Report

The Cost of Corrosion

A global survey of 1,000 manufacturers across architecture, agricultural and construction equipment (ACE), industrial, automotive, electric vehicles (EV), and functional sectors.

Join the powder revolution

AkzoNobel

Introduction

A cost industry can't afford to ignore

Corrosion can be seen in many ways as a 'hidden tax' on global industry, damaging individual organizations and global economies. It shortens product lifespans, undermines customer trust, and drives significant repair and replacement costs.

According to the Association of Materials Protection and Performance (AMPP), the global cost of corrosion exceeds US$3 trillion annually. That's the bad news; the better news is that up to 35% of that — worth as much as US$875 billion — is preventable with the right protective measures.

This report brings new insights into how manufacturers across sectors and regions are addressing the challenge. It explores:

- **the true scale and nature of the costs industry faces**
- **how manufacturers choose between different protection strategies**
- **where unexpected differences appear across sectors and regions**
- **what these choices mean for competitiveness, sustainability, and protecting an organization's current and future reputation.**

Based on a global survey of 1,000 manufacturers across six key sectors — architecture, automotive, electric vehicles (EV), industrial, functional equipment, and agricultural and construction equipment (ACE) — in Europe, North America, and South Asia & Australasia*, the study highlights not only the scale of the challenge, but also the opportunities that better protection can deliver.

The survey asked manufacturers how they view the cost and impact of corrosion, what drives their current choices, and what they expect to matter most in the future. It also goes further by interpreting the data to show what these findings mean for industry today — and tomorrow. It presents results at the global level, breaking them down by sector, and providing regional profiles, so the data can be understood from multiple perspectives.

*Survey conducted in English. China not included due to language restrictions.

Global insights

Findings

Corrosion is more than simply a technical issue: it represents a financial, environmental, and reputational risk.

In the oil and gas sector, for example, it causes nearly a third of all equipment failures. Seen in the context of the Gulf of Mexico, that represents an annual cost of around US$2 billion alone. In the water infrastructure business, the challenges are similar. In the US and Canada, corrosion contributes to more than 260,000 pipe failures every year, adding US$2.6 billion in repair costs to an already hefty bill. Businesses in the automotive sector are under similar pressures, evidenced by the scale of product recalls; between 2014 and 2016, three major US carmakers recalled 1.6 million vehicles due to corrosion-related failures.

Manufacturers report the same challenges. Almost a third (32%) say their biggest expense comes from lost customers and product returns, while 28% emphasize the environmental cost of waste and landfill. Agriculture shows the risks clearly: corrosion costs the US sector US$1.1 billion annually, and failures can disrupt harvests, livestock, and waterways.

Globally, the picture is equally bleak. Two fifths (40%) of all new steel production is simply to replace product that has already corroded and comprises 3.2% of global CO_2 emissions, which could be prevented. Corrosion is therefore not only an economic burden but also a climate problem with consequences far beyond balance sheets.

Reputations are also at stake. Product failures quickly erode consumer trust, and in high-profile sectors, like automotive or architecture, where consumer visibility means one incident can dominate headlines, and the costs can be counted not only in financial terms but as a risk to their long-term competitiveness.

Why this matters

These findings show that corrosion is a universal challenge that transcends multiple sectors. It damages trust, shortens product lifespans, and consumes resources that could otherwise fuel growth and innovation. For manufacturers, the costs are not only measured in repairs but also in customer loyalty and brand credibility. For society, the environmental impact of wasted steel and higher emissions adds pressure to industries already under scrutiny for sustainability.

To support sustainability, safeguard reputations, and achieve AMPP's estimated 35% cost savings, manufacturers need to use the right level of corrosion protection. It can be a complex decision, but industry standards provide helpful guidance. ISO 12944, created by international specialists, establishes benchmarks for steel protection. Initially designed for liquid coatings, it now also helps classify powder coatings. These classifications make it easier for architects, engineers, and manufacturers to select coatings that best fit their needs and environments.

Context and outlook

The changing climate and further tightened regulations will impact how corrosion is tackled in the future. The baseline for protection will also rise.

Products once adequately protected at C3 levels may need C4 or higher to achieve their intended lifespans. Companies that treat corrosion as a strategic issue — not just a maintenance task — will be better positioned to control costs, meet sustainability expectations, and build trust. Those that do not will likely see their costs escalate and their reputations challenged.

Environment classifications	Risk	Coating maintenance cycle	Exterior	Interior
C1	Very low			Heated buildings with clean atmospheres such as schools or offices
C2	Low	Up to 7 years	Atmospheres with low levels of pollution	Unheated buildings where condensation may occur such as depots or sports halls
C3	Medium	7-15 years	Urban and industrial atmospheres, moderate sulfur dioxide pollution, or coastal areas with low salinity	Production rooms with high humidity and some air pollution such as food processing plants, laundries, breweries, or dairies
C4	High	15-25 years	Industrial areas and coastal areas with moderate salinity	Chemical plants, swimming pools, coastal ships and boat yards
C5	Very high	25+ years	Industrial areas with high humidity and aggressive atmospheres	Buildings in areas with almost permanent condensation and high pollution levels
CX	Extreme		Offshore areas with high salinity and industrial areas with extreme humidity, an aggressive atmosphere and subtropical or tropical atmospheres	Industrial areas with extreme humidity and aggressive atmospheres

Sector insights

Architecture

Findings

Architecture faces unique exposure because corrosion failures are highly visible in the built environment. Almost half (47%) of architectural manufacturers use C3 levels of protection and 25% opt for C4 levels, selecting coatings that provide the appropriate level of protection while balancing cost with durability.

