The Need for **sustainability** in **electronics manufacturing**

Driving change through **circular design**, **green technologies** and **responsible production**

2025 industry outlook & innovation report

Summary

Dynamic summary slide
click on the part that interests you and go directly to the slide

1 Sustainability in electronics manufacturing

The electronics manufacturing industry is a cornerstone of modern life, enabling technological advancements across diverse sectors such as automotive, telecommunications, healthcare, and consumer goods. However, this growth comes with significant environmental challenges.

As the demand for electronic products increases globally, the pressure on natural resources, energy systems, and waste management infrastructures intensifies.

> ***We are at a crossroads where our pursuit of technological advancements must converge with our duty to protect the planet. Sustainability in manufacturing is no longer optional; it is imperative.***

Dr. **Ursula VON DER LEYEN**
President of the European Commission

Resource consumption

Printed Circuit Boards *(PCBs)* and custom electronic parts rely heavily on non-renewable raw materials such as copper, gold, silver, and rare earth elements. Mining and processing these materials have far-reaching environmental consequences, including habitat destruction, soil degradation, and water pollution. According to the International Energy Agency *(IEA)*, **the electronics industry accounts for approximately 10% of global copper consumption**, and demand for rare earth elements is expected to triple by 2040 due to increasing electronic production.

10%
of global copper consumption

Energy-Intensive processes

The manufacturing of PCBs and electronic components involves energy-intensive processes such as etching, plating, and soldering. These processes require high amounts of electricity, often derived from fossil fuels, contributing to significant greenhouse gas (GHG) emissions.
For example, **the global electronics industry's carbon footprint is estimated to be over 600 million metric tons of CO2 annually** — a figure comparable to the aviation industry (source: Global Carbon Project, 2023). Studies indicate that PCB manufacturing alone contributes 30% of the total emissions in the electronics sector.

30%
of the total CO2 emissions

E-Waste generation

E-waste, or electronic waste, refers to discarded electronic devices and equipment that are no longer functional, desired, or have become obsolete.

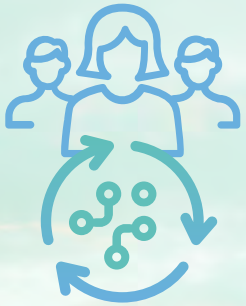
The rapid pace of innovation and shorter product lifecycles have led to a growing e-waste problem. The Global E-waste Monitor **2023 reported that over 53.6 million metric tons of e-waste were generated in 2022**, with less than 20% properly recycled. PCBs, being integral to most electronic devices, constitute a significant portion of this waste. Improper disposal of PCBs can release toxic substances, such as lead and brominated flame retardants, into the environment, posing risks to both human health and ecosystems.

≤20%
properly recycled e-waste

2 Regulatory and consumer pressure

Governments and consumers alike are increasingly prioritizing sustainability. Regulatory frameworks such as the European Union's Restriction of Hazardous Substances *(RoHS)* directive and Waste Electrical and Electronic Equipment *(WEEE)* directive aim to reduce hazardous materials in electronics and promote recycling.

According to a 2023 survey by Eurostat, 78% of EU consumers prefer to purchase electronics from companies with strong environmental commitments, emphasizing the growing demand for greener electronics.



78%

of EU consumers *prefer to purchase electronics from companies with* strong environmental commitments

Beyond RoHS and WEEE, upcoming regulations are set to further accelerate the sustainability agenda in the electronics industry:

The European Green Deal

This overarching policy aims to make Europe climate-neutral by 2050, with specific targets for reducing emissions in energy-intensive industries, including electronics. The Green Deal mandates a **55% reduction in greenhouse gas emissions by 2030** compared to 1990 levels.It also sets ambitious targets for energy efficiency, requiring a **36-39% reduction in final energy consumption by 2030** across industrial sectors, including electronics manufacturing.

The policy emphasizes the need for **eco-design and circular economy strategies**, pushing manufacturers to develop **longer-lasting and repairable electronics**. The Ecodesign for Sustainable Products Regulation *(ESPR)*, a key component of the Green Deal, is expected to ensure that at least **20% of materials used in electronic products come from recycled sources by 2030**. Additionally, the deal includes a **€1 trillion investment plan** to support industries transitioning to low-carbon production methods, with dedicated funding for sustainable electronics manufacturing.

-55%
gas emissions by 2030

Corporate sustainability reporting directive *(CSRD)*

Having come into effect, this directive now requires large companies operating in the EU to report detailed data on their environmental and social impact, including carbon footprints and waste management practices. The directive ensures greater transparency and accountability in sustainability reporting.

Under CSRD, a **large company** is defined as an entity that meets at least two of the following three criteria:

- *A net turnover exceeding €40 million*
- *A balance sheet total of more than €20 million*
- *An average of 250 or more employees during the financial year*

This directive will affect around 50,000 companies across the EU, a significant expansion from the previous 11,000 companies covered under the Non-Financial Reporting Directive *(NFRD)*. It requires companies to follow the European Sustainability Reporting Standards *(ESRS)*, covering climate impact, supply chain transparency, and corporate governance related to sustainability.

The ecodesign for sustainable products regulation *(ESPR)*

Expected to significantly impact electronic products, this regulation will introduce stricter design standards to enhance product durability, repairability, and recyclability. PCBs and custom electronic parts will need to comply with these guidelines to ensure extended product lifecycles and reduced waste.

Key ESPR requirements include:

- *A Digital Product Passport (DPP) to provide traceability of components and materials.*
- *Mandatory recycled content thresholds for specific electronic components.*
- *Restrictions on planned obsolescence to extend product life.*

The ESPR is set to replace the current Ecodesign Directive 2009/125/EC and broaden its scope beyond energy-related products to all physical goods sold in the EU.

Battery directive *(Revised)*

Though primarily targeting batteries, the revised directive includes provisions for electronic waste recycling and encourages the use of recycled materials in components such as PCBs.

The revised directive mandates:

- *A 70% collection rate for portable batteries by 2030.*
- *Mandatory recycling quotas for critical raw materials like lithium, cobalt, and nickel.*
- *Transparency on carbon footprint and environmental impact for battery production.*

These regulations not only set higher environmental standards but also encourage companies to innovate and adopt greener technologies. Failure to comply may result in significant penalties, reputational risks, and reduced market access.

On the consumer side, sustainability is becoming a key factor in purchasing decisions. Research by Deloitte *(2024)* indicates that 62% of global consumers are willing to pay a premium for sustainable electronics.

This trend is mirrored by procurement policies in B2B markets, where sustainability credentials increasingly influence supplier selection.

-55%
gas emissions
by 2030

-36/39%
energy consumption
by 2030

20%
recycled sources
by 2030

70%
portable battery collection rate
by 2030

3 Global **supply chain challenges**

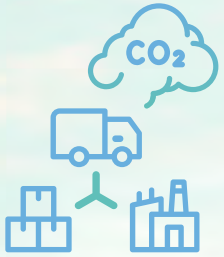
The globalized structure of electronics manufacturing has long relied on sprawling, interconnected supply chains that span multiple continents. While this has allowed for cost efficiencies and rapid scaling, it has also created considerable environmental and operational vulnerabilities.

Carbon footprint from logistics

Transporting raw materials and finished products across global supply chains contributes significantly to emissions.

According to **McKinsey & Company** *(2023)*, logistics emissions account for approximately 15% of the total carbon footprint of electronics manufacturing.

For example, shipping a 40-foot container from China to Europe emits around **2 metric tons of CO_2**, not including the upstream emissions from production and port operations



≈15%
of the total carbon footprint

Raw material sourcing and critical dependencies

Many essential electronic components *(e.g., capacitors, semiconductors, lithium-based batteries, and rare earth elements)* are heavily sourced from a limited number of countries.

China supplies over 60% of the world's rare earth elements and **70% of lithium-ion battery components**, creating risks related to geopolitical instability, trade restrictions, and overexploitation of resources.

The **EU's Critical Raw Materials Act** *(2023)* identified 34 materials essential to green and digital transitions, with over **80% of them imported from non-EU countries**.

80%
of green transition material come from outside EU

Supply chain disruptions

Recent global events—including COVID-19, the Russia-Ukraine conflict, the Red Sea shipping crisis, and shifting tariffs—have exposed the fragility of extended supply chains.

Lead times for critical components like microchips have fluctuated between **12 to 52 weeks,** delaying production and increasing e-waste due to stock obsolescence.

The **Semiconductor Supply Chain Report** *(2024)* from SIA notes that **40% of manufacturers experienced delays exceeding two months** during global disruptions.

40%
of delays exceeding 2 month

Lack of transparency and traceability

Limited traceability of materials makes it difficult to verify environmental and social compliance across the supply chain.

Less than **20% of electronics companies have full visibility** into tier 2 and tier 3 suppliers, according to **BCG's 2023 Supply Chain Sustainability Survey**.

This opacity increases the risk of labor violations, unethical sourcing, and environmental non-compliance.

<20%
of full visibility into suppliers

4 Opportunities for change

Despite these challenges, the electronics industry is positioned to become a global leader in sustainable transformation. Innovative technologies, regionalized production, and circular economy models offer pathways to reduce environmental impact while improving resilience and competitiveness.

Localized and resilient manufacturing

Companies are investing in **nearshoring and reshoring** to cut emissions and reduce reliance on fragile transcontinental logistics.

- ***Foxconn*** *is expanding operations in* ***Mexico and India*** *to supply North American and Asian markets more locally.*
- ***Bosch*** *plans to invest over* ***€1 billion in Europe and India*** *to localize production and reduce transport-related emissions.*

The EU's **Net-Zero Industry Act** aims to bring **40% of strategic clean tech manufacturing** back to Europe by 2030.

40%
of strategic clean tech manufacturing back to EU

Green logistics and transport

The shift to electric delivery fleets and green fuels (such as green ammonia and hydrogen) is underway.

