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SMART BUILDINGS
& THE CARBON FOOTPRINT

As the global push towards decarbonisation accelerates, smart buildings will play an indispensable role in achieving climate goals, says Milton D'Silva.

Buildings are a major source of global energy consumption and emissions. This starts right from the construction stage, with the production of materials like cement and steel having a substantial environmental impact. Traditional building practices contribute significantly to greenhouse gas (GHG) emissions through their operational and embodied carbon footprints. While embodied carbon refers to the GHG emissions associated with the materials and construction processes of a building, operational carbon refers to the emissions from its ongoing use, such as heating, cooling, and lighting.

As greenhouse gas emissions blanket the Earth, they trap the sun's heat. This leads to global warming and climate change. According to the United Nations Climate Change portal, the world is now warming faster than at any point in recorded history. The Net Zero Goal, also known as net-zero emissions, aims to balance GHG emissions released into the atmosphere with the amount removed or absorbed. In essence, it means achieving a state where the net effect of GHG emissions on the planet is zero, effectively halting global warming, and later, even reversing the process.

As the world prepares to achieve the ambitious target of Net Zero by 2050 in line with the Paris Agreement, smart buildings form an important component of the efforts that are needed to achieve the goal. To that end, it is important to first understand what exactly is meant by a smart building.

A smart building is the one which uses technology to optimise building performance, enhance occupant experience, and improve resource efficiency. This article delves deep into the entire gamut of issues concerning the evolving smart buildings ecosystem.

The concept of smart buildings

Buildings are man-made structures used for different purposes – homes, offices, commercial establishments, warehouses, etc. Varying in size and structure, these are occupied by humans and need creature comforts like proper ventilation, adequate lighting, and air-conditioning to maintain ambient temperature conditions. Depending on the purpose the building is used for, all these requirements vary in degrees, but are nonetheless essential. Apart from the construction features that ensure natural lighting and ventilation, everything else needs energy.

A smart building is one which uses technology to optimise building performance.
Photo by LYCS Architecture on Unsplash.

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The Siemens digital building portfolio included a cloud-based building operations twin software. Graphic by Siemens Smart Infrastructure

The concept behind smart buildings is to utilise technology to automate and optimise various building systems, ultimately improving efficiency, occupant comfort, and overall building performance. This is achieved through the integration of interconnected systems, sensors, data analytics, and artificial intelligence, allowing buildings to respond to their environment and user needs. Traditionally, all the building systems like lighting, air-conditioning, access control, etc., are independent of each other, which results in high energy consumption. Regardless of building occupancy at any given moment, lights remain on, and so does the air-conditioning. What integration does is connect all these functions together into a smart system that adjusts all the parameters like lighting, heating/cooling and converts the ambient conditions into optimal for human comfort.

The benefits of such automation in buildings are many, in terms of efficiency, comfort, sustainability, safety, cost savings. Automated control and optimisation of systems reduce energy consumption and operational costs. Personalised environmental control based on occupancy and preferences improves occupant comfort and productivity. Integrated security systems offer enhanced protection and can be coordinated with other building functions. Another advantage is that data analytics from such integrated systems can identify potential issues before they escalate, enabling proactive maintenance and preventing downtime. But the most significant benefit of smart building integration is that it contributes to sustainability by reducing energy consumption, optimising resource usage, and minimising environmental impact.

The early days: PLCs and the first wave of automation

Contrary to popular perception, the movement towards building automation is not a recent phenomenon. In fact, this is something that had started in the 1960s. However, the Bosch Building Solutions portal indicates it all started with the egg incubator – the process of keeping the egg incubators heated at a constant temperature. Dutch engineer Cornelius Drebbel is credited with the invention of the world's first heat regulator for this purpose in the early 1600s. This simple mercury thermostat, one of the earliest examples of a feedback-controlled device, was so effective that it was in use until the 1970s for temperature control in buildings. The next important development was the invention of the light switch in 1884, which marked the beginning of lighting control with the progressive electrification of homes.

The most significant development in building automation however was the development of the Programmable Logic Controller (PLC) in 1968 by Richard Morley. In fact the PLC has played a foundational and highly significant role in the early days of building automation, particularly from the 1970s through the 1990s. The PLCs replaced the then prevalent, relay-based, control systems regulating building systems like HVAC, lighting, and elevators. In addition to being complex and bulky, the electromechanical relays were also difficult to reconfigure or scale, prone to failure, and hard to troubleshoot. The PLCs allowed engineers to write custom logic for controlling building functions such as time-based lighting schedules, HVAC sequencing and zoning, elevator logic coordination as well as access control logic, providing unmatched flexibility controlled by mere software updates. By controlling and optimising multiple subsystems, PLCs not only helped reduce energy consumption through more efficient operations, but more importantly, formed the technical backbone of the first-generation Building Management Systems (BMS) or Building Automation Systems (BAS).

While PLCs offer reliable control in building automation, they do have drawbacks. For example, in spite of their proven efficiency in real-time control, PLCs have limitations in terms of processing power compared to general-purpose computers, as also limited memory for complex programs and data storage. This is a big disadvantage when it comes to extensive building automation systems. Another aspect is the programming of PLCs, which needs specialised skills and knowledge, and the lack of standardisation in programming languages and protocols, which becomes acute when different makes are involved. The third major drawback of PLCs is the cost – both hardware and software – as the initial investment can be significant, including the cost of the PLC unit, programming software, and specialised training. Even with these limitations, one thing is clear – it is the humble PLC that launched the process of building automation.

Evolution into BMS and integration technologies

Following the introduction of PLCs, building automation had progressively entered the digital era replacing the analog control systems. This was aided in no small measure by the emergence of Ethernet as a cost-effective, fast, widespread and universally accepted standard for high speed data transfer during the 1980s. There were two other important developments that happened during this period. One was the rise of BIM – Building Information Management – a digital representation of a building's physical and functional characteristics. BIM is a collaborative process that allows architects, engineers, and other construction professionals to plan, design, construct, and manage buildings using a 3D model. What BIM creates is a digital representation of a building across its entire lifecycle, from planning and design to construction and operations – in other words, a digital twin. The other one was the beginning of what is now known as Building Management Systems (BMS) or Building Automation Systems (BAS). Together, BIM and BMS have revolutionised the field of building automation, with BIM facilitating effective implementation of BMS right from the planning stage of a building.

BMS is a computer-based system that controls and monitors a building's mechanical and electrical equipment like HVAC, lighting, and security systems. Its primary role is to optimise building operations for enhanced energy efficiency, occupant comfort, and safety, while also reducing operating costs. This is achieved by centralised control and monitoring of the building's mechanical and electrical systems, such as HVAC, lighting, energy, fire, and security, to ensure efficient and safe operation, improve occupant comfort, and reduce energy consumption. The control and monitoring is done by using sensors, controllers, and a central control system to manage and automate building functions.

The following points encapsulate how exactly the BMS works in practice:

1. **Data collection**: This happens via sensors placed strategically throughout the building to gather data on various parameters like temperature, humidity, lighting levels, occupancy, and energy consumption.

2. **System control**: The BMS receives data from the sensors and compares it against predefined setpoints or parameters. Any deviation triggers an alarm setting automated actions to adjust the building's systems accordingly.

3. **Real-time monitoring and management**: The BMS provides a centralised interface, often a dashboard, for real-time monitoring of building systems and their performance, and responds to alerts or alarms.

4. **Fire safety and security**: BMS can integrate with security and fire safety systems, enhancing the overall safety of the building.

All these functions are linked together through a standard industry network protocol for building automation like BACnet (Building Automation and Control networks), which is a communication protocol that enables different building automation and control systems to communicate and work together. In fact BACnet plays a crucial role in BMS by allowing various devices like HVAC systems, lighting, access control, and fire detection to exchange information and be controlled centrally. This interoperability is a key benefit, as it allows for the integration of systems from different manufacturers, avoiding vendor lock-in and offering more flexibility in system design and expansion. Like BACNET, there are other vendor neutral protocols like LonWorks or Modbus, which are also used, though BACnet is by far the popular choice.

The impact of digital transformation and the IIoT era

Traditionally building automation relied on scheduled or manual control. If BACnet enabled different building automation and control systems to communicate and work together, digital transformation and the rise of the Industrial Internet of Things (IIoT) have contributed to further the cause of BMS, making buildings smarter, more efficient, and sustainable. IIoT sensors, which are designed to connect to the internet and transmit data wirelessly to a central system for analysis and action, now continuously monitor parameters like temperature, humidity, lighting, occupancy, and air quality. This in turn has led to real-time, remote control and fine-tuning via dashboards or mobile apps, resulting in better comfort, energy savings, and faster issue resolution. A further boost is provided with data-driven decision making as digital platforms collect and analyse large volumes of building data. AI and ML algorithms help in predictive maintenance, energy forecasting, and automated optimisation. Facility managers can now proactively address inefficiencies before they escalate.

Another significant advantage of IIoT in building an automation ecosystem is the integration of subsystems that were brought together thanks to BACnet and other platforms. IIoT facilitated connecting the previously siloed systems of HVAC, lighting, fire safety, security, elevators, etc., bringing them on unified platforms that allow centralised control and interoperability. The outcome is in the form of better coordination, reduced redundancy, and improved occupant experience. The smart, IIoT-enabled sensors dynamically adjust lighting, HVAC, and ventilation based on occupancy and time of day. Smart metering and analytics reduce energy waste and carbon footprint, and as a result, net-zero and green building goals are more achievable through smart automation.

Apart from these, there are other advantages listed below that the process of connected systems have brought to BMS, thanks to IIoT:

- **Remote operations & cloud connectivity**: Cloud-based BAS platforms enable remote monitoring, troubleshooting, and updates, especially valuable for large building portfolios (e.g., retail chains, campuses).
- **Enhanced security & safety**: Smart surveillance, biometric access, and AI-based threat detection are now integrated into BAS. Fire and emergency response systems are automated and connected for rapid action. Cybersecurity protocols, now critical due to increased connectivity, can also be integrated in the system.
- **Occupant-centric experiences**: Personalised climate control, lighting, and environmental settings based on user preferences. Touchless interfaces, voice commands, and mobile integration improve convenience and hygiene.
- **Scalability and flexibility**: IIoT-enabled systems are modular and scalable, ideal for future expansion or reconfiguration. These enable adaptive reuse of buildings without major rewiring or infrastructure changes.

Digital transformation and IIoT have thus helped in turning building automation from passive control systems into intelligent, adaptive, and user-centric ecosystems – enhancing efficiency, sustainability, safety, and comfort in the built environment. Examples of modern Smart Building platforms include Siemens Desigo CC, Schneider EcoStruxure, and Honeywell Forge, among others.

ABB and Samsung Electronics have collaborated to provide energy management and smart IoT connection for buildings. Infographic by ABB

Smart buildings and the net zero challenge

Globally, buildings consume about 30% of the total energy, which includes the energy used for the day to day operations of the building plus the energy used in its construction and building materials. Of the total energy consumed by buildings, electricity accounts for 35%, which is significant, considering that industry consumes just about 42% and commercial plus public services account for the rest. Today, smart buildings are playing a pivotal role in helping cities, companies, and countries meet the Net Zero Challenge – the drive to reduce greenhouse gas emissions to as close to zero as possible.

To begin with, smart buildings help optimise energy efficiency by integrating advanced automation, sensors, and AI-driven analytics to monitor and manage energy consumption in real-time. This includes: smart HVAC systems that adjust based on occupancy and weather; automated lighting using daylight harvesting and motion sensors; and energy usage analytics to detect and eliminate inefficiencies. These steps alone can reduce building energy consumption by up to 30-50%. In addition, integration of renewable energy into smart buildings, right from the planning stage, can reduce dependency on fossil fuels and cut Scope 2 emissions. Integration of rooftop solar panels and battery storage systems to use energy when needed can generate, store, and manage renewable energy on-site, creating microgrids to manage distributed energy resources efficiently. Smart buildings can thus dynamically adjust their power usage based on grid signals and participate in demand response programs by simple steps such as shifting energy-intensive tasks to off-peak hours and selling excess energy back to the grid. This will not only help decarbonise the power grid to a certain extent but also support grid stability.

Smart water and waste management figure next on this list of smart buildings ecosystems. Efficient plumbing systems, leak detection, and greywater recycling reduce water waste. Waste management systems track, sort, and minimise waste going to landfills. These steps cut down water usage and methane emissions from waste. Further, it is possible to incorporate Lifecycle Carbon Footprint Tracking through smart building platforms by using digital twins and BIM to monitor carbon-emissions from materials, construction, and

Honeywell Forge for Buildings has delivered key outcomes at One Bangkok, the largest holistically integrated district in the heart of Bangkok. Photo by Honeywell

renovation, and optimise building materials and processes. This enables low-carbon construction and retrofitting strategies.

The real benefit of smart buildings, however, is a healthier indoor environment with improved air quality, temperature, and lighting, which not only supports the well-being of the occupants, but also reduces reliance on carbon-heavy systems like constant heating/cooling. In addition, smart buildings generate rich data streams that feed into ESG (Environmental, Social, and Governance) reporting tools and sustainability dashboards, enabling compliance with green building certifications like LEED, WELL, BREEAM, and net-zero targets. By turning buildings from static energy consumers into intelligent, efficient, and sustainable assets, they not only reduce emissions but also serve as the foundation for smart cities and sustainable urban development.

Future trends and technologies

There has been considerable movement forward in the smart buildings ecosystem during the last few years as indicated by various use cases. Smart buildings can significantly reduce energy consumption, with some studies suggesting potential savings of 18% or even higher. So what exactly will be the future of smart buildings?

Future smart buildings will be characterised by advanced IoT integration, AI-driven automation, and a strong focus on sustainability and occupant well-being. Key trends include predictive maintenance, enhanced security, and optimised energy consumption through real-time data analytics and smart building as a service models.

Here's a more detailed look at the future trends:

1. **Advanced IoT and AI integration**: Smart buildings will rely heavily on the IoT to connect various systems like lighting, HVAC, security, and access control. The AL/ML combination will automate building operations, optimise energy consumption, and enhance security. AI-driven systems will analyse data to predict potential equipment failures, allowing for proactive maintenance and minimising downtime. Virtual replicas of physical buildings will enable scenario planning, optimisation, and enhanced building management through data analysis.

2. **Sustainability and energy efficiency**: Smart buildings will strive to produce more energy than they consume, utilising renewable energy sources like solar panels and geothermal systems. Buildings will be able to interact with the smart grid to optimise energy consumption and potentially sell excess energy back to the grid. Smart buildings will leverage data analytics to identify areas for energy conservation and optimise resource utilisation. More and more buildings will incorporate natural elements like light and greenery to enhance occupant well-being and reduce energy consumption.

3. **Enhanced security and safety**: Facial recognition, behaviour monitoring, and other AI-powered technologies will enhance security and provide predictive capabilities. Robust security protocols, encryption, and regular updates will be crucial to protect connected systems from cyber threats. Voice and motion controls will minimise physical contact, promoting hygiene and reducing the spread of germs.

4. **Occupant well-being and experience**: Smart buildings will adapt to individual preferences, optimising lighting, temperature, and other factors for occupant comfort. Sensors will track and optimise air quality, ensuring healthy and comfortable environments. Smart buildings will integrate with transportation networks, offering convenient and efficient mobility solutions for occupants.

5. **Smart Building as a Service (SBaaS)**: Building management systems will increasingly shift to cloud-based platforms for enhanced accessibility and scalability. Smart buildings will be designed to be flexible and adaptable to changing needs and technologies. Smart building ecosystems will be built around the collection and utilisation of data to guide decision-making and optimise performance.

6. **Increased cybersecurity focus**: Protecting connected systems is crucial, with emphasis on robust security measures. Keeping systems protected against new vulnerabilities is also important. Secure data transmission and access is a priority.

These trends indicate a future where smart buildings are not just more efficient and sustainable but also more responsive to the needs of occupants and the environment. As technology continues to evolve, smart buildings will play an increasingly crucial role in creating sustainable, comfortable, and efficient environments for all.

Challenges and considerations

So is everything fine on the smart buildings front? Well, not exactly. Once again, it is the same old story of technology being available but the usual arguments on the return of investment (RoI) and the short term gains seen in maintaining the status quo. But that is just part of the problem, not the whole story.

Implementation of smart building solutions faces several key challenges including high initial costs, cybersecurity concerns, interoperability issues, integration of legacy systems, lack of skilled personnel, and occupant privacy concerns, as seen in the following paragraphs.

1. **High initial costs**: Smart building technologies, including IoT devices, sensors, and software, can require a significant upfront investment. This includes the cost of hardware, software, installation, and potentially, ongoing subscription fees.

2. **Cybersecurity concerns**: Connecting building systems to the internet introduces vulnerabilities to cyberattacks. Smart buildings generate vast amounts of data, which needs to be secured. Robust security protocols and systems are crucial to protect against potential breaches.

3. **Interoperability issues**: Different smart building systems and devices may not always communicate seamlessly with each other. This can lead to data silos and hinder the smooth operation of the entire system.

4. **Legacy system integration**: Many existing buildings have outdated systems that are not compatible with modern smart technologies. Integrating these legacy systems with new technologies can be complex and costly.

5. **Lack of skilled personnel**: Implementing and maintaining smart building systems requires specialised knowledge and expertise. The demand for skilled professionals in this field is growing, but the supply may lag behind.

6. **Occupant privacy concerns**: Smart buildings often collect data on occupant presence, behaviour, and preferences. Some occupants may be wary of these data collection practices and concerned about their privacy.

Top 10 vendors of smart building systems
The top 10 vendors of smart building systems offer a wide range of solutions, from building management systems and energy management to security and automation, contributing significantly to the global smart building market.

- **Siemens**: A German conglomerate with a strong presence in power generation, intelligent infrastructure, and distributed energy systems.
- **Honeywell**: Known for its focus on energy-efficient advanced controls and innovative solutions for smart buildings.
- **Schneider Electric**: A leader in digital automation and energy management, offering open innovation platforms for quick connectivity of IoT devices.
- **Johnson Controls**: Specialises in electronics and HVAC equipment for buildings, with a strong position in building automation.
- **ABB**: Provides comprehensive smart building solutions, including real-time data, operational analytics, and solutions for smarter, more efficient buildings.
- **Cisco:** A key player in smart building solutions, offering systems for multi-residential buildings that mitigate water and fire damage.
- **Hitachi:** Offers a range of smart building solutions, including energy management, security systems, and building automation, with a focus on advanced analytics and AI.
- **IBM**: A major player in the smart grid market, supporting smart grid uptake through solutions like the Maximo Application Suite.
- **Legrand**: A global leader in home automation, offering a wide range of sustainable electric infrastructure solutions.
- **Huawei**: A major player in the smart building market, particularly in China, with solutions for energy management, security, and automation.

Conclusion
Summing up, smart buildings stand at the forefront of the Net Zero movement, acting as critical enablers of energy efficiency, sustainability, and reduced carbon emissions. By leveraging intelligent automation, real-time data analytics, and integrated energy management systems, these buildings not only minimise environmental impact but also enhance occupant comfort and operational efficiency. As the global push towards decarbonisation accelerates, smart buildings will play an indispensable role in achieving climate goals, serving as scalable, adaptable models for sustainable urban development and responsible resource usage in the built environment.

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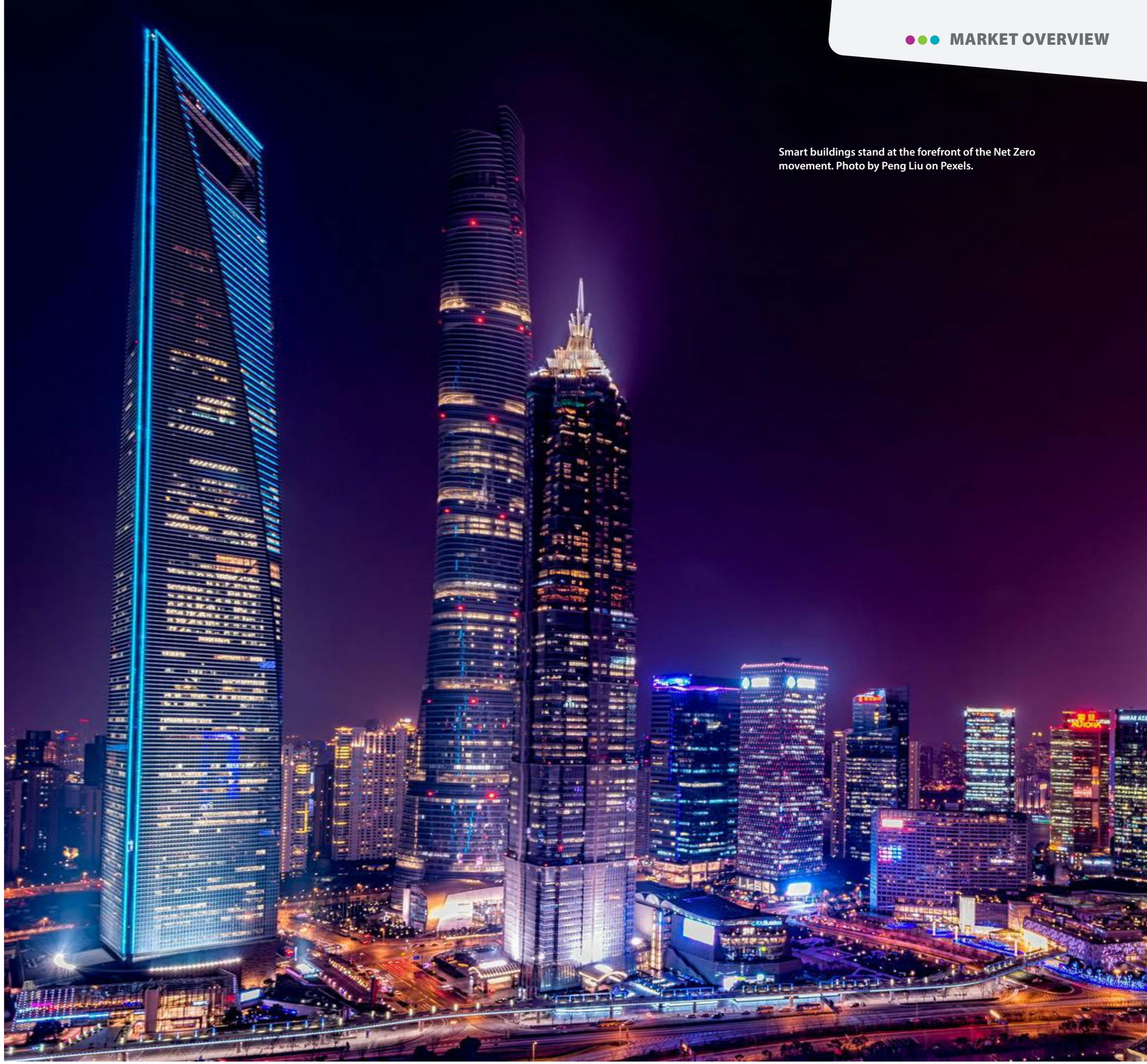

Smart buildings stand at the forefront of the Net Zero movement. Photo by Peng Liu on Pexels.