Electroplating is common, with 48% of firms using it for large-scale projects and mass production. Hot dip galvanizing (HDG) is less widespread but still significant: some 31% of construction companies use HDG to protect steel parts exposed to soil, wet cement, and potentially corrosive liquids and chemicals.

Despite these options, gaps remain, and nearly one in ten (9%) of all facade, window and door manufacturers report difficulty finding suitable anti-corrosion solutions for specific needs.

Regulatory pressure adds further complexity. In Europe, the Carbon Border Adjustment Mechanism (CBAM) and the Ecodesign for Sustainable Products Regulation (ESPR) are tightening standards on carbon emissions, durability, and recyclability. These requirements raise both costs and expectations for compliance.

Conditions to which a building or surface may be exposed also vary significantly. Facades and window frames in coastal cities, for example, will need to resist salt spray and humidity, while large-scale developments in heavily polluted urban areas face continuous corrosion pressure from poor air quality and increased condensation.

Contractors, architects, and developers rely on manufacturers to deliver systems that can meet these regulatory and environmental demands without compromising timelines or budgets.

Why this matters

For manufacturers supplying the architectural sector, corrosion protection is not only about avoiding failures and complying with relevant regulation. It's also about giving designers the freedom to express their imagination in ways that they know will endure.

Building products must perform for 20–30 years or more in harsh conditions, while still offering the aesthetic qualities an architect demands. Durability, product integrity and aesthetic quality are essential to building customer trust and securing new business in a highly competitive market.

9%

Nearly one in ten (9%) of all facade, window and door manufacturers report difficulty finding suitable anti-corrosion solutions for specific needs.

Context and outlook

The sector is currently at a crossroads. On the one side are entrenched processes such as electroplating and HDG, chosen for familiarity and function. On the other side are regulatory demands and customer expectations that require more durable and sustainable approaches in the future to address an ever-evolving need.

In Europe, regulation and customer specifications are driving faster adoption of advanced coating systems and particularly the use of powder coatings. The use of powder coatings, especially in architecture, is already well established in Europe thanks to their high durability, excellent corrosion protection, and low VOC credentials. The pressure comes not from lagging behind but from staying competitive in a market where regulations like CBAM and ESPR are tightening, and where architects increasingly expect solutions that go far beyond 'standard' durability and meet super-durability and enhanced corrosion resistance benchmarks.

Longer-lasting products also support the lifecycle goals of sustainability frameworks such as BREEAM and LEED*, where durability reduces material use, waste, and embodied carbon. Corrosion protection in architecture is therefore not only about longevity but also about safeguarding compliance and satisfying customer expectations for decades to come.

*BREEAM is an internationally recognized third-party assessment and certification of the sustainability performance of built assets over their lifespan. LEED is a widely used green building rating and certification system. Developed by the US Green Building Council it provides a framework for healthy, efficient, cost-saving green buildings which is used by project owners worldwide.

Automotive

Findings

Automotive manufacturers generally are very aware of the damage that corrosion can do to their businesses, because failures tend to be high profile. For instance, between 2014 and 2016, three major US carmakers recalled more than 1.6 million vehicles due to corrosion-induced faulty parts.

The risks, however, go a long way to explaining why 55% of automotive manufacturers in the survey choose coatings primarily to extend the lifespan of their products and prevent recalls, with the figure rising to 58% in the commercial vehicle segment.

In terms of how the automotive sector chooses to protect its products, liquid coatings remain dominant, used by 49% of automotive manufacturers, especially through e-coat processes that cover complex geometries such as cavities and seams. Powder coatings are closing the gap: nearly half (46%) of automotive manufacturers now use them, most commonly for wheels, trim, and underbody parts.

Survey results also reveal a shift toward higher levels of protection being used as 'standard'. Automotive coatings are typically validated through OEM-specific corrosion test procedures that are largely based on international or national standards such as ISO, BS, DIN, or ASTM, though some OEMs also include additional proprietary tests. The survey responses can be interpreted as indicating equivalent performance levels. Manufacturers tend to specify protection levels comparable to C3 or C4, with 29% reporting C4-equivalent performance.

Over the past two decades, this focus has already yielded results: according to AMPP, corrosion-related costs in the automotive industry have been cut by 52%, while average vehicle lifespans have increased by 49%.

The need to demonstrate and deliver even greater sustainability is also accelerating this trend. Today, almost a quarter (24%) of automotive firms select coatings based on their environmental impact. This will rise; in the future, nearly 46% expect sustainability to be the main driver in the coatings they choose.

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Why this matters

For automotive manufacturers, corrosion protection is not only about reducing warranty claims — it is about maintaining contracts with OEMs and safeguarding the trust in their brands. Recalls are expensive, visible, and damaging for both the supplier and the carmaker itself. OEMs are therefore demanding coatings that can withstand increasingly harsh conditions, from the 'traditional' challenges of de-icing salts and stone chips, to the additional mechanical demands and temperature rise associated with electrified drivetrains. Coatings that deliver durability while also supporting sustainability targets give manufacturers a competitive edge.