- ***DHL*** *aims to electrify* ***60% of its last-mile delivery fleet*** *by 2030 and reduce its logistics-related* CO_2 *emissions by* ***29 million tons*** *annually.*
- *Innovations* ***like blockchain traceability, AI-driven logistics optimization****, and* ***digital twins*** *are helping companies better manage their supply chains and reduce waste.*

60%
of DHL delivery fleet electrified by 2030

Circular supply chains

A **closed-loop system**, where materials are recovered, refurbished, and reintegrated into production, can dramatically lower resource consumption.

- ***Dell's** closed-loop recycling system has recovered **more than 125 million pounds of used electronics** since 2018.*
- ***Fairphone** designs smartphones using recycled and fair-trade materials and provides spare parts to extend product life.*

Collaborative sustainability platforms

Global coalitions are emerging to address supply chain sustainability collectively.

- *The **Responsible Business Alliance (RBA)** and **Circular Electronics Partnership (CEP)** provide frameworks and tools for responsible sourcing, traceability, and e-waste reduction.*
- ***Apple, Microsoft, and Cisco are** members of CEP, sharing best practices and setting supplier standards.*

Digital product passport & regulatory momentum

As part of the **EU Ecodesign for Sustainable Products Regulation *(ESPR)***, companies will be required to implement **Digital Product Passports** by 2027.

These passports will include origin, material composition, repairability scores, carbon footprints, and recycling instructions—enabling end-to-end visibility and sustainability tracking.

5

Upcoming trends: **paving the way** for **greener electronics**

The electronics industry is at a pivotal moment where sustainability and innovation must go hand in hand. As regulatory demands intensify and consumer expectations shift, the push for greener electronics is becoming a business imperative. Below are key trends and real-world examples paving the way toward greener electronics manufacturing.

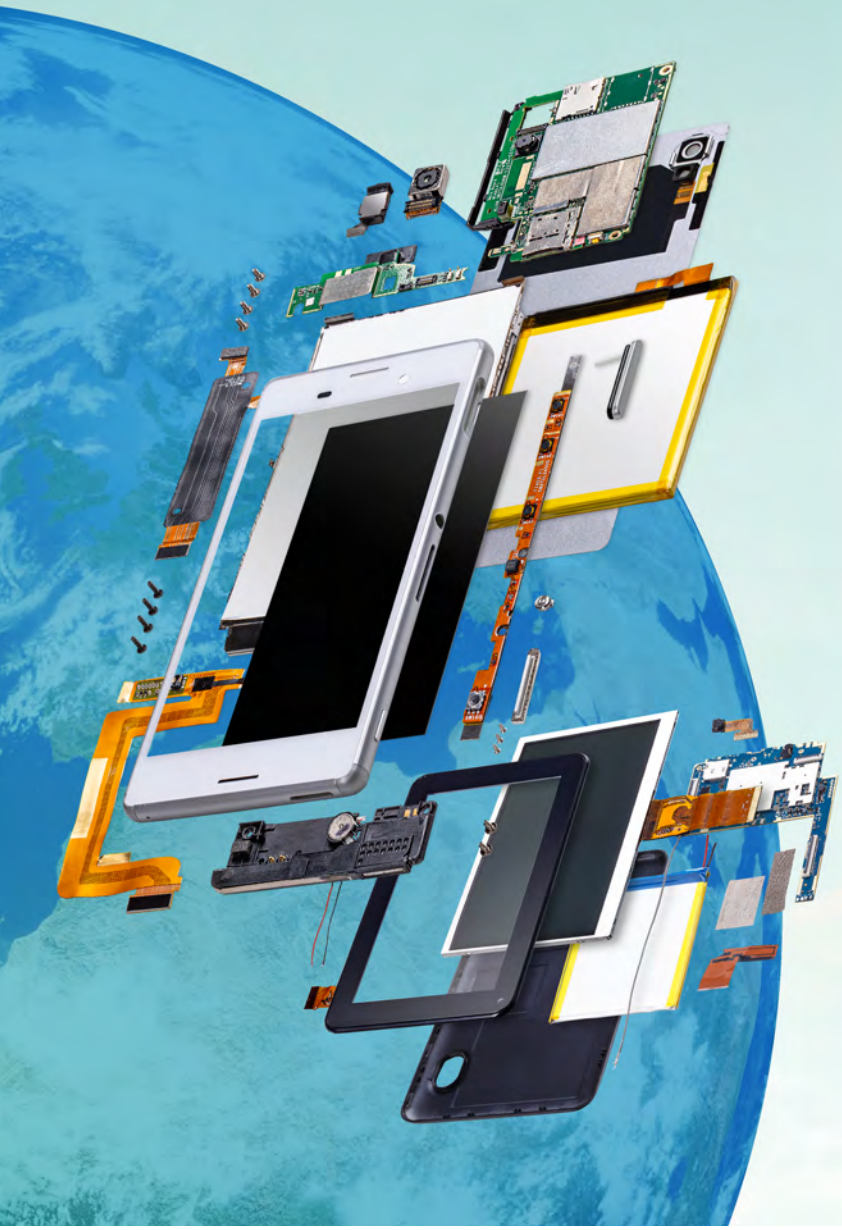
Recyclable PCBs

Traditional PCBs are made with non-biodegradable, multi-layer composites that are difficult to separate and recycle. However, innovations are emerging:

- ***Jiva Materials*** *(UK) has developed* ***Soluboard®,*** *a biodegradable PCB substrate made from natural fibers and a halogen-free polymer. When immersed in hot water, the material delaminates, allowing easy recovery of electronic components. This new technology* ***reduces carbon emissions by 60%*** *compared to traditional fiberglass boards.*
- ***Papershell*** *is pioneering sustainable electronics by developing* ***100% bio-based****, fossil-free materials for printed circuit boards (PCBs), aiming to reduce hazardous chemicals and carbon emissions by* ***up to 98%*** *through their innovative Biogenic CCL technology.*
- ***University of Washington*** *is exploring* ***fungus-based PCBs*** *using mycelium, which can be composted after use.*

Industrial Outlook: The global market for green PCBs is projected to grow from **$1.6 billion in 2023 to $3.5 billion by 2030**, driven by regulatory mandates and eco-conscious innovation *(source: Research and Markets, 2024).*

-60%
carbon emissions
biodegradable vs traditional PCB



Electronics recycling programs

The growing demand for electronics has led to a dramatic increase in electronic waste *(e-waste)*. Effective recycling programs are essential to recover valuable components and reduce landfill waste.

- ***End-of-Life Recycling Importance:*** *Proper recycling helps reduce hazardous waste and extract reusable materials, decreasing dependence on virgin raw materials.*
- ***Industry Collaborations:*** *Many electronics manufacturers are forming partnerships with recycling firms to establish take-back programs and refurbishment initiatives.*
- ***Success Stories:*** *Companies worldwide have successfully recycled old electronic components into new products, such as refurbished semiconductor chips, recovered circuit board metals, and reused plastics for new device casings.*

With e-waste projected to reach **74 million metric tons by 2030** *(UN Global E-Waste Monitor)*, proactive recycling is essential:

- ***Apple*** *has introduced* ***Daisy****, a robot capable of disassembling* ***23 different iPhone models*** *to recover valuable materials like rare earths, tungsten, and cobalt.*
- ***HP*** *uses over* ***30,000 tonnes of recycled plastic*** *annually in its products, including plastics sourced from ocean-bound waste.*
- ***Dell Technologies*** *runs* ***a closed-loop recycling system****, reclaiming gold from old computers and using it in new motherboard production.*

B2B Momentum: The Circular Electronics Partnership *(CEP)*, which includes **Cisco, Dell, Microsoft, and Google**, aims to increase global electronics recovery rates and promote design for recyclability across the value chain.

74M metric tons
e-waste by 2030

Energy-efficient production

Reducing energy consumption in electronics manufacturing is a critical step toward sustainability. As factories continue to expand, energy-efficient technologies are becoming a priority.

- ***Renewable Energy Integration:*** *Many facilities are transitioning to solar, wind, and hydroelectric power to reduce carbon emissions.*
- ***Smart Manufacturing:*** *The adoption of AI-driven energy management systems optimizes production lines and minimizes waste.*
- ***Energy-Efficient Equipment:*** *Upgrading to newer, more efficient machinery reduces overall energy usage and enhances sustainability efforts.*
- ***Elephantech's proprietary Pure Additive™ process****, which uses metal inkjet printing and electroless copper plating to deposit conductive materials only where needed, eliminates traditional etching and delivers major environmental benefits—reducing CO_2 emissions by up to* ***77%****, water usage by* ***95%****, and copper consumption by around* ***70%****.*

20-40%
costs reduce
with Industry 4.0 technologies

Manufacturing accounts for a significant portion of electronics' carbon footprint. Leading companies are investing in **smart, energy-efficient factories:**

- ***Samsung Electronics*** *committed to achieving* ***net-zero emissions across all operations by 2050****, with an intermediate goal of* ***100% renewable energy*** *use in its Device eXperience (DX) division by 2027.*
- ***Intel*** *has already achieved* ***82% renewable electricity usage globally*** *and is targeting* ***net-positive water and zero waste to landfill*** *by 2030.*
- ***Siemens*** *is deploying* ***digital twin and AI-based process optimization*** *in electronics manufacturing, reducing energy use by* ***up to 30%.***

Data point: The integration of **Industry 4.0** technologies *(IoT, automation, predictive analytics)* in electronics plants can reduce energy costs by **20–40%**, according to McKinsey *(2024)*.

Circular economy in electronics

The circular economy is an approach that minimizes waste by keeping products and materials in use for as long as possible.

- ***Design for Longevity:*** *Electronics manufacturers are shifting toward modular designs that allow for easy repair and component replacement.*
- ***Materials Recovery and Reuse:*** *Extracting and repurposing materials from old products reduces environmental impact and extends resource availability.*
- ***Lifecycle Management****: Companies are implementing longer product warranties and maintenance programs to extend product lifespans.*

Regulatory push: The EU's ESPR regulation mandates Digital Product Passports by 2027, enhancing traceability and repairability of electronic products sold in Europe.

