Stainless Steel Industry Awards 2026

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Market Development Case Studies

Introduction to the Market Development Award

Objective:

To recognize initiatives that have expanded demand or broadened the application of stainless steel in the market.

Evaluation Points Examples

- Market growth or penetration into new customer segments.
- Effective messaging, that highlights the unique benefits of stainless steels.

Initiatives Examples

- Development of new applications: Expanding into fields where stainless steels have not been widely used to date.
- Expansion within specific markets: Increasing adoption through educational campaigns, standardization activities, or regulatory support.
- Promotional activities: Marketing or communication strategies with successful outcomes that have demonstrably increased market share.
- Supply chain development: Establishing distribution channels or supporting entry into new markets, particularly in developing countries.

From 30 tonnes of carbon steel to 3 tonnes of stainless cable: Redefining sustainable infrastructure

Member company

Australian Stainless Steel Development Association

The Challenge

The Narre Warren Station development (located approximately 38km southeast of Melbourne CBD) required a structural ceiling solution spanning 25m between bridge crossheads above an active rail concourse. The original design specified approximately 30 tonnes of 800mm deep welded carbon steel beams – heavy, material-intensive elements that posed significant challenges in terms of installation, access, safety, and long-term maintenance.

Additionally, the solution needed to be delivered within a constrained live rail environment, where minimising disruption to services, reducing installation risk, and ensuring long-term durability were critical.

Why?

The challenge presented an opportunity to rethink conventional material selection in infrastructure projects, where carbon steel is typically the default.

The project team identified a need to:

- Reduce material consumption and embodied carbon
- Improve constructability in a constrained, live environment
- Deliver a long-life, low-maintenance solution
- Demonstrate a viable alternative application for stainless steel in structural infrastructure

Addressing this challenge aligned with broader industry priorities around sustainability, circular economy principles, and smarter material use.

Needed action

ASSDA Member Ronstan Tensile Architecture, in collaboration with Built Environs, developed an alternative structural solution using stainless steel cable bowstring trusses.

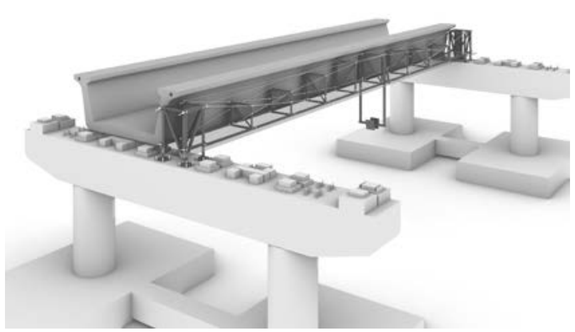
Key actions included:

- Replacing conventional beams with six stainless steel cable trusses across three bays, each spanning 25m
- Engineering a system using 316 grade stainless steel cables (8mm and 14mm diameter), fittings and bespoke components
- Conducting detailed load analysis, cable geometry modelling, and proof/ destructive testing

- 90% reduction in material usage (30 tonnes of carbon steel to 3 tonnes of stainless steel)
- Significant reduction in embodied carbon associated with steel production and transport
- Elimination of major lifting requirements and reduced installation time
- Avoidance of rail service disruptions during installation

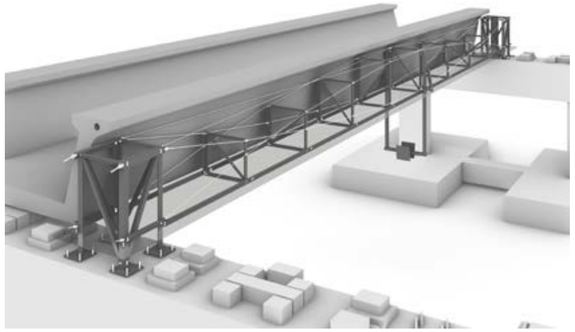
Achievable: The project successfully delivered a fully functional, compliant structural system that met all engineering, safety, and operational requirements. The solution performed as intended and has since been recognised with an industry award – 2024 ASSDA Fabricator Project of the Year Award in the Architecture, Building and Construction category.

Realistic: While innovative, the



solution leveraged existing stainless steel properties and cable engineering expertise. With appropriate upfront design investment, the approach is highly practical and replicable.

Time-bound: All design, fabrication, and installation activities were completed within the project's construction timeline, with efficiencies gained through prefabrication and modular installation.



Horizontal expansion capability

This project demonstrates strong potential for replication across:

- Rail and transport infrastructure projects
- Large-span architectural and structural applications
- Enclosed or difficult-to-access environments requiring low maintenance

The approach provides a scalable model for material substitution, enabling broader adoption of stainless steel in applications traditionally dominated by carbon steel.

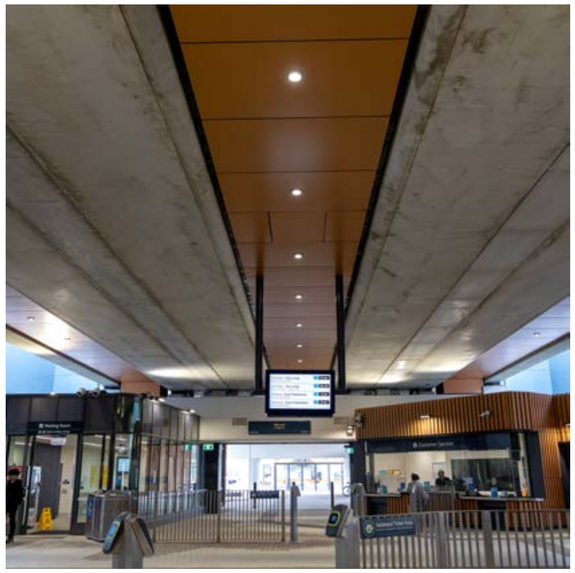
It also supports industry-wide advancement by showcasing how early-stage design collaboration and engineering innovation can unlock new markets for stainless steel.

Outcome

The project delivered significant, measurable benefits:

Sustainability and environmental impact:

- Substantial reduction in embodied carbon through 90% less material usage
- Lower transport and installation emissions due to reduced weight
- Long design life with minimal maintenance, reducing lifecycle



environmental impact
- Alignment with circular economy principles, including potential for future disassembly and reuse

Business efficiency and cost:

- Reduced installation complexity and time
- Elimination of large-scale lifting equipment
- Lower long-term maintenance costs due to stainless steel's corrosion resistance and durability

Material performance and quality:

- High strength-to-weight ratio of stainless steel enabled structural efficiency
- Superior corrosion resistance ensures longevity in a challenging urban environment
- Precision manufacturing improved quality and reliability

Workforce and safety:

- Safer installation due to lighter components and modular construction
- Reduced on-site risk and improved working conditions

Market development impact:

- Demonstrated a new application of stainless steel in metro rail infrastructure
- Shifted perception of stainless steel from a finishing material to a primary structural solution
- Established a precedent for future infrastructure projects in Australia and globally

Other comments

The Narre Warren Station project represents a breakthrough in how stainless steel can be used to deliver smarter, more sustainable infrastructure.

By successfully substituting carbon steel with a lightweight stainless steel cable system, the project not only achieved immediate performance and environmental benefits but also expanded the potential market for stainless steel in structural engineering.

This initiative highlights the importance of design-led material innovation and demonstrates how stainless steel can play a critical role in the transition to more sustainable, resource-efficient construction practices.

Please see the following link for ASSDA's article on this project:

https://assda.asn.au/blog/379-from-30-tonnes-of-carbon-steel-to-3-tonnes-of-stainless-cable

Market Development of Stainless Steel as a Copper Alternative for Refrigerant Pipe

Member company

POSCO

The Challenge

Copper has traditionally been the standard material for air conditioner refrigerant piping.

However, POSCO has aimed to expand its market presence by transitioning from copper to stainless steel for these applications. To achieve this, the company focused on two primary initiatives:

first, enhancing the ductility of stainless steel to approximate that of copper;

and second, establishing the necessary conditions for onsite installation of stainless steel piping. To support these efforts, POSCO has been actively involved in developing innovative technologies and spearheading the revision of national technical standards.

Why?

Copper has long been the primary material for refrigerant piping, favored for its superior thermal conductivity and excellent workability. However, the rapidly rising demand from emerging sectors—such as electric vehicles, data centers, and renewable energy—coupled with supply constraints, has driven copper prices into a long-term upward trend. Consequently, the industry is facing significant challenges due to escalating cost burdens and price volatility. In response, we have initiated the development of stainless steel as a cost-effective alternative, as it offers a significantly more stable and competitive price profile compared to copper.

Needed action

1. R&D Breakthrough: Developed world-class ductile stainless steel material (PossFD) in collaboration with our research institute.
2. Ductility Preservation: Partnered with SMEs to develop proprietary technologies that ensure the material retains its ductility even after the pipe manufacturing process.
3. Performance Validation: Completed rigorous performance testing across 13 critical criteria, including pressure resistance, corrosion resistance, and thermal performance, to certify the suitability of stainless steel for refrigerant piping.
4. Welding Solution: Engineered specialized welding rods and optimized welding methodologies exclusively for stainless steel refrigerant piping.
5. Fire Hazard Mitigation: In response to recurring onsite fire safety concerns during copper pipe welding, co-developed advanced pipe joint solutions with SMEs to enable secure, flame-free connections.
6. Component Localization: Collaborated with SMEs to develop a comprehensive range of essential accessories, including stainless steel branching pipes and service valves.
7. Standardization (KS): Successfully spearheaded the revision of the Korean Industrial Standard (KS D 3576), officially authorizing the use of stainless steel as a standardized material for refrigerant piping. (*KS : Korean Industrial Standards).
8. Regulatory Framework: Established a solid institutional foundation by amending the National Construction

Standards (KCS 31-20-15) under the Ministry of Land, Infrastructure and Transport (MOLIT).

9. Pilot Projects & Field Verification:
   Conducted pilot installations across eight POSCO-owned buildings and disseminated the performance data publicly.
   Executed collaborative pilot projects with major industry players, including Korea Land and Housing Corporation (LH), LG Electronics, and Samsung Electronics.
10. Market Outreach & Promotion:
    Executed comprehensive promotional campaigns to increase market awareness.

Action Review

Specific: New material development → Product application and specialized technology development → Establishment of regulatory frameworks and industry standards → Accumulation of empirical field data and pilot project validation → Media outreach and market promotion.

Measurable: A definitive long-term target has been set to achieve an annual sales volume of 3,000 tons or more.

Achievable: This target is based on the current domestic market demand for copper refrigerant piping, which stands at approximately 10,000 tons per year. By analyzing this market size, we have developed a realistic and achievable growth trajectory.

Realistic: Given the ongoing high-price volatility of copper, our strategic transition toward stainless steel alternatives is highly practical and economically sound, providing a viable solution to the industry's cost challenges.

Time-bound: Having systematically laid the groundwork for market expansion, we are confident in our capacity to achieve the annual sales target of 3,000 tons within the next five years.

Horizontal expansion capability

Our new market development model goes beyond material supply. We have pioneered a value-chain approach that encompasses joint product development with SMEs, technical advisory services, field-proven validation, and the development of industry standards to create a sustainable market ecosystem.

Outcome

We have successfully penetrated the previously stagnant refrigerant piping market, generating over 2 billion KRW in revenue within the past two years. Furthermore, we have achieved a significant milestone by entering the Chinese market. As we anticipate substantial expansion in China and solidified market adoption in Korea this year, we project a rapid growth trajectory for next year, with revenue expected to increase more than fivefold compared to this year.

Other comments

We have successfully spearheaded a paradigm shift in the global refrigerant piping market by establishing new industry standards and commercializing practical, cutting-edge technologies. This achievement is a direct result of a long-term, systematic collaboration between our research institute and key SMEs.
We believe this initiative serves as an exemplary model for identifying innovative solutions and pioneering the creation of entirely.

Orona Essentia Lifts

Member company

Acerinox Europa S.A.

The Challenge

Orona presents the Orona Essentia, our best-selling lift series designed to ensure maximum performance, comfort and sustainability in residential mobility. The challenge was to develop an accessible, highly reliable vertical transport solution that reduces energy consumption and maximises product lifespan without compromising on performance, aesthetic quality or hygiene. Approximately 60% of a typical Orona lift is made of stainless steel, which is a fundamental pillar of our proposal. This material allows us to build robust cabins, guide rails, and the chassis components, keeping them as light as possible, and can withstand daily and heavy usage. Furthermore, by integrating ACX stainless steel into the manufacturing process, the overall carbon footprint of the lifts can be naturally reduced, contributing directly to circular economy principles and offering another significant step forward in Orona's commitment to Sustainability.