Context and outlook

The direction of travel is clear: performance and sustainability requirements will continue to rise. The supply chain will need to follow suit to remain competitive, particularly given the OEMs' own testing standards will tighten further as sustainability becomes a decisive factor in procurement.

Future innovation is also becoming an increasingly important part of the automotive sustainability strategy. While liquid coatings will continue to be used, the wider adoption of powder coating technologies reflects the search for solutions that reduce waste, shorten curing times, accelerate production times and improve overall environmental performance.

In Europe, stricter rules on recyclability and embodied carbon are already driving change, while in North America and South Asia and Australasia, efficiency and durability remain the main levers. For manufacturers, corrosion protection is therefore more than a cost-control measure: it is an enabler of competitiveness in a market where durability, sustainability, and customer trust are inextricably linked.

Electric Vehicles (EV)

Findings

Electric vehicles represent one of the fastest-evolving sectors, and their rise is reshaping the requirements for corrosion protection.

EV manufacturers are adopting higher standards of protection than their internal combustion engine (ICE) counterparts. Powder coatings are widely used in the EV sector, with 52% of EV manufacturing respondents applying them — compared to 46% across the broader automotive industry. They are particularly valued for protecting battery housings, cooling systems, and hairpin stators, where temperature rise and electrical integrity pose additional challenges beyond conventional corrosion risks.

Protection levels are also higher. A growing share of manufacturers is moving toward more advanced protection for critical parts such as battery components. This reflects the higher operational and safety risks associated with EV components, where failures could cause severe performance or reputational damage.

Powder coatings are increasingly valued not just for corrosion resistance but also for electrical insulation and thermal management, making them well-suited to EV applications where multiple performance demands converge.

Sustainability is a growing influence: EV-related manufacturers show faster movement toward prioritizing environmental performance. For battery system and electric motor manufacturers, sustainability's importance has more than doubled from 18% to 37%, reflecting the EV sector's central role in advancing greener transportation.

Why this matters

EVs are setting new benchmarks for corrosion protection. The segment's demand for coatings that deliver both high durability and sustainability is reshaping expectations across the wider industry. Corrosion failures in EV components carry significant safety, operational, and reputational risks, while strong performance can extend component life, reduce warranty claims, and reinforce brand trust.

At the same time, OEMs are tightening testing standards and procedures along with sustainability requirements, which cascade down through supply chains. Suppliers that can deliver coatings offering protection designed for harsh conditions, combined with energy efficiency and recyclability, will gain a competitive edge in an increasingly scrutinized market.

52%

Powder coatings are widely used in the EV sector, with 52% of EV manufacturing respondents applying them — compared to 46% across the broader automotive industry.

Context and outlook

As EV adoption accelerates, the baseline for corrosion protection is rising. Standards once sufficient for ICE vehicles are no longer adequate. The EV sector's push for higher level of protection is expected to influence broader industry norms, especially as OEMs integrate sustainability targets into procurement.

Future innovation will be critical. Powder coatings are expected to gain further ground due to their ability to reduce waste, shorten curing times, and improve productivity on the line — helping manufacturers balance performance, efficiency, and environmental impact. Those who adapt early will be best positioned to succeed as EVs redefine durability and sustainability standards across the industry.

Industrial

Findings

In the industrial sector, corrosion protection is closely linked to productivity and efficiency. Half (50%) of all survey respondents in this segment use powder coatings. Manufacturers cite durability as the main reason for their coating choice, but nearly half (49%) also highlight manufacturing efficiency as a key driver.

Barriers to change remain significant. A quarter (25%) of respondents cite the cost of adapting existing production lines as a challenge, and nearly four in ten (39%) worry about compatibility with existing processes. Older coating lines are even more expensive to adapt or replace and where significant money has already been invested, slowing the transition to more efficient technologies.

Recent innovations offer a way forward. Single-coat powder coatings can now deliver up to C4 protection, while thinner films – reduced from 80 to 60 microns – cut powder consumption while maintaining performance and finish quality. These advances allow manufacturers to reduce production costs without sacrificing performance, especially in high-volume applications such as the manufacture of heating, ventilation and air-conditioning (HVAC) units, domestic appliances, office furniture, and warehouse systems.

Why this matters

For manufacturers in the industrial sector, corrosion protection is not only about extending product life but also about improving operational performance and production economics. Although a coating needs to perform its fundamental task (i.e. protecting a surface against corrosion), it is of even greater benefit if it can do so while reducing the curing time or the energy consumed in its application. This is especially relevant in domestic appliances and HVAC, where downtime, replacement costs, and energy use have a direct impact on profitability. That said, the cost of making the switch, especially where significant investment has already been made in an existing line, will make organizations reluctant to change, even when the efficiency gains are clear.

49%

Manufacturers cite durability as the main reason for their coating choice, but nearly half (49%) also highlight manufacturing efficiency as a key driver.

Context and outlook

Industrial manufacturers operate under constant pressure to reduce costs, increase production throughput, and meet growing sustainability expectations from customers and regulators. Innovations in powder coatings address these needs by delivering stronger protection with lower energy input, faster curing, and reduced use of materials.

The main barrier is not awareness but adoption. Companies with long-established liquid or plating lines face high capital costs to modernize, slowing the transition towards solutions that are inherently more efficient. Rising energy prices and increased carbon reporting requirements, however, will strengthen the case for change. In this sector, the future of corrosion protection will be defined not only by the durability of the coating itself but also by its ability to improve efficiency, lower energy use, and support sustainability reporting — making process innovation as critical as product performance.

