Practices and Reflections on Carbon Footprint Analysis of Port Machinery

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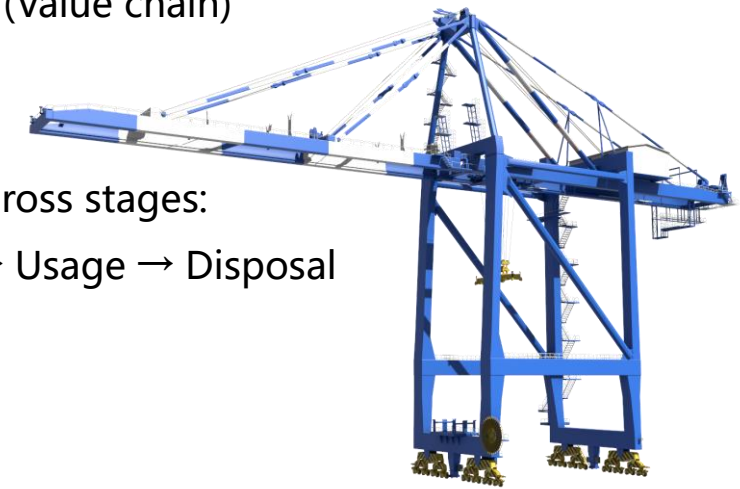
What is Carbon Footprint & LCA?

Carbon Footprint

- Total GHG emissions (CO_2e) from activities/products
- Scopes: **1** (Direct: fuel), **2** (Indirect: electricity), **3** (Value chain)



Life Cycle Assessment (LCA)

- Systematic analysis of environmental impacts across stages:

  Raw materials → Production → Distribution → Usage → Disposal

Key Solutions

- Identify hotspots for emissions reduction
- Guide sustainable decisions for tech, energy and logistics

Why Carbon Footprint Analysis for Port Machinery

Accelerating Climate Policy Commitments

- ZPMC’s Role: Contributing to social organization standards

Critical Need for Green & Zero-Carbon Ports

- ZPMC’s Contribution: Delivering low-carbon equipments

Driving Industry-Wide Technological Advancement

- ZPMC’s Impact: Green design, production & shipping

Enabling ESG Transparency for Ports & Industry Stakeholders

- ZPMC’s Value: Port-Industry alignment, Scope 3 emissions management

ZPMC's Green Advantage:
Innovative Tech + Proven Results in Carbon Reduction

Green Strategy

- **Research Investment**
- **Collaborative Ecosystem**

Market Infuence

- **Global Share**
- **First-Mover Advantage**

Open Collaboration

- **Case Study Impact**
- **Policy Advocacy**

Lifecycle Carbon Footprint Methodology

Core Standards: ISO 14067, ISO 14040/44, GHG Protocol

01

Goal & Scope Definition

Cradle-to-Grave

Cradle-to-Gate

02

Data Collection & Quality Assurance

Primary/Secondary Data

Supplier Engagement

03

Carbon Footprint Calculation

LCA Method

Corporate Standard

04

Result Analysis & Hotspot Identification

Contribution Analysis

Sensitivity Analysis

Lifecycle Carbon Footprint Methodology

System Boundary

- Cradle-to-Grave:

Full lifecycle (materials → production → transportation → usage → disposal)

Data Collection

- Primary Data
- Secondary Data

Calculation

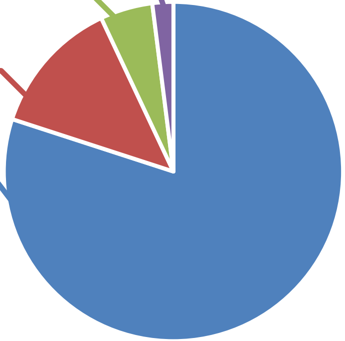
- Process-based LCA: Granular tracking of each material/process