Decentralized and sustainable supply chains

Companies are moving toward **regionalized manufacturing** to reduce emissions from global logistics and strengthen resilience:

- ***TSMC****, which makes* ***over 60%*** *of global semiconductors by revenue, is opening a design center in Munich to support the EU's chip goals, focusing on automotive, industrial, and AI chips. It's also co-investing in a Dresden plant with Infineon, Bosch, and NXP.*
- ***Samsung*** *and* ***LG*** *may shift dryer and fridge production from Mexico to U.S. plants in South Carolina and Tennessee to boost localization and cut trade risks.*

Insight: McKinsey estimates that nearshoring and local sourcing strategies could reduce scope 3 logistics emissions by **up to 50%** in the electronics sector.

-50%
scope 3 logistics emissions

Emerging regulations and reporting standards

Beyond existing frameworks like RoHS and WEEE, new regulations are accelerating sustainable practices:

- *The* ***CSRD*** *(2024) will require around* ***50,000 EU-based companies*** *to disclose detailed environmental, social, and governance (ESG) data.*
- *The upcoming* ***Ecodesign for Sustainable Products Regulation (ESPR)*** *mandates* ***20% recycled material*** *content in electronic products by 2030.*

Companies failing to comply may lose access to the EU market or face significant penalties. This creates a major incentive for sustainability-led transformation across the sector.

20%
recycled material

6 Our role: **driving the change**

Our company is actively embracing these trends through:

*R&D into **eco-friendly PCB alternatives** with industry partners (such as Jiva, Papershell, Elephantech, among others).*

*Implementing **energy-efficient equipment** and **renewable energy** in all new factory developments.*

*Expanding our **component recovery program** in partnership with certified recyclers.*

*Designing products with **modularity and repairability** in mind, ensuring alignment with future EU regulations.*

ESG ENVIRONMENTAL SOCIAL & GOVERNANCE 73% | Excellent

ENVIRONMENTAL MANAGEMENT SYSTEM ISO 14001

ecovadis Commited

80% of our partner factories are **ISO 14001 certified**

100% of our partner factories have a yearly **CSR audit**

*To learn more about our CSR and environmental initiatives, consult our Extra-Financial Report on our **website***

7 Conclusion: **a greener tomorrow starts today**

The future of electronics is green—and the transformation is already underway. From recyclable materials and smarter factories to circular design and transparent sustainable supply chains, these emerging trends signal a decisive shift in how electronic products are made and consumed. Companies that embrace these innovations will not only reduce their environmental impact but gain trust, competitiveness, and resilience in a rapidly evolving market.

Let's continue to innovate with purpose, collaborate across the value chain, and build a truly sustainable electronics ecosystem.

At our company, we are committed to leading this transformation. Through innovation, collaboration, and responsible manufacturing practices, we aim to build a future where electronics contribute to both technological progress and environmental preservation.

We invite our partners, customers, and industry peers to join us on this journey. Together, we can make electronics manufacturing a model for sustainability and ensure a greener future for generations to come.

Thank you to our partners, customers, and stakeholders for supporting this vision. Let's continue to push the boundaries of sustainable innovation.

JIVA

a pioneer in **sustainable electronics manufacturing**

JIVA is revolutionizing the electronics manufacturing industry with its groundbreaking product, Soluboard®.

Founded by Jack Herring, a visionary innovator from the Royal College of Art, and Steve Driver, a former CEO of Spirit Circuits UK, JIVA addresses one of the most pressing challenges in the industry: electronic waste reduction.

Their mission is to create a sustainable future for electronics manufacturing by integrating eco-friendly principles into every aspect of their operations.

The problem: the growing challenge of e-Waste

Electronic waste (e-waste) is one of the fastest-growing waste streams globally, with millions of tons discarded annually.

This poses significant environmental risks, including soil and water contamination and a loss of valuable materials. Additionally, increasing regulations and consumer demand for environmentally responsible products have intensified the pressure on manufacturers to adopt sustainable practices.

The innovation: Soluboard®

Soluboard® is a paradigm-shifting solution developed by JIVA to tackle the e-waste crisis. Unlike traditional printed circuit boards (PCBs), which are challenging to recycle, Soluboard® is made from natural fibers and is water-soluble.

At the end of its lifecycle, the material dissolves in water, leaving only the valuable metal components for recycling. This unique property significantly reduces landfill waste and simplifies the recycling process.

Soluboard® enables the recovery + reuse of electronic components after removal at end-of-life

Key features of Soluboard®

Sustainable materials:

Soluboard® is crafted from natural fibers, replacing petroleum-based materials typically used in PCB manufacturing. This makes it both renewable and biodegradable.

Water solubility:

One of its standout features, Soluboard® dissolves in water at the end of its use. The fibers disintegrate, leaving behind metal components that can be easily collected and recycled.

Versatility

Compatible with single- and double-sided *(PTH)* PCBs, Soluboard® meets the technical needs of various electronic applications without compromising performance.

Environmental impact reduction

By significantly reducing the amount of non-recyclable waste, Soluboard® helps manufacturers align with stricter environmental regulations and sustainability goals.

Soluboard®

International Patent: WO 2018/234801

Produced using fully biodegradable and non-toxic natural fibres

67% lower CO_2 vs. FR4

59% lower CO_2 vs. CEM-1

Fully recyclable via a novel hot water-based process

Incineration avoided at end-of-life, plus precious metal recovery improved

Supplied as Copper Clad Laminate for standard etching frabrication

Compatible with conductive inks and adhesives for additive applications

Mechanically and Electrically comparable properties to incumbents

Technical data sheet

Overview

Soluboard® CCL is a unique thermoplastic laminate system created using natural fibres and a water-soluble polymer. It has a reduced carbon footprint compared to other incumbent substrates and can be reycled at end-of life without the need for incineration.

Description

- *Alternative to glass fibre - epoxy laminates*
- *Optimised for 2-layer boards with PTH technology*
- *Compatible with standard PCB fabrication processes*
- *Supplied as un-clad or copper clad lamninate*
- *Produced using biogregradable non-toxic natural fibres and a water-soluble polymer*
- *Environmentally friendly end-of-life solution through hydro-mechanical processing, avoiding incineration*

Laminate properties

Characteristic	Unit	Value
Laminate Thickness	mm	0.5 - 3.2 (+/- 15%)
Copper Thickness	Microns	9 - 140

Mechanical properties

Characteristic	Unit	Value	Method
Tensile Strength	MPa	40.65	ASTM D638
Flexural Strength	MPa	84.22	ASTM D790
Peel Strength	N/mm	0.85	MIL-P-13949

Thermal properties

Characteristic	Unit	Value	Method
Decomposition Temperature (Td)	°C	285	IPC 2.4.24.6
Glass Transition Temperature (Tg)	°C	85	IPC 2.4.25
CTE (Ambient to Tg)	ppm/°C	37	IPC 2.4.24
Thermal Conductivity	W/mk	0.25	ISO 8894-1:2010
Flammability (UL file reference E539951, Soluboard R1.0 - preliminary results)	-	V-1	UL 94

Electrical properties

Characteristic	Unit	Value	Method
Dielectric constant (at 10 MHz)	-	3.5-4.1	ASTM D150-18
Dissipation Factor/tan δ (at 50 MHz)	-	0.094	ASTM D150-18

Design guidelines

Overview

Soluboard® CCL is a unique thermoplastic laminate system created using natural fibres and a water-soluble polymer. It has a reduced carbon footprint compared to other incumbent substrates and can be reycled at end-of life without the need for incineration.
Soluboard® CCL is compatible with single-sided, double-sided and plated through hole (PTH) PCB technologies.

Laminate properties

Characteristic	Unit	Value
Cu Thickness	Microns	9 - 140
Flammability	-	V1

Mechanical

Specification	Unit	Value
Minimum Track and Gap	mm	0.15
Minimum Annular Ring	mm	0.15
Minimum Feature to Profile	mm	0.40
Minimum Hole Diameter	mm	0.35
Minimum Slot Diameter	mm	1.00
Hole Size Tolerance	mm	+/- 0.05
Rout/Scoring Positional Tolerance	mm	+/- 0.30
Panel Dimension	mm	610 x 457
Panel Thickness	mm	0.50 - 3.20 (+/15%)

Finishing

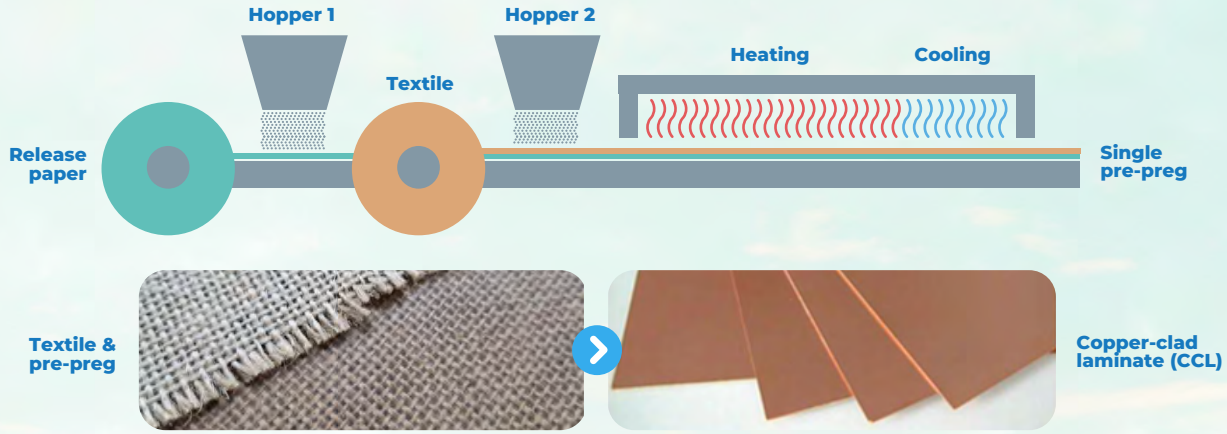
Feature	Unit	Value
Soldermask Colour	-	Green/White/Grey/Black/Blue/Red/Ckear
Minimum Soldermask Clearance to Cu	mm	0.05
Minimum Soldermask Feature	mm	0.25
Silkscreen/Legend/Ident Colour	-	White/Black/Yellow
Minimum Silkscreen Clearance to Cu	mm	0.25
Minimum Silkscreen Feature	mm	0.25
Surface Finish	-	Immersion Silver/Immersion Tin/OSP

Production process

Soluboard® is produced through a belt press process that consolidates multiple layers of natural fiber pre-preg under heat and pressure.