Functional

Findings

Functional equipment — including busbars, rotors, pipes, rebars, valves and fittings — operates under some of the most challenging of all conditions. Failures here can disrupt water supplies, energy systems, or transport networks. More than three-quarters (79%) of manufacturers in this sector say their anti-corrosion needs are too varied to be solved by a single technology.

When corrosion does occur, the consequences are severe. Because many pipes and valves are buried underground, they must withstand constant exposure to moisture, temperature fluctuations, and chemical contaminants that make conditions especially harsh. A failed pipe or valve can mean costly repairs and downtime, but also risks to water quality or chemical safety. These risks make corrosion protection not just a technical specification but a critical business and reputational issue.

Powder coatings are increasingly valued not only for corrosion resistance but also for electrical insulation and thermal management, helping protect electrical distribution center and energy storage against temperature fluctuations or electrical breakdown. This dual role reflects the sectors' demand for multifunctional solutions, and where a 'one size fits all' approach is simply not practical.

Protection levels are rising in line with these demands, driven not only by the need for durability but also by increasing sustainability expectations. Among functional equipment manufacturers, sustainability has become a decisive factor: the share of manufacturers citing it as their top driver for coating choices has nearly doubled, from 22% to 42%.

Why this matters

For manufacturers of functional equipment, corrosion protection is inseparable from customer expectations for safety, reliability, and compliance. Utilities, municipalities, and OEMs require solutions that keep essential systems running without interruption. Failures can lead to lost contracts (for commercial organizations), liability claims, and damaged trust. At the same time, customers increasingly expect coatings to support sustainability goals by extending equipment life, reducing waste, and improving energy efficiency.

79%

More than three-quarters (79%) of manufacturers in this sector say their anti-corrosion needs are too varied to be solved by a single technology.

Context and outlook

The growth of urban infrastructure and electrification will further intensify the demands on this sector. Functional equipment must deliver longer lifespans in increasingly challenging conditions — from rising temperatures and heavier rainfall to higher demands from expanding populations. At the same time, stricter regulations on water safety, carbon emissions, and energy efficiency are raising the bar for performance.

Powder coatings are well-positioned to support the functional sector in its drive for reliable corrosion performance and enhanced sustainability, but no single technology will cover the full range of requirements. Meeting future demands will require building on today's portfolio of multifunctional coatings — solutions that already combine corrosion protection with added properties such as electrical insulation, thermal management, or resistance to extreme environments — and continuing to expand these capabilities to address emerging challenges. While no single standard currently covers all these requirements, innovation and proven performance data will be key in guiding specifications and differentiating one manufacturer from the next.

For functional equipment producers, corrosion protection has never been a tick in the box nor will it ever be, but the demands on performance are now greater than ever for building in long-term resilience and consumer trust.

Agricultural and Construction Equipment (ACE)

Findings

Agricultural and construction equipment (ACE) manufacturers face corrosion risks from corrosive soil and chemicals. Tractors, combine harvesters, and bulldozers must withstand UV exposure, humidity, hot and cold weather and everyday wear and tear. They are also subject to abrasion, mechanical stresses, and damage caused by concrete and brake fluids, and are expected to maintain their finish over many years.

Most ACE manufacturers rely on C3 protection (40% Agriculture, 43% Construction) and C4 protection (27% and 24% respectively), balancing durability with cost.

Some 42% of agriculture and construction firms use electroplating, and many (31% in construction and 24% in agriculture) use HDG to protect steel parts with sharp edges exposed to soil, wet cement and potentially corrosive chemicals.

Despite the use of electroplating and HDG, their application is far from universal, and 10% of construction equipment and 13% of agricultural equipment manufacturers report difficulty finding suitable anti-corrosion solutions for their needs.

Powder coatings are widely used (46% in construction and 49% in agriculture), combining durability with a broad palette of colors. This dual capability aligns with customer requirements, offering corrosion resistance and abrasion protection, while also providing the design flexibility needed to meet equipment brands' specifications. The sharp, hard-working edges of ACE are notoriously difficult to protect, but there are powder coatings that have been specifically designed to increase film thickness on the edges without compromising the powder flow. Specialist powder formulations enable them to adhere to the sharp edges of the substrates in a uniform layer. This process delivers consistent protection right to edge, without drips and wastage.

Across the survey, 76% of manufacturers said powder coatings extend product lifespans, while 74% believe it reduces their environmental impact. Both are especially relevant where the cost of replacement is expensive and wasteful, and sustainability credentials are increasingly important.

How manufacturers choose their coating also reflects a shifting trend. Durability and corrosion protection remain key (54% overall), but sustainability is gaining ground. More than a third (37%) of manufacturers overall (rising to 46% within agricultural equipment manufacturing) expect environmental performance to be their leading criterion in the future, up from 24% today. In a sector where products are specified for long service in harsh outdoor environments such as fields, forests and building sites, this signals growing pressure to provide coatings that combine durability with proven and demonstrable sustainability credentials.