Why?

In the building sector, lifts are a critical infrastructure expected to operate seamlessly for decades. Traditional materials can degrade, require frequent maintenance, or lack the sanitary features necessary in a post-pandemic world. It was necessary to address this by creating a core elevator model that integrates the durability and recyclability of stainless steel. Additionally, minimising the carbon footprint of buildings is a global priority, making it essential to combine resilient materials with industry-leading energy efficiency.

Needed action

- Maximum unit durability and performance ensured by the exclusive use of Acerinox premium stainless steel.
- High recycled content (more than 80%) and eco-design according to circular economy criteria ensure materials like stainless steel can be reused, and environmental impact is minimised.
- Achieved a 75% reduction in electricity consumption by integrating an energy regeneration system, a low-consumption gearless drive, efficient LED lighting with automatic cabin switch-off, and a lift standby mode. By equipping the lifts with these eco-efficient elements, they achieve the highest Class 'A' energy efficiency

rating according to the ISO 25745 standard (Energy performance of lifts, escalators, and moving walks).

Action Review

Specific: Orona was the first company in the lift sector to adopt the ISO 14006 certification on Ecodesign. This initiative focused on upgrading key lift models, such as the Orona Essentia. Improvements included achieving EPD (Environmental product declarations), ensuring longevity through robust materials like stainless steel, optimising traffic flow with advanced power electronics and control algorithms, and improving energy efficiency.

Measurable: We quantified the environmental impact of these actions, successfully reducing the lift's electricity consumption by an impressive 75% compared to traditional lifts. Being Orona

Essentia our best selling lift, the achieved improvements are widely spread, making performance highly measurable and durable (approximately 25 years)

Achievable: The initial objectives behind the Orona Essentia were successfully achieved, providing the market with a practical, easily implemented solution that supports environmentally efficient construction.

Realistic: The Orona Essentia was designed as an immediate, practical solution for the market in 2019.

Time-bound: The Orona Essentia was developed in line with the delivery timelines and established at the outset. The solution is now being installed, and customers can request it for any type of projects, but mainly for residential buildings.

Horizontal expansion capability

Orona invests in R&D 2% of the sales and is committed to continuous and sustainable improvements. The foundational Eco-design certificate and circular economy parameters established serve as the baseline for Orona's entire portfolio. The integration of highly recyclable materials, such as stainless steel, alongside the 75% energy reduction blueprint, is being horizontally expanded to our higher-capacity models driving this to sustainability commitments.

Outcome

The most significant quantified benefit is a 75% reduction in electricity consumption, which heavily reduces costs and improves business efficiency. By making use of premium stainless steel, material quality is improved bringing extended product lifespans, which directly reduces maintenance interventions and minimises the need for high spare-part inventory levels.

Technology Case Studies

Introduction to the Technology Award

Objective:

To recognize technological innovations that enhance production, quality, or functionality of stainless steel products, manufacturing facilities, or applications.

Evaluation Points Example

- Novelty and horizontal expansion capabilities of the technology.
- Tangible improvements (e.g., reduced yield loss, cost savings, enhanced product quality)
- Potential for adoption by other member companies.

Initiatives Examples

- Development of new products: Introduction of new alloys with enhanced mechanical properties or unique features.
- Process improvement: Energy-saving upgrades, production digitalization, or AI-based technology.
- Overcoming technical challenges: Breakthroughs in forming complex shapes or joining dissimilar materials.
- Enhanced customer value: Improvements that enable new levels of performance or usability not achievable through traditional technologies.

Transforming STS AOD Refining with Intelligent One-Touch Automation

Member company

POSCO

The Challenge

The STS AOD (Argon Oxygen Decarburization) refining process is one of the most technically demanding and operationally complex stages in stainless steelmaking. Within a single vessel and under strict time constraints, it must perform several critical metallurgical functions in sequence, including decarburization, reduction, deoxidation, and desulfurization. Each stage requires highly precise control of oxygen flow, blowing patterns, ferroalloy additions, auxiliary material charging, temperature behavior, and carbon concentration. These variables are closely interconnected, meaning that optimization of one parameter cannot be pursued independently without influencing the overall process balance. For example, a control strategy aimed at improving decarburization efficiency may also affect temperature rise, alloy yield, reduction conditions, and the accuracy of final composition control. As a result, the AOD process has historically required not only technical expertise but also continuous real-time judgment based on a broad understanding of dynamic process interactions.

Because of this complexity, conventional STS AOD operation relied heavily on experienced operators' tacit knowledge and intuitive decision-making. Skilled operators were able to infer process conditions by combining observations of exhaust gas behavior, molten steel reactions, operating history, raw material conditions, and previous heat results. Based on such judgment, they adjusted oxygen input, selected blowing timing, and determined the amount and sequence of ferroalloy and auxiliary material additions. However, this expertise was rarely formalized into transparent or standardized logic. Instead, it remained embedded in personal experience, accumulated over years of shop-floor practice. This dependence on operator know-how created structural limitations. Even under similar equipment and raw material conditions, operating results could vary depending on who was controlling the process. Differences in individual judgment led to fluctuations in carbon endpoint accuracy, deoxidation performance, refining time, auxiliary material consumption, and ultimately product quality consistency. In other words, process stability and productivity were constrained by the level of operator experience rather than guaranteed by the system itself.

Operational inefficiency was also a serious issue at the shop-floor level. In the conventional environment, operators had to monitor and control the process through multiple distributed manual control screens. This was not simply an inconvenience of interface design; it meant that critical information was fragmented across different systems, requiring operators to collect, interpret, and mentally integrate process signals in real time before taking action. The burden of combining HMI data, PLC signals, process trends, and operational conditions manually increased complexity and reduced responsiveness, particularly during fast-changing refining stages. Even for highly experienced operators, this

working environment required intense concentration and caused significant fatigue. For less experienced personnel, it created a steep barrier to stable operation. In a process such as AOD refining, where timing and precision are essential, such a fragmented control environment increased the risk of human error and became a direct source of operational deviation and reduced efficiency.

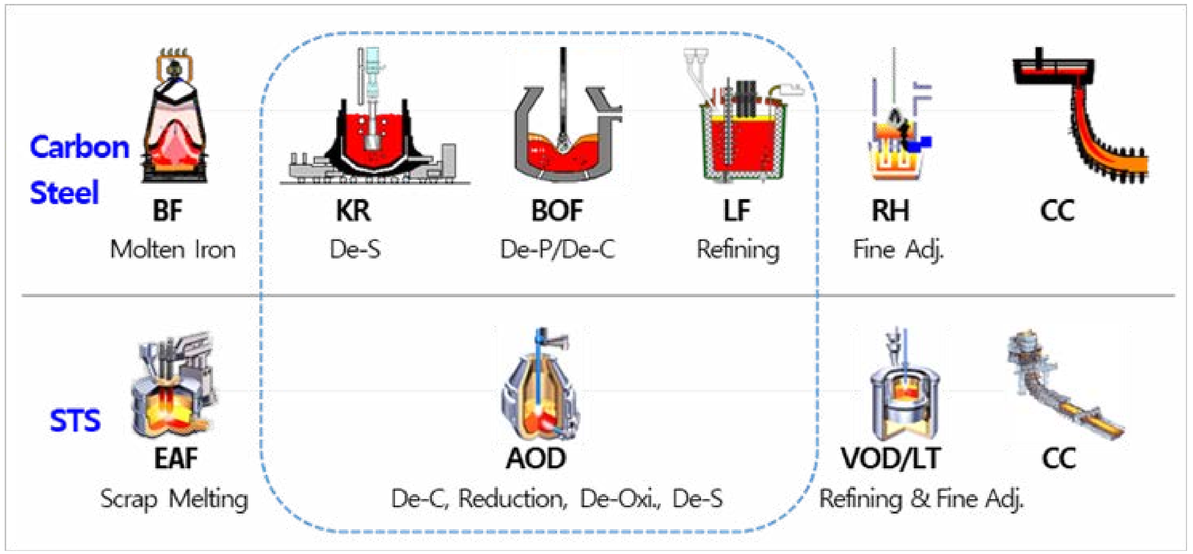
These issues were not limited to operator convenience; they directly affected manufacturing competitiveness. In stainless steelmaking, stable composition control, consistent quality, low material consumption, and high productivity are all essential for cost competitiveness and customer trust. If the process continues to depend on individual skill, operational performance inevitably varies with workforce capability, and the risk of rework, quality deviation, prolonged refining time, and excess material usage remains high. Moreover, as experienced operators retire and workforce generations change, valuable know-how can be lost unless it is captured and systemized. This made the challenge particularly urgent. We needed not only to automate part of the operation, but to fundamentally redesign how the process was controlled by transforming human expertise into a reproducible, data-driven operating system.

Therefore, our challenge was multi-dimensional. First, we needed to convert operator-dependent tacit knowledge into standardized and transparent operating logic that could be applied consistently across heats, steel grades, and operators. Second, we needed to replace a fragmented and manually intensive operating environment with an integrated platform that could support fast, reliable, and simplified decision-making. Third, we needed to establish a real-time process understanding capability that would enable more accurate control of decarburization behavior and downstream refining steps. Finally, all of this had to be implemented in a way that was not only technically advanced but also practical and acceptable in actual plant operation.

Ultimately, this challenge was far more than a simple automation project. It was a transformation of a highly skilled, operator-dependent refining process into an intelligent operating system based on real-time data, dynamic control, standardized logic, and AI-supported guidance. At its core, the challenge was to make hidden expertise visible, structured, and repeatable through a white-box approach. By doing so, we aimed to secure stable quality, consistent operation, improved productivity, and scalability across the stainless steelmaking process.

Why?

The fundamental reason for undertaking this transformation was the urgent need to bridge the gap between human expertise and process stability. In the STS AOD refining process, manufacturing competitiveness is defined by three pillars: quality consistency, cost efficiency, and operational safety. However, the reliance on tacit knowledge—while valuable—created a structural bottleneck in achieving these objectives. As the global stainless steel market evolves, the demand for high-spec, high-quality products has increased, and even minor variations in the refining stage can lead to substantial



Comparison of Production Processes: Carbon Steel vs. Stainless Steel

quality defects. We recognized that if we continued to rely solely on the manual judgment of operators, achieving a uniform, global-standard quality level across all shifts and steel grades would become increasingly unsustainable.

Moreover, the complexity of modern steelmaking requires data-driven decision-making. Manually managing variables such as oxygen supply rate, temperature, and material chemistry is no longer sufficient to optimize costs and minimize the use of expensive auxiliary materials.

By failing to digitize and standardize the process, we were effectively leaving potential performance gains on the table—gains that could only be captured through the precise, millisecond-level control that an automated system provides. We identified that the lack of a standardized control model was directly correlated with excessive refining times, inconsistent material yields, and higher energy consumption. Thus, moving to an intelligent, automated system was not just an efficiency upgrade; it was a strategic imperative to secure our position as a leader in the global stainless steel market.

Furthermore, we were motivated by the goal of human-centric digital transformation. The traditional AOD operating environment was physically and mentally demanding, with operators constantly exposed to high-pressure

decision-making. By automating repetitive and highly variable tasks, we aimed to transition the operator's role from a "manual controller" to a "process supervisor." This shift not only improves job satisfaction and safety but also preserves the invaluable "know-how" of our veteran workforce by encoding their expertise into a sustainable digital architecture. Ultimately, we launched this initiative because we believed that a truly world-class stainless steel plant must evolve beyond human-dependent operations toward an intelligent, transparent, and highly efficient manufacturing model that guarantees perfection in every heat.

Needed action:

We developed a “One-Touch” automatic refining system for AOD by integrating multiple distributed manual control screens into a single platform. To automate decarburization, we introduced an exhaust gas mass spectrometer and built a real-time prediction model for carbon concentration. Crucially, we converted operators’ tacit know-how—like decarburization efficiency and material yield rates—into transparent system logic and applied AI-based guidance to prevent operational deviations.

Action review

Specific: We fundamentally upgraded the POSCO STS AOD refining process. We established the required infrastructure using an exhaust gas analyzer, integrated distributed HMI and PLC systems, and developed a dynamic control mechanism. We successfully automated oxygen supply, ferroalloy input, and auxiliary material charging across all major blowing stages. Furthermore, we designed and embedded an AI model-based similar-operation guidance system to significantly improve operator convenience.