THE COST OF UNPLANNED DOWNTIME DUE TO INEFFICIENT MAINTENANCE PRACTICES

Organisations that prioritise maintenance as a strategic function will not only reduce downtime but also gain a competitive edge, says Milton D'Silva.

Downtime, in the industrial context, refers to periods when production or operations are halted, whether planned or unplanned. When planned, it is an organised happening and the time used for scheduled maintenance activities, tool changes, periodic servicing, and preventive checks on all equipment for wear and tear – something that is an accepted industry practice. However, unplanned downtime is a dreaded word, whether caused by equipment failures or material shortages. Such downtime significantly impacts industry by reducing production, leading to financial losses, delayed shipments, and potentially damaging customer relationships.

Manufacturing today has become a complex operation with an interplay of advanced technologies, either legacy machines with various states of automation operating under human supervision; or extremely sophisticated operations with fully automated or autonomous connected machines that function with minimal manual intervention. While the chances of human error can never be ruled out, even equipment failure is not a rare occurrence. Breakdowns happen for a myriad of reasons and not necessarily because someone has thrown the metaphorical spanner in the works.

One of the principal reasons for unplanned downtime is inefficient maintenance practices that sooner or later end in machinery breakdown and disrupt production. It may be recalled that the Space Shuttle Challenger exploded just 73 seconds into its flight in January 1986, killing all seven crew members aboard, in what is termed as one of the worst space disasters. Later, it was found that the failure was caused by a faulty seal, specifically an O-ring, in the right solid rocket booster, which failed to properly seal the joint, allowing hot exhaust gases to escape and ignite the external fuel tank. What was really appalling is that engineers at NASA were aware of, and failed to address, a known defect. Even if this is an extreme example, the jarring sound of a bearing or traces of oil around joints, are sure indications of an impending breakdown, the consequences of which could be a huge monetary loss or worse, if the root cause is not addressed promptly.

Unplanned downtime caused by material shortages are a different category. These may happen due to bad inventory planning, which would be really stupid, but more often, are caused by supply chain disruption that may happen due to natural calamities or any other emergency situation like war,

Breakdowns happen for a myriad of reasons. Image by Freepix

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or to cite a recent example, a pandemic. This article seeks to explore at length the issues of inefficient maintenance practices that contribute to unplanned downtime in industry, leading to huge losses.

The true cost of downtime

An unplanned downtime may initially appear like a temporary inconvenience, something that could be set right in minutes, and sometimes it could well be the case; but chances are it is something far more serious with unanticipated consequences. Every minute of downtime means the machines are idle and there is no production. In a high-volume manufacturing industry, this means loss of thousands or even millions of dollars in revenue, depending on the duration of the outage. For example, in the highly competitive automotive or heavily in demand semiconductor industries, even a one-hour halt can cause a significant backlog and delay in supply chains.

Financial loss is just one aspect of it and the cascading effect has a much higher price besides lost production. Increased labour cost, overtime, equipment damage, and above all, loss of reputation due to failure to meet deadlines in the age of just-in-time production, penal clauses in contract for late deliveries, etc., add to that. Hence it is of utmost importance to understand the real cost of downtime for companies to realise all the implications, and prepare them to adopt the right strategies to maintain efficiency, profitability, and competitiveness.

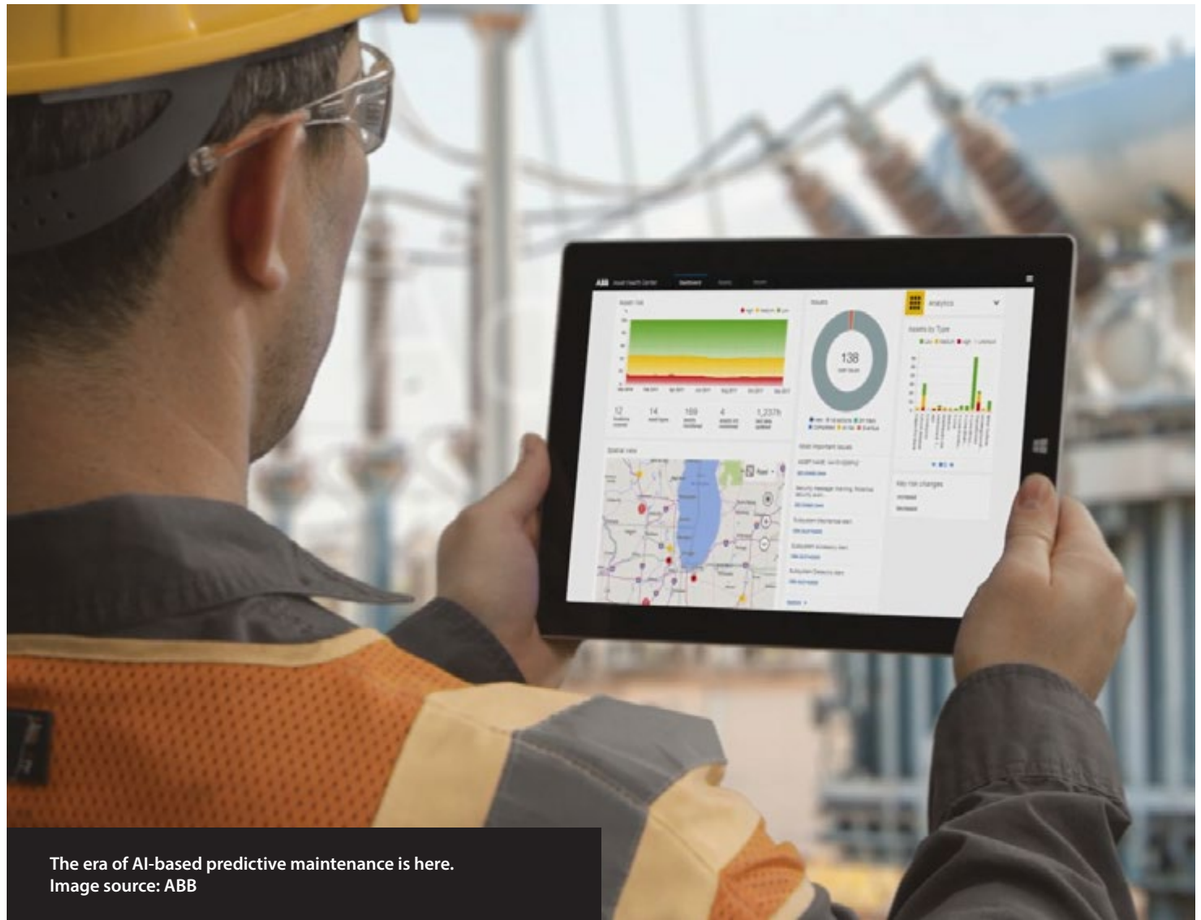
According to a much referenced report by Aberdeen Strategy & Research, 82% of companies have experienced unplanned downtime over the past three years and that unplanned downtime can cost a company as much as $260,000 an hour.

A 2023 ABB report, based on a survey conducted by Sapio Research of 3,215 plant maintenance leaders across the globe, found that outages cost the typical industrial business a hefty $125,000 USD per hour. A significant 69 percent of plants experience unplanned outages at least once a month.

A more recent survey by Siemens titled 'The True Cost of Downtime 2024' gives a fairly good idea of the losses incurred by four industry segments for just an hour's unplanned downtime, which varies from industry to industry. Just sample this:

- The Automotive industry faces the most significant financial repercussions from downtime, with every unproductive hour costing a staggering $2.3 million. This figure represents a twofold increase from 2019.
- Heavy Industry, with the high cost of halting large-scale machinery, has seen an even more dramatic rise in downtime costs, with a fourfold increase over the past five years.
- The FMCG sector has managed to keep downtime costs stable, despite fluctuations in global demand.
- In the Oil & Gas sector, the cost of downtime fluctuates in tandem with oil prices. During periods of high oil prices, such as early 2022, downtime costs soared. However, in 2023, as oil prices stabilised between $60 and $80 per barrel, downtime costs mirrored those of 2019.

A loose bolt or a leaky joint can spell trouble.
Photo by Cang Hai on Pexels.



The era of AI-based predictive maintenance is here.
Image source: ABB

Common causes of inefficient maintenance

At the very heart of unplanned downtime caused due to maintenance issues is the still widely prevalent culture of reactive maintenance, or the 'run to failure' mindset. Companies that follow this approach are still relying on the age-old practice of attending to equipment only after it has failed, which leads to unexpected shutdowns and the consequences that follow. The immediate outcome that results from this is emergency repairs and parts replacements, which is always more expensive than planned maintenance. While equipment failure is a primary cause of unplanned downtime, especially when reactive maintenance is the only strategy employed, there are other factors that contribute to unplanned downtime. These include, apart from poor maintenance practices, operator error, inadequate training and lack of proper planning from inventory to workflows.

Poor asset visibility and tracking is another reason that contributes to unplanned downtime. This refers to a lack of real-time, accurate information about the location, condition, and usage of assets – the machinery, control panels and other ancillary equipment that leads to inefficiencies and increased risk. So when a crisis hits in the form of sudden stoppage of the line, in the absence of precise knowledge of all assets and their location, it becomes difficult to identify, predict, diagnose and then proactively address potential issues with the equipment.

With poor asset visibility, what inevitably follows is lack of predictive maintenance capabilities in maintenance teams, which in turn makes it difficult to anticipate equipment failures. A well maintained plant is usually also well looked after from the maintenance perspective. What is unseen is also ignored until it is too late to pay attention to, delaying necessary repairs, and ultimately increasing the frequency and duration of breakdowns. Without predictive capabilities, maintenance teams are reactive rather than proactive, leading to costly and disruptive downtime. This makes a sound argument in favour of a proactive maintenance strategy. When maintenance teams lack predictive capabilities, they are more likely to react to breakdowns, resulting in increased downtime frequency and duration.

Another significant factor in the series of inefficient maintenance practices is inadequate training and skill gaps in maintenance teams. This results in human errors, hindering effective maintenance, and potentially leading to equipment failures and safety issues. Such skill gaps can result in a variety of problems, including incorrect procedures, missed preventive maintenance tasks, delayed or ineffective troubleshooting, and an overall reduction in the team's ability to maintain equipment reliably. Without the necessary skills to diagnose and fix issues quickly, maintenance teams may spend more time troubleshooting, leading to prolonged downtime while waiting for external help or resources.

It is pertinent to note here that inefficient maintenance practices are not restricted to machinery and equipment.

Today almost all industrial plants rely on a variety of software platforms to manage operations, from design and manufacturing to data collection and automation. These include Enterprise Resource Planning (ERP), Manufacturing Execution Systems (MES), Computerised Maintenance Management Systems (CMMS), Supervisory Control and Data Acquisition (SCADA) systems, and Computer-Aided Design/Manufacturing (CAD/CAM) software. In addition, with increasing digitisation of plants and connected equipment, there are also vulnerabilities like bugs and cyber attacks that afflict the IT infrastructure, which also contributes to unplanned downtime. According to David Flower, Member, Forbes Technology Council, data deluge – the exponential growth of data volume, variety and velocity – is a major downtime driver today. In a signed article on the Forbes portal – The True Cost Of Downtime (And How To Avoid It) – Flower emphasises that legacy tech stacks that weren't designed to handle such massive workloads can get overwhelmed, buckling under pressure. Hence periodic upgrades and regular maintenance of the IT infrastructure is critical to ensure system reliability and resilience.

In view of the causes mentioned above, what could be the logical thing to do for companies that still rely on reactive maintenance? One of the easiest things to do, to begin with, is to start keeping a meticulous record of the plant from a maintenance perspective. Proper documentation, or CMMS, can help reduce unplanned downtime in industry by centralising all maintenance information, streamlining processes, and facilitating proactive maintenance. By tracking equipment history, scheduling preventive maintenance, and optimising resource allocation, CMMS systems minimise the risk of unexpected breakdowns and improve overall equipment reliability.

Industry spotlights: Real-world downtime losses

One of the worst ever recorded incidents of a maintenance related industrial disaster occurred in the Indian city of Bhopal on the night of December 2-3, 1984. The pesticide plant of Union Carbide, a global MNC, released Methyl isocyanate (MIC) – a highly toxic gas that caused over 3,000 instant deaths in the thickly populated areas around the plant. The immediate cause of the leak was corroded valves and pipelines that remained unrepaired for months. It was exacerbated by multiple factors like the shutting down of the refrigeration system meant to keep MIC cool – and thus less volatile – to save costs; the scrubber system, which neutralises toxic gas leaks, was non-functional at the time; and the flare tower, meant to burn off leaking gases, was out of service due to maintenance neglect. The case dragged on for years in Indian courts. Up to 15,000-20,000 total deaths were attributed over time due to exposure-related illnesses and hundreds of thousands were injured, with long-term health effects. In 1989, Union Carbide reached a settlement with the Indian government by paying a one time settlement amount of $470 million, which was grossly inadequate given the scale of the tragedy. It permanently damaged the credibility of Union Carbide, the company later acquired by Dow Chemicals. The Bhopal plant site was abandoned and remains contaminated to this day. Like the 1986 Challenger Space Shuttle disaster, this too is an extreme example of the terrible consequences that could result from bad maintenance practices.

Digital twins, combined with ML-based analytics, are revolutionising predictive maintenance. Image by Freepix

The milk processing plant of Sachsenmilch Leppersdorf GmbH. Image source: Siemens

Presented below are a few more cases, prominent examples from three leading industry segments, including those related to poor maintenance of IT infrastructure:

Oil & Gas/Chemical

BP Texas City Refinery Explosion (2005): In March 2005, a massive explosion occurred at BP's Texas City refinery, later attributed to the failure of critical safety and maintenance procedures. A raffinate splitter tower was overfilled, and a blowdown drum vented flammable liquid, which ignited possibly to a vehicle engine running in the vicinity. The cause was determined as deferred maintenance, outdated equipment, and ignored warnings. Inadequate inspection and safety checks allowed systemic problems to build up. The impact was severe – 15 people killed, more than 180 injured. Operations shut down, and BP faced over $1.5 billion in fines, compensation, and upgrades. This is considered one of the worst (and costliest) industrial accidents in the US.

BASF Ludwigshafen Explosion (2016): An explosion and fire occurred during routine maintenance work on a pipeline system at BASF's main plant in Ludwigshafen, Germany. It was caused when some contract workers accidentally cut the wrong pipeline, which carried flammable materials. It was later found out that there was a lack of proper identification, communication, and risk mitigation during maintenance at the site. It resulted in the death of 5, including four firefighters, and 44 others were injured. BASF had to shut down multiple production facilities, affecting global supply chains. Financial loss ran into hundreds of millions of euros.

Shell Moerdijk Plant Outage (2014): A fire and explosion occurred at Shell's chemical plant in Moerdijk, Netherlands, due to failed maintenance on a heat exchanger. The cause was later identified as a corroded pipe that went unnoticed during maintenance checks, leading to a leak of flammable gases that ignited. As a result, the operations were halted for months, and Shell faced €200+ million in losses. Production of propylene oxide and styrene monomer—a critical input for plastics—was severely impacted.

Food Industry

Saputo Dairy UK (2019): In 2019, Saputo Dairy UK (formerly Dairy Crest), a major British cheese producer, experienced a plant shutdown at its Davidstow creamery, one of the UK's largest cheese manufacturing sites, due to a fault in its ammonia refrigeration system — a critical part of the cooling infrastructure. The leak was traced to a failure in maintenance procedures related to the plant's aging refrigeration equipment. There were inadequate inspections and delayed replacement of parts that should have been flagged during routine maintenance. The incident forced the partial shutdown of the plant for several days to address the safety and mechanical issues. The company incurred hundreds of thousands of pounds in direct losses, plus reputation damage.

JBS USA (2018): A critical freezer malfunction at a JBS beef processing facility in the US caused significant product losses. The root cause was a neglected component in the cooling system that had not been serviced on schedule. The

incident resulted in delayed shipments, product disposal, and lost contracts.

Automotive Industry

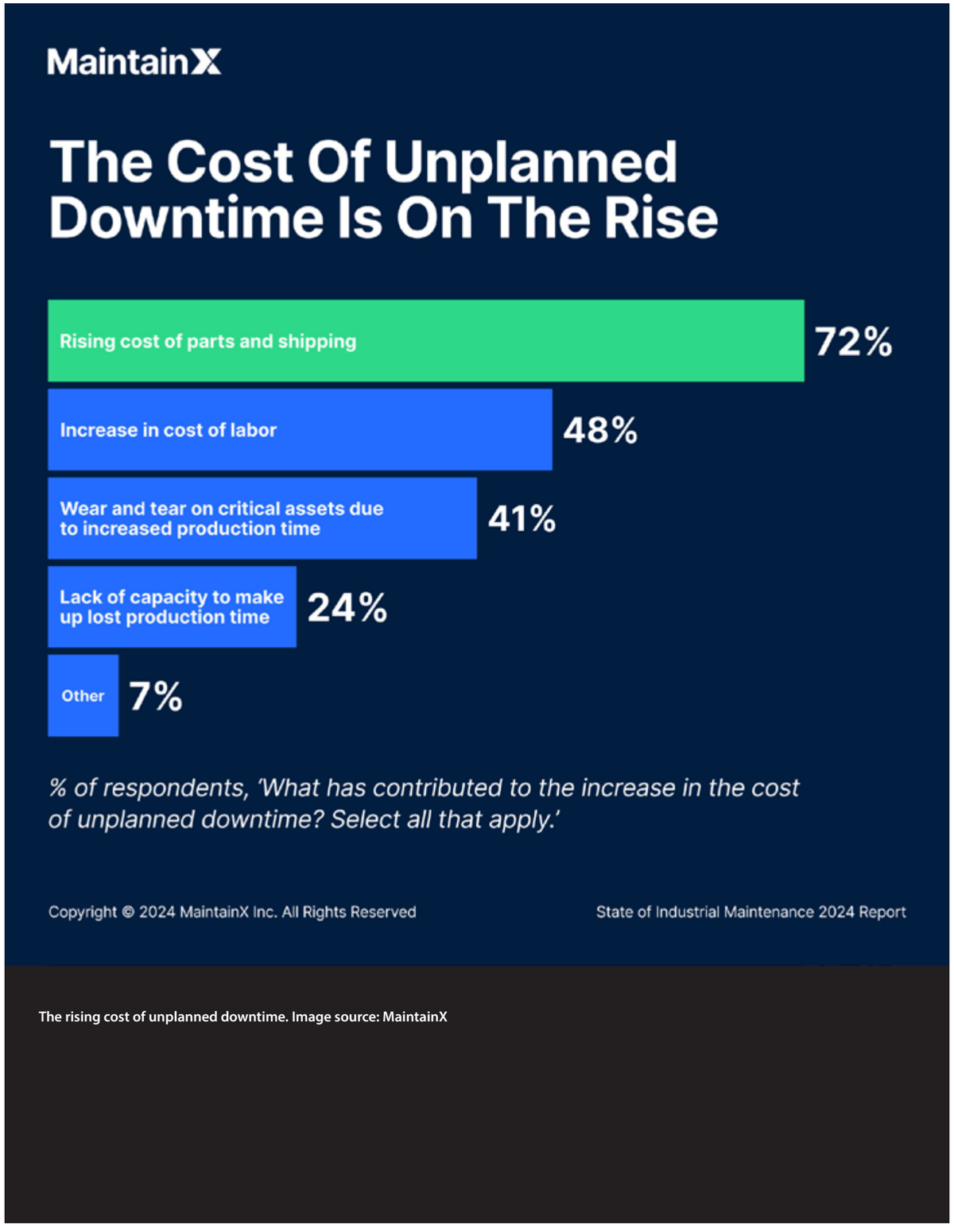
Toyota – Japan Production Shutdown (2023): In August 2023, Toyota had to halt operations at all 14 of its assembly plants in Japan due to a system failure in its parts ordering system. Production was completely stopped for a day across Japan. Approximately 13,000 vehicles were affected by the disruption. The root cause was later traced to insufficient disk space on a server following routine maintenance, which prevented the system from processing parts orders. Toyota operates on a just-in-time (JIT) manufacturing model. Even minor disruptions can cascade into major delays. The incident highlighted how IT infrastructure vulnerabilities—not just physical machinery breakdowns—can severely affect operations.

Nissan UK – Production Halt Due to IT Maintenance Failure (2017): In October 2017, Nissan's Sunderland plant in the UK—the company's largest manufacturing site in Europe—suffered unplanned downtime due to a failed IT system upgrade during scheduled maintenance. The plant was forced to halt production for nearly two days. The Sunderland facility produces over 500,000 vehicles per year, so even a short disruption had significant output and revenue implications. The failure occurred after a system maintenance upgrade did not go as planned, affecting the plant's ability to manage just-in-time supply chain operations.