Material handling equipment faces similar challenges. Forklifts, pallet trucks, and warehouse racking are constantly exposed to abrasion, vibration, and impacts, as well as corrosive conditions such as salty marine air, damp warehouses, or chemical spills in loading bays. These conditions make corrosion protection critical for safety and reliability. More than half (56%) of manufacturers in this segment rely on powder coatings for their combination of toughness, edge coverage, and corrosion protection, which also withstand everyday knocks and scrapes. Powder coatings also support fast line speeds and lower energy consumption, helping manufacturers balance durability with production efficiency.

Why this matters

For ACE and materials handling manufacturers, corrosion protection is about ensuring durability and reducing costly maintenance and replacement in highly demanding environments — whether that's tractors in muddy fields or forklifts in damp warehouses. Reliability directly influences customers' productivity, safety, and environmental performance, while sustainability credentials increasingly shape purchasing decisions. Coatings that withstand not only corrosion but also abrasion, impact, and mechanical stress help keep critical equipment operational for longer and reduce lifecycle costs.

43%

Most ACE manufacturers rely on C3 protection (40% agriculture, 43% construction) and C4 protection (27% and 24% respectively), balancing durability with cost.

Context and outlook

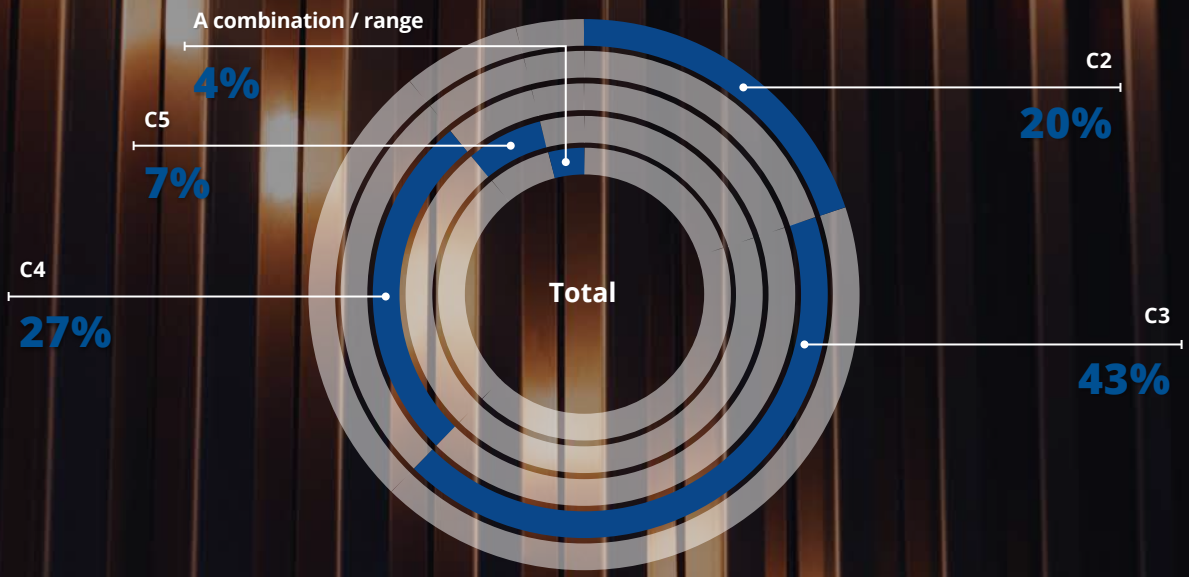
ACE and materials handling products are expected to perform over the long term, often under continuous mechanical stress and in environments that accelerate corrosion — from corrosive soil, wet cement, and brake fluids to salty marine air or chemically aggressive warehouse conditions. Buyers — from farmers to logistics companies — are under pressure to control lifecycle costs, avoid downtime, and demonstrate sustainability.

For these manufacturers, surface protection and anti-corrosion performance are non-negotiable. Coatings must combine durability, superior edge coverage and finish quality with resistance to abrasion and impact, while also supporting faster production speeds, lower energy use and a reduced environmental impact.

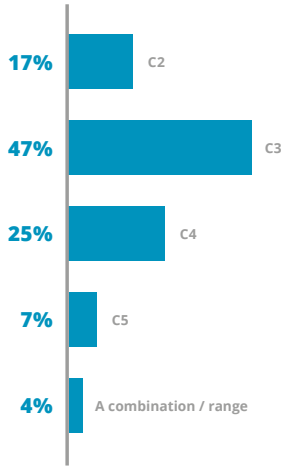
As sustainability standards tighten, the ability to deliver these qualities in efficient, single-coat systems will become a competitive differentiator. In this sector, corrosion protection is not just about preventing wear and tear; it is a first line of defense underpinning a company's reputation for quality, performance, safety, and sustainability.

Corrosion protection levels

Manufacturers' preferences



Architectural



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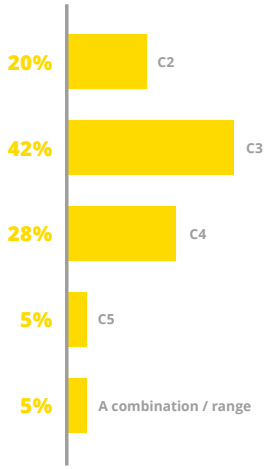
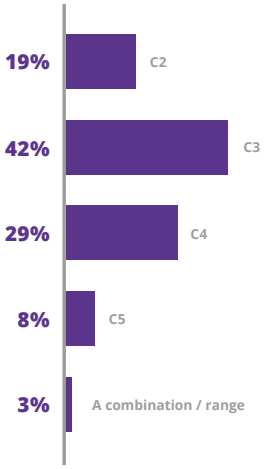
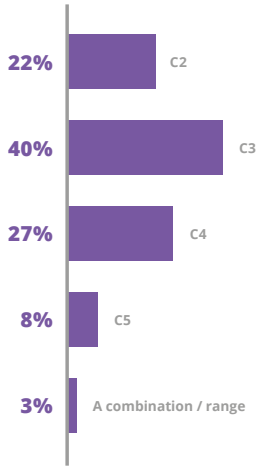