Measurable: Our automatic refining system delivered highly measurable results. Through dynamic control, we achieved a 100% hit rate in carbon concentration control within the AOD process. Compared to conventional methods, we reduced refining time by 5% and improved the deoxidation hit rate by 2%. Moreover, we successfully achieved an automation application rate of over 95% across all stainless steel grades produced at our POSCO STS steelmaking plants, demonstrating exceptional technical and operational performance.

Achievable: We achieved our objectives through a "One-Team" collaboration involving our R&D center, operating departments, and development teams. By actively reflecting field opinions on screen layouts and functions from the beginning, we lowered the barrier to automation adoption. Currently, our operators utilize the automation system for over 95% of POSCO STS AOD operations, proving that our development goals were highly realistic, perfectly achievable, and fully embraced on the shop floor.

Realistic: We ensured the project was realistic through a phased approach. From 2018 to 2020, we built the AOD automation infrastructure. In 2021, we developed the real-time decarburization behavior analysis model before launching the integrated system. To maximize usability in actual operations, we also developed an AI prediction model to act as a reliable substitute during periods when the physical exhaust gas analyzer was unavailable, making the solution highly practical and sustainable.

Time-bound: We executed the STS AOD automatic refining system development strictly within our planned timeframe from 2018 to 2024. Once we secured the core technology at the initial plant, we expanded and applied it to another STS steelmaking plat in just 1.5 years. This rapid deployment demonstrates that our project was completed within clear time constraints and that we can efficiently accelerate subsequent rollouts by leveraging our established, well-proven technological foundation.

Horizontal expansion capability

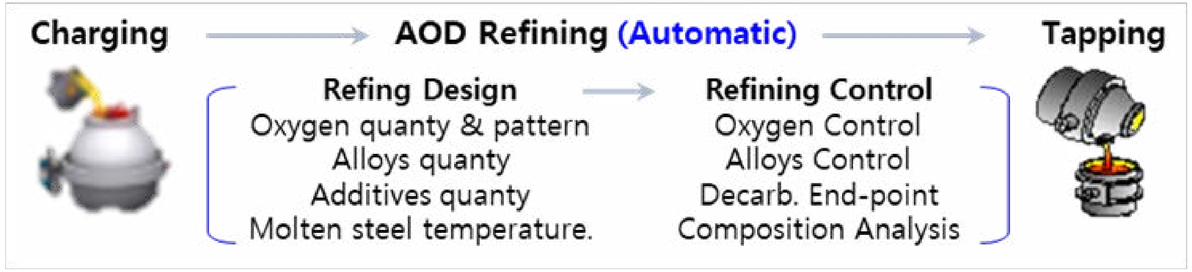
The One-Touch intelligent automation system developed for the STS AOD refining process demonstrates strong horizontal expansion capability across both internal and external manufacturing environments. Internally, the system has been successfully deployed across multiple stainless steelmaking facilities with different equipment configurations and operational cultures, proving its adaptability and robustness. The standardized control logic and AI-guided process models are not limited to specific steel grades or operator groups, enabling seamless application to all stainless steel products and shifts. The modular architecture allows for rapid customization to accommodate varying plant layouts, legacy systems, and local operational practices without compromising core functionality.

Outcome

Our technology reduced the consumption of auxiliary materials like reducing agents, quicklime, and fluorite. By automating the process, we drastically reduced operator fatigue and manual workloads, greatly improving job satisfaction and safety. Furthermore, our shortened refining time boosted business efficiency and per-capita productivity, while the complete elimination of human-dependent variation resulted in highly consistent material quality and overall process stability.

Other comments

This achievement is a vital cornerstone for building a world-class intelligent factory. Our success stems from a "white-box" approach, translating hidden human expertise into transparent, structured system logic. Building upon this highly successful STS AOD automatic blowing system, we plan to further expand our capabilities by introducing a GPT-based AI assistant, cementing our position at the forefront of digital innovation in the stainless steel manufacturing industry.



Stainless Steel AOD Automation Domain

Development of Austenitic Stainless Steel with Improved Diffusion Bonding Properties for PCHE

Member company

POSCO

The Challenge

The Printed Circuit Heat Exchanger (PCHE) market is rapidly expanding, driven by the surge in demand for high-efficiency, ultra-compact equipment in clean energy sectors such as the gas and hydrogen industries. These PCHEs must operate under extreme conditions of high temperature, high pressure, and cryogenic environments. However, manufacturing them requires Diffusion Bonding at over 1,000□, which inevitably causes severe internal softening and strength degradation in conventional stainless steel. Thus, the industry faces a critical 'Metallurgical Dilemma': the extreme heat required to achieve a flawless, reliable bonding interface fundamentally compromises the material's essential design strength.

Why?

It was imperative to resolve this challenge to meet the stringent safety and performance standards of next-generation clean energy infrastructure. Overcoming this metallurgical dilemma was the only way to guarantee both the flawless interfacial bonding of the heat exchanger and the intrinsic high strength of the base metal.

Needed action

To thoroughly understand the characteristics and mechanisms of the softening phenomenon during the diffusion bonding process, we analyzed microstructural changes in response to thermal cycles. Based on this analysis, we identified the optimal microstructure required to enhance diffusion bonding properties, and subsequently improved the rolling and annealing processes to successfully realize this microstructure.

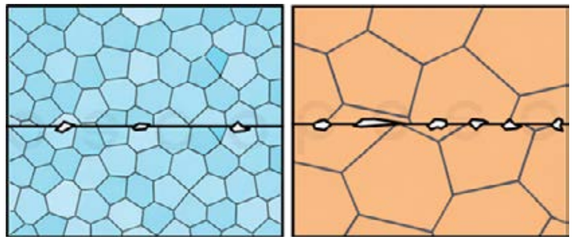
Action review

Specific: When following the context mentioned above, we analyzed the thermal history during the diffusion bonding process to understand how grain growth behaves depending on the initial grain size from a diffusion perspective. Through this analysis, we successfully identified the optimal grain size (grain refinement).

These initially refined grains play two critical roles:

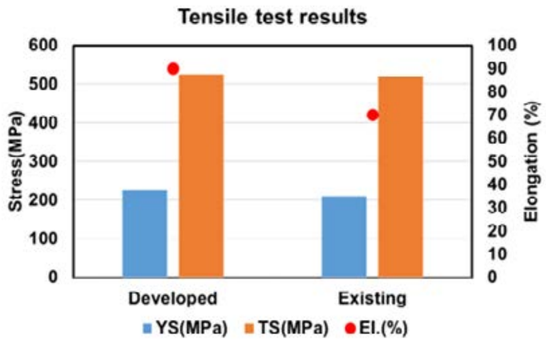
First, they dramatically promote grain boundary diffusion. The movement of atoms within a metal occurs much faster along the grain boundaries (the irregular interfaces of the crystal lattice) than through volume diffusion across the grain interior. By controlling the microstructure, we exponentially increased the total area of grain boundaries within the material, effectively building countless 'highways' for atomic transport. The expansion of the grain boundary area significantly lowers the activation energy required for overall diffusion, thereby inducing smooth diffusion even at relatively lower temperature ranges. As a result, we were able to drastically reduce the holding time in extreme high-temperature environments that was previously required to completely eliminate micro-voids.

Second, they maximize the material's intrinsic strength and offset the softening



Schematic illustration of the (a) fine-grained and (b) coarse-grained alloys after diffusion bonding.

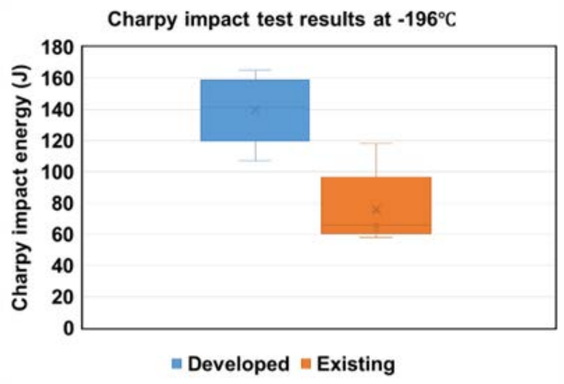
phenomenon. The refined grains not only facilitate atomic diffusion but also act as a strengthening mechanism that exponentially improves the material's mechanical strength. This is proven by the Hall-Petch effect, where yield strength increases as grain size decreases. By minimizing the average grain size, we maximized the initial yield strength of the material prior to diffusion bonding. Even when accounting for the inevitable strength loss caused by high-temperature exposure during bonding, the high initial



Tensile test results of the diffusion-bonded material

strength ensures that the final product fully meets the pressure resistance design strength required for PCHEs.

Measurable: We conducted a comparative evaluation of the mechanical properties after diffusion bonding between our existing austenitic stainless steel for PCHEs and the newly developed material applied with microstructure control technology. The results confirmed



Charpy impact test results at -196°C for the diffusion-bonded material

that the yield strength of the new material overcame the softening phenomenon caused by high-temperature exposure, increasing from 210 MPa to 225 MPa. Furthermore, the elongation significantly improved from 70% to 90%, confirming the formation of a robust, defect-free bonding interface. Notably, to verify structural stability in cryogenic environments, a Charpy impact test was conducted at -196°C. The impact absorbed energy surged by 75%, from 80 J in the existing material to 140 J in the new material, proving that exceptional bonding strength was secured.

Achievable: For PCHE manufacturing, a high-temperature process over 1,000°C is essential to achieve perfect interfacial bonding. During this process, austenitic stainless steel inevitably experiences internal grain growth and softening, leading to a significant drop in strength. Therefore, forming a flawless bonding interface while preserving the material's intrinsic high strength was a metallurgical dilemma difficult to reconcile with existing technologies. This project successfully overcame these limitations by applying grain refinement technology through precise control of rolling and annealing conditions. Ultimately, we successfully

achieved our initial objective of maximizing diffusion bonding quality while simultaneously securing high strength, high elongation, and excellent cryogenic toughness.

Realistic: This newly developed austenitic stainless steel was designed as a core material for PCHEs, which require high strength, a perfect bonding interface, and excellent cryogenic toughness simultaneously. With the recent global trend toward carbon neutrality and the full-scale development of the Liquefied Natural Gas (LNG) and liquid hydrogen storage and transport industries, the demand for high-efficiency, ultra-compact heat exchangers is rapidly increasing. The grain refinement and process control technologies applied in this project were realistically viable for mass production without additional large-scale capital expenditure, as they utilized existing commercial rolling and heat treatment lines. In particular, PCHEs manufactured using this material can be adopted in various eco-friendly energy plant facilities and are expected to play a pivotal role in maintaining the durability and reliability of heat exchangers even under the harsh cryogenic (-196°C) and high-pressure conditions.

Time-bound: The eco-friendly energy plant market, including hydrogen and LNG, is demanding the early establishment of infrastructure and the rapid innovation of high-efficiency, ultra-compact equipment. Keeping pace with this rapidly changing market, We successfully completed the development of this core material for PCHEs—which possesses both the high strength and excellent cryogenic toughness strongly demanded by clients—within the originally planned timeframe. We expect this material to be continuously adopted in next-generation heat exchanger projects.

Horizontal Expansion Capability

The application of the high-strength, high-cryogenic-toughness austenitic stainless steel developed in this project can be expanded beyond the PCHE market to specialized markets requiring extreme environments, such as the liquid hydrogen and aerospace industries. It can be applied to manufacture high-pressure storage vessels that do not undergo brittle fracture even at cryogenic temperatures of -196°C, as well as to the ultra-compact thermal management systems of next-generation Small Modular Reactors (SMRs). In particular, thanks to its strength of maintaining high base metal strength even after heat treatment, it can play a crucial role in reducing the weight and securing the durability of core components for eco-friendly mobility that must withstand extreme pressure.

Outcome

We are currently in close consultation with global heat exchanger manufacturers regarding ways to improve the efficiency of the diffusion bonding process using the new material. Furthermore, we are actively exploring the expansion of its application to various industrial sectors, including next-generation heat exchanger models that operate safely even in high-temperature environments.

Condition Monitoring for Smart Fault Detection

Member company

Aperam

The Challenge

Sensor faults are inevitable in production – they occur repeatedly and frequently lead to unplanned downtimes.

