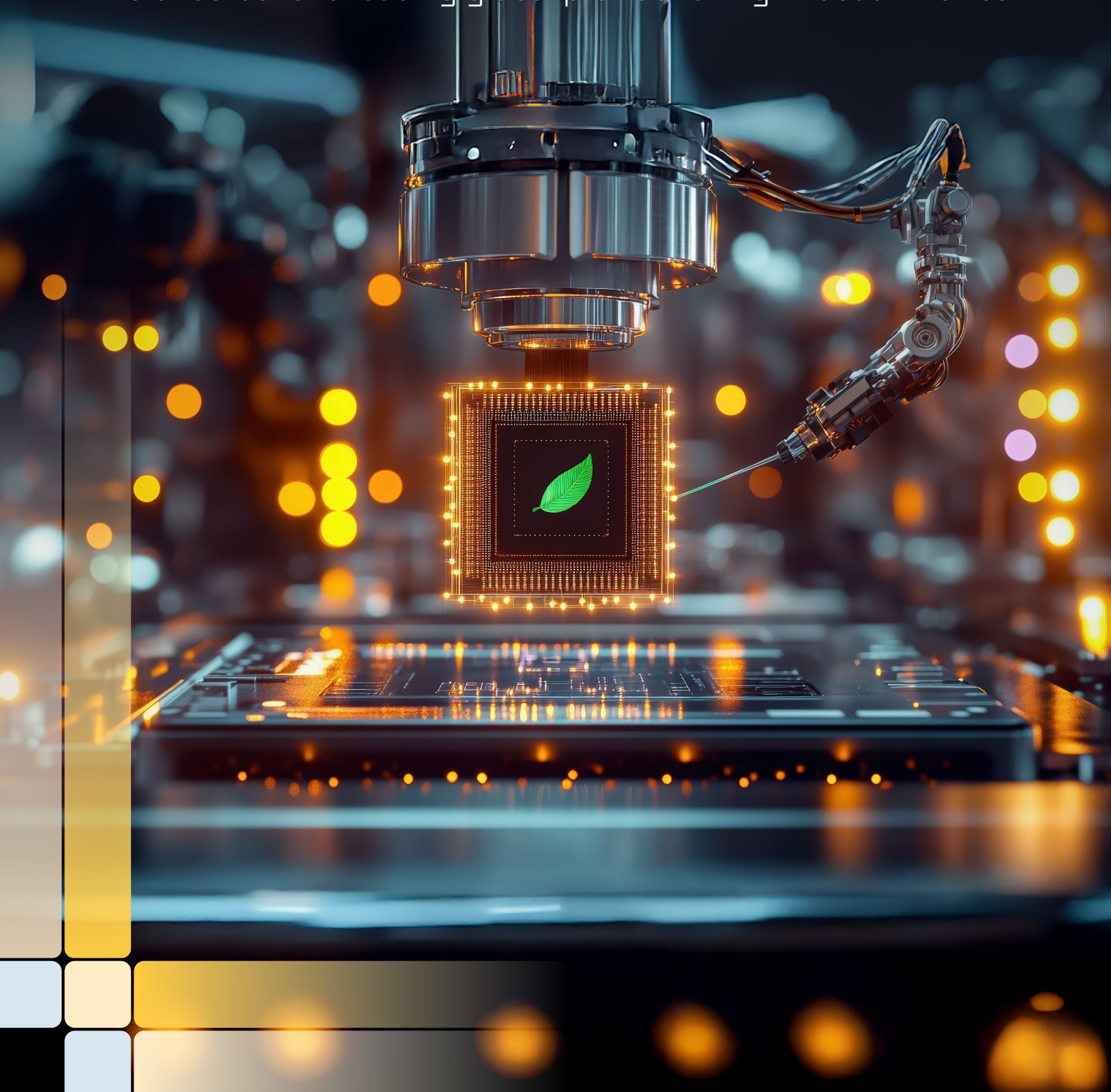
HCLTech | Supercharging Progress™

Engineering environmental transparency for semiconductor value chain readiness

Enabling end-to-end LCAs and EPDs aligned with ISO and EN standards for a leading global provider of high-vacuum valves



Overview

Our client, a leading global provider of high-vacuum valves for mission-critical applications — supplying critical components to industries such as semiconductors, life sciences, solar energy, advanced displays, space simulation research and high energy physics — partnered with HCLTech to advance product-level environmental transparency across its portfolio. As sustainability becomes a strategic imperative in the rapidly evolving semiconductor and advanced manufacturing sectors, supply chains are under intensifying scrutiny and customers are demanding greater clarity on Scope 3 emissions.