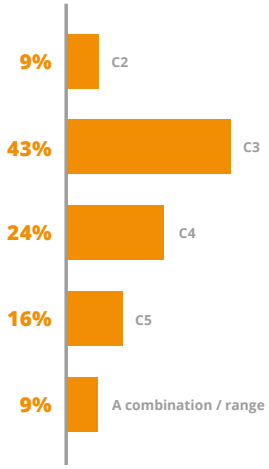
Automotive



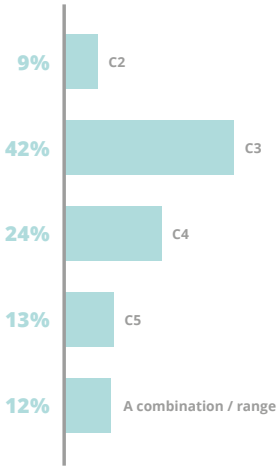
Agricultural equipment



Construction equipment



Material handling equipment



Regional insights

Sector preferences for corrosion protection levels

Europe

Findings

Europe stands out as a region where regulation and compliance strongly shape its coatings choices.

Some 43% of manufacturers in Europe say innovation is their top priority (compared to 35% in North America and 41% in South Asia & Australasia). Sourcing tends to be more challenging: only 33% of European firms find coatings easy to obtain (vs. 43% in North America and 38% in South Asia & Australasia).

The levels of protection demanded by European manufacturers also set them apart from their global competitors. Nearly a third (31%) of manufacturers specify C4 protection, higher than in North America (26%) and South Asia & Australasia (23%). By contrast, C5 remains a specialist category: only 6% of firms use it — consistent with its role in coastal or chemical environments rather than mainstream applications.

Sector dynamics add further nuance to the European picture.

- **In architecture, the region is advanced in specifying durability-led systems, with powder coatings widely established for exterior building products;**
- **In automotive, performance is validated through OEM-specific corrosion test regimes that are generally based on international or national standards (e.g. ISO, BS, DIN and ASTM), and European carmakers are tightening durability and sustainability expectations in ways that influence supply chains globally;**
- **The functional sector faces some of the toughest conditions, with coatings expected to provide not only long-term resistance to corrosion but also added functionality such as insulation or thermal management;**
- **Meanwhile, the industrial sector reflects global trends: manufacturers aim to balance durability with manufacturing efficiency, but barriers to switching technologies remain significant. A quarter (25%) of respondents cite the cost of adapting lines as a significant challenge to switching to powder coatings, and more than a third (39%) worry about process compatibility, with cost concerns particularly acute in construction (46%), materials handling (44%), and functional equipment (41%).**

Why this matters

For European manufacturers, corrosion protection is not only about extending product life; it is also central to regulatory compliance, customer confidence, and competitiveness.

Buyers expect long service intervals; regulators set rising sustainability and durability requirements; and export markets often demand certified evidence of performance. The higher reliance on C4 signals recognition of both environmental exposure (urban pollution, coastal climates, etc.) and compliance expectations. For many firms, and most notably the small- and medium-sized enterprises (SMEs), the challenge is meeting these requirements without sacrificing cost control or production efficiency and volumes.

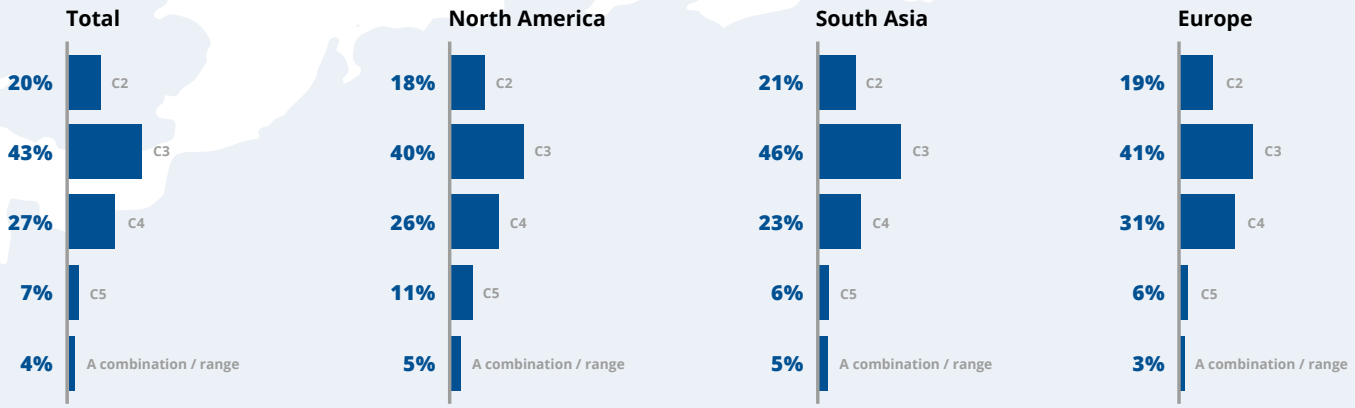
Context and outlook

EU rules are the primary driver of change in Europe. CBAM will apply a carbon price to imports of high-emission materials such as steel and aluminum, affecting both non-EU exporters into the EU and EU manufacturers that rely on imported inputs. ESPR, meanwhile, requires greater durability, 'repairability', and recyclability for any product sold in the EU, regardless of where it is produced. Together, these frameworks raise expectations for coating performance and product lifespans, since durability directly reduces replacement cycles and enhances environmental performance.