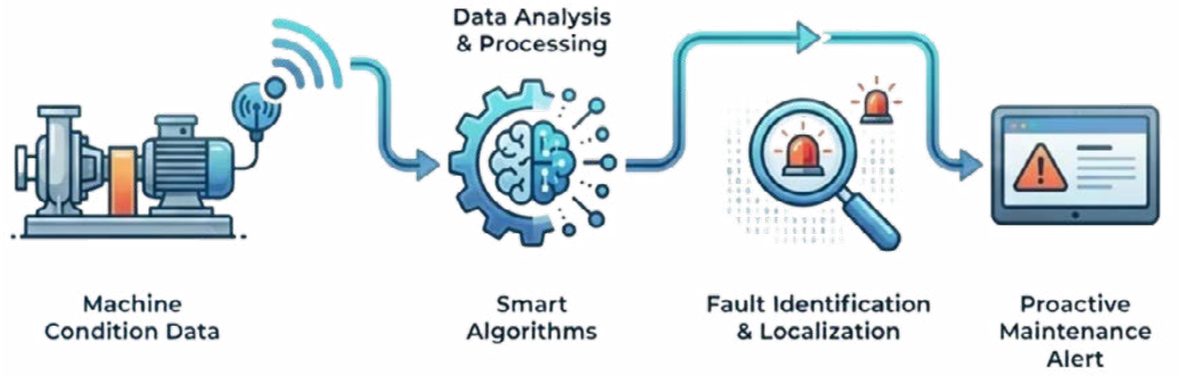
The Challenge: Machine operators are often unable to clearly identify or resolve such faults on their own.

Our motivation: By integrating condition monitoring into control systems (e.g., cylinders, motors), operators will be able to detect and resolve issues independently – quickly, reliably, and without external support.

- Troubleshooting on highly automated lines was time-consuming so the signal origins were unclear
- Growing automation complexity increased fault detection time
- To enable faster fault detection, reduce troubleshooting time, and improve system reliability in complex, highly automated environments through real-time comparison of PLC signals against a predefined truth table of valid machine states.
  - The project targeted a clear reduction of Mean Time To Repair (MTTR) and an increase of machine reliability and availability
  - Relief of maintenance and automation

Why?

In our industry, equipment downtime means high costs. There was no off-the-shelf software solution available for our industry. Due to the high level of automation we have achieved within our group in recent years, it has become increasingly difficult to locate errors.



As a result, our team of young automation engineers developed their own program to detect the errors.

Recurring sensor breakdowns often cause extended repair times. The main challenge is not the repair itself, but the fact that technicians first need to spend a lot of time locating the root cause of the malfunction and locating exactly which of the many sensors in the system has failed. This diagnostic time often takes multiple times longer than the actual repair.

With increased machine automation, system complexity grows; making it harder and more time-consuming to identify and fix faults. This delays recovery, negatively impacting key metrics:

- A structured, logic-based monitoring solution is required to reduce downtime
- Standardize troubleshooting
- Increase transparency

Needed action

1. Standardize PLC logic for condition monitoring
2. Conduct test run on machine M22
3. Evaluate results with maintenance & machine supplier
4. Rollout across all control systems
5. Adapt HMI visualization accordingly
6. Train production staff on usage and diagnostics

- Plug-and-play integration and open for any machines & plants
- The concept is modular and can be replicated across all production lines without additional hardware.
- It only requires minor adaptations of the PLC program and signal mapping

Methodology

- Inspired by smart automotive factory standards
- Cross-functional collaboration – project team
- Hands-on mentality
- 100% internal ownership, in-house development, no integration costs
- Alignment with WCMA+ Gold Standard “Autonomous Maintenance”

Action review

Specific:

- MTTR (Main time to repair)
- MTBF (Mean Time Between Failures)
- OEE

Measurable:

- MTTR (Main time to repair)
- MTBF (Mean Time Between Failures)
- T1 Time (Time to recover from failure and produce the first good part)

Achievable: Cost Savings direct production cost:

- 300 hours less unplanned stops only on one Site
- Productivity in %: + 5,05% productivity gain

Realistic: Yes, plug and play solution, no additional hardware needed.

Time-bound:

- Concept and validation phase completed : December 2024
- First implementation on separator completed : January 2025
- Implementation on entry coilcar completed : February 2025
- Testing, adjustments, and training completed : April 2025
- Rollout 2025/2026 to the other lines on our own and different Sites

Horizontal Expansion Capability

Our fully in-house developed software is **highly scalable, easy to implement,** and **compatible with all SIEMENS PLCs and software versions**. It integrates seamlessly into any machine environment with minimal effort and only basic PLC

knowledge required. -> Plug & Play solution.

Outcome

- The project boosts operational safety through clear, visual documentation of sensors and safety rules as well as autonomous maintenance
- Breakdowns can be identified more quickly, improving communication and problem-solving across the departments.
- At the same time, employees are actively involved by contributing to the documentation themselves – supporting knowledge sharing, appreciation, and better collaboration.
- Cost Savings direct production cost:
  - 300 hours less unplanned stops only on one Site
  - Productivity in %: + 5,05%

productivity gain

Other comments

This project was developed by Aperam to provide a tailored solution for our industry. The project can be implemented at our 70 production lines worldwide with minimal effort.

Safety Case Studies

Introduction to the Safety Award

Objective:

To honor initiatives that have significantly improved workplace safety and the well-being of employees in stainless steel operations.

Evaluation Points Examples

- Reduction in incident rates, number of injuries, or improvement in safety performance indicators.
- Positive worker feedback and continued adoption of the measures.
- Potential for broader application and long-term integration into daily operations.

Initiatives Examples

- Accident prevention measures: Targeted actions addressing common risks such as slips, trips, falls from height, or moving machineries.
- Practical safety training: Implementation of engaging and scenario-based training programs, toolbox talks, or peer-led safety briefings.
- Cultural transformation: Programs encouraging proactive reporting of near-misses, regular safety dialogues, or improved communication between frontline staff and management.
- Facility improvements: Upgrading aging equipment, improving lighting and signage, or installing physical safety guards or systems.

Safe Driving - Accident prevention measures, Cultural transformation

Member Company

Aperam

The challenge

Aperam BioEnergia, part of the Aperam Group, is a key driver of sustainable stainless steel production in Brazil. Operating over 150,000 hectares of certified forests in the Jequitinhonha Valley, it supplies renewable charcoal that replaces coal in blast furnaces, significantly reducing the carbon footprint of Aperam Green Steel. This fully integrated process, from forest to steel, combines innovation, sustainability and industrial excellence, while fostering development across six local communities.

Wood and charcoal transportation are essential logistics activities that sustain Aperam's stainless steel production and require high levels of attention and safety from drivers. The "Safe Driving" project adopts a comprehensive approach focused on drivers, vehicles and monitoring systems, addressing key risks and ensuring safer operations. By protecting these essential professionals, the initiative directly supports the reliability and continuity of Aperam Steel production.

Aperam BioEnergia operates in a vast territorial area encompassing six municipalities in the Jequitinhonha Valley (MG), in addition to a coal receiving unit located in Timóteo. This operational configuration results in an intense daily flow of light and heavy vehicles, which together travel more than 1.5 million kilometers per month. With more than 1,000 drivers involved in the operations, road transport is consolidated as one of the fundamental pillars for the continuity and sustainability of the company's activities.

In an operational model heavily dependent on mobility, virtually all stages of the production process are connected through road transport. The movement of people, the transport of timber, charcoal, supplies, and equipment make road logistics a critical element for the business to function. Furthermore, more than 90% of the company's activities take place in the field, requiring the constant use of vehicles and machinery not only for production processes but also for the movement of teams and to support forestry and industrial operations.

This operational dynamic structures a complex logistics network composed of different types of vehicles and applications: triple-trailer trucks for transporting wood, trucks dedicated to transporting charcoal and seedlings, flatbed trucks used for moving heavy machinery, tanker trucks for supplying water to work sites, dump trucks used for road maintenance, crane trucks for supporting maintenance and lifting loads, as well as buses, minibuses, and light vehicles intended for transporting employees.

Within this scenario of high operational intensity, diverse equipment, and vast territorial reach, the company identified the implementation of a structured road safety program as a strategic challenge. The objective is to guarantee the physical integrity of drivers, employees, service providers, and communities that share the roads used by the operation. The high volume of travel, combined with the varying road conditions—many of them rural—and the diversity of operational profiles, highlighted the need to strengthen safety management in transportation.

Why?

Before the project was implemented, the logistics of transporting coal and wood were entirely outsourced, carried out by service providers operating with dilapidated fleets, lacking standardization and effective operational safety management. This reality presented a critical challenge: reconciling productive continuity with the protection of life, in a context with a high potential for accidents.

In addition to technical and structural weaknesses, recurring risky behaviors were observed among drivers, such as:

- Using a cell phone while driving;
- Not wearing a seatbelt;
- Prolonged work hours that cause fatigue and loss of attention.

This scenario highlighted the urgent need for a structured approach to ensure standardization, control, and a safety culture in transportation, reducing worker exposure and ensuring operational efficiency.

Needed action

Given the challenging scenario of intense road traffic and high exposure to risk, it has become essential to structure an integrated approach to road safety management, capable of standardizing operational practices, strengthening controls, developing skills, and consolidating a preventive culture among all professionals involved in transportation activities.

The implementation of this program represented a milestone in the maturation of risk management at Aperam BioEnergia, uniting technical, behavioral, and managerial aspects around a common goal: preserving lives and ensuring safe and sustainable operations.

Following a comprehensive diagnosis and several studies, the first step was to internalize transportation activities, ensuring full governance of processes under in-house management. This strategic decision allowed for greater operational control, identification of vulnerabilities, and direct implementation of improvement actions, resulting in the creation of the Safe Driving Program.

Initially structured around three fundamental pillars — Driver Aptitude, Vehicle Safety, and Continuous Management and Monitoring — the program has become the central axis of accident prevention actions in all of the company's wheeled operations.

Pillar 1 - Driver Aptitude:

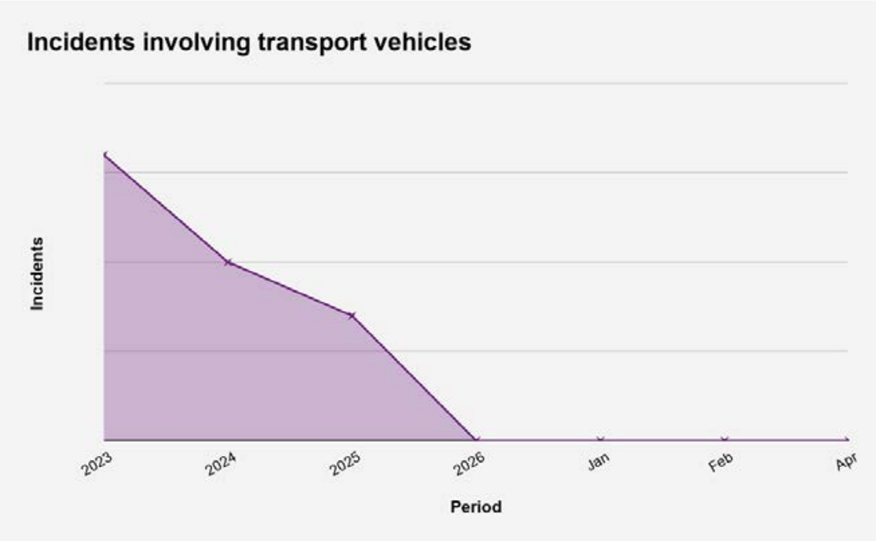
To ensure that all drivers operate in adequate physical, psychological, and technical conditions, rigorous controls have been instituted from the hiring

process to the training and maintenance of driver competence. Among the main actions:

- Specific clinical and psychological examinations for the driver role;
- Theoretical and practical training in defensive driving and road safety;
- Internal integration and training program for new drivers;
- Periodic health reassessments, including the use of a breathalyzer and toxicological tests;
- Driver accreditation and aptitude validation system;
- Emergency response drills to reinforce operational readiness.

Pillar 2 - Vehicle safety:

Fleet reliability was strengthened with a robust preventive and corrective



maintenance plan, supported by a dedicated technical team responsible for monitoring and overseeing all units. Implemented actions include:

- Daily checklists and periodic technical inspections;
- Definition of minimum safety requirements by vehicle type;
- Periodic fleet renewal and replacement;
- Safety assessments conducted by leadership and technical staff;
- Issuance of vehicle technical inspection reports at defined intervals;
- Real-time fleet management system integrating maintenance, tracking, and performance monitoring.

