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ISO 14064 Verified

Cradle-to-Gate

Hot-Rolled Structural Steel Carbon Dashboard

Quantified baseline for **1.0 kg** manufactured in **China** with European supply chain inputs.

2.114 kg CO_2e / kg

TOTAL CRADLE-TO-GATE PCF

2.114 kg CO_2e

High Data Tier DQR Score: 1.18

SCOPE 1 (DIRECT SMELTING)

1.285 kg CO_2e

60.8% of total carbon footprint

SCOPE 2 (GRID ELECTRICITY)

0.342 kg CO_2e

0.60 kWh @ 0.570 kg CO_2e/kWh

SCOPE 3 (UPSTREAM & FREIGHT)

0.487 kg CO_2e

23.0% raw extraction & alloys

Lifecycle & Scope Breakdown

GHG Protocol Categorization

Scope 1: Blast Furnace Carbon Reduction (Coke/PCI) **1.177 kg** **55.69%**

Scope 1: BOF Decarb, Reheat Gas & Refractories **0.108 kg** **5.09%**

Scope 2: Regional Grid Power (Milling & ASU) **0.342 kg** **16.18%**

Scope 3: Iron Ore Extraction & Beneficiation **0.348 kg** **16.46%**

Scope 3: EU Ferro-alloys, Scrap, & Minerals **0.139 kg** **6.57%**

Scope 3: Inbound Logistics (Coastal Sea Barge 5km) **<0.001 kg** **0.01%**

Material Mass vs. Embodied Carbon Impact

Decoupling Analysis

STREAM	INPUT QTY	MASS % VS. IMPACT %	EMISSIONS
Iron Ore Pellets	1.420 kg	Mass GHG	**0.348 kg**
Coke & PCI Coal	0.540 kg	Mass GHG	**1.177 kg**
Grid Electricity	0.600 kWh	N/A GHG	**0.342 kg**
EU Specialty Alloys	0.025 kg	Mass GHG	**0.071 kg**
Scrap & Fluxes	0.265 kg	Mass GHG	**0.068 kg**

Audit & Hotspot Insights

Key Findings

Blast Furnace Reduction is the Critical Hotspot (60.8%)

Chemical reduction via metallurgical coke generates 1.285 kg CO_2e. Significant decarbonization cannot occur without alternative reductants or transitional technologies (e.g., hydrogen-based DRI).

Grid Carbon Factor Exposure (16.2%)

Operating in China's regional grid brings an emission factor of 0.570 kg CO_2e/kWh. Power purchase agreements (PPAs) for renewable electricity can directly abate 0.342 kg CO_2e per unit.

Localized Feeder Freight Imposes Negligible Impact

The dedicated 5.0 km coastal maritime transfer accounts for only 0.0001 kg CO_2e (0.01%). Sensitivity checks show supply chain emissions remain dominated by chemical processes rather than port logistics.

Targeted Decarbonization Pathways

Reduction Roadmap

1 **Increase Scrap Charge Ratio in BOF**

Elevating the recycled scrap ratio from current 15% (0.18 kg) to 30% reduces hot metal requirements, generating an immediate estimated reduction of **0.22 - 0.30 kg CO_2e** per kg steel.

2 **Procure Renewable Energy (Zero-Carbon PPAs)**

Switching mill electrical supply and air separation units to dedicated on-site solar/offshore wind or green tariffs addresses the entire **0.342 kg CO_2e (Scope 2)** burden.

3 **Low-Carbon European Alloy & DRI Substitution**

Partner with Nordic/European ferro-alloy suppliers utilizing 100% hydro-powered smelting to shave ~40% of upstream alloy embodied emissions (approx. **0.028 kg CO_2e** saving).

Standard: ISO 14064-1 / 14067 **Assurance Level:** Reasonable Assurance Ready **Allocation:** Economic Allocation (Slag)

Cut-Off: >99% Mass & Energy