The impact varies by sector:

- **In architecture, regulations reinforce the shift toward high-durability powder coating systems for exterior applications;**
- **In automotive, European OEMs are tightening in-house corrosion and sustainability standards that permeate through supply chains;**
- **In functional equipment, compliance pressures favor coatings that combine protection with added properties such as insulation or thermal stability;**
- **In industrial markets adoption of single-coat powders and thinner films that deliver up to C4 protection helps align efficiency goals with higher durability standards.**

Looking ahead, EU regulation will continue to set benchmarks that shape both domestic practice and global supply chains. Firms that adapt early by offering solutions that deliver compliance, durability, and efficiency will turn regulatory pressure into a competitive advantage, while those that are slower to adopt new solutions will face rising costs and potentially limit their ability to compete on a global stage.



North America

Findings

North America combines advanced protection standards with a strong focus on production efficiency. The region leads globally in applying higher levels of corrosion protection: 11% of manufacturers already specify C5 performance, nearly double the rate in Europe and South Asia & Australasia (both at 6%). A further 26% use C4, reflecting recognition that robust systems are needed to withstand environments ranging from coastal exposure to highly-polluting industrial conditions.

Access to a wide choice of coating solutions also sets the region apart. Some 43% of North American firms report that coatings are easy to source — the highest figure across all three regions. This has supported the broad uptake of both liquid and powder coating technologies, with powder coatings gaining momentum in applications where efficiency and durability overlap. Survey data shows that 40% of manufacturers in North America strongly agree that powder coatings improve production efficiency, compared with only 25% in Europe and 36% in South Asia & Australasia.

Sector dynamics provide additional insight.

- **In automotive, liquid coatings — especially e-coat — remain the principal product of choice, primarily used as a primer to provide uniform corrosion protection and strong adhesion for subsequent layers. EV production, however, is gradually opening opportunities for powder coatings in sensitive electrical and underbody components;**
- **In the industrial sector, materials handling, as well as agriculture and construction demand coatings that resist abrasion and chemicals, while also fitting seamlessly into high-volume production lines;**
- **Functional equipment, such as pipelines and valves, face especially high stakes, with corrosion already costing billions annually in oil, gas, and water infrastructure.**

Across sectors, the pattern is consistent: established choices of coatings remain central, but there is an openness and willingness to adopt alternative solutions if and where they can be shown to deliver both performance and efficiency gains.

Why this matters

For North American manufacturers, corrosion protection is a balancing act between cost, durability, and efficiency. The relatively high uptake of C5-level protection reflects awareness of environmental and operational risks across the region's diverse climates. At the same time, long-standing investment in liquid and electroplating systems means that any switch to a new coating technology must be carefully weighed against the cost and disruption of retooling. This does not signal reluctance to innovate but highlights the importance of solutions that can integrate into existing lines while still delivering improved performance. For manufacturers in high-visibility sectors such as automotive and infrastructure, the stakes are especially high: failures can quickly erode trust, while successful upgrades in corrosion protection can deliver both cost savings and reputational gains.

> "North America leads in applying higher protection levels and shows strong recognition of a coating's role in improving efficiency.

Context and outlook

As a region, North America demonstrates both leadership and pragmatism. It leads in applying higher protection levels and shows strong recognition of a coating's role in improving efficiency. At the same time, the pace of adopting newer technologies is shaped by structural realities: there is an understandable reluctance to replace capital-intensive legacy systems and the need to minimize production risk. While regulatory drivers are lighter than in Europe, North American exporters to the EU will face growing pressure to align with European standards on durability and environmental performance. Domestically, infrastructure renewal programs are already demanding the use of longer-lasting protective systems.

Looking ahead, the opportunity for North American manufacturers lies in bridging the two poles of efficiency and sustainability. Firms that can adapt coating solutions to meet both objectives – whether by improving protection levels, reducing energy use, or integrating powder into an existing coating line and therefore maximizing the investment they have already made – will strengthen their competitiveness at home and abroad. Those who achieve this balance will be well-positioned to turn best-in-class corrosion protection from a necessary cost into a source of long-term value and differentiation.

South Asia & Australasia

Findings

South Asia & Australasia stands out for its reliance on lower levels of corrosion protection, but also for its agility and awareness of emerging technologies.

According to the survey, 67% of manufacturers in the region specify C2–C3 protection, compared with 60% in Europe and 58% in North America. Only 6% currently use C5, matching Europe but well below North America's 11%. These figures reflect both cost sensitivity in domestic markets and the differing performance requirements across local industries.