Pillar 3 - Continuous Management and Monitoring:

To ensure continuous monitoring of the operation, a 24-hour Monitoring Room was created, equipped with state-of-the-art technological systems for tracking, diagnosing deviations, and immediate intervention. Among the solutions implemented:

- Complete telemetry and geofencing setup with speed limits and driver alerts;
- Monitoring of fatigue and behavior, with real-time readings of distractions, fatigue, cell phone use, and failure to wear a seatbelt;
- Roadway scanning (load and alignment simulator) to determine the ideal speed for each curve and critical sections;
- Intelligent/Spoken Route Planner, which provides advance auditory

guidance on the route and recommended speed, as well as generating records of deviations made;
- Implementation of the Just Culture Policy, which values safe practices and addresses deviations in an educational and proportionate manner;
- Gamification program for recognizing drivers with the best performance in safe and efficient driving;

With these actions, the Safe Driving Program has established itself as a strategic initiative, promoting not only the reduction of accidents, but also the strengthening of the safety culture, the engagement of drivers, and operational efficiency throughout the Aperam BioEnergia logistics chain.

Action review

Specific: To implement and maintain a structured road safety program (Safe Driving) at Aperam BioEnergia, based on three pillars – Driver Aptitude, Vehicle Safety, and Continuous Management and Monitoring – covering 100% of its own transport operations (people, wood, coal, supplies, and machinery).

Measurable:

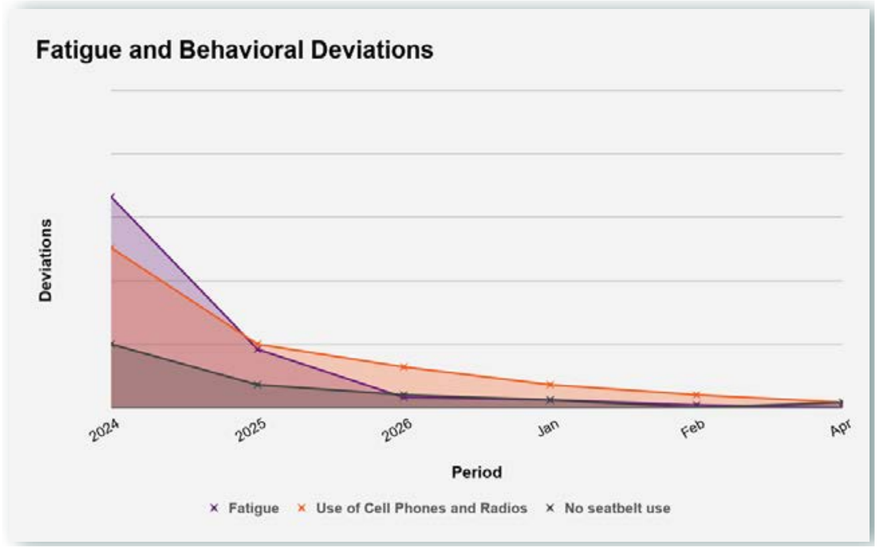
- Reduce the number of accidents involving company-owned fleet vehicles by 75% within 24 months.
- Ensure that 100% of drivers are licensed, trained in defensive driving, and undergo periodic health assessments and toxicological tests.
- Ensure that 100% of the fleet meets minimum safety requirements and undergoes preventive maintenance on schedule.
- Monitor 100% of movements in real time using telemetry, electronic fences, and fatigue/behavioral systems.

Achievable: The goals will be achieved through the outsourcing of transportation, the creation of a 24-hour Monitoring Room, a dedicated maintenance team, the implementation of medical and psychological controls, internal training, telemetry, Intelligent/Spoken Route Planning, gamification programs, and the application of the Just Culture Policy, using human and technological resources already planned in the company's strategy.

Realistic: This initiative is critical to preserving the lives of employees and third parties, reducing material losses and operational disruptions, increasing the maturity of risk management, strengthening the company's image as a safe and responsible organization, and supporting the sustainability of operations in an organization where more than 90% of activities are in the field and entirely dependent on road transport.

Time-bound:

- Implement all pillars of the Safe Driving Program within 12 months.
- Achieve a 75% reduction in road accidents within 24 months of full implementation.
- Continuously maintain quarterly compliance indicators (training, exams, maintenance, inspections, and monitoring) with a target of ≥ 95% compliance.



Horizontal Expansion Capability

Yes. The Safe Driving Program has full expansion potential to other companies within the group, as it is structured around pillars, processes, and management tools that can be replicated and standardized across different units, requiring only the necessary adaptations for each operational context. It is a corporate road safety model supported by technology, clear driver aptitude criteria, fleet requirements, real-time monitoring, and safety culture management practices, making it scalable and aligned with the group's strategic guidelines.

Outcome

Since its implementation, the Safe Driving Program has provided significant benefits to Aperam BioEnergia, with a substantial reduction in traffic incidents, a strengthened safety culture, and greater operational reliability. The strategic combination of prioritizing transportation, structured driver training, rigorous fleet maintenance, and 24-hour monitoring—with advanced telemetry and fatigue detection systems—has resulted in a decrease in risky behaviors, accidents, and near-misses, as well as increased vehicle availability for operation.

The results are impressive:

- 72% reduction in episodes of fatigue and drowsiness while driving;
- 64% reduction in seatbelt warnings;
- 60% reduction in alerts for cell phone and radio use while driving;
- 56% reduction in dangerous occurrences (near-misses) compared to the initial period.

These concrete indicators confirm the tangible gains of the program, demonstrating the evolution of maturity in road safety and positioning Aperam BioEnergia as a benchmark in preserving life and operational excellence.

Early Detection of CAP Trimming Abnormalities Using AI Image Processing

Member Company

JFE Steel

The challenge

In the Cold Annealing and Pickling Line (CAP, Fig. 1), a finishing line of stainless steel, trimming scrap generated during coil edge trimming sometimes became clogged and protruded from the equipment. This posed a significant safety risk, as delayed detection could lead to severe scrap entanglement. The objective of this initiative was to develop a system that detects trimming abnormalities in real time using AI-based image processing and automatically stops the trimming equipment, aiming to reduce the workload associated with scrap handling and improve operational safety. In addition, the system aimed to improve product quality by preventing interruptions of trimming in the middle of the process, and to enhance operational stability by avoiding reprocessing in downstream processes.

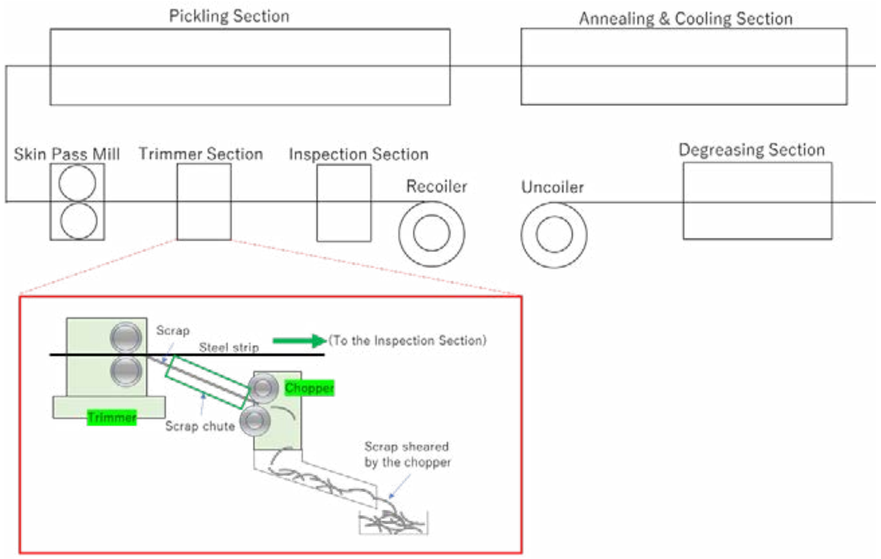


Figure 1: CAP Line and Trimmer Section

Why?

In the CAP trimming process, sheared scrap frequently accumulated inside the chute and protruded outward. Operators were required to monitor the process while simultaneously performing surface inspection tasks, making immediate detection difficult. When detection was delayed, scrap became so severely entangled inside the equipment (Fig. 2), that the operators were forced to fully enter the machine, manually disentangle the scrap, and pull it out. This task was performed near the operating equipment and represented a high-risk task. Therefore, this initiative aimed to shift from an approach dependent on human awareness and judgment to a system in which equipment autonomously detects abnormalities and avoids hazardous conditions.

Figure 2: Complexity entangled scrap

Needed action

An AI-based image judgment system was introduced in the CAP trimming process to detect trimming scrap protrusion at an early stage. The system consists of two industrial GigE cameras, a GPU, and an alarm device, forming a simple and robust configuration (Fig. 3). When an abnormality is detected, the AI system issues an alarm within as short as 0.2 seconds (and always within 0.5 seconds)

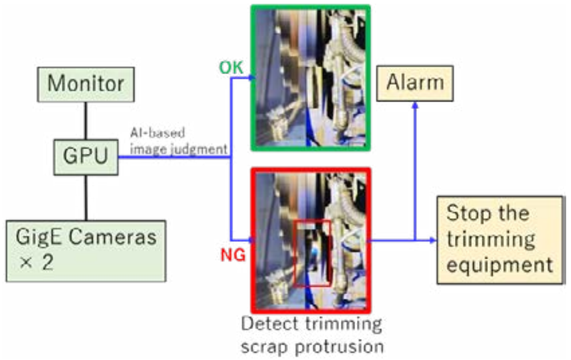


Figure 3: AI-based image judgement system

and simultaneously stops the trimming equipment. By stopping the process before scrap becomes severely entangled, operators can safely dispose protruding scrap using dedicated tools, without entering the equipment. More than 1,000 annotated training images were prepared, and after on-site validation, the system was transitioned to full-scale operation.

Action review

Specific: The system was designed and implemented as a minimal-configuration AI-based image judgment system with the specific objective of detecting the protrusion abnormalities of sheared scrap immediately and automatically stopping the trimming equipment. The fundamental design concept of the system is to minimize operator exposure to hazards during sheared scrap handling.

Measurable: The detection rate of abnormal protrusion of sheared scrap is 100%, with a false-detection rate is 1.0% or less. In addition, no occupational injuries related to sheared scrap handling have occurred since the system introduction. Under conventional ITV-based monitoring, it took at least five seconds for operators to respond after the occurrence of scrap protrusion. As a result, approximately 5% of coils required manual extraction of entangled sheared scrap from the equipment. After the system implementation, the time from abnormality occurrence to automatic trimming stoppage was reduced to less than one second. Consequently, the frequency of extraction work decreased to approximately 0.5% or less. Even when extraction is required, the sheared scrap is no longer severely entangled, and the handling workload is significantly reduced.

Achievable: The final system specification successfully resolved the initial issues, and stable operation has been maintained without abnormalities.
Realistic: The system adopts a realistic configuration integrated with existing equipment and can be operated without increasing operator monitoring workload.

Time-bound: After a three-month period of learning and improvement, the system was transitioned to full-scale operation and has already been standardized into the production process.

Horizontal Expansion Capability

This initiative is based on a versatile safety design concept that combines image-based abnormality detection with immediate automatic shutdown. It is not limited to the CAP trimming process but can be applied to other operations

involving safety risks. For example, the same AI image processing concept has been successfully applied to fire prevention by automatically stopping welding sequences when inflammables such as pieces of interleaving paper are detected near welding equipment.

Outcome

The early detection of trimming scrap protrusion and automatic stoppage of the trimming equipment significantly reduced the workload associated with scrap handling and improved workplace safety. As a result of this system, operators are no longer required to enter the equipment after line stoppage to disentangle and pull out heavily entangled scrap. Instead, protruding scrap can be handled safely using tools, thereby reducing direct exposure to hazards. Operational benefits include reduction of defective cut surfaces, improvement of yield and process flow, avoidance of line stoppages, and the continuous generation of significant cost reduction benefits.

Other comments

It is planned to deploy this system to trimming lines at other plants and to continuous monitoring systems for equipment related to product quality.

Unmanned operation

Member Company

Aperam

The challenge

Aperam BioEnergia, part of the Aperam Group, is a key driver of sustainable stainless steel production in Brazil. Operating over 150,000 hectares of certified forests in the Jequitinhonha Valley, it supplies renewable charcoal that replaces coal in blast furnaces, significantly reducing the carbon footprint of Aperam Green Steel. This fully integrated process, from forest to steel, combines innovation, sustainability and industrial excellence, while fostering development across six local communities.