Ford – Rouge Plant Explosion (2000): While older, this case underscores how maintenance neglect can have catastrophic effects. An explosion at Ford's Rouge power plant in Michigan, caused by accumulated dust in a boiler (a maintenance oversight), led to 6 fatalities and 14 injuries. It shut down vehicle production across multiple plants due to loss of power.

These cases illustrate the importance of rigorous safety and facility maintenance practices to avoid both human and operational losses in industrial plants. The chemical and oil & gas industries are particularly sensitive to unplanned downtime, where even brief disruptions can lead to huge financial losses, safety risks, and environmental hazards. Food plants rely heavily on refrigeration and hygienic systems, which are maintenance-sensitive. A small leak or breakdown can lead to product spoilage, compliance violations, and recalls. The automotive industry, traditionally one of the most automated, is today more susceptible to IT related snafus or cyber attacks and needs robust maintenance and protection of the IT system.

The digital divide: Leaders vs. Laggards in maintenance
Technology today offers various tools that can address the issues listed above; factors that are responsible for poor maintenance practices. The good thing is many companies are adopting them to their advantage. The bad thing, as noted in the ABB Report quoted at the beginning of this article, is that 21% of the 3,215 respondents still conduct run-to-fail or 'reactive maintenance'. Worse, they continue with the conventional practice not because of ignorance but



The rising cost of unplanned downtime. Image source: MaintainX

in spite of being aware of the solutions available to address the problem.

Digital technologies, particularly those related to predictive maintenance and asset management, significantly reduce unplanned downtime due to poor maintenance practices by providing real-time data, enabling proactive maintenance, and improving overall maintenance efficiency.

This is achieved in the following ways:

1. Real-time data and monitoring with IoT sensors: Industrial Internet of Things (IoT) sensors collect data on equipment performance, temperature, vibration, and other relevant parameters. Advanced analytics algorithms analyse sensor data to identify patterns, anomalies, and potential failures. This real-time data provides maintenance teams with immediate insights into equipment health, allowing them to identify potential issues before they escalate into unplanned downtime.

2. Predictive maintenance: Digital twins, combined with machine learning (ML)-based analytics, are revolutionising predictive maintenance by enabling real-time monitoring, failure prediction, and optimised maintenance planning. These technologies create virtual replicas of physical assets, continuously collecting and analysing data to identify patterns, forecast failures, and provide insights for proactive maintenance. ML models are trained on historical data to predict equipment failures and recommend maintenance actions.

3. Improved maintenance processes: Digital systems help automate the scheduling of maintenance tasks, ensuring that equipment undergoes regular inspections and repairs. Platforms like CMMS (Computerised Maintenance Management Systems) streamline maintenance workflows, making it easier to track, record, and analyse maintenance activities. Centralised dashboards and mobile accessibility keep all team members informed and facilitate better communication and collaboration.

4. Reduced costs and improved efficiency: Preventive or proactive maintenance reduces the need for emergency repairs and costly downtime. Digital systems also help optimise resource allocation, ensuring that maintenance teams are deployed efficiently. By preventing failures and optimising maintenance schedules, digital technologies help extend the lifespan of equipment.

Planned maintenance schedules, aided by digital technologies, significantly improve Overall Equipment Effectiveness (OEE) by increasing equipment availability, improving performance, and maintaining quality. By proactively scheduling maintenance tasks, companies can minimise unplanned downtime, optimise machine performance, and reduce the risk of equipment failure, all of which contribute to a higher OEE score.

By planning maintenance in advance, companies can allocate resources (labour, materials, and spare parts) more efficiently, reducing costs and improving productivity. OEE data can further be analysed and used to identify areas

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for improvement in maintenance schedules, optimising resource allocation and maximising equipment uptime.

The case for smart maintenance investments

In today's high-stakes industrial environment, unplanned downtime is among the costliest risks a company can face. Whether in manufacturing, oil & gas, or utilities, a single hour of unexpected downtime can cost thousands—sometimes even millions—of dollars. Against this backdrop, smart maintenance technologies—such as predictive analytics, IoT-enabled monitoring, and AI-driven diagnostics—offer not just reliability but a compelling return on investment (RoI).

Traditional reactive or time-based maintenance strategies are no longer sufficient. They often lead to over-maintenance, premature part replacements, or, worse, catastrophic failures. In contrast, smart maintenance leverages real-time data to predict and prevent equipment failures before they occur. This shift dramatically reduces unplanned downtime and allows for more efficient allocation of maintenance resources.

Studies have shown that predictive maintenance can reduce maintenance costs by 20-30%, eliminate breakdowns by up to 70%, and cut downtime by up to 50%. For example, a mid-sized automotive plant that typically loses $20,000 per hour of downtime can save hundreds of thousands annually by preempting just a few hours of unexpected failure. Beyond direct savings, smart maintenance also enhances asset life, improves safety, ensures compliance, and supports sustainability goals by minimizing energy waste and material loss.

The upfront investment in smart maintenance—sensors, analytics software, cloud infrastructure—can be substantial, but the RoI is both measurable and fast. Many organisations report payback periods of less than 12 months, particularly in asset-intensive sectors. Furthermore, with scalable and modular solutions now available, even small and medium enterprises can begin with pilot programs and scale up as savings are realized. A recent Siemens news release featuring Sachsenmilch Leppersdorf GmbH, the company operating one of the most modern milk processing plants in Europe, illustrates the efficacy of AI-based predictive maintenance integrated with SAP Plant Maintenance (SAP PM). This pilot with Siemens Senseye Predictive Maintenance has already achieved significant cost savings by reducing unplanned downtime.

Smart maintenance is not merely a technical upgrade; it's a strategic investment. It transforms maintenance from a cost center into a source of competitive advantage—driving uptime, productivity, and long-term operational efficiency. When viewed through the lens of RoI, the question isn't whether to invest in smart maintenance, but how soon it can be implemented to safeguard profitability and resilience.

Conclusion

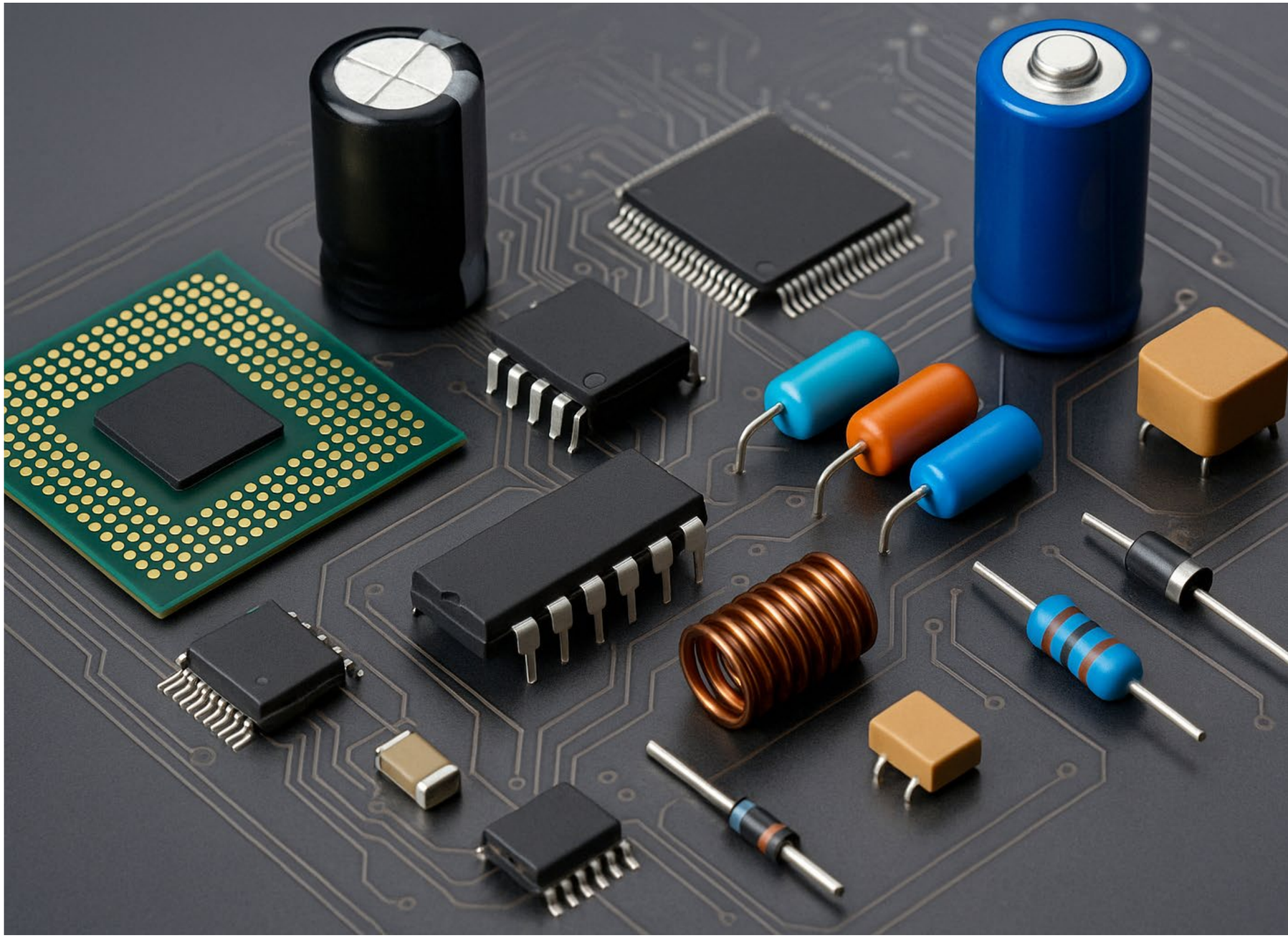
In conclusion, unplanned downtime stemming from ineffective maintenance practices represents a critical vulnerability in industrial operations. From lost productivity and damaged equipment to safety hazards and reputational harm, the ripple effects are extensive and costly. This article has explored how reactive approaches, lack of predictive insights, and underinvestment in modern maintenance strategies contribute to avoidable disruptions.

The scenario is far from bleak, though. In fact, MaintainX, a leading maintenance and frontline work execution platform, maintains that the industry is learning and adapting to the changed environment. In August 2024, the company released its first annual State of Industrial Maintenance Report, a comprehensive analysis of the challenges, trends and opportunities facing industrial maintenance teams. The global survey captures the sentiments of 1,165 maintenance, repair, and operations (MRO) professionals across a wide range of sectors, facility sizes, and locations. Commenting on the findings in the report, Chris Turlica, CEO and Co-Founder of MaintainX, said, "*The decline in the frequency of unplanned downtime highlights that facilities across industries are making positive progress toward improving maintenance, asset reliability, and operational processes.*" *He added, "This report highlights the importance of a proactive maintenance strategy in reducing excessive costs associated with unplanned downtime, improving productivity, and increasing overall efficiency.*"

The way forward lies in embracing smart maintenance solutions—leveraging real-time data, analytics, and automation—to shift from a reactive to a proactive maintenance culture. Ultimately, organisations that prioritise maintenance as a strategic function will not only reduce downtime but also gain a competitive edge through enhanced reliability, efficiency, and resilience.

SUSTAINABILITY IN ELECTRONIC COMPONENTS: ECO-FRIENDLY MATERIALS AND RECYCLING INITIATIVES

Innovations in eco-friendly materials, closed-loop manufacturing, sustainable product design, and recycling systems offer a new vision for the future of electronics, writes K.A. Gerardino.



As global demand for electronic devices accelerates—driven by rapid advancements in consumer electronics, automotive technology, industrial automation, and the Internet of Things (IoT)—the environmental footprint of the electronics industry is drawing increased and justified scrutiny. The production of electronic components, from printed circuit boards (PCBs) and semiconductors to capacitors, resistors, connectors, and plastic housings, is resource-intensive and heavily reliant on processes that consume vast amounts of energy, water, and rare materials. These processes often involve hazardous substances, such as lead, mercury, brominated flame retardants (BFRs), and toxic solvents, which pose significant risks to both human health and the environment.

Compounding the issue is the industry's continued dependence on a linear manufacturing model, where devices are designed for short-term use and are rarely built with reuse, repair, or recyclability in mind. As a result, mountains of electronic waste (e-waste) are generated every year—much of it ending up in landfills or informal recycling hubs, where it releases harmful pollutants and fails to recover valuable materials like gold, palladium, and rare earth elements. The United Nations estimates that over 62 million metric tonnes of e-waste were generated globally in 2023, a number expected to rise sharply unless significant reforms are adopted.

Yet, in the face of these environmental challenges, a transformative shift is underway. Innovations in eco-friendly materials, closed-loop manufacturing, sustainable product design, and recycling systems are offering a new vision for the future of electronics—one that balances technological progress with environmental responsibility. From biodegradable PCB substrates and halogen-free laminates

MARKET OVERVIEW

to circular design principles and urban mining technologies, stakeholders across the value chain are investing in more sustainable alternatives.

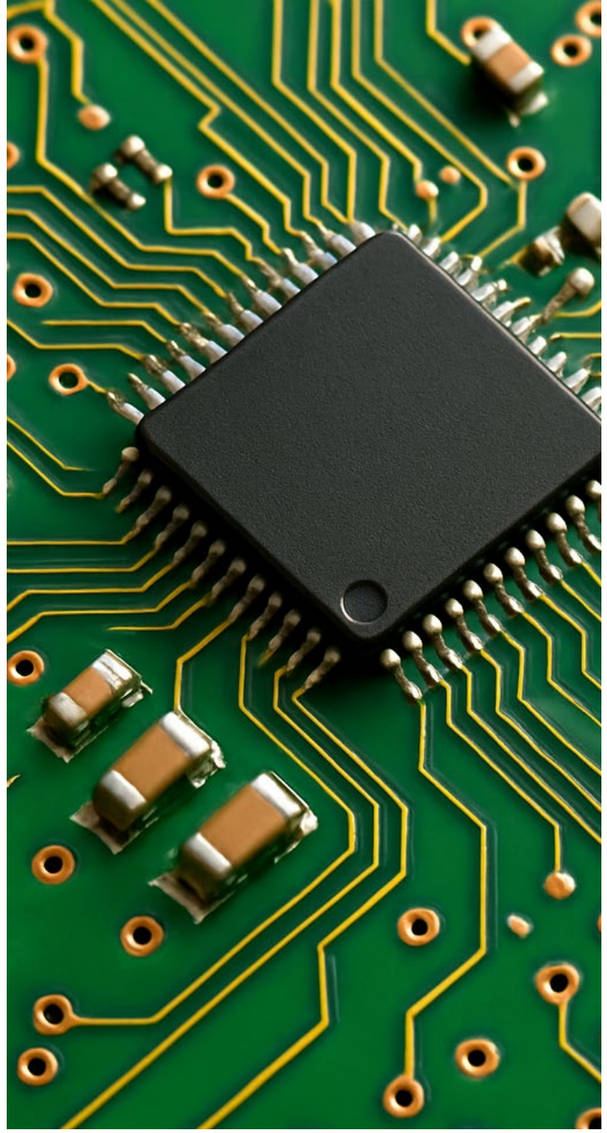
This evolving landscape is being shaped not only by environmental necessity but also by regulatory pressure, consumer demand for greener products, and global initiatives aligned with the United Nations Sustainable Development Goals (SDGs). The electronics sector—historically seen as a contributor to environmental degradation—is now at a pivotal point where it can become a catalyst for circular economy practices, leading the charge in decarbonizing industry, conserving resources, and reducing waste through innovation and accountability.

As we delve deeper into the strategies and solutions being developed, it becomes clear that sustainability in electronic components is no longer a future aspiration—it is a present-day imperative with growing momentum across both industry and policy spheres.

The Environmental Impact of Electronic Components

The environmental impact of electronic components is significant and multifaceted, spanning the entire lifecycle of a product—from raw material extraction and component manufacturing to product use and end-of-life disposal. Each stage presents its own set of ecological challenges, contributing to climate change, resource depletion, and pollution.

One of the most pressing concerns is the use of hazardous substances in the manufacturing of printed circuit boards (PCBs), which form the foundation of virtually all electronic devices. Traditional PCB production involves heavy metals like lead, cadmium, and mercury, as well as brominated flame retardants (BFRs) and volatile organic compounds (VOCs). These substances pose risks not only to human health during production and handling but also to ecosystems when devices are discarded improperly.



Equally problematic is the semiconductor fabrication process, which is among the most resource-intensive sectors in the electronics industry. Semiconductor manufacturing requires enormous quantities of ultrapure water, energy, and toxic chemicals such as arsine, phosphine, and hydrofluoric acid. According to the International Energy Agency (IEA), data centers and semiconductor fabs combined consumed over 2% of global electricity in 2023, with projections indicating continued growth as AI and high-performance computing demand increases. The carbon footprint of semiconductor production is particularly high in countries reliant on fossil-fuel-based electricity grids.

Meanwhile, the world's escalating dependence on digital devices—from smartphones and wearables to industrial control systems and electric vehicles—has led to an explosion of electronic waste (e-waste). The Global E-waste Monitor 2024 by UNITAR and the International Telecommunication Union (ITU) estimates that over 62 million metric tonnes of e-waste were generated worldwide in 2023. Shockingly, only about 17.4% of this was formally collected and recycled, and the trend is worsening. By 2030, the global collection and recycling rate is projected to drop to just 20%, primarily due to inadequate recycling infrastructure, lack of consumer awareness, and inconsistent regulatory enforcement in many regions.

This uncollected e-waste often ends up in landfills or informal recycling hubs, especially in developing countries, where it poses severe health and environmental risks. Toxic substances from decomposing electronics can leach into groundwater or release carcinogenic dioxins during incineration. Informal recycling practices, such as open-air burning and acid baths used to extract metals, contribute heavily to air and soil pollution, impacting nearby communities and biodiversity.

The environmental cost is also economic: according to the United Nations University (UNU), the raw materials embedded in e-waste—gold, platinum, palladium, copper, and rare earth elements—are worth over US$57 billion annually. Yet most of this value is lost due to poor recycling systems.

In light of these challenges, there is a growing consensus among industry leaders, governments, and environmental organizations that a fundamental redesign of electronics manufacturing and distribution systems is urgently needed. This includes rethinking the materials used, minimizing resource consumption, and building robust infrastructure for collection, reuse, and safe recycling. It also involves embedding sustainability principles at the design stage, often referred to as "*Design for Environment*" (DfE), which includes strategies such as modular design for easy repair, use of biodegradable or recyclable materials, and reduction of component complexity.

Additionally, initiatives like the European Union's Green Deal, Right to Repair laws, and Extended Producer Responsibility (EPR) frameworks are gaining traction globally. These regulatory frameworks are pushing manufacturers to take accountability for the full lifecycle of their products, encouraging eco-innovation and circular economy models.

In summary, the environmental impact of electronic components is a critical concern that extends far beyond production. It encompasses systemic issues in energy use, toxic material handling, and waste management. Without decisive action and cross-sector collaboration, the industry risks exacerbating planetary boundaries. But with the integration of sustainable design principles, responsible sourcing, and effective recycling systems, there is a clear path forward—one that aligns technological progress with environmental protection.

Sustainable PCB Manufacturing: Eco-Friendly Materials and Innovations

Printed Circuit Boards (PCBs), the foundational elements of virtually all electronic devices, are among the most environmentally burdensome components due to their complex construction, intensive material requirements, and chemically harsh fabrication processes. Traditional PCBs typically consist of fiberglass-reinforced epoxy resins laminated with copper layers and treated with a host of chemicals during etching, plating, and cleaning. These steps often involve toxic heavy metals such as lead and chromium, halogenated flame retardants, and volatile organic compounds (VOCs), all of which pose risks to workers and contribute to air, water, and soil pollution if not properly managed.

While regulatory frameworks like the EU's Restriction of Hazardous Substances (RoHS) and REACH directives have prompted the industry to transition away from some of the most dangerous substances, including lead and cadmium, challenges remain. The widely adopted lead-free solder alloys, such as tin-silver-copper (SAC), while less toxic, still depend on the extraction of finite resources like silver and copper—processes that involve significant energy use, habitat disruption, and environmental degradation. Furthermore, these alloys may suffer from thermal fatigue issues, especially in high-reliability applications, raising questions about their long-term durability and sustainability.

In response, a new wave of research and innovation is reshaping the sustainability landscape of PCB manufacturing:

- **Bio-based PCB substrates** derived from cellulose, lignin, starch, and natural fiber composites are gaining attention for their biodegradability and renewability. Companies like Jiva Materials have developed commercially viable alternatives such as Soluboard, which dissolves in hot water, allowing for the easy recovery of components and materials without toxic processing. These materials can match traditional epoxy-based laminates in thermal and electrical performance for low-to-medium power applications, while drastically reducing end-of-life disposal issues.
- **Green chemistry innovations** are replacing traditional toxic solvents and etching agents with water-based solutions, ionic liquids, and supercritical CO_2. These alternatives reduce worker exposure to harmful chemicals, cut down on wastewater treatment costs, and reduce greenhouse gas emissions from volatile organic compounds.
- **Additive manufacturing** (3D printing), though still emerging for PCBs, is enabling more sustainable production models by reducing substrate waste, shortening design-to-manufacture cycles, and enabling on-demand, local manufacturing. Materials such as conductive inks based on silver nanoparticles or carbon nanotubes allow for the printing of flexible, lightweight PCBs with reduced energy input and material consumption. Researchers are also exploring inkjet-printed biodegradable PCBs, which could be suitable for transient electronics, such as medical implants or disposable sensors.
- **Embedded component technology** is helping reduce the number of discrete parts needed on a PCB, decreasing overall size and material usage. This design approach also improves electrical performance and thermal management, contributing indirectly to energy efficiency.
- **Implementation of Life Cycle Assessment (LCA) tools** has become critical for evaluating the true environmental impact of PCB manufacturing. LCA helps identify carbon hotspots, water usage, and material inefficiencies throughout the value chain—from raw material extraction to end-of-life management—enabling manufacturers to optimize design and production decisions for minimal environmental harm.
- Furthermore, **renewable energy integration** in PCB fabrication plants is emerging as a trend, with companies investing in solar panels, battery storage systems, and energy-efficient HVAC solutions to reduce Scope 2 emissions. For example, leading EMS providers in Europe and Japan have already begun reporting emissions reductions through such facility upgrades.