Awareness of multiple solutions, however, is strong. Half of all respondents (50%) in the region strongly agree that powder coatings offer superior edge coverage — the highest recognition globally, compared with 34% in North America and 35% in Europe. Some 39% highlight ease of application and another 39% emphasize reduced environmental impact as being critical to their choice of powder coatings, both ahead of Europe and North America. This suggests that while adoption is uneven, knowledge of the benefits of powder coatings in the fight against corrosion is widespread.

Export ambitions are a defining feature. Many firms in South Asia & Australasia supply to markets with stricter standards, particularly Europe and North America. While local demand often tolerates lower protection levels, exporters must align with higher specifications to remain competitive abroad.

The region also faces varied sectoral pressures:

- **Automotive and EV suppliers are adapting to meet international OEM standards;**
- **Industrial manufacturers see efficiency and cost control as essential but are open to line innovations that reduce energy use;**
- **The agriculture and construction sectors are trying to increase the durability of products and flexibility in production;**
- **Functional equipment producers face demands for coatings that can combine corrosion resistance with insulation or thermal stability in fast-growing infrastructure markets.**

Why this matters

For manufacturers in South Asia & Australasia, corrosion protection is shaped by a dual reality. On the one hand, local markets emphasize affordability, leading to widespread use of C2–C3 solutions. On the other, export markets demand evidence of higher durability and sustainability, obliging firms to raise their standards or risk limiting their ability to compete globally. The region's strong awareness of the advantages of powder coatings suggests a readiness to move when the incentives align. For producers targeting global supply chains, failing to upgrade protection levels could restrict potentially valuable business; for those who succeed, coatings that deliver both protection and efficiency could unlock significant growth.

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South Asia & Australasia can more easily adopt newer technologies more quickly when required and benefit accordingly.

Context and outlook

South Asia & Australasia is uniquely positioned to accelerate its use of advanced powder coating solutions. Without the same level of legacy investment in liquid or electroplating infrastructure, it does not face the same barriers to adoption. Put another way, it can more easily adopt newer technologies more quickly when required and benefit accordingly. Export ambitions add further momentum: to compete in Europe and North America, regional manufacturers will need to demonstrate compliance with stricter standards on durability and sustainability, but will have greater flexibility in meeting these obligations.

At the same time, climate conditions across the region are becoming more challenging, with more intense rainfall, humidity, and coastal exposure raising the risk of corrosion and the speed with which surfaces can become affected. Climate change is an ongoing problem, and products designed for today's environments may not achieve their intended lifespans tomorrow unless higher levels of protection are adopted.

Manufacturers that act early will not only secure access to global markets but also strengthen resilience against climate-driven risks at home. In this region, a manufacturers choice of corrosion protection could be a strategic enabler of competitiveness and longer-term growth.

Conclusion and way forward

Corrosion remains one of the world's most expensive industrial challenges, draining more than US$3 trillion annually. Up to US$875 billion of that figure, however, could potentially be saved through better protection. This survey confirms that while the challenge is a global one, the ways manufacturers respond vary by sector and by region.

Across sectors, the patterns are clear:

- **Automotive leads in innovation, driven by OEM standards and accelerated by the rise of EVs;**
- **Industrial manufacturers highlight efficiency, balancing corrosion protection with increased production throughput and reduced cost;**
- **Architecture balances aesthetics and compliance, increasingly adopting higher-durability solutions to protect surfaces and reputations;**
- **Functional equipment demands multipurpose performance, with coatings expected to provide not only corrosion resistance but also insulation and thermal stability.**
- **·Europe is shaped most strongly by regulation, with frameworks such as CBAM and ESPR obliging manufacturers to adopt higher protection levels and more sustainable solutions;**
- **North America combines leadership in high protection levels with a focus on efficiency, while managing the realities of legacy systems and capital-intensive infrastructure;**
- **South Asia & Australasia remain cost-sensitive but show strong awareness of advanced technologies and a readiness to adopt new solutions as export ambitions and climate risks demand higher standards.**

The common thread is that corrosion protection is no longer simply about maintenance or repair. It is a strategic choice that influences competitiveness, sustainability performance, and long-term brand reputation. Failures shorten lifespans, increase costs, and erode trust. Put more positively, success reduces product recalls, reduces carbon emissions, enhances sustainability and strengthens brand confidence.

Looking ahead, the baseline for protection is shifting. What was adequate yesterday — solutions equivalent to C2 or C3 — may not suffice tomorrow as climate conditions intensify and regulations tighten. EVs are already setting new benchmarks with higher protection levels, while architecture and industrial equipment face rising demands for both durability and efficiency. For functional infrastructure especially, consumer visibility and media scrutiny of system reliability will continue to raise the bar.

The opportunity for manufacturers is to move beyond treating corrosion as a cost to be managed and to see protection as a value creator. With the right strategies, coatings can enable faster production, longer lifespans, lower emissions, and stronger reputations. The manufacturers who act early - and the supply chain partners who support them with accredited, proven, and sustainable solutions - will be the ones best placed to turn the cost of corrosion into a value-added, competitive advantage.

Put another way, the true cost of corrosion is not what it takes away, but the value lost when protection is left to chance.

Notes & references

1. Association for Materials Protection and Performance (AMPP), Global Cost of Corrosion report.
2. AMPP and industry data on oil & gas equipment failures, Gulf of Mexico.
3. North American water infrastructure break rates and repair costs (industry association reports).
4. Public recall filings, 2013–2016, three major US OEMs. Ford, General Motors and Toyota

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