As safety is a priority to Aperam, Aperam BioEnergia is advancing safety through its “Unmanned Operation” project, using cutting-edge technology to remove people from hazardous activities and redefine standards in safe, low-carbon steel production.

The main challenge was to reduce operator exposure to field environment risks such as weather, noise, vibration, and movement, in addition to operational time losses. Our goal was to develop a remote operation solution, allowing equipment control from a distance in a controlled environment.

Why?

The traditional model presented operational limitations and risks to employees.

Remote operation enables:

- Greater efficiency
- Risk reduction

- Improved working conditions
- Inclusion and diversity

Needed action

- Operational process analysis
- Development of a remote system with cameras and sensors
- Operational testing and adjustments
- Operator training
- Operation monitoring

Action review

Specific: We conducted a detailed evaluation of the traditional bucking operation to identify opportunities related to productivity, safety, and operator exposure.

Based on this analysis, we developed and implemented a remote operation

system, integrating cameras, communication systems, and remote control interfaces that allow the operator

to control the equipment from a remote station in a controlled environment. We also performed operational tests, system adjustments, and operator training to ensure a safe and efficient implementation.

Measurable: The implementation generated measurable operational improvements. By eliminating operator travel to the field and reducing time associated with shift transitions, we increased the effective operational hours of the equipment. In addition, operator exposure to field risks such as weather conditions, noise, vibration, and transportation hazards was significantly reduced.

Achievable: The initial objectives were successfully achieved. The remote operation system was implemented and validated, enabling the operator to perform bucking activities from a remote station while maintaining operational efficiency and safety. The solution proved to be viable and aligned with the goals of improving productivity, safety, and innovation in forest operations.

Realistic: The actions were realistic and feasible because they were based on existing technologies such as remote control systems, cameras, and communication infrastructure. The project was developed gradually, starting with operational analysis, followed by system implementation, testing, and operator training to ensure a reliable transition to the new operational model.

Time-bound: The implementation followed the planned timeline. The stages of analysis, system development, testing, and operational validation were completed within the expected timeframe, allowing the remote operation to be introduced in a structured and controlled manner.

Horizontal Expansion Capability

Yes. The solution has strong potential to be replicated in other areas of the company and in similar operations across the group. The remote operation concept can be applied to different equipment and activities, improving efficiency, reducing operator exposure to risks, and accelerating innovation in forest operations.

Outcome

The implementation of the remote bucking operation generated significant benefits across safety, employee well-being, operational efficiency, and cost management.

One of the most important impacts was the reduction of operator exposure to harsh field conditions such as weather, dust, noise, vibration, and transportation risks. By removing the need for frequent travel to the work site, we created a safer and more controlled working environment, contributing directly to improved occupational health and safety.

The initiative also improved employee quality of life and job satisfaction. Operators can now perform their activities from a remote station located in a controlled environment closer to the city, reducing daily travel and providing more comfortable working conditions. This approach makes the role more attractive and aligns forestry operations with modern technological trends.

From a business perspective, the elimination of daily field travel generated an average gain of approximately four additional operational hours per day, significantly increasing equipment utilization and operational productivity.

In addition, the initiative reduced operational costs associated with vehicle rental, maintenance, and fuel consumption, since support vehicles are no longer required for operator transportation. The use of personal protective equipment (PPE) was also reduced because operators no longer need to access the field as frequently.

Overall, this initiative delivered measurable improvements in safety, employee well-being, operational efficiency, and cost optimization, while also reinforcing the company's commitment to innovation and modernization in forestry operations.

Other comments

This initiative represents an important step in the modernization of forestry operations,demonstrating how technology can be used to generate simultaneous gains in safety,operational efficiency, and employee quality of life.

Beyond the direct benefits already observed, the project also supports a cultural shift within the operation, encouraging the search for innovative solutions that challenge traditional field workmodels. The implementation of remote operation shows that it is possible to increase productivity while reducing employee exposure to operational risks.

Another important aspect is the initiative's potential for scalability. The solution can be adapted to other operations and equipment, expanding efficiency and safety gains across different areas of forestry activities.

Therefore, more than a single operational improvement, this initiative represents a meaningful step toward using technology to transform how forestry operations can be performed in the future.

Sustainability Case Studies

Introduction to the Sustainability Award

Objective:

To recognize efforts that contribute to environmental, social, and economic sustainability in the stainless steel industry.

Evaluation Points Examples

- Quantifiable outcomes (eg; emissions reductions, improvements in recycled materials usage rates).
- Broader social impact (eg; contributions to local community, job creation)
- Efforts to build inclusive and supportive workplaces that improve employee retention and promote long-term engagement.

Initiatives Examples

- Environmental impact:
  Reduction of CO_2 emissions, energy savings, waste minimization, or adoption of renewable energy sources.
- Product design
  Lowering life cycle environmental impact through Life Cycle Assessment or designing for recycling and circularity.
- People-oriented initiatives:
  Promoting diversity and inclusion, supporting employee well-being, or improving workplace environment, and increasing employee retention.
- Economic sustainability:
  Implementing environmentally responsible strategies that are financially viable and support long-term business success.

SIDECO Blue Footprint – Hybrid Water Leak Detection and Control System

Member company

Acerinox Europa

The Challenge

Acerinox Europa's industrial water distribution network at the Los Barrios plant (Cádiz, Spain) suffered from uncontrolled, undetected water leaks causing persistent losses of up to 30 m³/h. The traditional management model was entirely reactive: leaks were reported manually via phone calls, response times were long, and there was no systematic tracking of incidents or repairs. Critical points such as cooling towers, pump bases, drainage channels and the metallurgical laboratory faced overflow risk, with direct consequences for the plant's water footprint.

Why?

Water scarcity in Andalusia creates structural pressure on industrial water use. Acerinox Europa's Integrated Environmental Authorisation (AAI) sets binding obligations on water management, and the plant's sustainability strategy includes explicit targets to reduce the water footprint indicator. Uncontrolled leaks represented a measurable loss of treated water (up to 109,500 m³/year at baseline), with associated energy and treatment costs, and risk of regulatory non-compliance and environmental sanctions. The urgency to act was reinforced by the escalating severity of drought conditions in the region.

Needed action

A three-component hybrid system was designed and deployed using internal talent with zero external consultants:

1. Web Leak Flow Estimator: A proprietary prototype web tool that quantifies leak flow rate (L/h) from a photograph, eliminating the need for risky manual flow measurements in active industrial areas.
2. Low-cost IoT Overflow Detectors (~€10/unit): Humidity sensors combined with Wi-Fi control boards installed at critical overflow points (Calderas drainage channel, cooling tower bases, water treatment overflows, office basements). Devices send instant alerts upon detection.
3. Google Workspace Automation Platform (Sheets + Forms + Apps Script): Zero additional software cost. The platform centralises incident reporting, auto-generates repair work orders, dispatches individual and weekly summary alerts to maintenance managers, processes repair confirmations, and archives the full historical incident database.

Action review

Specific: The SIDECO system has been developed by the factory´s environmental team and deployed across Acerinox Europa's Los Barrios factory (Cádiz, Spain), targeting all identified high-risk water overflow and leak points within the industrial distribution network.

Areas where has been implemented:

Critical monitoring points were selected

based on historical incident frequency and potential environmental impact:

- AP lines recirculation circuits
- Cooling tower
- BA lines pumps
- Boiler drainage channels
- Laboratory water outlets
- Office building basements
- Water treatment plant overflows

Points installed

Hardware: Low-cost IoT overflow detectors

Each monitoring point was equipped with an IOT humidity/flood sensor paired with a Wi-Fi control board. Unit cost: approximately €10. Installation requires no cabling infrastructure beyond standard power supply — existing plant Wi-Fi coverage is sufficient for data transmission.

Installed IOT dispositive.

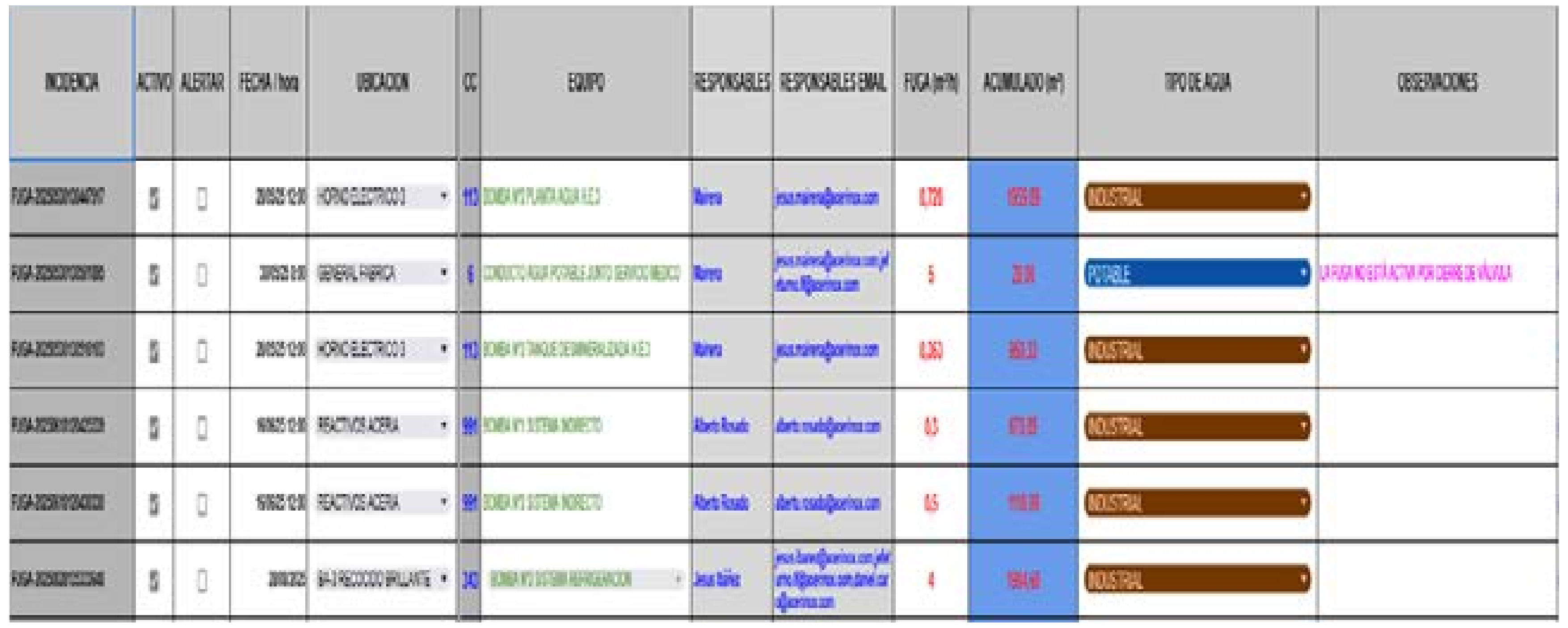
Installed IOT dispositive.

Web tool: Leak Flow Estimator

In parallel, a proprietary web-based prototype tool was developed internally to quantify leak flow rate (L/h) from a photograph of the leak. This eliminates the need for manual flow measurement in active industrial areas, removing both safety risk and measurement error.

Adaptive web-based prototype tool to quantify leaks flow rate.

Software: Google Workspace automation platform



The control and management layer, runs entirely on Google Workspace (Sheets, Forms, Apps Script) — available at zero additional software cost. The platform:

- Receives alerts from IoT devices in real time
- Auto-generates repair work orders and dispatches them to maintenance teams
- Sends individual incident notifications and weekly summary reports to managers
- Logs all incidents, response times and repair confirmations
- Maintains a searchable historical archive of the full incident database

Measurable: Baseline leak discharge estimated at 30 m³/h = 109,500 m³/year potential loss. Projected reduction of 15–25% = ~20,000 m³/year of water saved. Quantified direct annual savings: €16,270 (water supply cost) + €2,852 (pumping energy) + >€10,000 (indirect: treatment, maintenance, regulatory risk avoidance) = >€29,000/year total. Payback period: weeks. Water footprint reduction directly traceable to leak elimination events logged in the platform.