This process ensures durability and performance comparable to conventional PCBs while being environmentally friendly. The material's design aligns with industry standards, making it an easy transition for manufacturers seeking sustainable alternatives.

The pre-preg for Soluboard® copper-clad laminate is produced via belt press process. Multiple layers of the pre-preg are consolidated under heat/pressure via industry standard presses.



End-of-life benefits

The unique water-soluble feature of Soluboard® simplifies the recycling process. Traditional PCBs often end up in landfills because separating their components is complex and costly. With Soluboard®, the dissolution process ensures efficient separation of metals and fibers, maximizing material recovery and minimizing waste.

The visionaries behind JIVA

Jack HERRING

Founder and Chief Product Officer

The inventor of Soluboard®, Herring conceptualized this innovation during his studies at the Royal College of Art.

His vision is to integrate sustainability into electronics design.

Steve DRIVER

Chief Executive Officer

A seasoned leader in the electronics industry, Driver brought his expertise and leadership to co-found JIVA, turning Herring's vision into a market-ready product.

Market adoption and future potential

JIVA's Soluboard® is already gaining traction among environmentally conscious manufacturers. ICAPE Group has invested in JIVA and has started testing Soluboard® production in its factory in Sweden, underscoring its potential as a sustainable alternative in the electronics industry.

Current Landscape:

- ***Competitors:*** *Shengyi's RecyClad, Papershell's paper-based materials, and pre-development wood-based solutions.*
- ***Customers:*** *Forward-thinking companies aiming to lead in sustainability audits and environmental evaluation systems.*

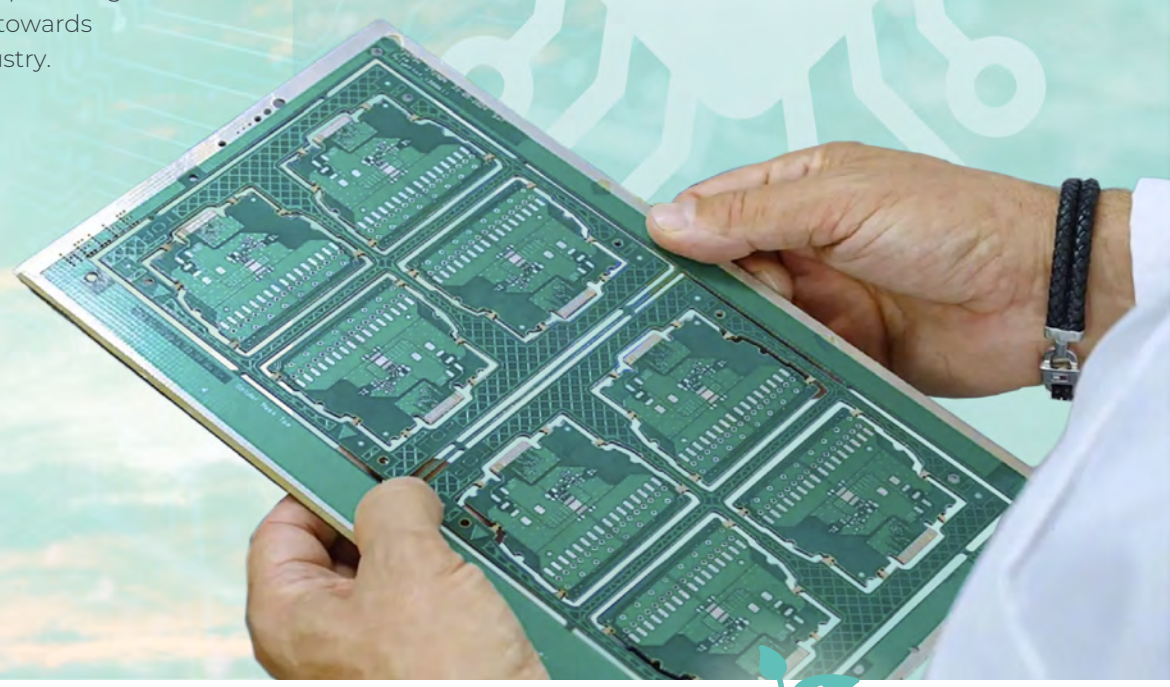
Future Outlook: JIVA plans to expand its production capabilities, refine its technology, and increase partnerships with industry leaders. The ultimate goal is to set a new standard for eco-friendly manufacturing in electronics.

Impact and value proposition

JIVA's innovation offers tremendous value to stakeholders:

- ***Manufacturers:*** *Gain a competitive edge by adopting eco-leading technologies.*
- ***Consumers:*** *Access to greener, more sustainable electronics.*
- ***Environment:*** *Significant reduction in e-waste and associated environmental harm.*

Through Soluboard®, JIVA is not just providing a product but inspiring a movement towards sustainability in the electronics industry.



Jack HERRING

Founder and Chief Product Officer of JIVA Materials

Interview with **Jack Herring**

Founder of **JIVA Materials**

Jack Herring is the founder of Jiva Materials Limited and the inventor of Soluboard®, a sustainable alternative to traditional PCB substrates. He developed the concept during his academic studies, drawing on his background in architecture and product design to bring a fresh perspective to the electronics industry.

Since founding Jiva in 2017, Jack has led the company's sustainability strategy, overseen the development of its core intellectual property, and managed both grant-funded projects and investor relations.

JIVA

1 Origins and motivation

Soluboard® emerged during your studies. What problem in the electronics industry were you aiming to solve?

Jack Herring:

The core issue I wanted to tackle was electronic waste — the fastest-growing waste stream globally. Specifically, I focused on printed circuit boards *(PCBs)*, which lacked an effective end-of-life solution. PCBs are typically made with fiberglass, epoxy resin, and flame retardants, making them difficult to recycle.

My idea was to reverse-engineer a more sustainable alternative using materials with a lower carbon footprint that could still be processed using standard PCB manufacturing equipment. The goal was to develop a truly viable and scalable eco-friendly solution.

What personal experiences led you to believe sustainability could drive innovation in this field?

Jack Herring:

My background is in product design, not electronics or materials science. Approaching the problem with a fresh perspective helped. Many in the industry initially doubted whether it was possible to create a water-soluble material that could withstand water-based manufacturing processes — but we proved it could be done.

Soluboard® dissolves in hot water at the end of its life, enabling a cleaner recycling process compared to traditional shredding or incineration. I believe this unconventional approach was key to our breakthrough.

2 Sustainability as a Strategic Advantage

How can sustainability evolve from a compliance issue to a competitive advantage for electronics manufacturers?

Jack Herring:

Sustainability must align with cost and feasibility. If a sustainable product can be integrated with minimal changes to existing infrastructure and without significant cost increases, it becomes a practical business solution — not just a compliance requirement.

That principle has guided our development from the start.

What kind of ROI — environmental, social, or financial — can companies expect from adopting Soluboard®?

Jack Herring:

Companies benefit from reduced carbon emissions and energy usage, particularly due to the use of low-temperature soldering. Socially, they meet growing consumer expectations for sustainability.

Financially, savings arise from lower energy consumption and potential regulatory advantages. It's a triple-bottom-line return.

3 Technical and market readiness

How does Soluboard® compare to traditional PCB substrates in performance, reliability, and cost?

Jack Herring:

Soluboard® closely matches the properties of FR4, the standard PCB substrate. While we're still improving in areas like RF performance *(important for antenna applications)*, we're making progress by adjusting material thickness. Thermal and electrical properties are already on par.

We use low-temperature solder due to our thermoplastic base, which not only suits our material but also reduces energy usage and carbon emissions.

What changes do manufacturers need to make to adopt Soluboard®?

Jack Herring:

Very few. Some adjustments to line speed or temperature settings may be needed, but the equipment remains the same. We've prioritized seamless integration from the outset to eliminate barriers for manufacturers.

4 Real-world application and feedback

How are early adopters using Soluboard® today?

Jack Herring:

We're seeing strong uptake in IT and computing peripherals, consumer electronics *(especially white goods and kitchen appliances)*, chargers, power adapters, and increasingly, the lighting industry — which is under pressure from environmental regulations.

These sectors align well with our material's performance and sustainability profile.

What feedback or use cases have surprised you the most?

Jack Herring:

The level of organic interest from major brands has been surprising — many reached out to us because they were actively searching for a solution.

While there was initial resistance, especially in such a conservative industry, we've now gained strong traction and clearer positioning. It's encouraging to see mindsets shifting.

5 Industry-wide challenges and opportunities

What are the biggest barriers to widespread adoption of sustainable materials in electronics?

Jack Herring:

The industry is understandably risk-averse and hesitant to change, especially without a strong cost case. Testing, certification, and qualification take time, and manufacturers are cautious.

However, increasing regulations are starting to force movement. Ultimately, risk aversion and cost sensitivity are the main barriers.

Which industry segments are most ready — or overdue — for change?

Jack Herring:

Consumer electronics and domestic appliances are long overdue. Many of these products have very short lifespans yet are made with non-recyclable materials.

Lighting is another area where waste is unnecessarily high. Automotive is aware of the need, but regulatory processes take time. Still, that sector is progressing in the right direction.

6 Innovation journey and lessons learned

What were the key turning points in commercializing Soluboard®?

Jack Herring:

The major shift came when OEMs began testing Soluboard® in real-world applications. Getting access to their designs allowed us to validate and refine the product.