In combination, these innovations represent a significant departure from the conventional PCB manufacturing model, offering new pathways to reduce toxicity, energy consumption, and waste. However, the adoption of sustainable PCB solutions is still uneven across the industry, with cost, performance trade-offs, and limited standardization posing hurdles to widespread implementation. Scaling these technologies—especially among small and mid-sized manufacturers—will require not only technological refinement but also policy support, supply chain incentives, and market demand for greener electronics. Nonetheless, the momentum is building, and sustainable PCB manufacturing is poised to play a pivotal

role in the broader decarbonization and circularity of the electronics industry.

Circular Manufacturing and End-of-Life Management
To further enhance sustainability in the electronics sector, the adoption of a circular manufacturing model is becoming an increasingly critical strategy. Unlike the traditional linear model of "take, make, dispose," circular manufacturing seeks to maximize the lifecycle of materials through reuse, refurbishment, remanufacturing, and recycling—drastically reducing the demand for virgin raw materials and minimizing waste.

In this model, Printed Circuit Boards (PCBs) and other components are designed with ease of disassembly in mind, allowing for the retrieval of valuable and finite resources such as gold, silver, copper, palladium, and rare earth elements. Design features like non-permanent adhesives, standardized fasteners, and layered modular assemblies make it easier to separate components at the end of a product's life. This is especially vital as raw material prices soar and concerns grow over supply chain vulnerabilities and conflict minerals.

Modular product design plays a central role in circularity. By allowing individual components—such as memory chips, sensors, batteries, and display units—to be upgraded or replaced independently, manufacturers can extend the useful life of a product without having to replace the entire system. Notable examples include the Fairphone, which enables users to swap out cameras, batteries, and processors with minimal tools, and Framework's modular laptops, which are built entirely around repairability and upgradeability.

Several companies and programs are already implementing circular practices:

- Apple uses disassembly robots like Daisy and Dave to recover components from returned devices and extract rare materials for reuse in new products. Apple also reuses materials such as recycled cobalt in batteries, reclaimed gold in logic boards, and recycled aluminium in enclosures.
- Cisco launched a Takeback and Reuse Program which recovers old networking equipment from customers and reintroduces parts into new systems. In FY2023, Cisco reused or recycled nearly 99.9% of returned hardware by weight.
- Dell operates one of the largest global electronics recycling programs and incorporates recycled plastics, carbon fiber, and rare earth magnets into new products. It also partners with recycling centers and NGOs in developing countries to create responsible e-waste infrastructure.
- Panasonic and Sony have invested in facilities for closed-loop plastic recycling, enabling them to produce new devices using plastics reclaimed from older units, thereby cutting down both plastic waste and oil dependency.

Circular manufacturing also involves innovative recovery technologies. Methods such as cryogenic separation, laser ablation, chemical-free PCB depopulation, and bioleaching (using bacteria to extract metals from e-waste) are being explored to increase recovery efficiency and reduce environmental impact.

Despite the promise, the pace of circular transition across the industry remains uneven and relatively slow. Several challenges persist:

- SMEs (Small and Medium Enterprises), which make up a large portion of the electronics supply chain, often lack access to the capital, technical knowledge, and infrastructure needed to redesign products or invest in sophisticated recycling and remanufacturing capabilities.
- The fast-paced innovation cycles typical of consumer electronics push companies to launch new models frequently, sometimes at the expense of repairability or backward compatibility. This built-in obsolescence undermines circularity goals.
- Lack of standardization across product categories and regions hinders disassembly and recycling efforts. A fragmented approach to material labeling, component sizing, and assembly techniques makes recovery more complex and less economically viable.
- Regulatory inconsistencies across global markets can either encourage or deter circular practices. While the European Union's Circular Economy Action Plan and EcoDesign Directive are setting strong precedents for product longevity, repairability, and material efficiency, many countries still lag in enforcement and incentives.

Going forward, a more robust circular approach will require:

- Policy support, including tax incentives for sustainable design, mandatory product take-back schemes, and eco-labeling for recyclability and repairability.
- Collaborative platforms where OEMs, recyclers, material suppliers, and logistics providers can exchange best practices and standardize recovery processes.
- Consumer engagement, as awareness and participation in recycling and repair programs remain low in many markets.
- Digital product passports, as proposed by the EU, which would provide detailed data on component origin, material composition, and disassembly instructions to facilitate recovery and recycling.

Circular manufacturing and effective end-of-life management represent one of the most powerful levers the electronics industry can pull to reduce its environmental footprint. When properly executed, it not only reduces e-waste and raw material dependency but also creates new business models focused on service, refurbishment, and resource recovery—moving the sector closer to a truly regenerative and resilient electronics ecosystem.

Sustainable Practices in Component Distribution
Beyond manufacturing, electronic component distribution plays a pivotal role in sustainability. The distribution process—from sourcing and inventory management

to packaging and logistics—offers multiple avenues for reducing environmental impact.

One of the most immediate areas for improvement is eco-friendly packaging. Distributors are beginning to replace traditional plastic-based packaging with recyclable, biodegradable alternatives. Additionally, streamlining logistics through optimized shipping routes, consolidated deliveries, and the adoption of electric vehicles for last-mile delivery can significantly cut carbon emissions.

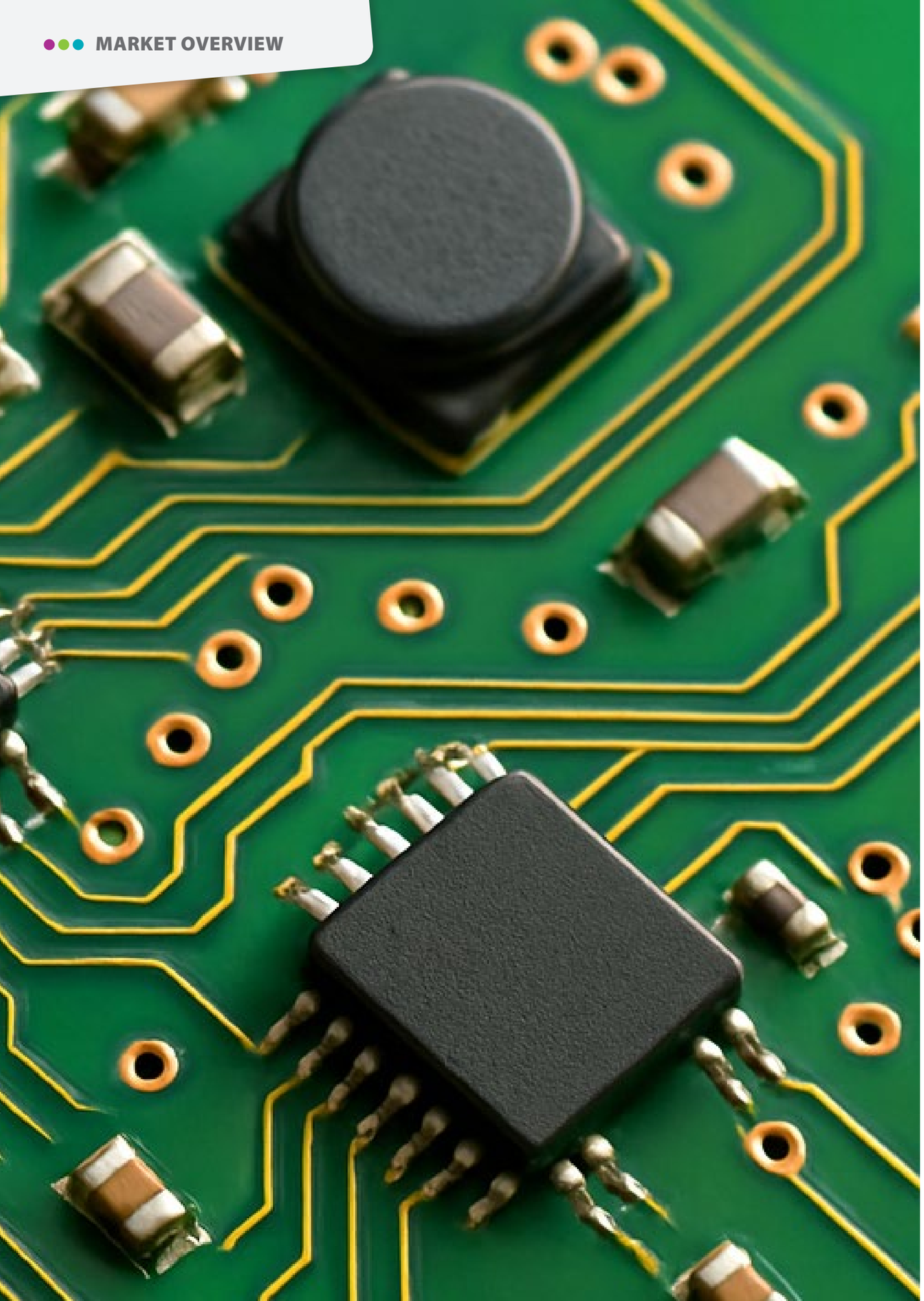
The implementation of sustainable inventory management systems is also critical. By using advanced forecasting tools and AI-driven analytics, distributors can better match supply with demand, reducing obsolete stock and e-waste. Moreover, recovery and resale of unused or refurbished components not only contributes to a circular economy but also enhances the distributor's value proposition.

Collaboration and Transparency Across the Supply Chain
True sustainability in electronics requires coordinated, cross-functional collaboration across the entire supply chain—from raw material suppliers and component manufacturers to OEMs, contract assemblers, and distributors. This cooperation is essential not only to standardize sustainability metrics—such as carbon intensity per unit, water usage, or recycled content ratios—but also to ensure the use of ethically sourced, conflict-free, and low-impact materials.

Technologies like blockchain and digital product passports are being increasingly explored to trace the origin, handling, and lifecycle of electronic components. These tools enable both businesses and consumers to verify environmental and social compliance at every stage, from mining and manufacturing to distribution and end-of-life. Enhanced transparency empowers stakeholders to make informed decisions and hold suppliers accountable, especially in the context of ESG (Environmental, Social, and Governance) targets and regulatory frameworks such as the EU's Corporate Sustainability Reporting Directive (CSRD) and the U.S. Dodd-Frank Act on conflict minerals.

A growing number of companies—spanning both multinationals and emerging innovators—are already taking proactive steps:

- Intel, Infineon, and STMicroelectronics are not only reducing carbon emissions through renewable energy procurement but also investing in green fabs, closed-loop water systems, and low-impact packaging materials. STMicroelectronics has committed to becoming carbon neutral by 2027, one of the most ambitious goals in the semiconductor sector.
- Apple has developed a highly integrated closed-loop supply chain strategy, including its recycling robot "Daisy" for iPhones and the use of 100% recycled rare earth elements in some of its products. Apple's Supplier Clean



Energy Program has pushed more than 300 suppliers to commit to renewable electricity.

- Dell Technologies is pioneering circular design by incorporating recycled plastics and carbon fiber into its products and offering free global take-back programs for old electronics. Dell aims to reuse or recycle an equivalent product for every device a customer buys by 2030.
- Jiva Materials, a UK-based startup, has introduced Soluboard, a water-soluble PCB substrate made from natural fibers, offering a biodegradable solution for non-critical electronics and helping recover valuable components without chemical processing.
- Sony has set comprehensive environmental targets under its "Road to Zero" program, with ambitions to achieve a zero environmental footprint by 2050, including low-power IC design, water-saving technologies, and green logistics.
- HP is using ocean-bound plastics in its ink cartridges and laptops and has committed to zero deforestation in its paper-based product packaging. Its Sustainable Impact report is now integrated into its annual financial filings to demonstrate accountability.
- Flex (formerly Flextronics), a global EMS provider, has implemented sustainability scorecards across its supply chain and adopted supplier carbon data dashboards to monitor and reduce Scope 3 emissions.
- Samsung Electronics is working toward carbon neutrality in its device experience division by 2030, expanding its use of recycled plastics and integrating circular economy principles into its production and R&D strategies.
- Arrow Electronics and Avnet, leading component distributors, are investing in sustainable logistics, eco-friendly packaging, and digital inventory tools to reduce waste and emissions in the component distribution process.
- Fairphone, a social enterprise based in the Netherlands, stands out for its modular smartphone design, use of ethically sourced tin, tungsten, and cobalt, and active participation in responsible mining cooperatives in Africa.

These examples reflect a growing realization: sustainability is no longer a siloed responsibility—it is a system-wide endeavor. As more companies embed circularity, traceability, and ethical sourcing into their operations, the electronics industry moves closer to a resilient, transparent, and low-carbon future. To accelerate this shift, future efforts must emphasize open data standards, cross-industry consortia, and inclusive engagement of smaller suppliers, many of whom need support and resources to align with global sustainability goals.

Market Trends, Challenges, and Future Goals

According to MarketsandMarkets, the global green electronics market is expected to reach USD 150 billion by 2030, growing at a CAGR of over 10%. Drivers include increased regulatory pressure, consumer demand for sustainable products, and corporate ESG commitments.

Still, challenges remain. The lack of standardization, high upfront costs, and inconsistent awareness across regions and company sizes create roadblocks. Furthermore, the short-term mindset prevalent in consumer electronics—where rapid innovation drives frequent product obsolescence—undermines long-term sustainability objectives.

To overcome these barriers, the industry must focus on:

- Policy incentives that reward sustainable practices and penalize environmentally damaging behaviors.
- Education and training to bridge the knowledge gap, especially for SMEs.
- Investment in R&D to improve the reliability and affordability of green materials and processes.
- Global collaboration to harmonize standards and accelerate scalable solutions.

Conclusion: Paving the Way for Sustainable Electronics

Sustainability in electronic components is no longer a niche concern—it is a global imperative. As the electronics industry continues to expand, it must do so without compromising the planet's future. By integrating eco-friendly materials, adopting green manufacturing and distribution practices, and embracing circular economy principles, companies can reduce their environmental footprint while enhancing their competitive edge.

The path ahead requires bold leadership, cross-industry collaboration, and a willingness to invest in long-term change. But with innovation and resolve, the electronics industry has the potential to become not only smarter and faster—but greener, too.

HOW TIER-ONE SUPPLIERS ADAPT TO EVS: STRATEGIES AND SHIFTS IN A FAST-EVOLVING LANDSCAPE

As electric vehicles shift from niche to norm, Tier-One automotive suppliers are in the midst of a profound transformation, writes K.A. Gerardino.

As electric vehicles (EVs) shift from niche to norm, Tier-One automotive suppliers—those that deliver directly to Original Equipment Manufacturers (OEMs)—are in the midst of a profound transformation. Once anchored in the legacy of internal combustion engine (ICE) systems, these suppliers are now racing to keep pace with an automotive industry where electrification, software, and sustainability define competitive advantage.

According to BloombergNEF, global EV sales are projected to surpass 20 million units in 2025. This dramatic acceleration in EV adoption is triggering strategic reinventions across the supplier base. From product portfolio shifts and acquisitions to localization and full software integration, Tier-One suppliers are reinventing their core business models to stay viable in the rapidly evolving automotive landscape.

Pivoting Product Portfolios Toward Electrification

One of the most immediate and visible shifts among Tier-One suppliers is the transformation of their product portfolios. The traditional core of many suppliers—components such as turbochargers, exhaust systems, and fuel injection units—is being phased out. These parts are either irrelevant or dramatically reengineered for EVs, leading Tier-One suppliers to pivot towards technologies better suited for electrified drivetrains.

Major players such as Bosch, Magna, Denso, and Continental have announced multi-billion-dollar investments to expand capabilities in e-motors, power electronics, thermal management systems, battery management systems (BMS), and advanced driver-assistance systems (ADAS). Bosch, for instance, opened a state-of-the-art semiconductor plant in Dresden, Germany, dedicated to producing silicon carbide (SiC) chips optimized for EV powertrains. SiC semiconductors offer higher efficiency and lower heat generation, which translates to improved battery range and durability.

Similarly, Magna launched a joint venture in India in early 2025 to build integrated e-drive systems aimed at mass-market EVs in Asia. The company recognizes that the future of electrification will require scalable, modular systems adaptable to a wide array of OEM platforms.

Denso has introduced a new range of power modules and inverter systems specifically engineered for EVs, with production facilities ramping up in Japan, Thailand, and the United States. The company's next-generation BMS

technology also incorporates AI-based predictive analytics to improve battery longevity and performance.

Continental, beyond its investments in ADAS, is also developing 800V power electronics platforms to support ultra-fast charging infrastructure. These developments are key as EV manufacturers push to reduce charging times and improve vehicle uptime.

Aptiv has expanded its product line to include high-voltage cabling and integrated electrical distribution systems that reduce weight and enhance the efficiency of EV architecture. The company also continues to evolve its modular "Smart Vehicle Architecture" to meet increasing demand from global automakers for scalable, intelligent platforms.

BorgWarner has unveiled its HVH320 electric motor, capable of producing up to 400 kW of peak power, which is already being integrated into commercial EV applications. Additionally, the company is advancing its dual inverter technology to improve drivetrain efficiency and reduce thermal losses.

Marelli, a global Tier-One with strong roots in both Japan and Italy, is rapidly expanding its e-Axle systems, which combine motor, inverter, and transmission in a compact unit. Marelli recently announced a major partnership with a European OEM to supply these systems for premium electric sedans launching in 2026.

Hitachi Astemo is focusing on integrated powertrain solutions for EVs and hybrids. The company is scaling up its EV-specific brake-by-wire systems and compact traction inverters. By 2026, Hitachi aims to triple its global EV component output, targeting both Japanese and global OEMs.

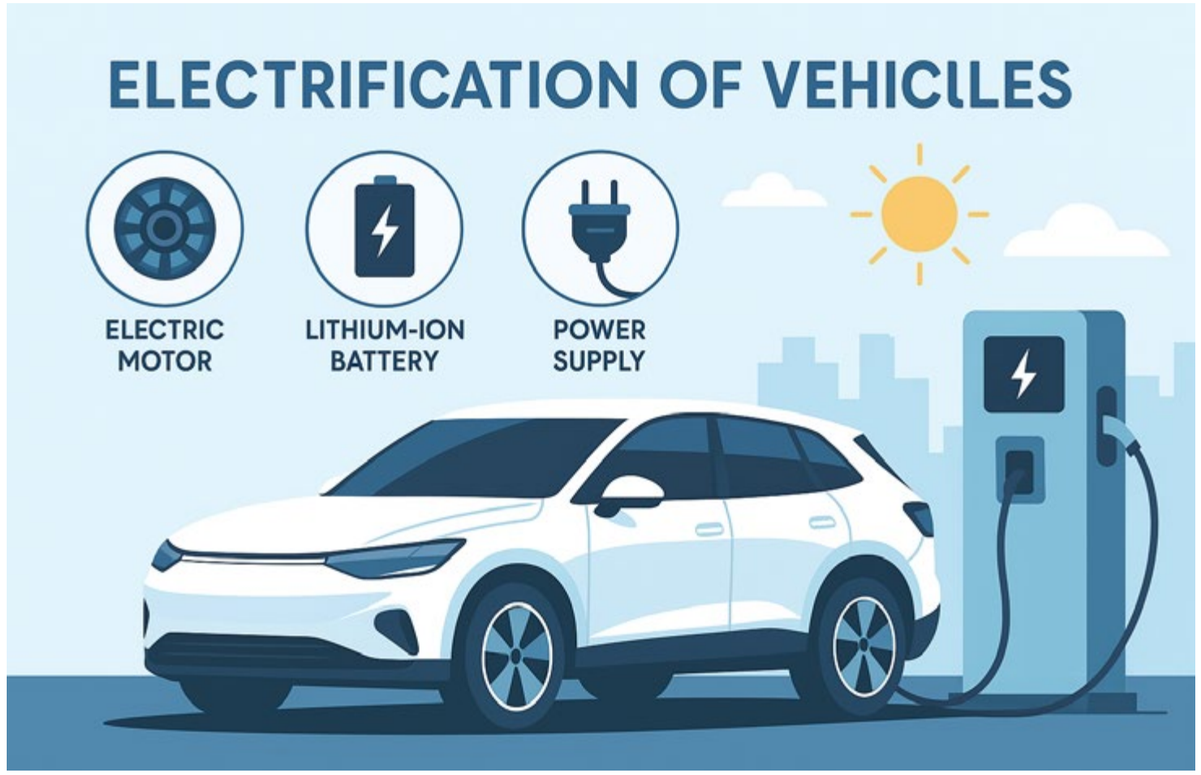
Hyundai Mobis is also aligning its product roadmap with electrification goals. In addition to power modules and battery packs, Mobis is developing wireless BMS systems and autonomous-ready platforms that combine LiDAR sensors, in-wheel motors, and AI-based safety software.

These comprehensive shifts underscore the industry's recognition that EVs are not simply a new propulsion system, but a complete overhaul of vehicle architecture. Tier-One suppliers that successfully pivot their portfolios to offer high-efficiency, modular, and software-integrated solutions will play a central role in shaping the next generation of mobility.

Strategic Acquisitions and Joint Ventures

Tier-One suppliers recognize that time is of the essence. Instead of building new capabilities from scratch, many are accelerating their transition through acquisitions and strategic alliances. These moves provide immediate access to advanced technologies, reduce development timelines, and enable deeper integration into OEM EV platforms.

In 2024, ZF Friedrichshafen acquired Aeva's lidar unit, providing immediate access to next-generation sensor technology critical for autonomous EVs. The acquisition also strengthens ZF's position in advanced perception systems used in Level 3 and Level 4 autonomous driving.



Aisin Seiki has formed a high-profile collaboration with Thailand's state-backed EV initiative to develop thermal management systems customized for tropical environments. This regional partnership reflects a growing trend among Japanese suppliers to deepen ties in Southeast Asia, where EV adoption is accelerating due to government incentives and infrastructure investments.

