

Commercial Smart EV Charging Station (Dual-Socket 22 kW AC)



Functional Unit: 1.0 unit (24.35 kg packaged)



Boundary: Cradle-to-Gate (Factory Gate, NL)



Standard: GHG Protocol Product Life Cycle & 2026 LSR

174.62 kg CO₂e

NET CRADLE-TO-GATE FOOTPRINT

TOTAL PRODUCT FOOTPRINT

174.62 kg CO₂e

Market-based Loc-based: 178.64 kg

CARBON MASS INTENSITY

7.17 kg CO₂e/kg

Packaged mass: 24.35 kg (Net: 22.05 kg)

TOP HOTSPOT COMPONENT

PCBAs (32.8%)

57.38 kg CO₂e from just 1.35 kg mass



SCOPE 3 UPSTREAM SHARE

98.91% Scope 3

Factory direct (S1+S2): only 1.09%

GHG Protocol Scope & Lifecycle Stages

Cradle-to-gate inventory stage contribution

98.4% LCI Coverage

SCOPE APPORTIONMENT

174.62 kg CO₂e

- Scope 3 (Upstream): **172.72 kg**
(98.9%)
- Scope 1 (Gas Heat): **1.45 kg**
(0.8%)
- Scope 2 (Power GOs): **0.45 kg**
(0.3%)

Stage 1 & 2: Raw Materials & Parts	166.45 kg • 95.3%
Stage 3: European Inbound Freight	5.26 kg • 3.0%
Stage 4: Dutch Assembly & Testing	1.90 kg • 1.1%
Stage 5: Packaging & Factory Gate Staging	1.89 kg • 1.1%
Use Phase & End of Life (Excluded)	0.00 kg • Cradle-to-Gate Boundary

2026 LSR Standard Compliant Removal: -3.41 kg CO₂e biogenic carbon stored in 2.30 kg FSC packaging (reported separately per non-netting protocols).

Mass vs. Carbon Impact Disparity

Identification of high-emissions intensity materials

Carbon %
Mass %

PCBA Electronics & Microcontrollers		57.38 kg CO ₂ e (32.8%) vs 1.35 kg (5.5%)
CARBON		32.8%
MASS		5.5%
Extruded Aluminum Enclosure (40% rec.)		50.31 kg CO ₂ e (28.8%) vs 7.80 kg (32.0%)
CARBON		28.8%
MASS		32.0%
Copper Wiring & Power Busbars		17.02 kg CO ₂ e (9.7%) vs 4.10 kg (16.8%)
CARBON		9.7%
MASS		16.8%
Galvanized Steel Internal Frame		9.44 kg CO ₂ e (5.4%) vs 3.90 kg (16.0%)
CARBON		5.4%
MASS		16.0%
Polymers (PC/PBT Casing Blend)		11.06 kg CO ₂ e (6.3%) vs 2.85 kg (11.7%)
CARBON		6.3%
MASS		11.7%

HOTSPOT DRIVER #1

Electronics Density vs Mass Disparity

The controller PCBAs, LCD, and metrology comprise only **1.80 kg (7.4% of total mass)**, yet generate **63.77 kg CO₂e (36.5% of footprint)** due to cleanroom semiconductor lithography, noble metals, and energy-intensive wafer processing.

HOTSPOT DRIVER #2

Structural Aluminum Smelting Burden

The 7.80 kg extruded aluminum enclosure accounts for **50.31 kg CO₂e (28.8% of total footprint)**. Even with 40% recycled content, virgin smelting portions dominate structural emissions, making post-consumer scrap replacement the top mitigation lever.

OPERATIONAL WIN

Decarbonized Dutch Operations

Factory gate Scope 1 & 2 operations in Eindhoven represent just **1.90 kg CO₂e (1.09%)**. Direct emissions are minimized via certified Dutch Wind GOs and on-site submetered efficiency, ensuring production itself is lean and near net-zero.

Decarbonization Action Plan & Reduction Levers

Prioritized engineering and procurement pathways to achieve a ≤120 kg CO₂e product footprint

Potential Reduction: -50.1 kg CO₂e (-28.7%)

PRIORITY	MITIGATION ACTION	TARGET HOTSPOT	EXPECTED REDUCTION	IMPLEMENTATION FEASIBILITY
IMMEDIATE	Specify ≥75% Post-Consumer Recycled Aluminum Transition extrusion profile to certified low-carbon billet (e.g. Hydro CIRCAL or equivalent)	Structural Enclosure	-28.20 kg CO ₂ e	High (Drop-in Alloy)

PRIORITY	MITIGATION ACTION	TARGET HOTSPOT	EXPECTED REDUCTION	IMPLEMENTATION FEASIBILITY
MID-TERM	Procure Low-Carbon / Eco-design PCBAs Partner with EMS suppliers using European renewable foundries & halogen-free substrates	Main Controller PCBA	-14.30 kg CO ₂ e	Medium (Supplier Audit)
NEAR-TERM	Secondary European Copper Busbars Transition internal conductors and socket contact ribbons to 100% recycled Cu cathode	Wiring & Busbars	-7.60 kg CO ₂ e	High (Readily Available)

✓ GHG Protocol Product Standard

2026 LSR Accounting Compliant

Data Quality Rating: 1.3/5.0 (Very High)