Balancing innovation with industry practicality is a constant challenge, but a necessary one.

What lessons can you share with other innovators in sustainable materials?

Jack Herring:

Put the customer first. Understand their needs and make your solution easy to implement. Test thoroughly and collect as much data as possible.

Your product must fit into existing systems with minimal disruption.

7 The Role of Partnerships

What makes an ideal partner for scaling a solution like Soluboard®?

Jack Herring:

An ideal partner understands both the technical requirements and the long-term environmental impact.

Many of our OEM partners have set ESG goals years ago and are actively working toward them. They must be willing to invest in validation and understand the markets they serve.

How can other stakeholders help normalize sustainable PCBs?

Jack Herring:

The key is getting Soluboard® specified at the design stage — added to the bill of materials from the start.

That means buy-in from top management to design engineers. This is a systemic shift that requires commitment across the entire organization.

8 Future Vision

What's next for JIVA in terms of scale and product development?

Jack Herring:

We're focused on scaling up production to meet demand in computing, domestic appliances, and lighting.

We're also expanding our product line — different thicknesses and custom laminates for specific applications. Our goal is to become a market leader in sustainable electronic materials.

What would you say to companies that see sustainability as too costly or complex?

Jack Herring:

Sustainability is no longer optional — especially for short-lifespan products. It's becoming a baseline expectation.

Our materials prove you don't have to sacrifice performance or cost. Companies that embrace this shift now will lead the industry in the future.

conducted by statista

10

Sustainability survey

Sourcing and manufacturing of electronic components

To better understand current trends, challenges, and opportunities surrounding sustainability in the electronics manufacturing sector, our company commissioned a dedicated survey conducted by Statista, a global leader in data analytics and market research.

With its reputation for delivering reliable, industry-specific insights across more than 170 sectors, Statista was selected for its rigorous methodology and global reach. This analysis explores how companies across various roles, regions, and industries perceive and implement sustainability practices.

Top 5 Key Findings

1 Sustainability is widely valued, but cost is still a barrier

- **86%** see sustainability as important in manufacturing, and **74%** in supplier selection.
- However, **53%** are unwilling to pay a premium, with only **13%** accepting a 6–10% price increase.

2 Larger companies and sourcing teams are leading the transition

- **67%** of large companies say sustainability is “very important”.
- Sourcing/buying roles consistently prioritize sustainability more than operational roles — especially in supplier selection and certifications.

3 Formal sustainability targets and KPIs are gaining ground

- **58%** of companies have formal sustainability goals with KPIs, especially in the USA and Germany.
- China and small businesses lag behind, often citing unclear targets or planning stages

4 Audits, dashboards, and certifications are becoming standard tools

- **93%** conduct third-party audits, and **94%** use dashboards.
- Most-used certifications: **RoHS (75%)**, **ISO 14001 (72%),** and **Carbon reporting (63%)**.

5 The future is sustainability-first

- Today, only **58%** say it’s the industry’s top priority, but **87%** believe it will be within 5 years.
- No respondent sees it becoming less important — showing rare strategic consensus.

Question 1

How important is sustainability in your company when it comes to the manufacturing of electronic products or components (e.g., PCBs)?

86% Very important

1% Not important

Total overview

- **86%** of respondents rate sustainability as either "Very important" (**45%**) or "4" (**41%**), indicating a strong overall emphasis across the sector.
- Only **1%** rate it as "2" and none say it's "Not important at all", showing near-universal acknowledgment of its relevance.

By **country**

- USA leads with **65%** saying sustainability is "Very important", followed by Germany at **48%**.
- China lags significantly, with only **24%** selecting "Very important" and a notable **30%** placing it at "3" — suggesting less urgency or different priorities.
- Germany has **7%** unsure or less convinced ("Don't know" + "2").

By **job position**

- Sourcing/Buying roles rate sustainability highest (**64%** "Very important") — likely due to direct involvement with supply chain ethics and compliance.
- Operational roles are more moderate: only **38%** say it's "Very important", suggesting implementation challenges or other competing priorities on the ground.

By **company size**

- Larger companies (1,000+ employees) are far more sustainability-driven (**67%** "Very important"), likely due to stricter ESG requirements and public visibility.
- Mid-sized companies (200–999 employees) are mixed: **54%** rate it "4", but only 26% choose "Very important".
- Small companies (<200) show varied opinions, with no respondents selecting "Very important" and **38%** choosing "3" — possibly reflecting resource constraints or lower ESG pressure.

Total overview

- **44%** say sustainability is "Very important", and **30%** rate it as 4 → **74%** overall emphasis, slightly lower than the first question (**86%**).
- Only **4%** say it's "Not important at all," showing mostly positive sentiment with minor resistance.

By **job position**

- Sourcing/Buying roles have the highest emphasis (**58%** "Very important") — a logical trend, as supplier evaluation falls within their responsibility.
- Operational roles are less driven by this concern (**24%** "Very important", **45%** choose "4"), likely because they focus more on production efficiency than supplier selection.

By **country**

- Germany leads with 52% rating sustainability as "Very important", followed by USA at **43%**.
- China again shows lower urgency (**33%** "Very important", **27%** "3"), confirming a more balanced or cautious approach compared to the West.

By **company size**

- Large companies (1,000+ employees) again show the highest engagement (**61%** "Very important").
- Mid-sized companies are more moderate, with only **17%** choosing "Very important" and **39%** opting for "4".
- Small companies (<200 employees) are skeptical: **67%** say it's "Not important at all", hinting at resource limitations or low procurement leverage.

Key insights

When it comes to supplier selection, sustainability remains very important but less unanimous than in internal manufacturing. The strongest advocates are large companies, sourcing professionals, and industries with external visibility or strict regulations, while small businesses and operational teams are less engaged, suggesting a gap in procurement maturity or differing business priorities.

Question 2

How important is sustainability in your company when selecting suppliers for electronic products or components (e.g., PCBs)**?**

44%
Very important

4%
Not important

Question 3

Which activities does your company engage in to track and report sustainability efforts?

80%
Tracking manufacturing sustainability data

74%
Collecting supplier sustainability data via certifications/disclosures

93%
Conducting third-party sustainability audits/assessments

94%
Integrating sustainability into internal dashboards

48%
Publishing sustainability data formally

Tracking manufacturing sustainability data *(e.g., energy use, emissions)*

- Total: **80%** say this applies — a strong base practice across the board.
- Germany (**96%**) and USA (**90%**) lead.
- China lags at **58%**, indicating regional disparity.
- Sourcing/Buying roles (**88%**) slightly outpace Operational (**77%**).
- Large companies (**88%**) outperform mid-sized (**69%**).

Conducting third-party sustainability audits/assessments

- **93%** total adoption — the most widely shared activity.
- High consistency across countries, job roles, and company sizes — this is clearly becoming a standard practice.

Publishing sustainability data formally *(e.g., ESG reports)*

- Only **48%** overall do this — the least common activity.
- Large companies (**72%**) dominate vs. mid-sized (**21%**), confirming that reporting maturity grows with size.
- USA (**61%**) and Germany (**66%**) are far ahead of China (**17%**).
- No small companies (<200 employees) publish formal reports — possibly due to resource limits.

Collecting supplier sustainability data via certifications/disclosures

- **74%** total say it applies — a strong, but less universal practice.
- Sourcing/Buying roles (**83%**) lead this category, confirming procurement's central role.
- Smaller companies (**33%**) show low adoption.
- Germany (**72%**), USA (**77%**), and China (**73%**) show rare alignment here.

Integrating sustainability into internal dashboards

- **94%** of companies use dashboards — another widespread practice.
- USA (**100%**) lead.
- Even smaller companies (**88%**) adopt this well, showing its increasing accessibility.
- A few gaps remain in Germany (**91%**) and China (**91%**), though still strong.

Key insights

- Audits and dashboards are becoming industry standards — nearly universal across regions, roles, and sizes.
- Smaller companies and Chinese firms lag behind in formal tracking and especially in publishing ESG reports.
- Sourcing/Buying roles consistently lead in supplier-related tracking.
- Formal sustainability reporting is the maturity frontier: it strongly correlates with company size and regional development.

Total overview

- **58%** of all respondents report having clearly defined sustainability targets with KPIs.
- **35%** have targets but lack clarity or structure.
- Only **7%** are considering setting targets; **0%** explicitly say they do not plan to set any → a sign of growing commitment across the board.

By **country**

- Germany (**74%**) and USA (**72%**) lead in setting clear, measurable targets.
- China lags significantly (**29%**), with the majority (**57%**) saying targets are not clearly defined, and **14%** still only considering them.
- This reflects a regional maturity gap in sustainability strategy.

By **job position**

- Sourcing/Buying roles (**73%**) are highly engaged in structured sustainability, while only **49%** of Operational roles say the same.
- This difference may stem from sourcing professionals needing to justify supplier practices with traceable goals.

By **company size**

- Larger companies (1,000+ employees) are far ahead: **82%** have defined KPIs, only **17%** unclear.
- Mid-sized (200–999 employees) are mixed: **32%** have KPIs, **58%** unclear.
- Small companies (<200) struggle: only **13%** have KPIs, **63%** have vague goals, and **25%** are still considering. This may be due to resource constraints or lack of internal frameworks.

Key insights

- Formal sustainability targets with KPIs are becoming the norm, especially among larger firms, German/US companies, and procurement professionals.
- Small businesses and companies in China lag in maturity — often lacking structure or still in the planning phase.
- While no respondents rejected the idea of sustainability targets, clarity and measurability remain a major differentiator between leaders and laggards.

Question 4

Does your company have formal sustainability targets related to electronic products and components?

58%
clearly defined

35%
lack clarity or structure

Question 5

Which sustainability regulations or initiatives have the most impact on your company's sourcing and/or design decisions?