In a major move within the North American market, BorgWarner announced the acquisition of Santroll's eMotor business in early 2025. The deal enhances BorgWarner's capabilities in integrated drive modules and aligns with its Charging Forward 2027 strategy, which aims to derive over 45% of revenue from electrified products.

Meanwhile, Dana Incorporated has partnered with Israeli startup REE Automotive to co-develop flat, scalable EV chassis systems. These skateboard platforms support various vehicle classes, from last-mile delivery vans to passenger EVs, offering OEMs a plug-and-play solution that reduces design and engineering time.

In Europe, Valeo entered a joint development program with STMicroelectronics to co-design next-generation automotive silicon carbide (SiC) power modules. These components are critical for improving the efficiency of electric drivetrains, especially in premium and high-performance vehicles.

Hyundai Mobis has invested in Silicon Valley-based lidar company Luminar to jointly develop advanced autonomous driving features for the global EV market. This partnership is aimed at enhancing Mobis' competitiveness in ADAS and long-range sensor systems.

Continental, through its subsidiary Elektrobit, is collaborating with Google Cloud to offer high-performance, cloud-connected automotive software platforms that can be continuously updated over the air. The partnership highlights the convergence between automotive and tech industries, especially as vehicles become more software-defined.

Bosch has also expanded its footprint through a joint venture with China's Qingling Motors to produce commercial electric trucks. The venture allows Bosch to gain deeper insights into the Chinese market while leveraging Qingling's local manufacturing capabilities.

These collaborations not only help suppliers acquire cutting-edge technologies, but they also support regional localization, accelerate time-to-market, and reduce capital expenditure. As the EV landscape grows more complex, Tier-One suppliers are forming ecosystems—not just contracts—that redefine how value is created and delivered across the industry.

Localizing the EV Supply Chain

The EV revolution has exposed vulnerabilities in the global supply chain, particularly around critical battery minerals such as lithium, cobalt, and nickel. With increasing geopolitical tensions, trade barriers, and export restrictions from key supplier countries like China, the Democratic Republic of Congo, and Indonesia, Tier-One suppliers are actively localizing their production and sourcing strategies to ensure continuity and resilience.

Denso has significantly expanded its EV component manufacturing footprint in Southeast Asia. With new production facilities in Indonesia and Vietnam, the company is not only tapping into cost advantages but also positioning itself as a regional supply hub for the growing ASEAN EV market. These facilities focus on producing battery management systems, power modules, and thermal components, which are essential for local and export EV platforms.

Hyundai Mobis has begun localizing EV module production in India, supported by government incentives under the Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) scheme. The facility will manufacture battery packs and drive control systems, contributing to India's ambition to become a global EV export base.

Continental has expanded its footprint in Mexico, opening a new plant in San Luis Potosí to produce high-voltage inverters and sensor modules. The plant is strategically positioned to serve North American OEMs including GM and Ford, who are increasingly sourcing components from the USMCA region to reduce dependency on East Asian supply chains.

Japanese Tier-One supplier Nidec has launched a major investment program in Poland and Hungary to produce e-axles and electric drive systems for European automakers. These investments are backed by EU funding aimed at enhancing the region's EV value chain independence, particularly from Chinese imports.

In China, Bosch has ramped up its joint ventures with local battery producers and is investing in rare-earth recycling facilities to ensure long-term material availability. These localized approaches also enable Bosch to comply with China's domestic content requirements and benefit from subsidies offered for locally made EV components.

Meanwhile, American suppliers like BorgWarner and Dana are increasingly investing in the U.S. Midwest and Southern states to build out battery pack assembly and thermal system production, leveraging Inflation Reduction Act (IRA) incentives that favor North American manufacturing.

OEMs like Hyundai, Toyota, and BYD are demanding that suppliers provide regional support to avoid disruptions caused by cross-border logistics bottlenecks. This shift is fueling growth in new EV manufacturing corridors including Mexico, Thailand, India, Eastern Europe, and the southern United States—regions where governments are aggressively courting investment with tax breaks, expedited permits, and infrastructure grants.

MARKET OVERVIEW

Localization is no longer a cost-driven strategy; it is a necessity in the era of electric mobility. It enhances flexibility, strengthens supply chain resilience, and ensures that Tier-One suppliers can meet the evolving regulatory, environmental, and market demands of the EV ecosystem.

Software and Electronics Integration
The automotive world is becoming more software-defined with every passing year. From battery control systems to infotainment and ADAS, software now represents a significant portion of a vehicle's value. Tier-One suppliers are responding by evolving into software-first organizations.

Continental spun off its software division to operate as an independent business unit focused on developing embedded systems and cloud integration. Valeo, another major player, is investing heavily in centralized domain controllers and over-the-air (OTA) update platforms that enable real-time software enhancements post-purchase.

One of the most notable advancements came at CES 2025, where LG Magna e-Powertrain unveiled an AI-driven e-drive system that optimizes energy consumption based on real-time traffic data, weather, and user behavior. This convergence of AI and electrification is reshaping how suppliers approach design, engineering, and service delivery.

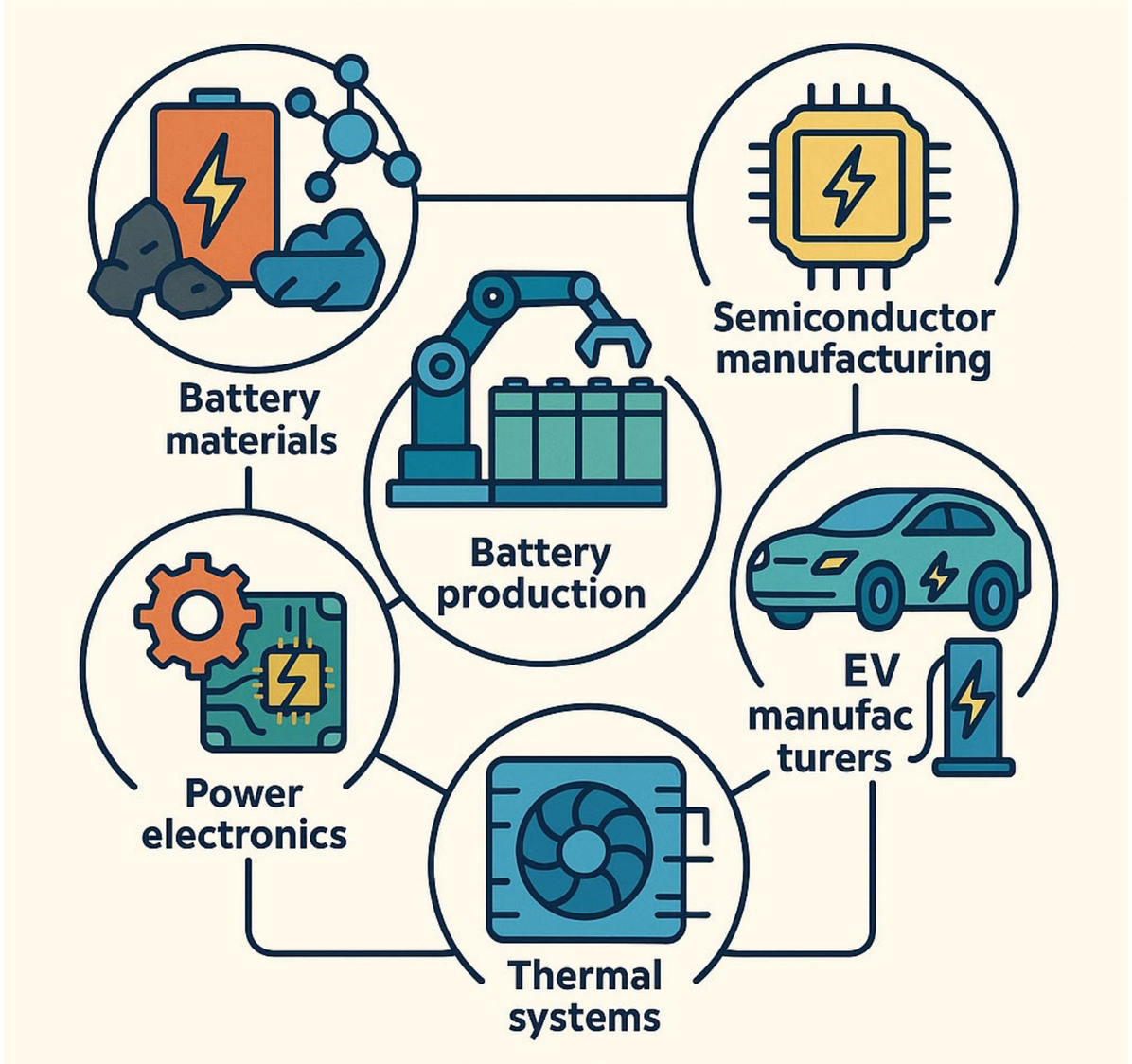
Embracing Smart Manufacturing
To meet the changing demands of OEMs and improve production agility, Tier-One suppliers are adopting smart manufacturing technologies. The days of rigid assembly lines and batch manufacturing are giving way to flexible, data-driven production environments that can quickly adapt to changing vehicle specifications.

Atlas Copco's Smart Integrated Assembly platform provides a blueprint for such transformation. The system includes assembly tools, software, and services that create fully connected production environments. Capabilities such as automated torque control, MES integration, and real-time data analytics allow suppliers to reduce waste, lower energy use, and deliver consistent quality at scale.

In addition, Atlas Copco's automation solutions—including turnkey robot cells and vision inspection systems—enable Tier-Ones to scale production efficiently while meeting the high traceability requirements of global OEMs. The company also supports cobot integration, enhancing assembly line flexibility while optimizing labor utilization.

Navigating Platform Proliferation
The shift to EVs has introduced a paradox: while vehicle architectures are becoming more software-defined and modular, the number of distinct EV platforms is rising. By 2028, over 200 individual automotive platforms will exist globally, up 117% from 2020, according to Oliver Wyman.

While automakers are consolidating R&D efforts into fewer platforms to boost volume efficiency, the customization demands from consumers and regional regulations are creating fragmentation. Tier-One suppliers must therefore adopt a modular product strategy that enables mass customization. Platform-agnostic solutions—such as scalable battery enclosures, modular e-axles, and adaptable thermal systems—are in high demand.



Suppliers that can offer plug-and-play components compatible with multiple OEM platforms will capture greater market share while reducing costs through economies of scale.

The Economics of Transition: Short-Term Pain vs. Long-Term Gain
Adapting to EVs comes with a steep financial curve. Suppliers must continue servicing ICE programs—many of which remain profitable—while investing heavily in electrification. Balancing short-term profitability with long-term positioning is a delicate dance.

The shift also exposes suppliers to volatility in raw material costs. Metals such as lithium and cobalt have experienced dramatic price swings, and suppliers often lack the pricing power to pass these costs on. Consequently, long-term contracts, vertical integration with raw material suppliers, and advanced forecasting systems are becoming essential tools.

Bosch, for instance, is securing long-term cobalt supply through strategic partnerships with mining firms and has begun hedging commodity prices to protect margins. These risk mitigation strategies will become increasingly important as material shortages and geopolitical risks continue to challenge the global EV supply chain.

The Control Tug-of-War: OEMs vs. Suppliers
The evolving EV landscape is also redrawing the boundaries between OEMs and Tier-One suppliers. Where OEMs once relied on suppliers for full-system solutions, they are now building in-house capabilities to control the software stack, battery development, and even semiconductor design.

This desire for control is leading to a reconfiguration of supplier-OEM relationships. Some suppliers are doubling down on proprietary ecosystems, while others, such as ZF and NXP, are adopting an integration-friendly approach. The latter are developing flexible, standards-based platforms that make it easier for OEMs to plug their technologies into existing architectures without vendor lock-in.

This strategic repositioning is essential, as OEMs increasingly prioritize supply chain control, faster innovation cycles, and cost optimization.

Failures and Lessons: What Not to Do
Not all Tier-One transitions have been smooth. Aptiv's 2022 acquisition of software firm Wind River is a cautionary tale. While the acquisition was touted as a move into cloud-native platforms, integration challenges and a lack of software monetization led to a sharp decline in investor confidence. As of early 2025, Aptiv's stock has dropped by more than 50% from pre-acquisition highs.

Similarly, Bosch and Continental have had to enact significant layoffs and cost-cutting measures. Bosch's plan to eliminate over 5,000 jobs and reduce hours at key EV-component plants is indicative of the financial strain involved in transformation. The key takeaway: strategic alignment, execution capability, and operational integration matter just as much as acquisition size.

Stop Selling Parts, Start Selling Outcomes
For decades, Tier-One suppliers thrived by perfecting components. In the new EV landscape, however, OEMs are no longer looking for individual parts—they want integrated solutions that solve real problems.

This means suppliers must shift from an engineering-centric mindset to an outcome-oriented approach. Companies like Harman and Bosch have made this leap by delivering platforms, not just products. Harman has evolved from a stereo and infotainment supplier into a connected vehicle enabler offering OTA software, cybersecurity, and cloud-based diagnostics.

Bosch, too, now positions itself as a mobility provider, offering everything from fleet management to smart charging and ADAS solutions. These capabilities turn Bosch from a component supplier into a strategic partner, deeply embedded in the OEM's value chain.

The Road Ahead: Three Strategic Options
Tier-One suppliers now face three strategic paths as the automotive industry rapidly transitions to electrification, software-defined vehicles, and regionalized production

models. Each path presents unique risks and opportunities, and the decisions made today will determine whether suppliers remain central to the mobility ecosystem or are marginalized in the years to come.

1. Integration Partner: The most promising and sustainable route is to become a collaborative, integration-focused partner to OEMs. These suppliers provide modular, interoperable systems that plug seamlessly into multiple vehicle platforms, accelerating time to market and reducing complexity for OEMs. Integration partners embrace open standards, offer co-development capabilities, and support over-the-air updates and lifecycle service integration. Companies like ZF, Bosch, and NXP are already exemplifying this model by working closely with automakers to develop intelligent systems that support autonomy, connectivity, and electrification. These suppliers don't just ship components—they solve problems, support flexibility, and deliver innovation as a service.

2. Proprietary Ecosystem Builder: This route involves doubling down on exclusive technologies and vertically integrated systems in an attempt to lock OEMs into specific supplier ecosystems. While this strategy worked in previous decades—where high investment in mechanical systems created dependency—the software-driven nature of modern vehicles makes it less viable today. OEMs are increasingly wary of vendor lock-in and are instead investing in internal software teams and open-source platforms to maintain control. Suppliers that insist on proprietary stacks may be perceived as restrictive and inflexible, leading to marginalization. Aptiv's Wind River acquisition and its struggles to monetize a tightly integrated software suite serve as a cautionary tale for those pursuing this path without a clear execution roadmap.

3. Commodity Supplier: The least desirable path is to remain a supplier of undifferentiated, low-margin components. These suppliers' risk being replaced by lower-cost Tier-Two or offshore vendors as OEMs seek aggressive cost reductions. As electrification reduces mechanical complexity, the perceived value of basic components diminishes, unless paired with smart data, traceability, or platform integration. Commodity suppliers also have little influence over design or product roadmap decisions, making them reactive rather than strategic. This path is marked by shrinking margins, diminishing market share, and eventual obsolescence in an industry driven by platform consolidation and rapid innovation.

The most successful Tier-Ones will be those that understand their new role in a decentralized, software-defined, sustainability-driven industry. They will not only supply parts but co-create value alongside OEMs. This requires shifting mindsets from engineering deliverables to business outcomes, and from transactional relationships to long-term, strategic partnerships. In the future, the real differentiator won't be just what you build, but how well you integrate, adapt, and elevate the OEM's brand and experience.

Conclusion: Reinvention or Irrelevance

The global auto industry is undergoing its most dramatic transformation in over a century. Electrification, software dominance, and new consumer expectations are redefining mobility. For Tier-One suppliers, this is a moment of reinvention—one that demands courage, capital, and a long-term commitment to structural change.

Survival depends on more than innovation—it demands strategic vision, operational agility, and a willingness to redefine long-standing business models. It requires investment in talent, reengineering of product lines, and a culture that welcomes disruption rather than fears it. The suppliers that embrace this change will become indispensable partners in the next era of mobility. Those that cling to the past will be left behind as OEMs bring more functions in-house or forge direct partnerships with agile tech startups.

As the world accelerates toward a 50/50 mix of ICE and EVs by 2030, Tier-One suppliers are no longer just linkages in the value chain. They are now key architects of a new automotive future—one built on digital ecosystems, sustainable manufacturing, and intelligent, connected vehicles. Their influence will not only be measured by the parts they produce but by the outcomes they enable: cleaner air, safer roads, and smarter transportation networks.

The road ahead is clear: evolve or exit. For Tier-Ones willing to lead, this transition marks not an end, but the beginning of their most impactful era yet.

DATALOGIC AND B. BRAUN ENABLE SAFER ONCOLOGY TREATMENT

Datalogic's Memor 17 Healthcare mobile computer is certified for use with B. Braun's OncoSafety Remote Control oncology workflow solution.

Datalogic, a global leader in the automatic data capture and factory automation markets, announced the certification of the Memor 17 Healthcare mobile computer with OncoSafety Remote Control®, the advanced oncology workflow solution developed by B. Braun, a global leader in smart infusion therapy and healthcare technology.

This integration combines Datalogic's most advanced healthcare-grade mobile computer with B. Braun's OncoSafety Remote Control®, enabling unmatched traceability, medication accuracy, and compliance in oncology treatment. Together, these technologies deliver a safer, more efficient experience for healthcare professionals and patients alike.

Designed for front-line healthcare, the Memor 17 Healthcare features 5G connectivity, Wi-Fi 6E, and an ultra-rugged, disinfectant-ready design. The integrated Halogen™ 2121DL scan engine ensures fast and accurate barcode capture – even on damaged or poorly printed labels – while Datalogic's signature Green Spot technology provides silent scan confirmation, ideal for quiet zones such as neonatal wards or intensive care units.

The certification with OncoSafety Remote Control® extends the capabilities of the Memor 17 Healthcare across oncology workflows – from bedside medication administration to remote patient visits – ensuring the highest standards of patient safety, data access, and workflow efficiency.

The Memor 17 Healthcare also supports programmable emergency alerts and custom gestures, allowing clinical staff to trigger safety protocols instantly. With long-term Android™ support (version 18 and beyond), AI-powered software tools from the Datalogic Mobility Suite, and a slim, ergonomic form factor, this device is ready to meet the evolving needs of healthcare environments.

"*The Memor 17 Healthcare sets a new benchmark for patient care and safety in oncology,*" said Rosario Casillo, Data Capture Product and Solutions Executive VP at Datalogic. "*Its certification with B. Braun's OncoSafety Remote Control® enables seamless verification of patient-treatment matching with their advanced solution, ensuring healthcare professionals can rely on a connected, secure, and highly functional device to deliver critical care wherever it's needed.*"

"*Our mission at B. Braun is to protect and improve the health of people around the world. We are pleased to collaborate with Datalogic to equip caregivers with the technology needed to make well-informed decisions and reduce medication errors,*" added Thore Heinemann, Senior Digital Solution Manager at B. Braun.

www.datalogic.com

MORE INFORMATION

MADE TO MEASURE: NEW MITUTOYO EUROPE PRESIDENT SETS OUT PLANS FOR GROWTH

Our headquarters in Neuss – where ideas become reality and teams collaborate to drive excellence.

President Ray Penny – leading with vision, experience, and a commitment to innovation.

Precision in action – our cutting-edge machinery delivering unmatched performance and reliability.

Ray Penny becomes the first non-Japanese President of Mitutoyo Europe, marking a strategic shift toward new growth and continued metrology market leadership.

Headquartered in Japan, Mitutoyo Corporation stands as a pillar in the field of metrology, renowned for its unwavering commitment to precision and innovation. Backed by a long and successful legacy, Mitutoyo has established itself as a global market leader, providing advanced measurement solutions to industries worldwide. As a prominent player in Europe, Mitutoyo has built a strong network of subsidiaries, sales offices and service centres across the continent, ensuring seamless support for customers in diverse sectors.

Although new to the role of President at Mitutoyo Europe, Ray Penny is far from new to Mitutoyo. He embarked on a career at the company as a UK service technician in 1986. Further roles in field service and technical sales/support ultimately led to his appointment as UK Export Sales Manager. In 2017, he was appointed Managing Director of Mitutoyo UK, which included a role on the board of Mitutoyo Europe. Today, as the President of Mitutoyo Europe, his responsibilities span the entire EMEA (Europe, Middle East, Africa) region.

This career progression is indicative of the opportunities available at Mitutoyo, thanks largely to its corporate ethos of promoting from within and nurturing young talent through a positive workplace environment.

"*I guess I'm a good example of that,*" he says. "*I'm proud of my achievements and proud of Mitutoyo. I feel very much part of the company, but never take it for granted. Whatever the role here, you need to demonstrate commitment.*"

The European way

Expanding Ray Penny's responsibilities Europe-wide means understanding cultural ways of working across many different countries, both internally and with the customer and dealer base, something he says he is keen to learn quickly.

"*Although Mitutoyo Europe has a new President, it's business as usual for our dealers and customers. However, one of the clear reasons for placing a European in this position for the first time is to implement a strategic change in Mitutoyo's organisation - scrutinising the market through the eyes of more regional/local representation. I'm not seeking wholesale changes because we're a very successful company, but our HQ in Japan wants a 'local' organisation in Europe that reacts in a fast and agile way to the ever-evolving market here.*"

This is a primary goal of Mitutoyo Europe's current mid-term management plan (2024-2029) as the company works towards its global "*Vision 100*" in 2034, a year that marks Mitutoyo's 100th anniversary. Vision 100 sets out a clear ambition: to continue leading the future of measurement.