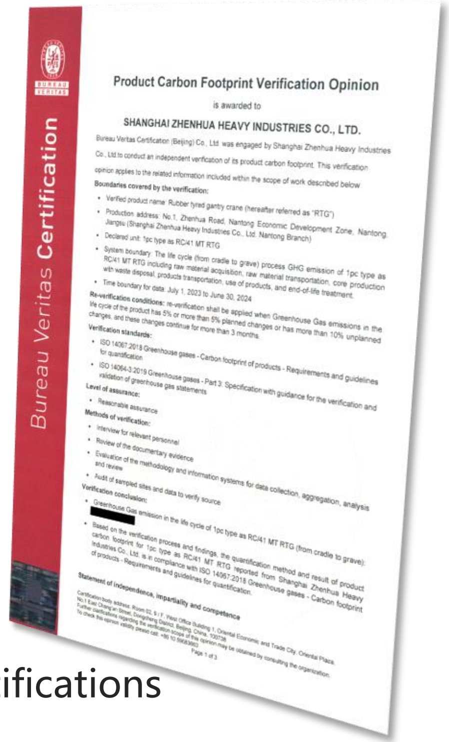
Result Analysis

- Contribution Analysis
- Sensitivity Analysis

ZPMC’ s RTG Carbon Footprint Assessment

Key Findings





Bureau Veritas Certification

Product Carbon Footprint Verification Opinion

is awarded to

SHANGHAI ZHENHUA HEAVY INDUSTRIES CO., LTD.

Bureau Veritas Certification (Beijing) Co., Ltd. was engaged by Shanghai Zhenhua Heavy Industries Co., Ltd to conduct an independent verification of its product carbon footprint. This verification opinion applies to the related information included within the scope of work described below.

Boundaries covered by the verification:

- Verified product name: Rubber tyred gantry crane (hereafter referred as "RTG")
- Production address: No.1, Zhenhua Road, Nantong Economic Development Zone, Nantong, Jiangsu (Shanghai Zhenhua Heavy Industries Co., Ltd. Nantong Branch)
- Declared unit: 1pc type as RC/41 MT RTG
- System boundary: The life cycle (from cradle to grave) process GHG emission of 1pc type as RC/41 MT RTG including raw material acquisition, raw material transportation, core production with waste disposal, products transportation, use of products, and end-of-life treatment.
- Time boundary for data: July 1, 2023 to June 30, 2024

Re-verification conditions: re-verification shall be applied when Greenhouse Gas emissions in the life cycle of the product has 5% or more than 5% planned changes or has more than 10% unplanned changes, and these changes continue for more than 3 months.

Verification standards:

- ISO 14067:2018 Greenhouse gases - Carbon footprint of products - Requirements and guidelines for quantification
- ISO 14064-3:2019 Greenhouse gases - Part 3: Specification with guidance for the verification and validation of greenhouse gas statements

Level of assurance:

- Reasonable assurance

Methods of verification:

- Interview for relevant personnel
- Review of the documentary evidence
- Evaluation of the methodology and information systems for data collection, aggregation, analysis and review
- Audit of sampled sites and data to verify source

Verification conclusion:

- Greenhouse Gas emission in the life cycle of 1pc type as RC/41 MT RTG (from cradle to grave): [redacted]
- Based on the verification process and findings, the quantification method and result of product carbon footprint for 1pc type as RC/41 MT RTG reported from Shanghai Zhenhua Heavy Industries Co., Ltd. is in compliance with ISO 14067:2018 Greenhouse gases - Carbon footprint of products - Requirements and guidelines for quantification.

Statement of independence, impartiality and competence

Certification body address: Room 02, 5 / F, West Office Building 1, Oriental Economic and Trade City, Oriental Plaza, No.1 East Chang'an Street, Dongcheng District, Beijing, China, 100738
Further clarifications regarding the verification scope of this opinion may be obtained by consulting the organization.
To check this opinion validity please call: +86 10 59683883

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Verification & Certification

Third-party audits by BV to ensure compliance with ISO 14067

Values to Stakeholders

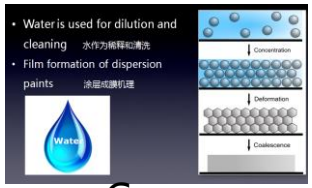
Clients —— Transparent carbon data supports green port certifications

Investors —— Aligns with ESG reporting frameworks

Regulators —— Prepares for future carbon pricing mechanisms

Pathways to Decarbonization

Design Innovations



Green Materials

Lightweight Design

Green Production

Welding Smoke Control

Automatic Production Line

Green Transpotation

Energy Monitoring

Shore Power

Smart Operations

Lithium Battery Driven IGV

Methanol-hybird, Hydrogen Fuel Cell Driven RTG

GREEN SUPPLY CHAIN

Future Directions for Green Port

Collaborative Ecosystems

- Cooperation with ports
- Partnerships with energy providers
- Industry cooperation for standardized carbon accounting

Next-Gen Technologies

- Application of Hydrogen/Methanol
- Transport-Energy Convergence (Generation, Storage, Utilization)
- Digital twin of terminal operation

Carbon Management

- Carbon inventory in the manufacturing stage
- Establishment of carbon footprint accounting standards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