To strengthen their position as a trusted and environmentally responsible supplier, the client aimed to quantify the full lifecycle emissions of its flagship products and publish verified Environmental Product Declarations (EPDs). HCLTech conducted a cradle-to-grave Life Cycle Assessment (LCA), fully aligned with ISO 14040/44, ISO 14025 and EN 15804 standards. This comprehensive engagement empowered the client with actionable decarbonization insights while enabling the successful publication of Type III EPDs, positioning them as a sustainability leader in the semiconductor value chain.

The Challenge

Although the client was committed to environmental transparency and achieving net-zero goals, implementing this vision presented significant challenges. Accurately quantifying lifecycle emissions for a diverse range of high-performance valves demanded more than conventional methods.

To drive effective decarbonisation and address growing ESG disclosure requirements, the client needed a robust, standards-based methodology to identify environmental hotspots. Verified EPDs were essential for validating client's sustainability claims and aiding partners in Scope 3 emissions reporting.

However, launching and standardising LCAs for Isolation and Control Valves brought unique operational and technical complexities due to the specialised nature of these critical components:

Data availability: Effective assessment across multiple environmental indicators required harmonization of data throughout the product's entire lifecycle. Inconsistent or incomplete datasets posed a barrier to accurate and comprehensive analysis.

Uniqueness of the product: Assessment methodologies are governed by Product Category Rules (PCRs), which define how environmental impacts are calculated for specific product groups. Due to the niche nature of the isolation and control valves, aligning the product with existing PCRs introduced additional complexity.

Variation in emission calculations: As the valves are manufactured across multiple global sites, emission factors and lifecycle datasets had to be carefully customized for each location to ensure geo-specific accuracy.

Dual standard adherence: Given its European market footprint, the product's environmental assessment required compliance with both the ISO 14000 series and EN 15804 standards — ensuring the LCA and resulting EPDs met international and regional certification requirements.

The Objective

The client sought consistent, product-level environmental insights across multiple geographies and product categories to support data-driven sustainability decisions.

To ensure accuracy, traceability and alignment with global standards, HCLTech set out to:

- Conduct a cradle-to-grave LCA for two flagship valve products, delivering precise emission calculations tailored to target geographies and fully compliant with ISO 14040/14025 and EN 15804 standards.
- Identify environmental impact hotspots across the product lifecycle and apply Design for Sustainability (DfS) principles to generate actionable, evidence-based strategies for reducing carbon and material footprints.
- Facilitate the publication of verified EPDs for both valves, enhancing transparency and enabling easier Scope 3 accounting for downstream partners.

Our Solution

Engineering-led sustainability with accelerated EPD outcomes

Our Engineering and R&D Services (ERS) Sustainability team led a comprehensive LCA using HCLTech's custom-built approach tailored for precision, speed and compliance. Covering all life stages (A1 to D) over a 25-year lifetime, the study provided granular insight into environmental impacts and improvement opportunities.

Key solution components included:

Data harmonization and geo-mapping: We collected data from manufacturing sites across regions, applying location-specific emission factors to ensure accurate impact modelling

Hotspot identification and design feedback loops: Our LCA revealed high-impact areas across logistics, material sourcing and maintenance, identifying root causes and enabling targeted sustainability interventions

Eco-efficiency recommendations: We provided evidence-based ideas to reduce Global Warming Potential (GWP), material consumption and process inefficiencies, through circular design

EPD enablement and publishing: We enabled the complete lifecycle of Type III EPD creation, from LCA modelling and documentation to third-party review, audit and successful publication, in full compliance with ISO and EN standards

The Impact

Environmental insight meets strategic advantage

The LCA delivered critical environmental intelligence, positioning the client as a sustainability-forward partner and enabling measurable decarbonization opportunities.

Hotspot Area	Lifecycle Stage	Key Driver	Impact Severity
Logistics	A4 – Transport to Customer	Air freight emissions	**Very High**
Material Sourcing	A3 – Manufacturing	100% virgin usage material	**High**
Maintenance	B4 – Replacement	Replacement of steel and elastomer parts	**Medium**

Key quantifiable outcomes:

- 90%+ reduction potential in transportation-related emissions through optimized logistics
- 3+ major design optimization levers identified to enhance and achieve material efficiency
- Identified key opportunities to improve circularity and minimize process inefficiencies through sustainable design enhancements

Looking Ahead

With verified EPDs now published for two flagship valve products, the client is well-positioned to scale LCA initiatives across its broader portfolio. Building on this strong foundation, HCLTech continues to serve as a trusted sustainability partner, embedding circularity, digital traceability and ESG compliance into engineering innovation.

Together, we are advancing the future of net-zero hardware, where high performance meets environmental responsibility.