Achievable: All three system components were delivered using existing resources: internal engineering expertise, standard IoT components (COTS), the plant's existing Wi-Fi infrastructure, and Google Workspace licences already available at no additional cost. No SCADA integration, no proprietary software, no external contractors. The first IoT overflow

detection was logged on 8 September 2025 and alert emails were dispatched to maintenance managers at the end of 2025, confirming the system was fully operational within the planned timeframe.

Realistic: The system was designed from the outset to be deployable within the constraints of an industrial plant environment: available Wi-Fi coverage,

standard electrical supply, and no IT infrastructure changes required. Hardware cost of ~€10/unit made large-scale rollout financially viable. The Google Workspace platform required no software procurement. All objectives set for 2025 were achievable with internal resources, and the v2.0 report (sept. of 2025) confirms targets were met on schedule.

Time-bound: Project initiated 2024; v1.0 system operational by mid-2025; v2.0 report issued Dec 2025 confirming full deployment. First automated detection event: 8 September 2025. Weekly alert summaries active from August 2025. All core milestones delivered within the original timeline. Next phase (v2.0): LoRaWAN/NB-IoT extension to non-Wi-Fi industrial zones, planned for 2026.

Horizontal Expansion Capability

The SIDECO system is architecturally designed for seamless replication. All components use standard, universally available technology: Google Workspace (available to any Acerinox Group entity), if needed other commercial off-the-shelf IoT sensors (~€10/unit), and standard Wi-Fi or, in future, LoRaWAN/NB-IoT for areas without Wi-Fi coverage. The Web Leak Flow Estimator is a portable web application deployable at any facility. The entire system can be replicated at any Acerinox Group plant or any stainless steel industry member company at minimal cost, with no dependency on proprietary infrastructure. This makes SIDECO a transferable industry-wide best practice for affordable water management.

Outcome

Environmental: ~20,000 m³/year water saved; reduction in CO_2 emissions from avoided pumping energy; reinforced compliance with Integrated Environmental Authorisation obligations; measurable improvement in water footprint KPI (m³/tonne steel).

Operational: Automated real-time alert system replaces manual telephone-based incident reporting; centralised incident database with full repair traceability; weekly executive summaries for management; response times reduced from hours to minutes.

Financial: >€29,000/year in direct and indirect savings; ROI payback in weeks; total system cost under €5,100.

Cultural: Raised water awareness across maintenance and environmental teams; visual representations of leak losses (m³/h converted to equivalent volumes) used in internal communication and training.

Other comments

SIDECO positions Acerinox Europa as an industry benchmark in accessible, high-impact water management. The project demonstrates that outstanding environmental and financial results can be achieved without large capital investment or complex technology — by combining freely available platforms (Google Workspace), ultra-low-cost commercial IoT hardware, and a bespoke web estimation tool developed with internal talent.

In a region facing structural water scarcity (Andalusia, southern Spain), SIDECO represents a direct and measurable response to one of the most pressing environmental challenges facing the stainless-steel industry. Its modular design and near-zero replication cost make it immediately applicable across the global stainless- steel sector.

This submission reflects Acerinox Europa's commitment to embedding sustainability into everyday operational practice — not only through large-scale capital projects, but through innovation, ingenuity, and the intelligent use of existing resources.

Água Circular: Water Sustainability in Aperam and the Jequitinhonha Valley

Member company

Aperam

The Challenge

Aperam BioEnergia, part of the Aperam Group, is a key driver of sustainable stainless steel production in Brazil. Operating over 150,000 hectares of certified forests in the Jequitinhonha Valley, it supplies renewable charcoal that replaces coal in blast furnaces, significantly reducing the carbon footprint of Aperam Green Steel. This fully integrated process, from forest to steel, combines innovation, sustainability and industrial excellence, while fostering development across six local communities.

Water is a strategic resource in Aperam BioEnergia's operations, particularly in nursery and charcoal production, requiring disciplined and forward-looking management in a region historically impacted by low rainfall. The "Circular Water" project enables the reuse of treated domestic effluent from a local municipality, advancing circularity, reducing pressure on natural water sources and increasing resource efficiency across operations. By strengthening environmental resilience and securing the sustainability of key inputs, the initiative reinforces the integrity of the value chain and directly underpins the low-carbon, responsible production of Aperam Steel.

Aperam BioEnergia operates in the Jequitinhonha Valley, a region historically affected by long periods of drought and severe water scarcity. Despite operating within the limits permitted by water rights, the company recognized the need to reduce its dependence on natural water sources and strengthen the sustainability and resilience of its operations.

The challenge was to develop an innovative and sustainable solution capable of increasing water availability for forestry operations while preserving local water resources and maintaining harmonious coexistence with surrounding communities.

To address this challenge, Aperam BioEnergia developed the "Água Circular" (Circular Water) project, aiming to transform sanitary effluent generated in nearby municipalities into a safe and reliable water source for use in the company's forestry operations, promoting water reuse and strengthening circular economy practices.

Why?

The Jequitinhonha Valley faces chronic water scarcity, which directly impacts forestry productivity, operational stability, and regional water security.

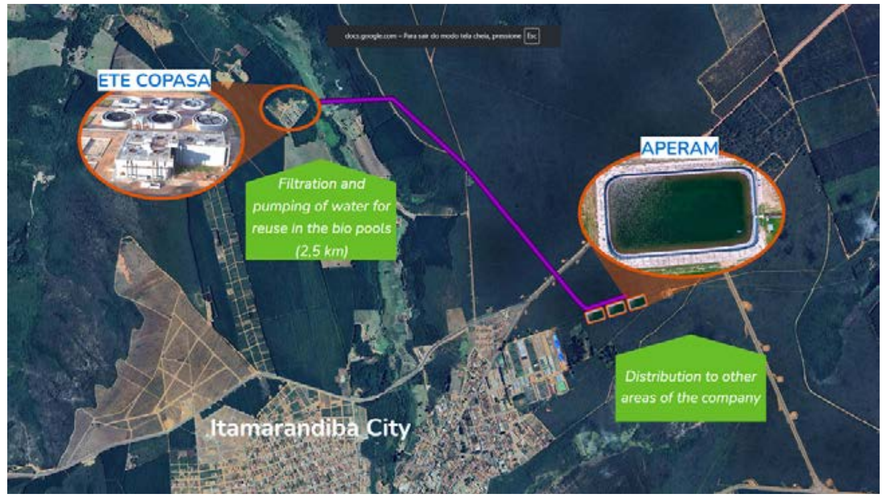
In this context, it became essential to seek alternative water sources that could ensure the continuity and efficiency of Aperam BioEnergia's operations while reducing pressure on natural water bodies used by both the company and local communities.

Additionally, sanitary effluent treated by the local sanitation company (Copasa) was previously discharged into rivers after treatment. Although compliant with regulations, this discharge still generated discomfort for the population and represented a missed opportunity for resource reuse.

By addressing this challenge, the company sought to:

- Strengthen sustainable water management.
- Promote circular economy principles.
- Reduce environmental impacts.
- Increase water security for forestry production.
- Contribute positively to regional environmental and social sustainability.

Needed action



Aperam BioEnergia implemented the Água Circular project, establishing a strategic partnership with the Government of the State of Minas Gerais and Copasa to reuse treated sanitary effluent from the municipality of Itamarandiba.

The project was conducted by a multidisciplinary team involving professionals from environmental management, silviculture, nursery operations, and safety.

The main actions included:

- Technical feasibility studies to evaluate the characteristics of the effluent and define appropriate treatment requirements.
- Selection and implementation of a robust treatment system capable of performing filtration and ensuring compliance with environmental and sanitary standards.

- Field testing and validation, including controlled irrigation tests in nurseries and planting areas to confirm that the treated water would not affect seedling development or operational performance.
- Continuous environmental and operational monitoring, including laboratory analyses, irrigation records, and seedling survival assessments.
- Establishment of strategic partnerships with public authorities and Copasa to formalize the reuse process.
- Implementation of water logistics, initially through tanker trucks and, in the near future, through a dedicated pipeline system with pumping stations to transport treated water directly to Aperam's operations.

The project was structured using the PDCA methodology (Plan, Do, Check, Act) to ensure systematic planning, validation, and

continuous improvement.

- Plan: structured planning of the stages together with the operational areas.
- Do: In this phase, the technical feasibility, the effort required for implementation, and the potential environmental and productive gains were evaluated.
- Check: Controlled tests of effluent use in Aperam BioEnergia's processes were carried out, monitoring all parameters required by environmental and sanitary legislation.
- Act: With confirmation of regulatory compliance and safety for employees, the project was validated and definitively implemented.

Action review

Specific: The project implemented a structured process to collect, treat, and reuse sanitary effluent from the municipality of Itamarandiba. Actions included technical studies, installation of a treatment system, irrigation field tests, environmental monitoring, and the establishment of infrastructure to transport treated water to Aperam BioEnergia's forestry operations.

Measurable: The system currently treats and pumps 35 liters per second of treated effluent, representing approximately 1.1 million cubic meters of reused water per year. This volume replaces water that would otherwise be collected from natural sources.

Additional measurable indicators include:

- Volume of reused water
- Compliance with water quality standards
- Seedling survival and growth performance
- Reduction in water intake from reservoirs

Achievable: The project successfully met its initial objectives. Field tests confirmed that the treated effluent met environmental and sanitary requirements and did not negatively affect seedling

production or forestry activities.

As a result, the reuse system was validated and incorporated into the company's operational processes.

Realistic: The actions were technically and operationally feasible, supported by multidisciplinary expertise and collaboration with public authorities. The treatment system was designed to comply with environmental regulations and to integrate efficiently with existing forestry operations.

Time-bound: All project phases—from feasibility studies and testing to validation and implementation—were completed according to the planned schedule. The project is currently operational and will be further optimized with the upcoming installation of a dedicated pipeline system.

Horizontal Expansion Capability

The project has a high level of scalability and replication potential. Its modular treatment structure and operational model allow it to be adapted to other Aperam units, as well as to other industrial sectors located in regions facing water scarcity. The initiative also demonstrates an effective model of collaboration between industry and public sanitation systems, which can be replicated in municipalities where treated sanitary effluent is available but underutilized.

The relevance and innovative nature of

the Água Circular project were publicly recognized by the Governor of the State of Minas Gerais, Romeu Zema, and by AMIF (Associação Mineira da Indústria Florestal) during an official event highlighting sustainable initiatives in the forestry sector.

On that occasion, AMIF expressed its support for expanding the project across the forestry sector in Minas Gerais, recognizing its potential to strengthen water resilience and promote circular water management within the industry. Aperam BioEnergia also formally demonstrated its interest in supporting the broader adoption and expansion of the initiative, reinforcing its commitment to sharing best practices and contributing to the sustainable development of the forestry sector.

This recognition reinforces the project's potential to become a benchmark for sustainable water reuse in forestry operations, encouraging other companies to adopt similar circular economy solutions.

Outcome

The project has generated significant environmental, operational, and social benefits.

Environmental Benefits

- Replacement of natural water sources by 1.1 million m³ of reused water per

year.

- Reduction in pressure on regional reservoirs and preservation of water bodies.
- Lower risk of pollution, as treated effluent is no longer discharged into local rivers.

These benefits contribute directly to environmental protection and the long-term sustainability of regional ecosystems.

Operational and Business Efficiency

- Increased water availability for forestry operations, particularly for nurseries and irrigation activities.
- Greater operational stability, enabling activities such as planting even outside the rainy season.
- Reduced operational risks related to water scarcity.
- Lower costs associated with water collection and transportation.

These improvements strengthen

operational efficiency, productivity, and the resilience of the company's production chain.

Social and Community Benefits

- Preservation of local water reservoirs that directly supply surrounding communities.
- Reduced environmental discomfort previously associated with effluent discharge into rivers.
- Strengthening of relationships with local stakeholders and authorities.

Employee Health, Safety and Job Satisfaction

The project ensures safe reuse through strict environmental and sanitary monitoring, guaranteeing that water quality meets regulatory standards and protecting employees involved in nursery and forestry operations.

The initiative also reinforces a strong sustainability culture within the company, increasing employee engagement and pride in contributing to innovative environmental solutions.

Other comments

The Água Circular Project represents a pioneering and transformative initiative in Brazil's forestry sector, demonstrating how industrial operations can successfully integrate circular economy principles into water management while advancing sustainable production practices.

Beyond its immediate operational gains, the project plays a strategic role in strengthening water security in the Jequitinhonha Valley, a region historically affected by severe water scarcity. Through a collaborative model that integrates industry and public sanitation infrastructure, the initiative establishes a scalable and replicable solution capable of being adopted by other regions and sectors facing similar water challenges.