Let the market lead

Says Ray Penny: "*A core target of our mid-term management plan is for Mitutoyo Europe to become a 'market-in' driven organisation. By that I mean we want to reach a position where we have a clear understanding of the market's needs both today and tomorrow. We can then feed this information to our R&D team in Japan. The ideas for new products should come from the market. That's why we've set up a regional marketing division in Europe.*"

Key differences exist between the metrology markets in Japan and Europe. While both serve all sectors, the semiconductor industry - for instance - is far more prevalent in Japan than Europe, while aerospace and medical have a strong presence in Europe.

"*Equally, we cannot forget our legacy sectors as they evolve. While it was great to see the recent opening of our Semiconductor Competence Centre in Veenendaal, Netherlands, for example, we cannot take our eye off the changing demands of legacy industries.*"

Automating the future

Astute and targeted product development is clearly pivotal for both new and existing sectors, with Ray Penny identifying automation as a focus area.

"*We are of course already involved in automation, but it's an area of our business where we see future growth. Mitutoyo has a broad portfolio of solutions from hand tools to the latest co-ordinate, form, optical and vision measuring systems - and everything in between. However, there's areas across that spectrum where we have niche competition. So we have to think about extending our market differentiation and one area is the automation of inline measurement.*"

Another growth area for Europe is Mitutoyo's OEM business, where the company can supply its solutions for seamless integration into products made by other manufacturers. Providing OEMs with Mitutoyo lenses or sensors, for example, can shorten time-to-market and mitigate the challenges and costs associated with manufacturing in-house. Mitutoyo has focused heavily on this area over the past two years, already recording green shoots of encouragement and notable successes.

Style and substance

Ensuring Mitutoyo and its customers benefit from these advances and others will take all of Ray Penny's experience and know-how, where deploying the appropriate management tactics will be paramount. So how would he describe his leadership style?

"*I'm very focused but also very open,*" he says. "*The team know their roles and the targets expected of them - and I trust them to deliver. Of course, in a senior role there are key decision to make but I'm a good listener and believe an open-minded approach garners a better response from employees. It also fosters motivation and helps with employee retention, which is vital in the current workforce market.*"

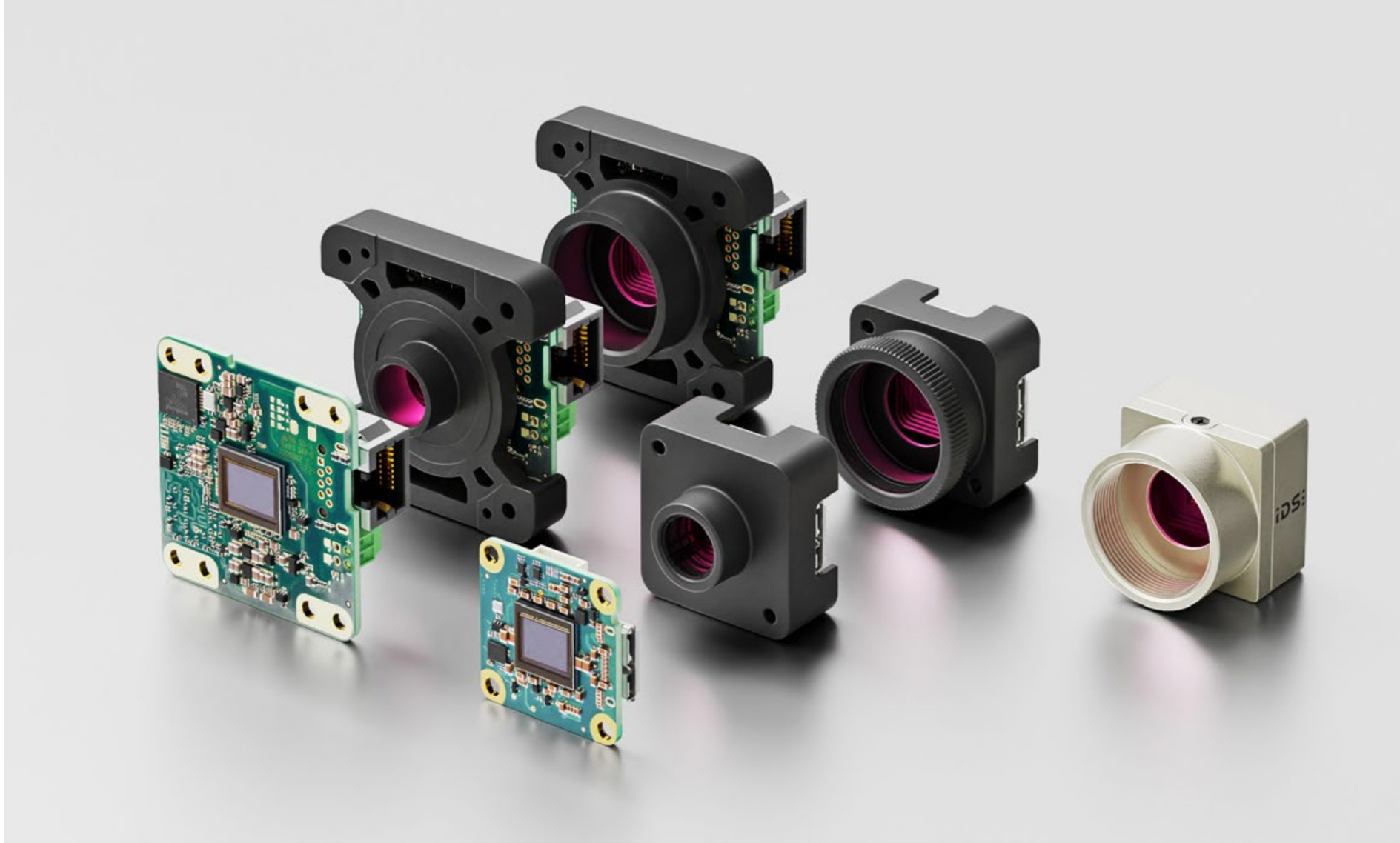
He adds: "*We know where we are strong: we're a metrology company with a name that the whole industry associates with precision measurement - a brand built on fundamental Japanese business attributes that include organisation, efficiency, progress and structure. And while we can never rest on our laurels, it's held us in good stead for 91 years. Mitutoyo Europe is currently on an even keel in terms of annual sales revenues, which can be viewed as positive considering the challenging economic and political headwinds currently in play. That said, we set ourselves ambitious targets, which means getting creative at all levels of the business.*"

Ray Penny's subtle, warm demeanour is complemented by positivity and commitment in abundance. With Europe already a significant contributor to Mitutoyo's global turnover, he is confident that growth across the EMEA region is obtainable. His experience at Mitutoyo and in the metrology market means few should bet against the company achieving the gains it seeks in the coming years.

www.mitutoyo.eu

MORE INFORMATION

HIGH IMAGE QUALITY DESPITE SMALL SIZE



IDS integrates Sony IMX900 into uEye low-cost models.

Small camera housings and powerful sensors are not mutually exclusive: IDS Imaging Development Systems GmbH integrates the Sony IMX900 sensor into selected models of the compact USB3 uEye XCP, XLS and GigE uEye LE series. IDS is thus expanding its portfolio with cost-efficient industrial cameras that deliver pin-sharp images even in confined installation situations.

As part of the Sony Pregius S series, the IMX900 offers an outstanding combination of high resolution, compact pixel size and excellent image quality. The 2.25 µm miniature pixels of the compact global shutter sensor with a resolution of 3.2 MP (2048 x 1536 pixels) deliver brilliant results, even with fast-moving objects - ideal for demanding automation and inspection tasks. Another highlight of the sensor is its exceptional sensitivity in the near-infrared range at 850 nm. This makes it the first choice for applications with infrared lighting, for example in product inspection, in driverless transport systems or in autonomous mobile robots. At the same time, the increased light sensitivity in the red spectral range ensures that even fine details such as barcodes are reliably recognised - even in difficult lighting conditions.

IDS is also focussing on efficiency in the design of the new industrial cameras: Thanks to their compact size, they are particularly suitable for applications with limited space but the highest demands on image quality. "By integrating the IMX900, we have created a perfect combination of compact design, high-performance sensor technology and an attractive price structure," explains Marcus Rembold, Product Owner 2D Cameras at IDS. "This opens up new possibilities for our customers to realise high-quality image processing solutions even where space or budget were previously limiting factors." The option of flexible lens selection, with support for C-mount and space-saving, cost-efficient S-mount lenses, provides additional customisation options.

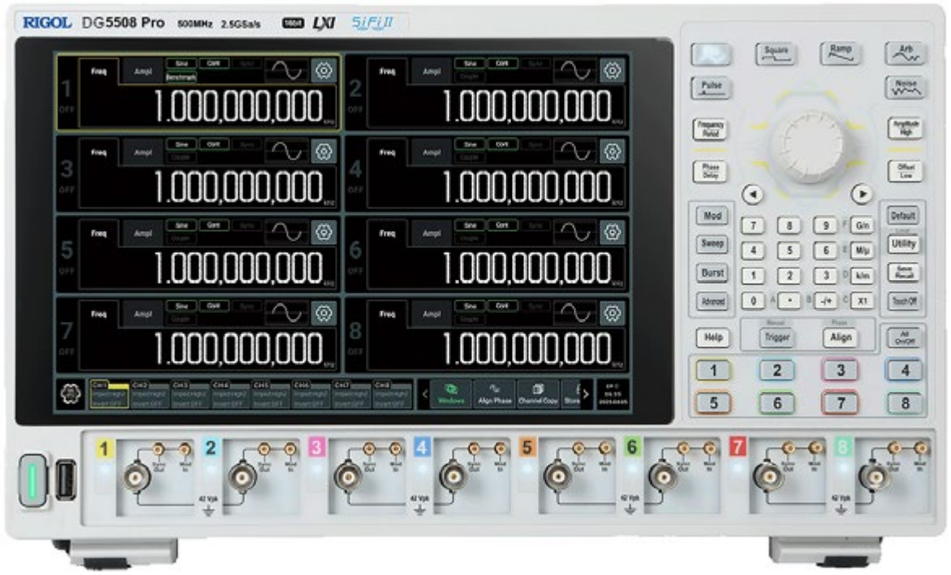
IDS thus demonstrates how the highest image quality can be achieved even with compact camera models.

Further information:
https://en.ids-imaging.com/store/products/cameras/ids-sensor-short/imx900/sort-by/name/sort-direction/asc.html

MORE INFORMATION

MORE INFORMATION

RIGOL LAUNCHES DG5000 PRO SERIES IN INDIA – A NEW BENCHMARK IN MULTI-CHANNEL WAVEFORM GENERATION



RIGOL

High-performance 8-channel Function/Arbitrary Waveform Generator delivers 500 MHz output, advanced modulation, and isolated channel design tailored for precision testing needs across Indian R&D and industrial sectors.

Rigol Technologies, a global leader in electronic test and measurement solutions, has officially launched the DG5000 Pro Series Function/Arbitrary Waveform Generator in India. Designed for high-speed, multi-domain signal generation, the DG5000 Pro Series is engineered to meet the demanding requirements of Indian R&Dlaboratories, manufacturing lines, and electronic system developers.

With up to 8 fully isolated channels, each capable of generating signals up to 500 MHz, the DG5000 Pro offers extensive capabilities for synchronized and independent multi-signal generation. It features a 2.5 GSa/s sampling rate, 16-bit vertical resolution, and up to 128 Mpts/channel of arbitrary waveform memory —ensuring exceptional precision and flexibility in testing workflows.

Compared to previous-generation models, the DG5000 Pro delivers 4x more memory, a broader set of modulation options, and a refined 10.1″ HD touchscreen interface with remote web-based control, all in a compact benchtop form factor.

Performance that Scales with Application Demands
Available in 2, 4, or 8-channel configurations, the DG5000 Pro Series enables engineers to address a wide range of design validation and signal integrity challenges. Each channel is electrically isolated and can operate independently or in synchronization with others — ideal for testing systems with high-voltage isolation, multi-domain analog-digital integration, or differential signal requirements.

Key Technical Highlights – DG5000 Pro Series

Multi-Channel Performance: Up to 8 isolated channels, each supporting 500 MHz output frequency, for synchronized or independent signal generation.

High Fidelity Signal Generation: 2.5 GSa/s sampling rate, 16-bit vertical resolution, and 128 Mpts/channel memory for ultra-precise, real-world waveform simulation.

Advanced Modulation Support: Built-in AM, FM, PM, FSK, PWM, IQ, and PRBS modulation modes—ideal for complex communication and radar system testing.

Flexible Output Architecture: Electrically isolated channels and digital triggering for safe, scalable multidomain testing.

Modern User Interface: 10.1″ HD touchscreen, web-based control, and LAN/USB connectivity for seamless test automation and remote operations.

Engineered for High-Fidelity Testing in Real-World Conditions
The DG5000 Pro's isolated channel architecture not only improves signal integrity but also ensures safer and more flexible test configurations. Engineers working on safety-critical or multi-domain systems—such as power electronics, medical diagnostics, or automotive EMI/EMC compliance—can confidently replicate real-world scenarios in controlled lab conditions.

As India accelerates its innovation across sectors such as quantum computing, radar and RF system development, EV and automotive power electronics, and 5G communication, the DG5000 Pro Series provides a scalable platform for high-bandwidth, high-fidelity signal generation. Its modular design and advanced capabilities empower test engineers to replicate real-world scenarios with greater control and accuracy.

The introduction of the DG5000 Pro Series underlines Rigol's continued commitment to supporting India's evolving test and measurement ecosystem with solutions that combine robust engineering, cutting-edge specifications, and future-ready performance.

For product details or media inquiries, please visit https://in.rigol.com/ind/products/DG_detail/DG5000_Pro or email info.in@rigol.com

in.rigol.com

MORE INFORMATION

TAIWAN'S FIRST: BENQ GROUP EARNS ISO 20121: 2024 CERTIFICATION AT COMPUTEX

Achieves 30% Carbon Reduction and Fulfills All 22 ESG Goals To Build a Green and Sustainable Exhibition.

BenQ Group has once again raised the bar for sustainable exhibitions. At the 2025 COMPUTEX TAIPEI, the Group adopted the new ISO 20121:2024 sustainable event management system and achieved all 22 ESG goals with third-party certification. It is the first enterprise in Taiwan to be certified under the updated standard and the only company worldwide to receive ISO 20121 certification at COMPUTEX for three consecutive years.

To reduce waste at large-scale exhibitions, BenQ Group curated its booth under the sustainability philosophy of "*Together, Make the World Better,*" elevating its green exhibition approach in 2025. Building on a 15% carbon reduction in 2024, this year's booth used 100% circular materials and doubled in size while reducing carbon emissions by 30% compared to 2024 through design and reuse strategies. After the event, booth materials were returned to their design partner, KY-POST, for reuse at the 2025 SDG Asia Expo in September, demonstrating a strong commitment to sustainable legacy.

Joe Huang, General Manager of BenQ Group, emphasized that, as COMPUTEX remains a global tech benchmark, the Group has brought together 23 subsidiaries to showcase AI innovation and support customers in green transitions. BenQ Group also led the adoption of ISO 20121:2024, incorporating climate mitigation, AI financial fraud prevention, and smart healthcare into its exhibit. It emphasized digital responsibility, inclusion, responsible sourcing, and supply chain sustainability. As Taiwan's first enterprise certified under the new standard, BenQ Group is committed to advancing sustainability and building a green value chain with partners.

30% Carbon Reduction and Circular Reuse for a Sustainable Legacy

BenQ Group has advanced its sustainable practices from 3R design in 2023, a 15% carbon reduction in 2024, to its full-scale green exhibition 3.0 upgrade in 2025. Through 100% circular materials, equipment rentals, and low-impact methods, the Group significantly cut its carbon footprint. According to the Industrial Technology Research Institute (ITRI), despite doubling the booth size, emissions from construction and electricity use dropped over 30% from 2024.

To extend material life, the booth installations were returned to KY-POST for disassembly and reuse. Part of the structure will be reused at the 2025 SDG Asia Expo in September, reinforcing sustainable legacy through upstream design and cross-venue reuse, leaving a traceable sustainability record.

Certified to ISO 20121:2024 – All 22 ESG Goals Achieved

Aligning with ISO 20121:2024, BenQ Group met all 22 ESG targets across three pillars: Environment – Carbon Footprint Verification of booth design, 90% digitalization of printed materials, and 100% reusable utensils. Social – over 50% AI green smart solutions, offering Green Travel Guide, and recycled booth materials repurposed into gifts. Governance – 100% vegan locally sourced catering, 90% local souvenirs and gift sourcing, and 80% of construction materials from Taiwan. These efforts covered planning through post-event impact, engaging customers, partners, schools, foundations, social welfare groups, and suppliers.

New 2025 initiatives included: Environment - using 100% circular materials to address climate change. Social - hosting campus seminars to build sustainability literacy among students; sharing circular design strategies at Taipei Computer Association forums; showcasing digital responsibility through AI financial fraud prevention and hospital management; livestreaming AI sessions during the expo to expand audience and practice digital accessibility. Governance - prioritizing local sourcing from B Corps, NGOs, and social enterprises to create shared value.

Co-Creation and Prosperity: Calling on 30 Partners to Respond to Sustainable Actions

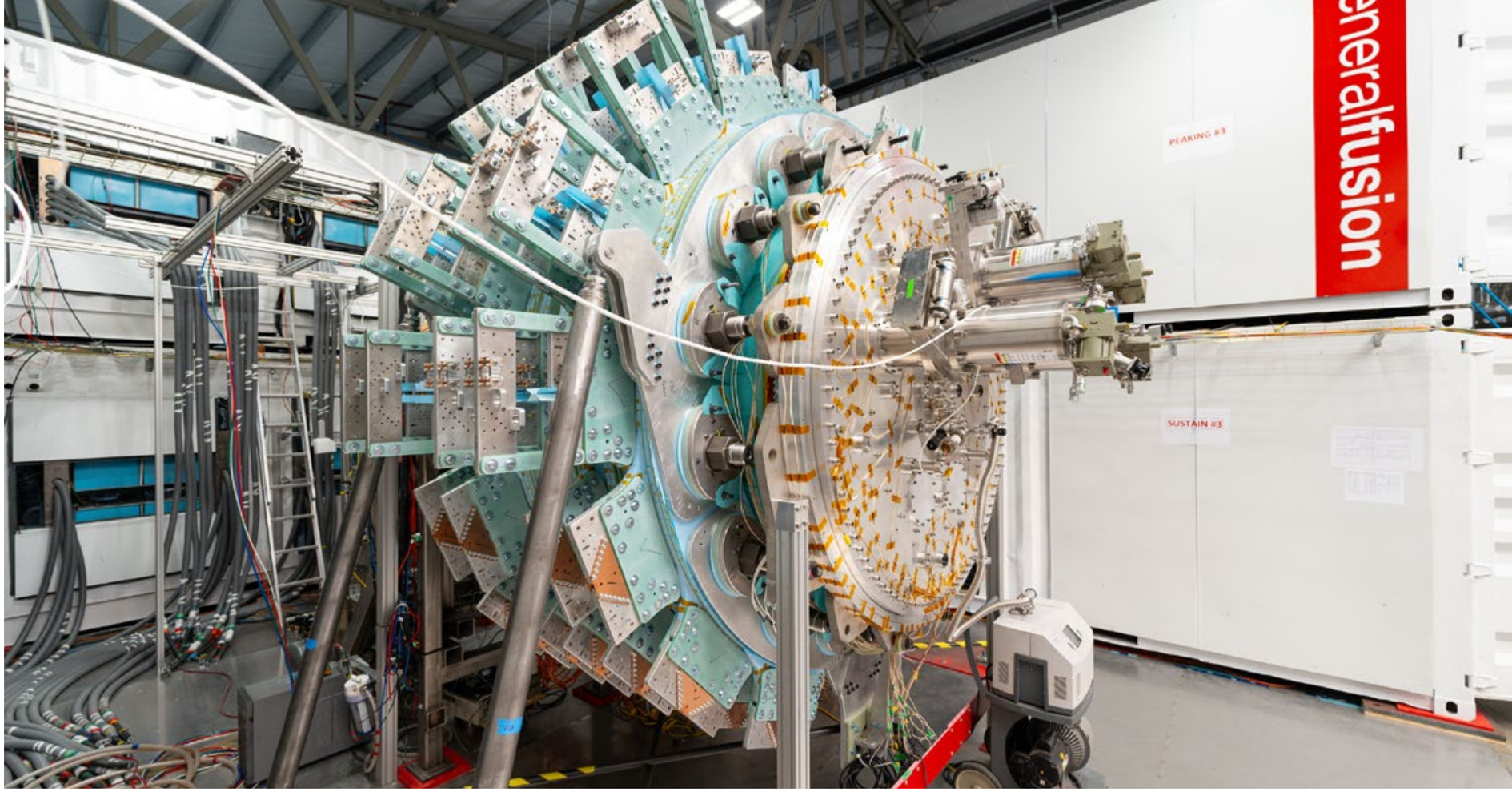
BenQ Group invited 30 sustainability partners to join its ISO 20121:2024 COMPUTEX initiative. Group companies included BenQ, Qisda, ACE PILLAR, ACE Energy, AEWIN, Alpha Networks, APLEX, Data Image, DFI, DIVA, DKABio, DSIGroup, D8AI, Ecolux, Epic Cloud, FiberLogic, Grandsys, Hitron, MetaAge, MetaGuru, Marketop Smart Solutions, Partner Tech, WiXtar.

External collaborators included KY-POST Design International, Mepax, CHINGPIAO, uCup, inBlooom, CircuPlus, and Unity Sustainability Services, contributing AI and sustainability efforts.

According to ISO (www.iso.org), ISO 20121:2024 emphasizes climate action, human rights, DEI, and legacy. It uses the High-Level Structure (HLS) for alignment with other systems, promotes stakeholder engagement, and introduces themes like supply chain responsibility, digital responsibility, and governance resilience—embedding sustainability into organizational culture.

www.benq.com

WORLD'S FIRST FUSION MACHINE DESIGNED USING COMSOL MULTIPHYSICS



COMSOL

General Fusion uses multiphysics simulation to analyze the internal behavior of a fusion demonstration machine and predict its performance.