77% RoHS
Reduction of hazardous substances

63% EPR
Extended Producer Responsibility

Total overview

- RoHS (**77%**) has the highest impact — a baseline standard in electronics.
- Extended Producer Responsibility (EPR) is second (**63%**) — a growing global pressure.
- EU Green Deal & CBAM (**47%**) and REACH (**44%**) follow — important but more regional.
- China's carbon neutrality goals (**34%**) and US SEC climate rules (**17%**) reflect regional policy pressures.

By **country**

- Germany shows strong influence from EU policies: RoHS (**86%**), EU Green Deal/CBAM (**89%**), and REACH (**63%**) are top.
- China stands out on national carbon neutrality (**100%**) and EPR (**89%**), showing localized compliance.
- USA companies focus more on RoHS (**72%**), SEC rules (**36%**), and EPR (**42%**), with less EU policy influence.

By **job position**

- Operational teams are heavily influenced by RoHS (**80%**) and China's carbon goals (**41%**), likely due to execution demands.
- Sourcing/Buying roles emphasize EPR (**58%**), EU policies (**58%**), and REACH (**50%**), aligning with procurement risk and compliance.

By **company size**

- Large companies (1,000+ employees) are more affected by RoHS (**90%**), EU Green Deal (**58%**), and REACH (**60%**) — indicating greater exposure to global regulations.
- Smaller firms show less exposure overall but are still significantly influenced by EPR (**63%**) and RoHS (**63%**).
- Mid-sized companies have balanced awareness across categories.

Key insights

- Formal sustainability targets with KPIs are becoming the norm, especially among larger firms, German/US companies, and procurement professionals.
- Small businesses and companies in China lag in maturity — often lacking structure or still in the planning phase.
- While no respondents rejected the idea of sustainability targets, clarity and measurability remain a major differentiator between leaders and laggards.

Total overview

- Only **1%** report that customers ask about sustainability very frequently.
- **56%** say customers ask occasionally, and **19%** say regularly.
- A concerning **25%** say customers never ask — showing a still-limited demand pressure from clients in many cases.

By **country**

- USA has the most customer-driven momentum: **33%** say “regularly”, **53%** “occasionally”, only **14%** “never”.
- Germany and China are similar: **~57%** say “occasionally”, but more than 1 in 4 say “never” — indicating regional differences in client engagement.
- Only Germany (**3%**) had any report of “very frequent” inquiries.

By **job position**

- Sourcing/Buying roles (**28%**) are more likely to hear regular sustainability inquiries than operational roles (**14%**).
- Still, **50–59%** in both roles say “occasionally”, with around 25% never hearing such inquiries — showing modest but present awareness among clients.

By **company size**

- Large companies (1,000+ employees) report higher regularity (**30%**) and lower “never” (**18%**) — suggesting more sophisticated or sustainability-aware clients.
- Mid-sized firms show the most consistent “occasional” pattern (**63%**) but higher rates of “never” (**32%**).
- Small companies (<200) report mostly “occasionally” (**63%**), but their small base size limits deeper conclusions.

Key insights

Customer interest in sustainability is emerging but not yet mainstream:

- Most companies experience occasional inquiries.
- Only a small fraction see consistent customer pressure, except in consumer-facing sectors like electronics.
- Larger firms and U.S.-based companies experience more frequent demand, while smaller firms and China-based companies receive less.

Question 6

How often do your customers inquire about the sustainability of your electronic products and components?

1%
very frequently

56%
occasionally

19%
regularly.

25%
never

Question 7

Which of the following statements best describes your company's approach to considering sustainability when selecting suppliers of electronic products or components (e.g., PCBs)?

(Filtered: only respondents involved in sourcing)

41%
sustainability in supplier selection

37%
with other key factors like cost and performance

Total overview

- **41%** of companies say sustainability is their top priority in supplier selection.
- **37%** balance sustainability with other key factors like cost and performance.
- **14%** say it's a secondary consideration, and only **3%** say it plays no role.
- Overall, more than **75%** of respondents include sustainability as at least a balanced factor in sourcing.

By **country**

- Germany (**52%**) shows the strongest prioritization of sustainability, followed by USA (**37%**).
- China (**33%**) is more divided: most companies balance sustainability (**40%**), while **27%** say it's secondary.
- Only Germany (**8%**) admits some companies for whom sustainability plays no role.

By **job position**

- Sourcing/Buying roles (**58%**) are far more likely than Operational roles (**18%**) to list sustainability as a top priority.
- Operational roles tend to balance factors (**52%**) or downplay sustainability (**18%**), highlighting a classic strategic vs. tactical difference in supplier evaluation.

By **company size**

- Large companies (1,000+ employees) lead: **59%** prioritize sustainability in supplier decisions.
- Mid-sized companies (200–999) lean toward balancing factors (52%), with only **13%** making it the top priority.
- Small companies (<200) (small sample size) show lower prioritization and even **33%** unaware or unclear ("don't know").

Key insights

- Sustainability is either a top priority or balanced factor for most companies — only a small minority fully deprioritize it.
- Sourcing professionals and large companies lead the charge, while operational teams and smaller firms are more pragmatic or hesitant.
- Germany and regulated industries consistently show greater commitment to sustainable sourcing.

Total overview

- The top three evaluation methods are:
  *Third-party environmental certifications (**82%**)*
  *Use of sustainable materials (**68%**)*
  *Life cycle assessments (LCAs) (**65%**)*
- Also common: assessing carbon footprint transparency (**65%**) and supply chain traceability (**63%**).
- Less used: self-reported data (**43%**) and favoring local sourcing (**40%**).

By **job position**

- Sourcing/Buying teams score highest in nearly all methods:
  ***84%** certifications, **71%** materials, **68%** carbon, **71%** traceability*
- Operational roles rank lower, especially on traceability (**55%**) and footprint (**55%**) — reflecting less decision-making power in sourcing strategy.

By **country**

- Germany leads in structured tools: **83%** use certifications, **74%** check materials, **70%** do LCAs, and 78% value traceability.
- USA prioritizes certifications (**89%**) and carbon footprint (**67%**), but is slightly behind on LCAs (**56%**) and traceability (**48%**).
- China shows high usage of LCAs (**73%**) and local sourcing (**53%**), but relies less on self-reported data (**27%**).

By **company size**

- Large companies (1,000+ employees) show high engagement across the board: certifications (**82%**), materials (**80%**), traceability (**73%**).
- Mid-sized firms use fewer advanced tools: lower LCA use (**55%**), and only **25%** use self-reported data.
- Small company sample (n=1) scored **100%** on all criteria — not representative, but indicates high potential when engaged.

Key insights

- Third-party certifications are the gold standard, widely used and trusted across regions and industries.
- LCAs and sustainable materials are gaining ground, especially in regulated industries and among sourcing professionals.
- Self-reported data and local sourcing are less trusted or less feasible, especially for global operations.
- Germany and large firms are consistently more advanced in supplier sustainability evaluation, while China and smaller companies are catching up but more selective.

Question 8

How does your company evaluate a supplier's sustainability efforts when making purchasing decisions regarding electronic products or components (e.g., PCBs)?

(Filtered: only companies that consider sustainability when selecting suppliers; multiple responses allowed)

82%
Third-party environmental certifications

68%
Use of sustainable materials

Question 9

How challenging are the following aspects for your company when sourcing sustainable electronic products or components (e.g., PCBs)?

(Filtered: respondents who consider sustainability when selecting suppliers)

Higher costs for sustainable components

- Top challenge: **46%** rate it as challenging (Top2).
- Most affected: USA (**56%**), and Sourcing/Buying roles (**50%**).
- Large companies (**41%**) and Germany (**39%**) show moderate concern.
- Least concerned: Operational roles (only **38%** Top2), and China (**40%**).

Limited supplier Options

- **31%** rate it as a challenge, while **34%** don't find it challenging.
- Particularly challenging for: Sourcing/Buying roles (**45%**)
- USA (**37%**) more concerned than Germany or China.
- Smaller companies may be more affected, but low base makes comparisons limited.

Lack of transparency in the supply chain

- **32%** rate it as challenging, but majority stay neutral or only slightly challenged.
- Germany (**35%**), and Sourcing roles (**29%**) are more impacted.

Complex compliance requirements

- Biggest overall challenge in the list: **49%** Top2, especially for: USA (**56%**), Germany (**57%**), Sourcing roles (**50%**)
- Indicates real operational burden for firms dealing with certifications and regulatory paperwork.

Insufficient demand from customers

- **22%** rate this as a challenge.
- But a significant **51%** are neutral.
- USA (**30%**) sees higher pressure, while China (**9%**) sees little.

Lack of internal Expertise

- Only **18%** consider it a challenge, and **34%** find it not challenging.
- Germany (**17%**), USA (**15%**), and large companies (**16%**) manage better.
- Suggests most companies have internal capabilities or external support for sustainable sourcing.

Longer lead times

- **37%** find it challenging; especially in: USA (**56%**), Sourcing (**41%**)
- Germany and China report it as less of a burden.
- Highlights logistical concerns tied to sourcing sustainable alternatives.

Key insights

- Cost and compliance are the top obstacles to sustainable sourcing.
- Supplier options and lead times are significant but secondary.
- Customer demand and internal expertise are less problematic, which could suggest companies are pushing change more than their clients are.
- Sourcing roles and regulated industries (Medical, Consumer Electronics) feel the strongest pressure, while Operational roles and smaller markets (e.g., China, low-sample industries) report lower concern.

Main Thematic Clusters

- Supply Chain & Sourcing Challenges
- Cost-Related Barriers
- Standards, Regulations & Verification
- Technical & Product Constraints
- Infrastructure & Expertise Gaps
- Transparency & Data Issues

Frequently Mentioned Unique Points

- Global shipping's emissions impact
- Price pressure from low-cost alternatives
- Lead time for sustainable parts
- Difficulty finding payment-flexible supplier

Question 10

Are there any other challenges your company faces when sourcing sustainable electronic products or components (e.g., PCBs)?

(Open answers: We have collected and sorted the responses into main topics, which are displayed on the left side of the page)

Question 11

Which sustainability-related certifications does your company prioritize when evaluating suppliers of electronic products or components (e.g., PCBs)?

