined for recovery is attributed a zero-carbon footprint (burden-free), since it has already been quantified in the upstream flow of the inventory of AFV Beltrame Group as scrap input to the production process, following the cut-off approach (ISO14064 category 4.1)
- Instead, emissions are quantified on 10% of the residual material at the end of life, not intended for recovery but for landfill, considering the stages of treatment of the material that becomes waste and its disposal in landfill as reported in the study by: Gervasio, H. & Dimova, S. - JRC (2018): Model for Life Cycle Assessment (LCA) of buildings

Summary in the table and chart below:

Life-cycle phases	tCO ₂ eq/t	%
Upstream + Production	0,571	82,9
Transport	0,068	9,9
Demolition	0,021	3
Transport	0,026	3,7
Waste processing + Disposal	0,004	<1
Total	0,689	100



CONCLUSIONS

By quantifying the emissions related to downstream activity outside the Chalibria reporting boundary, it is shown that the "gate to grave" approach's contribution has an incidence lower than 20% compared to emissions arising from the entire product life cycle.

It is, therefore, confirmed that the emissions considered in the perimeter of the Chalibria project are higher than 80% of total CO₂eq emissions related to the life cycle of the finished product.

SOURCES

- ISO 14064-1: ("Greenhouse gases - Part 1: Specifications and guidance at organisational level for the quantification and reporting of greenhouse gas emissions and their removal"), specifying the requirements for the design and development of the Organisations' Greenhouse Gas Inventories
- Chalibria (technical documents) and internal analysis
- Gervasio, H. & Dimova, S. - JRC (2018): Model for Life Cycle Assessment (LCA) of buildings
- Ecoinvent 3.8 (transport, freight, lorry >32 metric ton, EURO4)
- Ecoinvent 3.8 (transport, freight, lorry 16-32 metric ton, EURO4)
- Ecoinvent 3.8 (sorting and pressing of iron scrap - RER)
- Ecoinvent 3.8 (Residual material landfill)