COMSOL, a global leader in modeling and simulation software, today announced that engineers at General Fusion have used the COMSOL Multiphysics® software to design and optimize a large-scale fusion demonstration machine called Lawson Machine 26 (LM26), which it has successfully begun operating. LM26 will be used to de-risk General Fusion's eventual commercial Magnetized Target Fusion (MTF) machine, which works by compressing a magnetized plasma with a liquid metal liner to achieve the high temperatures and pressures needed for fusion. With MTF technology, General Fusion aims to bring fusion power to the commercial power grid by the early to mid 2030s. MTF power plants have the potential to produce significant amounts of energy with comparatively inexpensive technology and without releasing carbon emissions.

General Fusion's partnership with Veryst Engineering, a COMSOL Certified Consultant specializing in highly nonlinear simulation and material modeling, was essential in the development of LM26. Sean Teller, a principal engineer at Veryst, worked alongside Jean-Sebastien Dick, an engineering analysis manager at General Fusion, to develop material models that enabled the team to accurately simulate the response of the machine's lithium liner. This information was critical for accurate predictive modeling of the LM26 liner trajectories, which enabled General Fusion to create and assemble LM26.

Different LM26 designs were able to be analyzed simultaneously in the COMSOL® software. During the validation campaign of the models, 40 lithium liners were compressed electromagnetically. The team conducted physical experiments using a small-scale prototype of the compression system.

Modeling and simulation enabled General Fusion to adjust the impedance of the power supply, see how design alterations would impact the performance, and maximize the compression efficiency.

"The framework of COMSOL has allowed us to incrementally build in complexity, build confidence in our design intentions, and avoid having to reiterate the design phases," Dick said. "We have not had to change any major parts of these experiments. They were always behaving as intended."

General Fusion achieved a major milestone with LM26 in April, successfully compressing a large-scale magnetized plasma with lithium. The full, integrated system and diagnostics operated as designed, and early review of data indicates positive results.

www.comsol.com

MORE INFORMATION

CONTINENTAL PRESENTS ULTRACOMPACT TRANSPORT ROBOT

The base version of the NXS 300 in action: the ultracompact AMR is optimized for small load containers (600 x 400 mm) and navigates safely through narrow aisles thanks to omnidirectional drives and 360-degree sensors.

The NXS 300 ensures immediately deployable automation: no infrastructure modifications to existing floor-roller tracks are needed. Thanks to native VDA 5050 integration, the NXS 300 plugs seamlessly into existing AMR fleets.

With the ability to transport stacked small load containers of up to 300 kg, NXS 300 drives the next generation of automated small load carriers.

Continental has developed an ultracompact transport robot that transports stacked small load containers (SLCs) of up to 300 kg fully automatically. The NXS 300 ensures immediately deployable automation: no infrastructure modifications to existing floor-roller tracks are needed, and thanks to native VDA 5050 integration, the NXS 300 plugs seamlessly into existing AMR fleets. It delivers top speeds of up to two m/s and safe omnidirectional movement thanks to its 360-degree view.

The NXS 300 comes in two versions: the base version with a 600 mm fork length for classic 400 x 600 mm SLCs on carts and the extended version with an 800 mm fork length for half-pallets to effectively double the capacity per trip. Unveiled at LogiMAT 2025 in Stuttgart, it will be available in early 2026. The NXS 300 is currently being piloted in internal projects at Continental locations in Rheinböllen (Germany) and Sibiu (Romania), with more to follow until the end of the year. First project evaluations indicate a return on investment within well under two years.

Ultracompact design for maximum flexibility

Real-time data and increasing product variants are driving the pace in smart factories. Production managers and logistics leaders must adapt material flow quickly for new products and batch sizes. Consequently, conventional Automated Guided Vehicles (AGVs) are hitting their limits – they remain static and are not flexible enough to change and scale with production layouts. The NXS 300 bridges this gap with an ultracompact design (1,100 × 405 × 1,025 mm) and broad adaptability.

The base version, with a fork height of only 110 mm, is compatible with over 80 percent of carts available in the market. It lifts them via an integrated lift platform at sources and sinks, enabling highly efficient material flow. Omnidirectional drives allow on-the-spot rotations, while 360-degree sensors with obstacle detection ensure safe maneuvers even in mixed-traffic scenarios in narrow aisles. Continental's new AMR combines AGV and AMR modes for great versatility. Its flexible system configuration allows seamless adaptation to various process requirements and production layouts.

Extended version doubles the transport volume per trip

The extended version builds on this mature base system, adding a fork extended by 200 mm. This enables it to handle stacked half-pallets (800 × 600 mm) or combinations of different SLC types – doubling the transport volume per trip and maximizing transport efficiency. Beyond their technical capabilities, the NXS 300 variants deliver a compelling return on investment (ROI). By automating the transport of SLCs, they reduce manual handling, minimize process interruptions and enhance overall efficiency. Companies can expect a significant reduction in operational costs and an ROI within six to 24 months, depending on the specific application and deployment scale.

Comprehensive service to facilitate operations

The ergonomic, user-friendly human-machine interface (HMI) enables intuitive operation and maintenance, while local service teams and a 24/7 hotline guarantee maximum system availability. Proactive maintenance cycles minimize downtime and ensure continuous operation.

www.continental.com

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SIEMENS POWERS BAC'S NEXT-GEN MONO CAR DEVELOPMENT

SIEMENS

Siemens Xcelerator portfolio empowers Briggs Automotive Company to develop its next-generation Mono car, addressing global homologation and enhancing customer experience.

Siemens Digital Industries Software announced today that Briggs Automotive Company (BAC) will move to the Siemens Xcelerator portfolio of industry software and use it to develop the next generation of Mono, its single-seater road legal race car.

BAC was founded in 2011 by Neill and Ian Briggs to fulfill their vision of a road vehicle that offers the most authentic and pure driving experience possible while implementing the very latest racing technology. Developed to be equally at home on the road as it is on the track, BAC's 570 kg Mono supercar is powered by a naturally aspirated 2.5-liter powertrain which develops 311 hp and 313 Nm of torque which translates to a power-to-weight ratio of 546 hp-per-tonne.

When combined with optimal weight distribution and the lightweight structure featuring BAC's world-leading graphene-infused carbon panels, the result currently allows the Mono to sprint to 60 mph in just 2.7 seconds – which the team is looking to dramatically improve for the next-generation vehicle. The need to push the boundaries of what's achievable in the high-performance automotive industry led BAC's senior management and design team to reevaluate its core vehicle development technologies. BAC has selected NX X from Siemens' Designcenter suite of product engineering software for the development of its next generation Mono.

"Anything that helps us be ahead of the game and be ahead of anybody else. The reason we chose Siemens' Designcenter software to develop the next generation of Mono is because it's the best – and it gives us the tools we need to take our vision to the next level," said Ian Briggs, design director and co-founder. "*Our vision was to create a car that simply didn't exist. The fundamental principle of a sports car is choosing excitement over utility, and we took that to the nth degree. Mono is that philosophy made real—a vehicle without compromise, built to prove that being ahead of the game means refusing to compromise on the driving experience.*"

Solving the challenge of homologation

One of the key drivers for the move to Designcenter is to solve the challenge serving a global customer base and certifying that a vehicle complies with the regulatory and safety standards set in a particular region or country.

As Briggs explains, "*A key challenge for us is homologating the car for the global market. Understanding the specific positional requirements for everything from headlights to driver sight lines is a complex minefield. The great advantage of Designcenter is that it allows us to build that entire regulatory framework directly into our 3D CAD model, giving us new levels of confidence and a greater speed of development.*"

https://youtu.be/nMM4k7W0inc

www.sw.siemens.com

www.siemens.com

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REALMAN ROBOTICS SHOWCASES AI-DRIVEN, ULTRA-LIGHTWEIGHT ROBOTICS AT AUTOMATICA 2025

realman

Redefining Industrial Automation with Precision, Agility, and Collaborative Intelligence.

RealMan Intelligent Technology, a global leader in ultra-lightweight humanoid and embodied robotic solutions, is showcasing its latest innovations at Automatica 2025, the world's leading trade fair for smart automation and robotics. At Booth A4.220, RealMan is presenting its AI-powered ECO Series and Embodied Dual-Arm Platforms, designed to empower small and medium-sized enterprises (SMEs) with agile, deployable, and intelligent automation—fully aligned with this year's themes of Dynamic Automation and Healthtech.

RealMan's Ultra-Lightweight Robotics: A Timely Response to Global Automation Needs
RealMan's technologies are engineered to tackle global labor shortages and enhance accessibility to automation. Key highlights include:

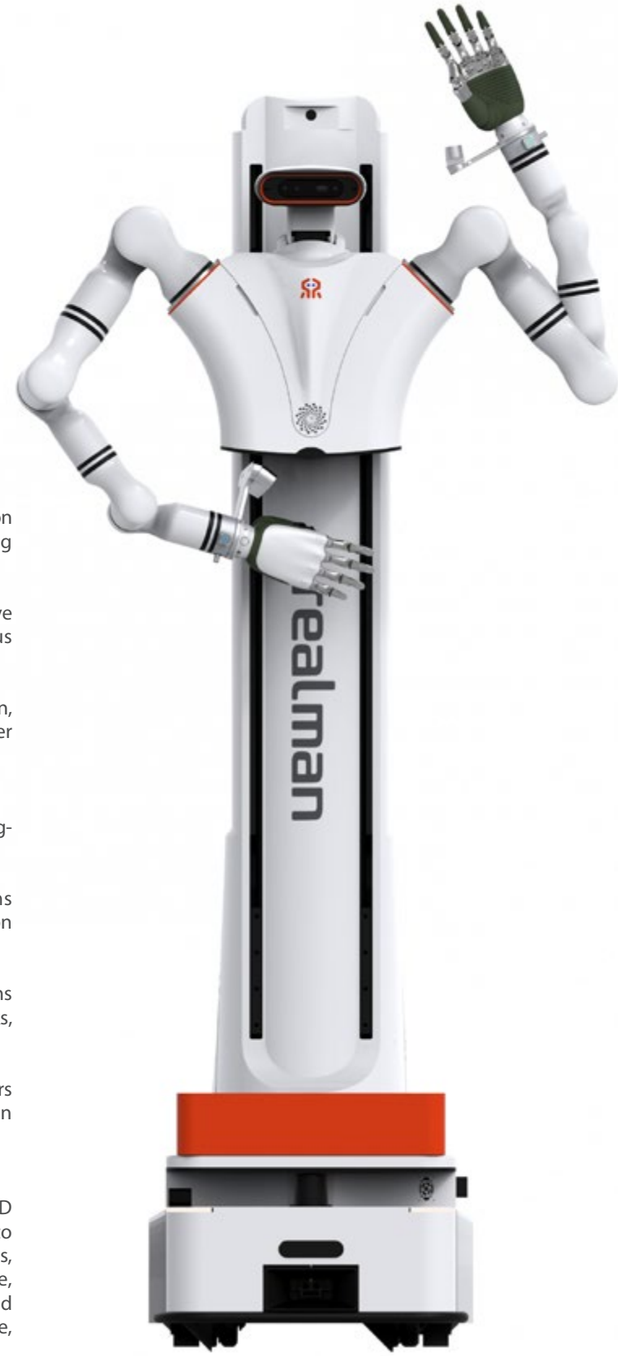
AI-Enabled Precision: Patented servo actuators achieve ±0.05 mm repeatability—supporting surgical-grade assembly and high-precision industrial tasks.

Unmatched Portability: The ECO-65 arm, weighing only 7.8 kg, enables installation up to 70% faster than traditional robotic arms.

Worker-Centric Safety: The Embodied Dual-Arm Platform significantly reduces injury risks in warehouse and logistics environments.

Featured Technologies on Display
ECO Series (ECO-62 / 63 / 65) – The world's lightest industrial arms, ideal for electronics assembly, inspection, and lab workflows.

RML-63 – A compact 6-axis manipulator for precision pick-and-place tasks in confined environments.



RM75-B – A high-payload robotic arm with built-in collision detection, suitable for automotive and manufacturing applications.

Embodied Dual-Arm Lifting Platform – A collaborative platform with force-sensing wrists and autonomous mobility for flexible deployment.

Integrated Actuators – At the core of RealMan's innovation, these components support over 124 patents and power advanced real-time control and connectivity.

On-Site Demonstrations & Live Engagements
At Booth A4.220, visitors are experiencing RealMan's cutting-edge robotics through:

EV Auto-Charging Demo – The RML-63 performs autonomous electric vehicle charging with high precision and adaptability.

Smart Factory Workflow Simulation – Dual ECO-62 arms are orchestrating real-time loading and unloading tasks, simulating agile manufacturing workflows.

Embodied Platform Expert Sessions – RealMan engineers are hosting daily sessions on how dual-arm platforms can optimize SME operations across industries.

Innovation in Action
RealMan's global impact is driven by its strong R&D foundation: over 50% of its workforce is dedicated to research and development. With 20,000+ deployed units, 124+ patents, and an AI-ready hardware infrastructure, RealMan is setting new benchmarks in motion control and embodied intelligence across sectors such as aerospace, e-commerce, healthcare, and precision manufacturing.

www.realman-robotics.com

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MEMOR K20-25: THE MOST VERSATILE KEY-BASED MOBILE COMPUTER IS HERE

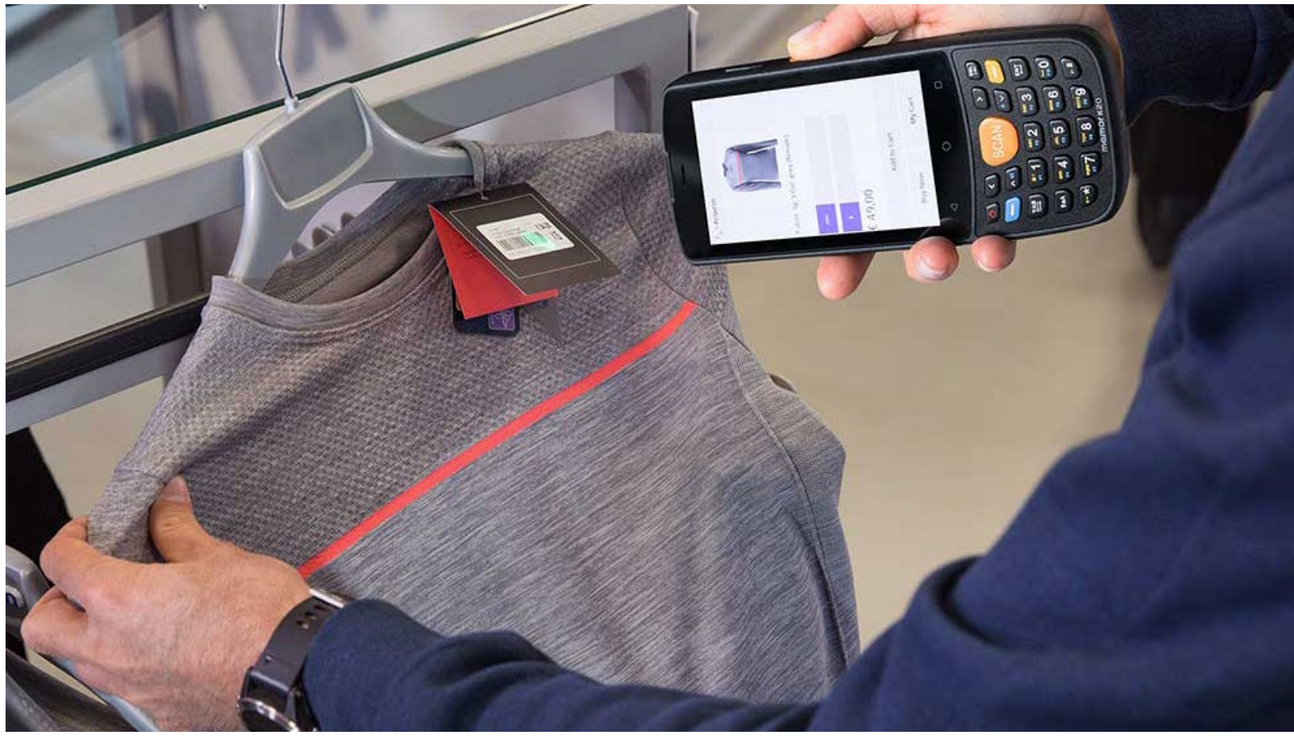
DATALOGIC

Datalogic expands its ever-growing mobile computing portfolio with the new Memor K20-25, a compact, keypad-based mobile computer engineered to maximize efficiency in many operational environments.

Datalogic, a global leader in automatic data capture and industrial automation markets, proudly announces the launch of the new Memor™ K20-25, the next-generation key-based mobile computer designed for businesses that demand speed, precision, and flexibility from their data capture tools. The Memor K20-25 is set to redefine industry expectations by addressing the diverse needs of both touchscreen and keypad applications, making it suitable for organizations of all sizes across different verticals, regardless of budget constraints.

Designed to streamline operations across retail, healthcare, hospitality, transportation & logistics, and light manufacturing, the Memor K20-25 maximizes productivity through its perfect balance of portability and durability. Workers can confidently scan any barcode - even damaged or complex ones, including GS1 Digital Link formats – with exceptional speed and accuracy thanks to Datalogic's powerful Megapixel Halogen™ DE2102-HP scan engine, reducing delays and minimizing errors that impact customer satisfaction and operational efficiency.

Frontline workers can input data quickly and accurately in any lighting condition – even low light - thanks to the device's clear 4-inch display and illuminated 24-key physical keypad, designed for comfortable extended use. With Android™ 13 OS (upgradeable to Android 15) and Google Mobile Services (GMS), businesses can protect their investment while ensuring seamless usage of their software applications across different devices and maintaining enterprise-grade security.



Built to keep workers productive throughout their entire shift, the Memor K20-25 eliminates downtime as it features a 4,850 mAh battery that supports up to 10 hours of continuous work. Its rugged housing survives inevitable drops (from up to 1.5 meters) and harsh conditions of daily fieldwork. Options for Wi-Fi only or Wi-Fi/4G connectivity provide flexibility for both indoor and remote operations. The high-quality 13MP rear camera further enhances proof-of-delivery processes and documentation tasks, reducing manual paperwork and accelerating customer services.

Datalogic's Memor K20-25 sets the new standard for mobile computing versatility, uniquely combining touchscreen convenience and keypad efficiency, offering unmatched value and reliability for growing businesses. With the full support of Datalogic Mobility Suite and its Android SDK, customers can now unlock our scanner's full potential, making it the definitive choice for organizations seeking one device that can evolve with their operations and deliver maximum return on investment.

www.datalogic.com

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DRIVE SOLUTIONS FROM NORD DRIVESYSTEMS FOR FOOD & BEVERAGE

Durable, efficient and easy to clean.

In the food and beverage industry, maintaining high hygiene standards is essential. NORD's drive solutions not only meet the basic requirements but also impress with their durable, robust design and high efficiency. With its new NXD tupH® surface treatment, NORD once again makes aluminium as resistant as stainless steel, offering the perfect solution for drive technology in hygiene-sensitive production areas.

Drive solutions for processes in the food and beverage industry must be resistant to detergents, as they are frequently cleaned and disinfected due to the high hygiene standards. While stainless steel is the preferred material in wash-down areas, it presents significant disadvantages when applied to drive technology. The NXD tupH® surface treatment developed by NORD makes aluminium an interesting alternative for applications in the food and beverage industry: It strengthens the surfaces of drive components such as gear units, smooth motors and frequency inverters, making them resistant to harsh environmental conditions. In the NXD tupH® version, it also provides protection against aggressive cleaning agents, chemicals, acids and alkalis. Drives made of aluminium are furthermore significantly lighter and operate at lower temperatures.