(Multiple responses possible; filtered to companies that consider sustainability in supplier selection)

75% RoHS
Reduction of hazardous substances

72% ISO 14001
Environmental management systems

Total overview

- RoHS (**75%**) – Restriction of Hazardous Substances
- ISO 14001 (**72%**) – Environmental management systems
- Carbon footprint reporting (**63%**) – CDP, Science-Based Targets
- REACH (**54%**) – Regulation on chemicals
- Conflict minerals compliance (**26%**) – Dodd-Frank, EU

By **job position**

- Sourcing/Buying roles heavily favor: Carbon reporting (**76%**), RoHS (**71%**), ISO 14001 (**71%**)
- Operational roles focus more on RoHS (**83%**) and REACH (**66%**) but are lower on Carbon (**45%**).
- Reflects a split: strategic buyers focus on reporting, while operations focus on compliance.

Notable points

- Only **6%** of total respondents say they do not prioritize any certifications, mostly from China (**20%**) or Operational roles (**7%**).
- Conflict minerals compliance remains a niche requirement (**26%**), highest in Germany (**39%**) and Industrial Equipment (**43%**) sectors.

By **country**

- Germany strongly favors RoHS (**83%**), Carbon (**78%**), and REACH (**65%**).
- USA prefers ISO 14001 (**85%**) and Carbon reporting (**70%**), but less emphasis on REACH (**41%**).
- China prioritizes RoHS (**80%**) and REACH (**60%**) but trails on Carbon reporting (**27%**).

By **company size**

- Large companies (1,000+ employees) emphasize RoHS (**82%**), ISO 14001 (**70%**), and REACH (**61%**).
- Mid-sized companies (200–999) are aligned, but less emphasis on conflict minerals (**15%**).
- Small companies (single respondent) checked all boxes — not representative but shows awareness potential.

Key insights

- RoHS and ISO 14001 are baseline certifications, seen as table stakes by most.
- Carbon footprint tracking is rapidly gaining ground, particularly among sourcing professionals and in Europe.
- Regional and role-specific variations show how strategy and regulation drive certification priorities differently.
- Conflict minerals are still under-addressed outside of specific sectors.

Total overview

- **53%** of respondents say no – they are not willing to pay more.
- **34%** are willing to pay up to **5%** more, while **13%** accept **6–10%** more.

By **country**

- China (**60%**) and Germany (**52%**) show the highest refusal to pay more.
- USA is slightly more open, with **50%** not willing and **17%** willing to pay **6–10%** extra.
- Overall, Europe and Asia remain cost-sensitive, despite sustainability goals.

By **job position**

- Operational roles are more resistant (**64%** not willing).
- Sourcing/Buying roles are more flexible, with:
  __23%__ willing to pay __6–10%__ extra
  __43%__ still not willing to pay more
- This reflects a strategic-pragmatic divide: sourcing teams factor in long-term value more than operational cost drivers.

By **company size**

- Larger companies (1,000+ employees) are the most open to paying a premium:
  Only __45%__ not willing, and __16%__ willing to pay __6–10%__ more.
- Mid-sized companies (200–999) are the most conservative (**65%** unwilling).
- Small companies (n=3) trend toward cost sensitivity (**67%** unwilling).

Key insights

- There's a clear ceiling for premium acceptance: most buyers are only willing to pay up to **5%**.
- Sourcing professionals and large companies show the greatest willingness to invest in sustainable options.
- Medical, China-based, and operationally led companies show the strongest resistance — despite otherwise favorable sustainability signals.

Question 12

Would your company be willing to pay a premium for sustainable electronic products or components (e.g., PCBs)?

(Filtered: companies that source electronic products/components)

53%
Not willing to pay more

34%
Up to pay 5% more

Question 13

Which of the following statements best describes your company's approach to considering sustainability when designing electronic products or components?

(Filtered: respondents who work in companies that design/develop electronic products/components)

56%
Sourcing/Buying show stronger prioritization than Operational

Total overview

- **47%** say sustainability is their top priority during the design phase.
- **43%** balance sustainability with other factors like cost and performance.
- Only **8%** treat it as secondary, and **0%** say it plays no role, showing universal relevance.

By **country**

- USA (**61%**) and Germany (**59%**) are clear leaders in designing for sustainability.
- China (**24%**) lags, with **58%** balancing it and **18%** treating it as secondary.
- Indicates regional maturity differences in design-phase commitment to sustainability.

By **job position**

- Sourcing/Buying roles (**56%**) show stronger prioritization than Operational roles (**42%**).
- Operational teams are more likely to balance or deprioritize sustainability — similar to their stance on supplier selection

By **company size**

- Large companies (1,000+ employees): **69%** rate sustainability as their top design priority.
- Mid-sized companies are more moderate (**29%** top priority, **57%** balancing).
- Small companies (<200) mostly balance it (**75%**) — possibly due to resource constraints or less formalized sustainability practices.

Key insights

- Sustainability in design is a clear priority across most respondents — especially in the USA, Germany, sourcing teams, and larger firms.
- China, operational staff, and industrial sectors are more pragmatic, prioritizing cost/performance but still acknowledging sustainability.
- The absence of "no role" responses shows near-universal awareness of the importance of sustainable design practices.

Total overview

- Reduction of hazardous substances (**78%**) – e.g., RoHS, REACH – the most commonly adopted standard.
- Followed by:
  - *Product lifespan (**69%**)*
  - *Energy-efficient manufacturing (**69%**)*
  - *Use of sustainable materials (**67%**)*
  - *Reduction of product energy consumption (**65%**)*
  - *Design for recyclability (**60%**)*
  - *Modular design (**54%**)*
- Water usage reduction (**24%**) is the least common.

By **job position**

- Operational roles report strong implementation across the board, especially:
  - *Hazardous substance control (**80%**)*
  - *Energy-efficient processes (**70%**)*
  - *Sustainable materials (**68%**)*
- Sourcing/Buying roles emphasize:
  - *Product lifespan (**80%**)*
  - *Energy-efficient processes (**72%**)*
  - *Water usage (**36%**) — perhaps due to external supplier audits and compliance review.*

By **country**

- USA leads in product lifespan (**84%**), energy efficiency (**74%**), and energy consumption reduction (**84%**).
- Germany tops hazardous substance reduction (**81%**) and recyclability (**70%**).
- China lags slightly in most areas, especially in modular design (**45%**) and energy consumption reduction (**45%**), though still participates in core practices.

By **company size**

- Large companies (1,000+ employees) lead in hazardous substances (**90%**), sustainable materials (**73%**), and energy efficiency (**75%**).
- Mid-sized companies (200–999) hover around **60–69%** across categories.
- Smaller firms (<200) show interest but lower maturity, except for modular design (**75%**).

Key insights

- Hazardous substance reduction is a nearly universal standard, followed closely by design-driven sustainability efforts.
- Energy- and material-focused practices are broadly implemented but show variation based on region and company size.
- Modular design and water reduction remain niche or evolving practices, more common in sourcing roles or consumer-facing sectors.

Question 14

Which sustainability practices are implemented in your company's manufacturing of electronic products or components?

(Multiple answers possible; filtered to companies involved in product/component design and development)

78%
RoHS
Reduction of hazardous substances

Question 15

How important is end-of-life management (e.g., recyclability, e-waste reduction) in the manufacturing process of electronic products or components in your company?

(Filtered: companies that design/develop electronic products/components)

Total overview

- **30%** of respondents rate it as “very important” and **49%** as “important” → **79%** total recognize the importance of end-of-life (EoL) practices.
- Only **3%** find it unimportant, and **0%** say it's “not important at all”, confirming broad recognition of the issue.

By **country**

- USA leads with **52%** saying “very important”, followed by Germany (**26%**).
- China lags significantly: only **12%** “very important”, though **67%** rate it “important” — signaling awareness but lower prioritization.
- Germany shows a more balanced view between “important” (**44%**) and “very important” (**26%**).

By **job position**

- Sourcing/Buying roles (**44%**) are more likely to call it “very important” than Operational roles (**26%**).
- Still, over half of Operational roles rate it as “important,” suggesting broad buy-in but varying degrees of priority.

By **company size**

- Larger companies (1,000+ employees) show stronger commitment: **46%** “very important”, **38%** “important”.
- Mid-sized (200–999) are more cautious: only **14%** “very important”, but **69%** “important”.
- Small companies (<200) lean “important” (**38%**) or “neutral” (**50%**) — limited resourcing may explain their middle-ground stance.

Key insights

- End-of-life sustainability is widely valued, especially in the US, sourcing teams, and large firms.
- China and operational teams recognize the importance but rank it lower — likely due to cost or process constraints.
- No segment dismisses EoL practices entirely, confirming that e-waste, recyclability, and circularity are on everyone’s radar.

Total overview

- Top Areas of Exploration (Total)
  1. *Low-carbon footprint components (**74%**)*
  2. *Recycled PCBs (**71%**)*
  3. *Lead-free / halogen-free solder (**69%**)*
  4. *Renewable energy-powered manufacturing (**66%**)*
  5. *Water/waste reduction (**31%**)*
- These results show strong industry interest in materials with direct emissions reduction potential and manufacturing inputs with regulatory or consumer pressure.

By **job position**

- Sourcing/Buying roles lead interest in:
  *Low-carbon components (**84%**)*
  *Water/waste reduction (**40%**)*
- Operational roles are more interested in:
  *Renewable energy processes (**70%**)*
  *Recycled PCBs and safer solder (**74%** and **71%**)*
- This suggests strategic sourcing teams are tracking long-term investments, while operations focus on immediate process impacts.

By **country**

- USA & Germany (**81%**) lead in exploring low-carbon components.
- Recycled PCBs are popular across all regions (**~74%**), with China slightly lower (**64%**).
- China (**76%**) is more focused on renewable energy-powered manufacturing, whereas USA and Germany trail slightly.
- Water/waste tech is least popular overall, especially in Germany (**26%**) and China (**27%**).