By transforming treated sanitary effluent into a valuable and reliable production resource, Aperam BioEnergia not only reduces pressure on natural water sources but also reinforces its leadership in sustainability, environmental innovation, and responsible stewardship of natural resources.

Video: ÁGUA CIRCULAR.mp4

Water Security and Circularity: Implementing Shade Ball Technology for Evaporation Control

Member company

Columbus Stainless

The Challenge

South Africa is one of the 30 most water-scarce countries in the world, characterized by low annual rainfall (around 464 mm, less than half the global average), high evaporation rates, uneven distribution of precipitation, and increasing pressures from population growth, urbanization, economic development, and climate change. As of 2026, the country faces ongoing and worsening water challenges, with projections indicating physical water scarcity emerging around 2025 and a potential 17% water deficit by 2030. Recent assessments highlight that nearly half of municipal water supply systems perform poorly or critically, non-revenue water losses exceed 46-47% due to leaks, aging infrastructure, mismanagement, and overconsumption. Events like recurrent droughts, low dam levels and localized shortages underscore the urgency. While some argue absolute scarcity is absent and issues stem primarily from governance and infrastructure failures, the consensus points to a combination of climatic, infrastructural, and demand-related factors exacerbating the crisis.

Water conservation and sustainable management remain high national priorities, as emphasized by the Department of Water Sanitation and Environment (DFFE) through initiatives like National Water Week (March 20-26 annually), awareness campaigns, partnerships for pollution prevention and recycling, and strategies under the National Water Resource Strategy (NWRS-3). Broader efforts include nature-based solutions (e.g., invasive plant removal, catchment restoration), rainwater harvesting, wastewater reuse, desalination exploration, smart metering, and integrated water resources management (IWRM) to balance demand reduction with supply enhancement.

Columbus Stainless is in a fortunate position to harvest rainfall on site by means of well-constructed and positioning of dams on site. Except from this we also are dependent on raw water supplied by the Local Municipality.

Columbus Stainless has also a dam dedicated for condensate water produced by the effluent Treatment Plant. Cost in producing the condensate is high thus the loss of water via evaporation must be limited.

Effort and process involved in recovering condensate from the North Storage Dam:

Spent pickling liquor (waste acid) is sent to the Effluent Treatment Plant for processing, where hexavalent chromium is reduced and the acid is neutralized. Metal hydroxides are then removed using plate filter presses, and the resulting brine liquid is sent to the evaporator plant.

Through the evaporation process, 95% of the water is recovered as condensate. The salts or purge from this process are sent to the crystallizer plant, where calcium sulphate is removed and calcium nitrate is recovered.

The recovered condensate is stored in a facility for reuse in the steelmaking process. However, because this is an open dam, significant evaporation losses occurred. To minimize these water losses, evaporation balls were installed in the dam

to reduce the amount of water lost to the atmosphere.

Main purpose of the water use on site is for cooling purposes.

Why?

Addressing this challenge was critical for three primary reasons:

1. **Economic Value**: Recovered condensate is of extremely high quality. Losing 21,900m^3 annually was a direct financial loss in terms of energy, chemical treatment, and procurement of replacement municipal water.
2. **Operational Resilience**: With municipal reliability at only 68% nationally, internal water security is a prerequisite for maintaining our 600,000 ton annual production capacity.
3. **Sustainability Mandate**: Under the "Acerinox Positive Impact 360º" plan, we are committed to a 20% reduction in water withdrawal and a 7.5% reduction in energy intensity by 2030. Mitigating evaporation is the most direct method to improve circularity without additional energy-intensive treatment.

Needed action

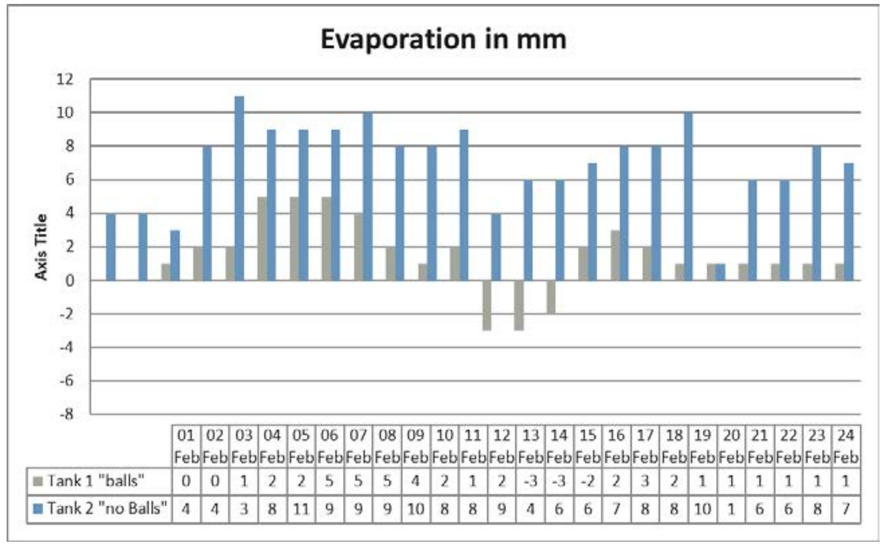
We implemented Shade Ball Technology at the North Storage Dam. This involved deploying thousands of 100mm UV-stabilized High-Density Polyethylene (HDPE) hollow spheres to create a floating cover.

- Evaporation Control: The spheres self-arrange to cover 91% of the liquid surface, creating a physical barrier that reduces evaporation by up to 90%.

- Water Quality Preservation: By blocking UV rays, the balls suppress algae growth and prevent the formation of harmful chemicals like bromate, reducing the need for energy-intensive downstream chlorine treatment.
- Low-Impact Infrastructure: Unlike rigid covers, shade balls adapt to fluctuating water levels and require zero power or mechanical maintenance.
- Wildlife Protection: The technology serves as a bird deterrent, protecting local fauna from industrial hazards and preventing feather-borne contamination.

Action review

Specific: Deployed 100mm HDPE shade balls specifically to cover the 60,000m^3 North Storage Dam to target a known 60m^3day evaporation loss.



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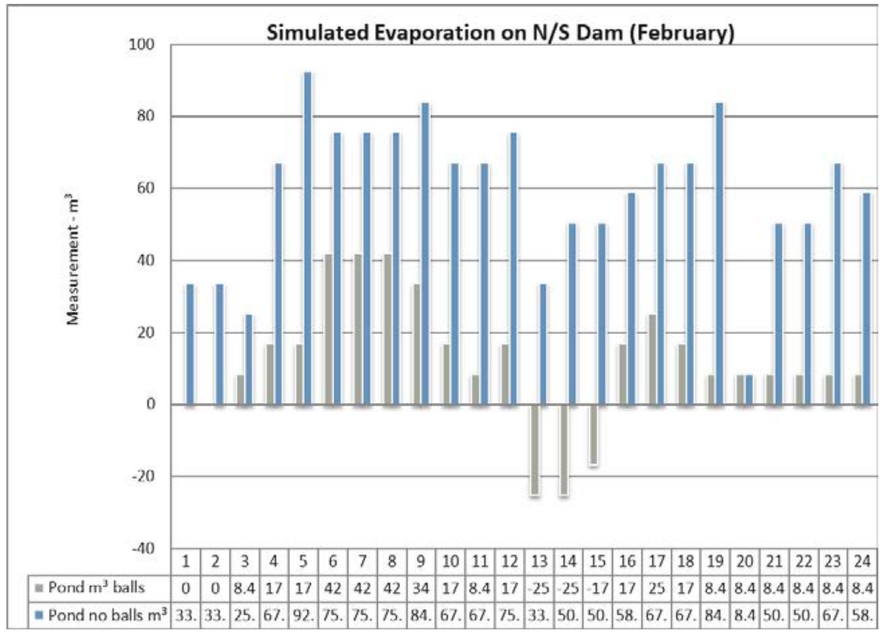
Tank 1 "balls"	0	0	1	2	2	5	5	5	4	2	1	2	-3	-3	-2	2	3	2	1	1	1	1	1	1
Tank 2 "no Balls"	4	4	3	8	11	9	9	9	10	8	8	9	4	6	6	7	8	8	10	1	6	6	8	7



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Pond m³ balls	0	0	8.4	17	17	42	42	42	34	17	8.4	17	-25	-25	-17	17	25	17	8.4	8.4	8.4	8.4	8.4	8.4
Pond no balls m³	33.	33.	25.	67.	92.	75.	75.	75.	84.	67.	67.	75.	33.	50.	50.	58.	67.	67.	84.	8.4	50.	50.	67.	58.

Measurable: Quantifiable reduction in daily evaporation by 90% (54 m^3day saved) and a measurable decrease in chlorine usage for algae control. Calculated energy savings based on the "embedded energy" of recovered condensate water—using a benchmark of 0.06 kWh/kg for treated water recovery.

Achievable: Used proven, non-toxic HDPE technology with a 25-year service life, requiring no structural modifications to the existing dam. Preventing algae growth avoids "biofouling energy creep," where even 0.001"of fouling can increase energy consumption by 10%.

Realistic: A cost-effective solution compared to rigid covers, particularly given that industrial plastic is a poor heat conductor, keeping the water thermally stable.

Time-bound: Project completed to mitigate the immediate impact of the 2025/2026 regional water crisis and meet 2030 sustainability targets.

Horizontal Expansion Capability

Yes. The approach is highly scalable:

- Within Acerinox Group: This solution can be exported to other Group facilities, particularly those in arid or high-solar-intensity regions where evaporation rates exceed 1400mm/annum.
- Industry-Wide: Steel manufacturing industry utilizing open-air cooling ponds, fire water reservoirs, or wastewater lagoons can adopt this low-maintenance approach to reduce their environmental footprint.
- Cross-Sectoral: The technology is

applicable to mining tailings ponds and municipal reservoirs, making it a key benchmark for industrial-community water stewardship.

Outcome

- **Environmental Impact:** We have conserved approximately 21,900m3 of water annually, which has directly reduced our annual carbon footprint by approximately 1,190 tonnes CO2e (calculated based on avoided energy for distillation and a SA grid emission factor of 0.906kg CO2e/kWh). Additionally, the drastic reduction in UV exposure has significantly lowered chemical consumption, improving the overall eco-efficiency of our water lifecycle by minimizing chemical discharge into aquatic ecosystems.
- **Business Efficiency & Cost:** By maintaining higher quality condensate, we have reduced scaling in cooling equipment and lowered maintenance costs. We have also mitigated the impact of municipal tariff hikes and avoided the extreme cost of emergency tanker water, which can reach R602.70kl.
- **Social Impact:** Water security ensures the operational stability of a plant that supports thousands of local jobs. This stability allows us to continue vital community programs, such as our 2025 support for 19 NGOs (including the Bethesda House of Hope) and our Food Security corporate garden.

Other comments

This initiative aligns with the South African Stainless Steel Master Plan roadmap to 2030 and demonstrates that the industry can lead the national "Year of Water Resilience". By choosing a solution with a 25-year lifespan, we ensure that the "water debt" of manufacturing the plastic is repaid many times over through decades of conservation. This project serves as a model for decentralized, industrial-led solutions to the global water crisis and demonstrates the "Water-Energy Nexus" in action, where every litre of water saved is a direct saving of the electricity required for treatment and pumping.

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About worldstainless

worldstainless is a not-for-profit research and development association which was founded in 1996 as the International Stainless Steel Forum.

Its primary roles are to undertake stainless steel industry beneficial tasks that are better coordinated centrally in the fields of

- Promoting industry and material sustainability benefits
- Conserving resources and promoting the circular economy
- Providing economic and industry-leading statistics
- Support industry health & safety needs and developments
- Outlining market development and expansion opportunities
- Maintaining brand reputational positioning
- Materials education

Contact

You can contact the worldstainless team through the following email address:

info@worldstainless.org

Disclaimer

world stainless association

Avenue de Tervueren 270
1150 Brussels
Belgium

T: +32 (0) 2 702 89 00
F: +32 (0) 2 702 88 99
E: info@worldstainless.org

C413 Office Building
Beijing Lufthansa Center
50 Liangmaqiao Road
Chaoyang District
Beijing 100125
China

T : +86 10 6464 6733
F : +86 10 6468 0728
E : china@worldsteel.org

worldstainless.org

worldstainless