By **company size**

- Large companies (1,000+ employees) show broad interest:
  ***79%** in low-carbon, **77%** in recycled PCBs, **69%** in renewable energy, and **42%** in water/waste.*
- Mid-sized companies (200–999) are slightly more conservative.
- Smaller companies (<200) focus mostly on low-carbon components (**88%**), less on circularity or energy.

Key insights

- Low-carbon footprint materials are the most attractive area across nearly every segment — especially in the USA, sourcing, and large enterprises.
- Recycled PCBs and safer solder alternatives are also critical areas of innovation.
- Water/waste reduction technologies lag behind in interest — likely due to perceived complexity or lower ROI.
- Differences between strategic (sourcing) and execution (operations) roles reveal different drivers: long-term viability vs. short-term feasibility.

Question 16

What sustainable materials or technologies is your company most interested in exploring for its electronic products or components?

(Multiple answers possible; filtered to companies that design/develop electronic products/components)

74%
Low-carbon footprint components

71%
Recycled PCBs

Question 17

In your view, how important is sustainability in electronics manufacturing today, across the industry?

(All respondents – perception-based question, not specific to company practices)

58% Top priority

37% One of several key factors

Total overview

- **58%** believe sustainability is a top priority across the industry.
- **37%** view it as one of several key factors, while only 5% consider it secondary.
- No one views it as a "minor factor with limited impact" — showing universal acknowledgment of its importance.

By **country**

- USA leads with **52%** saying "very important", followed by Germany (**26%**).
- China lags significantly: only **12%** "very important", though **67%** rate it "important" — signaling awareness but lower prioritization.
- Germany shows a more balanced view between "important" (**44%**) and "very important" (**26%**).

By **job position**

- Sourcing/Buying roles (**68%**) are the most likely to say sustainability is a top priority, reflecting their role in supplier selection and compliance.
- Operational roles (**52%**) lean toward a balanced view, with **41%** saying it's one of several key factors.
- Slight gap suggests sourcing is more forward-looking, while operations juggle more day-to-day constraints.

By **company size**

- Large companies (1,000+ employees) are the strongest advocates:
  77% *view sustainability as a top industry priority*
- Mid-sized companies (200–999) are more tempered: **42%** top priority, **47%** say it's one of several factors.
- Smaller companies (<200 employees) overwhelmingly recognize its importance (**88%** say it's one of several key factors), but none say it's the top priority — likely reflecting resource limitations.

Key insights

- There is near-universal recognition that sustainability matters in electronics manufacturing.
- The majority see it as a top priority, especially in Germany, large companies, and regulated sectors like medical or energy.
- China, operations teams, and mid-sized firms are more likely to view it as one of multiple business priorities.
- Strategic sourcing sees the clearest value in sustainability as a business driver.

Total overview

- **87%** of respondents believe sustainability will be a top priority across the industry in 5 years.
- The remaining **13%** say it will remain one of several key factors, alongside cost and performance.
- **0%** believe it will be secondary or minor — showing universal confidence in its growing role.

By **job position**

- Sourcing/Buying (**88%**) and Operational (**87%**) roles are closely aligned on sustainability's growing strategic weight.
- No disagreement between functions on this — clear industry-wide consensus.

By **country**

- China (**91%**), USA (**89%**), and Germany (**80%**) all project sustainability as the top future priority.
- Germany has slightly more respondents expecting it to be balanced with cost/performance (**20%**), possibly due to ongoing cost pressures in manufacturing.
- Across regions, the trajectory is clear: sustainability is rising fast.

By **company size**

- Large companies (1,000+ employees): **95%** predict sustainability will be a top priority.
- Mid-sized companies (200–999): **79%** agree, but **21%** still see other factors (like cost) sharing the spotlight.
- Small companies (<200 employees) are more cautious: only **63%** say "top priority", and **33%** see it as "one of several key factors."

Key insights

- The future of electronics manufacturing will be sustainability-first: **87%** expect it to be the dominant priority.
- This represents a +29-point jump from current perception (**58%** say it's already top priority today).
- No group sees sustainability declining or stagnating, not even small businesses or cost-sensitive functions.
- A rare instance of strategic alignment across countries, job roles, and company sizes.

Question 18

How important do you think sustainability in electronics manufacturing will be in 5 years, across the industry?

(All respondents – forward-looking perception)

87%
Top priority

13%
One of several key factors

Question 19

In your view, how important is sustainability in electronics manufacturing today, across the industry?

(All respondents – perception-based question, not specific to company practices)

Total overview

- Global Rankings (Total Perception)
  - *1. Europe – **81%** of respondents rank it as the leading region.*
  - *2. China – **69%** see it as a leader, though this is regionally skewed.*
  - *3. Japan/South Korea – **62%**, particularly strong support from China and mid-sized companies.*
  - *4. North America – **56%**, but this is heavily influenced by U.S. respondents (**97%**).*
  - *5. India (Other) – Mentioned by **4%** overall, mainly by USA, China, and sourcing roles.*

By **country**

- Germany (**100%**) and USA (**69%**) strongly back Europe as the sustainability leader.
- Chinese respondents (**97%**) rank China #1 — showing national confidence, though external validation (Germany/USA) is lower (**42–69%**).
- North America's rating is inflated by U.S. bias (**97%**), but drops to **17%** in China and **51%** in Germany.

By **job position**

- Sourcing/Buying roles favor:
  - *Europe (**95%**)*
  - *North America (**73%**)*
  - *Lower support for China (**53%**)*
- Operational roles have more global distribution:
  - *China (**77%**)*
  - *Japan/South Korea (**71%**)*
  - *Europe (**72%**)*

By **company size**

- Small companies (<200):
  - *Strong preference for Europe (**88%**)*
  - *Modest ratings for China (**50%**) and North America (**50%**)*
- Mid-sized (200–999):
  - *Broad support across regions (Europe **76%**, China **76%**, Japan/South Korea **71%**)*
- Large companies (1,000+ employees):
  - *Europe (**83%**)*
  - *Lower enthusiasm for China (**67%**) and Japan/South Korea (**57%**)*

Key insights

- Europe is overwhelmingly viewed as the global sustainability leader in electronics, especially by sourcing teams and large firms.
- China is respected but viewed more favorably by domestic and operational roles than sourcing or Western peers.
- North America's position is largely driven by U.S. respondents, with limited international validation.
- Japan/South Korea enjoy a solid reputation across company sizes and geographies.
- India (Other) is emerging in perception, but still marginal in global awareness (**~4%**).

Total overview

- Top Drivers Across All Respondents
  *1. cost-competitive sustainable options – **65%***
  *2. Better traceability and supplier transparency – **45%***
  *3. Increased customer demand – **45%***
  *4. Clearer industry standards and regulations – **44%***
- There is no single dominant barrier, but cost and transparency top the list.

By **job position**

- Sourcing/Buying teams highlight cost competitiveness (**70%**) and customer demand (**50%**), consistent with their market-facing and margin-conscious roles.
- Operational roles also focus on cost (**64%**) and regulation (**49%**), showing concern for compliance readiness.

By **country**

- China prioritizes cost competitiveness (**71%**) and regulatory clarity (**51%**) – reflecting a price-sensitive yet policy-driven environment.
- Germany is more focused on transparency (**60%**) and customer demand (**51%**), in line with its stricter corporate responsibility culture.
- USA ranks cost (**69%**) and regulatory guidance (**47%**) slightly higher than supplier transparency or demand.

By **company size**

- Small companies (<200 employees):
  *Need traceability (**50%**) and cost relief (**50%**), reflecting limited internal bandwidth or ESG infrastructure.*
- Mid-sized (200–999 employees):
  *Push for clearer regulations (**53%**), but still want cost competitiveness (**68%**).*
- Large enterprises (1,000+ employees):
  *More confident about customer-led sustainability (**47%**), yet still demand better cost alignment (**65%**).*

Key insights

- Cost remains the greatest friction point in the adoption of sustainable electronics.
- Transparency and traceability gaps are seen as equally critical in more regulated or complex industries.
- Clearer standards and customer demand both play secondary — but still substantial — roles.
- There's no belief that "nothing would help" — meaning barriers are actionable, not structural or philosophical.

Question 20

What would help your company adopt more sustainable electronic products or components in the future?

(Multiple answers possible – max 2 responses per respondent)

65%
More cost-competitive sustainable options

45%
Better traceability and supplier transparency

Survey Methodology

This survey was conducted by Statista+ Research for ICAPE Group to assess current sustainability trends and practices in sourcing and manufacturing electronic components.

Survey Method

Computer-assisted telephone interviews (CATI)

Target Group

Professionals responsible for manufacturing or sourcing electronic products/components

Sample Size

106 respondents
USA: 36 | **Germany**: 35 | **China**: 35

Survey Period

April 11–25, 2025

Respondents by Job Function

Job Function	% of Respondents
Procurement / Sourcing / Purchasing	34%
Product Design / Engineering	33%
Research & Development (R&D)	17%
Manufacturing / Operations	14%
Logistics / Supply Chain	2%

Company Size (Employees)

Company Size (Employees)	% of Respondents
Less than 50	0%
50 to 199	8%
200 to 499	17%
500 to 999	18%
1,000 to 4,999	39%
5,000 or more	18%
Don't know	0%

Respondents by Industry

Industry	% of Respondents
Electrical Equipment Manufacturing	54%
Industrial Equipment / Machinery	19%
Consumer Electronics	15%
Medical Devices	7%
Energy / Utilities	3%
Automotive	2%

ICAPE GROUP

Group Headquarters

Immeuble Volta
33 avenue du Général Leclerc
92260 Fontenay-aux-Roses, France
+ 33 1 58 18 39 10

Asia Headquarters

18F/19F/20F, Parkway Center,
No. 121, Dong Men Zhong Lu,
Chang An, Dongguan, Guangdong
P.R China 523852
+86 769 8999 7000

Americas Headquarters

8102 Zionsville Rd,
Indianapolis, IN 46268 USA
+ 33 1 58 18 39 10

www.icape-group.com