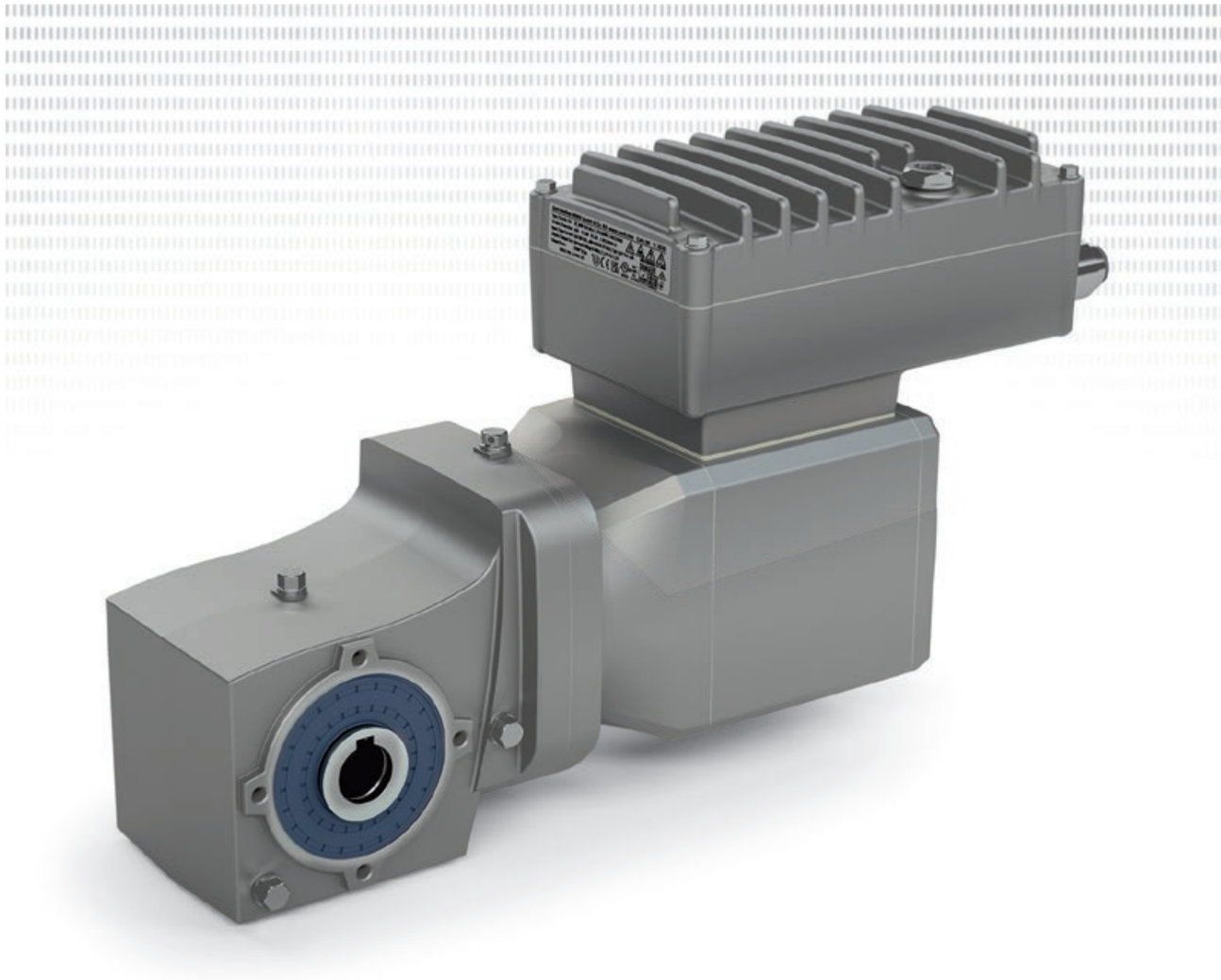
Durable treatment of aluminium surfaces thanks to NXD tupH®

NXD tupH® is specifically developed for applications that require food-safe surfaces. The aluminium surfaces treated in this manner are resistant to frequent cleaning and disinfection for a long time. The NXD tupH® treatment is created in two steps: First, the upper layer of the aluminium body is transformed into a corrosion-resistant, hard layer. Second, a sealer is added to provide a high resistance to chemicals. NXD tupH® surfaces are free from PFAS, and food-safe according to the FDA, the EU Regulation 1935/2004 and the respective regulations in Switzerland and the MERCOSUR states. They can therefore be used in hygienically critical areas in the food, beverage, packaging, pharmaceutical or chemical industry.

A thousand times in use, a thousand times trusted

The innovative NXD tupH® surface treatment is the latest addition to NORD's range of drive solutions, specifically developed for the food and beverage industry with its increasingly stringent regulations. Thousands of these drives are already being used in food and beverage applications across the world: They are robustly built and designed for a long life cycle, offering high investment security. Modern IE5+ drives ensure high efficiency and thereby help to reduce operating costs. For hygiene-sensitive environments, NORD offers customers a selection of fanless smooth motors that can be cleaned easily, quickly and thoroughly. With the optional NXD tupH® treatment, these drives are wash-down capable, corrosion-resistant, sustainable and available in stock ready for installation.

www.nord.com



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BOBCAT'S INNOVATION: ADVANCING PRACTICAL TECHNOLOGY FOR BETTER JOBSITE PERFORMANCE

Bobcat

Bobcat focuses on practical, affordable innovations—like autonomy, electric power, and smart tech—to help users work faster, safer, and more sustainably across diverse jobsites.

Bobcat's Innovation department has presented some futuristic concepts of new machines in recent years, such as the autonomous and all-electric RogueX1 and RogueX2, the all-electric T7X compact track loader and S7X skid-steer loader and the AT450X electric and autonomous articulating tractor. These prototypes were primarily intended as visions of the future, but they are also platforms for testing new technology, which is now gradually finding its way into the new models. *"Our innovation approach is mainly focused on practical developments that help users do their jobs faster and better,"* says Joel Honeyman, vice president of Global Innovation at Bobcat.

Honeyman has been with Bobcat for 28 years. He studied mechanical engineering and has a master's degree in agricultural economics. Before taking on responsibility for product development and innovation, he spent 10 years in sales. This was a valuable experience for him. "*In sales, I often came into contact with questions from customers and prospects about new technology, functionality and applications. That automatically makes you think about product development.*" Since 2014, he has led a dedicated full-time team of employees who focus on innovation. The team is in close contact with customers and dealers to gain insight into the everyday problems and challenges that users face.

He said: "*We come up with solutions, develop them and ultimately apply them to our machines. We see technology as a tool that helps customers do their work more efficiently. You don't necessarily need earth-shattering innovations or super-advanced technology for this. The greatest added value is often in the basic things that make machines easier to use and deliver better performance. We introduce our customers to innovations as quickly and as extensively as possible in order to optimize them based on their experiences.*

RogueX, T7X and AT450X

For Joel Honeyman, the development of concept machines such as the RogueX1 and RogueX2, the T7X compact track loader and the AT450X articulating tractor is therefore not an end in itself. "*We are focusing on the jobsite of the future, in which autonomous machine operation, enhanced safety, sustainability and connectivity play a key role. Certain technologies are inevitable for this. It is important to explore new ways of working and new machine designs based on this development direction.*

"*This leads to concept machines. It is not certain that these exact machines will actually come onto the market in this form, but they do provide a platform on which we can test new technology. If you build an autonomous machine, you no longer have an operator and therefore no cabin. You can see that with the RogueX. The T7X is fully electric, and in the design, we have therefore replaced the traditional hydraulic system that typically operates the lift arms with electric actuators, which are controlled by special software.*"

Bobcat is a pioneer when it comes to sustainability. The E10e was one of the first electric excavators to be produced in series and various additional battery electric or all-electric machines have already been introduced, such as the T7X, the S7X, the AT450X and the recently presented TL25.60e telehandler. At the LogiMat trade fair earlier this year, Bobcat showed a forklift with a hydrogen fuel cell.

Partners

In addition, Bobcat works closely with other companies when applying new technology. There are partnerships with companies such as Ainstein, which develops high-resolution radar technology; Greenzie, which develops industry-leading autonomous software for commercial lawn mowers and outdoor power equipment; Agtonomy, an agtech software company; and Trimble, which deals with 3D scanning and virtual reality. Bobcat itself is mainly involved in the engineering of the machines and the underlying software platform, which connects and controls all the new technology.

Practical Innovation

The main priority of Bobcat's innovation strategy is to develop new technology and applications so that customers can do their work faster, more efficiently, more safely and more sustainably. "But the starting points for innovation can be very different," Honeyman explains. "*Look at automating work. Mowing is very different from digging or moving loads on a busy construction site. Mowing is a fairly simple activity in principle, where the machine does little more than drive in straight lines and fixed patterns over a terrain, while avoiding obstacles. A loader or excavator on a construction site is in a much more dynamic and even unpredictable environment.*

There are trees, pipes, buildings and water features; there are other machines at work and people walking around. In addition, every job is unique. The environment, logistics, surface and driving behaviour vary. This makes innovation and automation a major challenge, for which multiple technological solutions can be used."

Bobcat has developed many practical innovations and technology for the machines and their users. This varies from compact track loaders developed for driving on difficult terrain, the Bob-Tach® system that allows customers to easily mount attachments on their machines and MaxControl for the remote operation of Bobcat loaders. But also small adjustments, such as simple buttons for automatically performing standard actions such as lifting the bucket can result in enormous efficiency and time savings.

Object Detection

"*We now have access to enormous amounts of data that are important for the execution of the work, but the construction site itself also generates enormous amounts of data. In our view, information about the work area and object detection are extremely important,*" emphasises Honeyman.

"*This data not only makes manoeuvring with (autonomous) machines easier, but also enhances safety. We use GPS equipment, among other things, because it is very accurate and can map all static objects in a terrain perfectly. This can be done using real-life images, but also with virtual reality, which you can project onto a display in the cabin or wearables such as VR glasses. Incidentally, you can also use it to show non-visible objects such as underground pipes or provide work instructions.*

"*With the help of OLED technology, images can be integrated into the windows of machines, so that the windows themselves can function as a transparent display to enhance operator productivity and bring efficiency to the task at hand. For moving objects and people, technology such as smart cameras, radar and sensors can improve operators' jobsite awareness. With technology like Bobcat's concept collision warning and avoidance system, operators can receive an audible alert or enable the machine to automatically stop upon detecting an object in its path. We also expect that drones in construction will play an important role in mapping the terrain and the objects present on it.*"

Machine IQ

He continued: "*In addition, there are now also huge amounts of data available about the machines themselves. We have introduced Bobcat Machine IQ, which allows owners and users to remotely monitor all relevant data about the machines: their location, whether they are stationary or working, fuel consumption and technical condition. Based on this data, you can, for example, improve the deployability of machines, optimise consumption or schedule maintenance and repairs. This helps operators get the most out of their machine, while also protecting their investment.*

"*And that brings us to the costs and benefits of innovation. Every innovation must provide added value but must also be affordable. We conduct research into this and regularly ask our customers what they are prepared to pay. We want to make innovation accessible to customers. That is why we not only introduce innovations as an update on new models, but also offer tech enhancements as a retrofit on existing machines, so that you can also benefit from new technology without necessarily having to purchase the very latest machines. In this way, innovations are not only reserved for early adopters, but customers with a fifteen-year-old machine can also benefit from innovation.*"

www.bobcat.com

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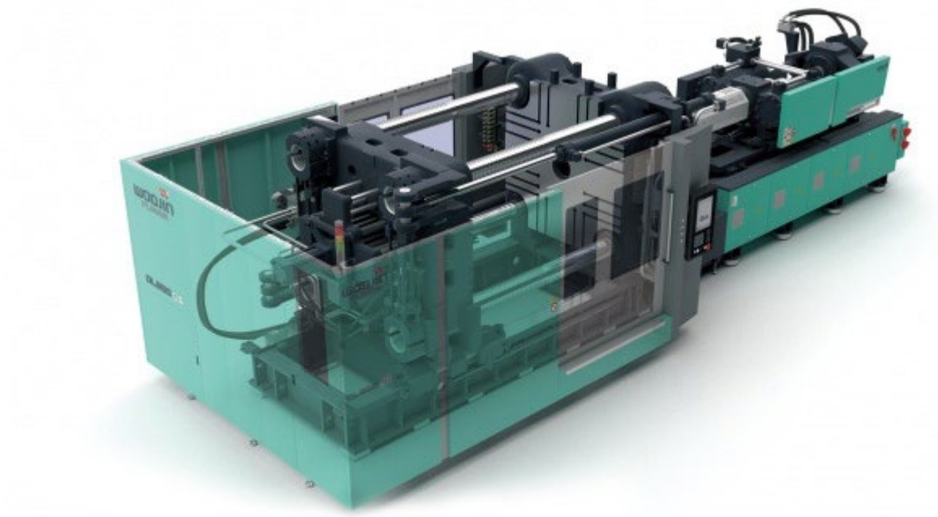
WOOJIN PLAIMM DEVELOPS DEDICATED INJECTION MOLDING MACHINE FOR ECO-FRIENDLY CXP MATERIAL THROUGH STRATEGIC PARTNERSHIP



WOOJIN PLAIMM is collaborating to commercialize CXP, an eco-friendly material. They are developing and supplying injection molding systems optimized for CXP.

WOOJIN PLAIMM, South Korea's leading manufacturer of plastic injection molding machines, has announced a collaborative initiative to advance sustainable material processing by supporting the commercialization of an innovative eco-friendly material called CXP (Cellulose Cross-linked Polymer). In collaboration with a local forestry cooperative and a domestic CXP developer, WOOJIN PLAIMM is playing a pivotal role by developing and supplying dedicated injection molding systems optimized for the unique properties of CXP.

A Sustainable Partnership for a Greener Future
This tripartite partnership brings together key players across the value chain: the forestry cooperative provides biomass by-products such as wood chips and agricultural residues, the CXP developer conducts material R&D, and WOOJIN PLAIMM is responsible for manufacturing the custom-tailored injection machines required for molding CXP.

DL-G5: A Machine Tailored for CXP
To address the specific challenges of processing CXP—such as carbonization at relatively low melting points—WOOJIN PLAIMM has developed a dedicated injection molding solution: the DL-G5. This two-platen direct pressure machine features a custom screw design that minimizes frictional heat and optimizes low-temperature melt flow, significantly reducing the risk of carbonization and gas emissions during molding.

Key technologies integrated into the DL-G5 include:
- Servo pump system for energy efficiency
- Fast dry cycle (6.0 sec at 1800 tons EUROMAP 6)
- Half-nut synchronous locking for reduced cycle time
- Modular controller with multilingual support
- Integrated inverter cabinet to minimize installation area
- Ball-bearing linear guides for reduced friction and enhanced precision

The injection unit also includes high-rigidity dual-axis rods and closed-loop backpressure control, enhancing both repeatability and responsiveness in molding CXP.

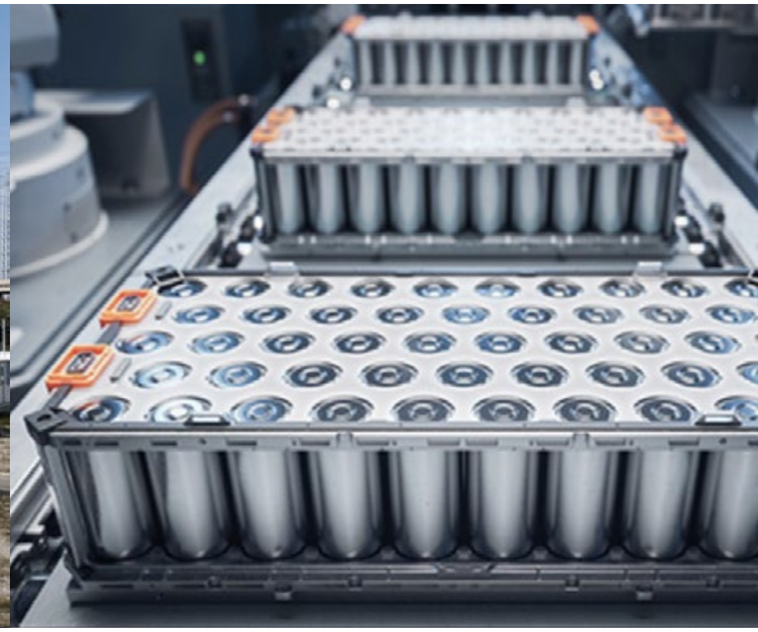
Global Market Strategy and K 2025 Participation
WOOJIN PLAIMM is actively preparing to expand this solution globally. Its 2 branches(Chennai, Anantapur) in Indiaare serving as key contact points for inquiries in the respective markets, with dedicated sales and support networks already in place.

Additionally, WOOJIN PLAIMM plans to showcase live demonstrations of its CXP molding capabilities at K 2025, the world's largest plastics and rubber trade fair, to be held in Düsseldorf, Germany, from October 8 to 15, 2025. The demonstration will feature the TE250NC, an electric two-color injection machine processing CXP resin on-site.

www.woojinplaimm.com

MORE INFORMATION

PREVENTING FIRE HAZARDS AT BESS SITES WITH FLIR THERMAL IMAGING



FLIR

Battery Energy Storage Systems (BESS) are revolutionizing the way we power our world, acting as the source that keeps renewable energy flowing even when the sun isn't shining or the wind isn't blowing.

As the backbone of modern energy infrastructure, BESS plays a crucial role in balancing supply and demand. However, with the increasing adoption of large-scale battery storage comes the responsibility for manufacturers, site managers and regulators to manage its risks effectively.

The High-Voltage Threat: Thermal runaway in battery storage

Thermal runaway is the equivalent of a system overload. It's a dangerous chain reaction in which an overheated battery cell loses its stability and begins to ignite its neighbors, setting off a firestorm that's incredibly difficult to contain. It's of particular concern when dealing with lithium-ion batteries used in products such as electric vehicles, portable electronics, and grid-scale storage.

Much like an electrical surge that fries a circuit, thermal runaway rapidly escalates, putting lives, infrastructure, and energy security at risk.

Several factors can cause this dangerous phenomenon to ignite, including:

- Overcharging or overdischarging: Pushing a battery beyond its limits can cause excessive heat buildup, leading to system failure.
- Physical damage or manufacturing defects: Cracks, punctures, or design flaws can create weak links in the chain, making failures more likely.
- Environmental conditions: Exposure to high temperatures or external heat sources can turn a stable BESS into a ticking time bomb.

The fallout from a BESS fire can be severe, resulting in massive financial losses, grid instability, and environmental harm. And when you consider that these storage units are often installed near other high-energy infrastructure, the potential for disaster multiplies.

With the adoption of BESS units ramping up across the globe, soaring by more than 50% in 2024* alone, the potential risks must be managed in a way that safeguards workers, critical assets, communities, and the environment.

Stop the Spark Before it Starts: The power of thermal monitoring

The best way to prevent thermal runaway is to detect heat anomalies before they escalate. But without the right monitoring tools in place, operators are left in the dark, often unaware of hidden dangers until it's too late.

That's where thermal imaging technology plays a pivotal role. By offering continuous, real-time temperature surveillance, advanced thermal imaging can alert personnel to dangerous situations as they being to develop, so that no hot spot beyond specifications goes unnoticed. Like a circuit breaker that prevents an electrical overload, thermal monitoring acts as a failsafe, allowing site managers to catch and address overheating batteries before they ignite.

Energizing Safety: What makes a strong thermal monitoring system?
To truly keep BESS operations running smoothly without the risk of meltdown, thermal monitoring systems must offer:

- High-resolution imaging: The ability to detect even the slightest temperature variations across battery stacks, ensuring no heat anomaly slips through the cracks
- Wide field of view: Comprehensive coverage that leaves no blind spots, just as a well-designed electrical grid leaves no home without power
- Advanced analytics: Smart detection technology that filters out false alarms caused by reflections, weather, or routine human activity
- 24/7 real-time monitoring: A non-stop watchdog that never sleeps, ensuring site managers stay wired into potential risks at all hours.

With 640 × 480 thermal resolution, FSX® (Flexible Scene Enhancement) technology, on-the-edge analytics, and offered fields of view up to 80°, FLIR's industry-leading A500f/A700f Advanced Smart Sensorcamera is key to ensuring site owners' valuable peace of mind.

Powering a Safer Future

BESS technology is charging ahead, and with it, the responsibility to keep energy storage systems safe and stable. If left unmonitored, thermal runaway could pull the plug on renewable energy progress, jeopardizing the benefits of grid resilience, sustainability, and energy security.

By integrating cutting-edge thermal imaging into BESS infrastructure, operators can stay ahead of the curve, preventing small temperature fluctuations from sparking massive disasters. Because in the high-stakes world of energy storage, early detection isn't just a bright idea it's the only way to keep the power on.

Learn more about solutions for early fire detection at BESS and other industrial sites here.

www.flir.com

MORE INFORMATION

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LEADING THE DISCOVERY OF THE FUTURE – SUSTAINABLE MACHINING THROUGH DATA INTELLIGENCE

Seco

Seco aims to make manufacturing fast, easy, and sustainable by leveraging machine data, which is crucial for overcoming future sustainability and regulatory challenges.

At Seco, our purpose is *"Together we make manufacturing fast, easy and sustainable."* As manufacturing companies work towards more sustainable manufacturing, there are challenges regarding the collection, analysis and management of relevant data. As highlighted by future legislation, data connected to the machine and machining environment will become key to drive sustainability in the most effective way.

The project

To address this challenge, Seco has partnered with the Advanced Manufacturing Research Centre North West (AMRC), in Samlesbury, UK, which plays a key role in driving recovery, growth, productivity, and innovation. The collaboration aims to drive utilization of Internet of Things (IOT) hardware, various industrial communications, and IOT Protocols to produce a single source of truth for facility use and machine data, relevant for environmental impact assessments and improvements.

This project segments the manufacturing ecosystem into three interrelated domains: the machining process itself, the immediate machine environment, and the broader facility context. By monitoring each area individually and then analyzing how they influence one another, stakeholders gain both detailed diagnostics and a holistic perspective on sustainability challenges.

For the machine – The approach enables monitoring and hotspot analysis of the machining process directly. This includes information on the energy consumption of the machine, broken down by sub-process, cutting fluids and other material consumption. This can then be directly converted into real time costs and CO2 impact through live grid carbon intensity factors and cost per kilowatt hour.

- For the machine environment – The monitor tracks the humidity and temperature, which can impact the energy required to ensure environment stability for the machine.
- For the facility – The monitor tracks the entire manufacturing plant and identifies high level patterns that can negatively impact energy and cost.
- The relationship between – Did the humidity around the machine increase the required energy for cooling? Are open windows requiring more energy? Or are closed windows not providing sufficient natural ventilation and thereby increasing cost to maintain the required temperature? Are the machines optimized?

This approach will help to identify patterns and factors that can help companies reduce their CO2 and costs most relevant to the customer's specific context. Within this monitored environment, Seco UK can analyze a machining program and processes in fine detail – and further refine the programs by associating power consumption and CO2 emissions within the machine.

The future

By harnessing independent monitoring of power consumption and facility usage, we can pinpoint the hidden costs of inefficiency and translate every kilowatt hour into real-time CO_2e and expense metrics. This level of insight allows us to compare the energy demands and carbon footprints of any two products, programs or machines – empowering our teams to make data-driven decisions and embed sustainability at the heart of manufacturing design.

The test environment, complete with integrated monitoring for both Seco products and guest supplier machines, bridges Life Cycle Assessment of Seco with live machine data. By doing so, we gain precise, component-level environmental scores and open the door to targeted innovation and validation of greener machining strategies.

Looking ahead, we are building toward an AI-powered, automated feedback system that continuously optimizes processes in real time. This solution will balance productivity and cost imperatives with environmentally responsible best practices, ensuring every adjustment drives us closer to net-zero goals. Together with the AMRC and our customers, we're turning comprehensive data intelligence into actionable sustainability, living our purpose of making manufacturing fast, easy and sustainable.

www.secotools.com

MORE INFORMATION

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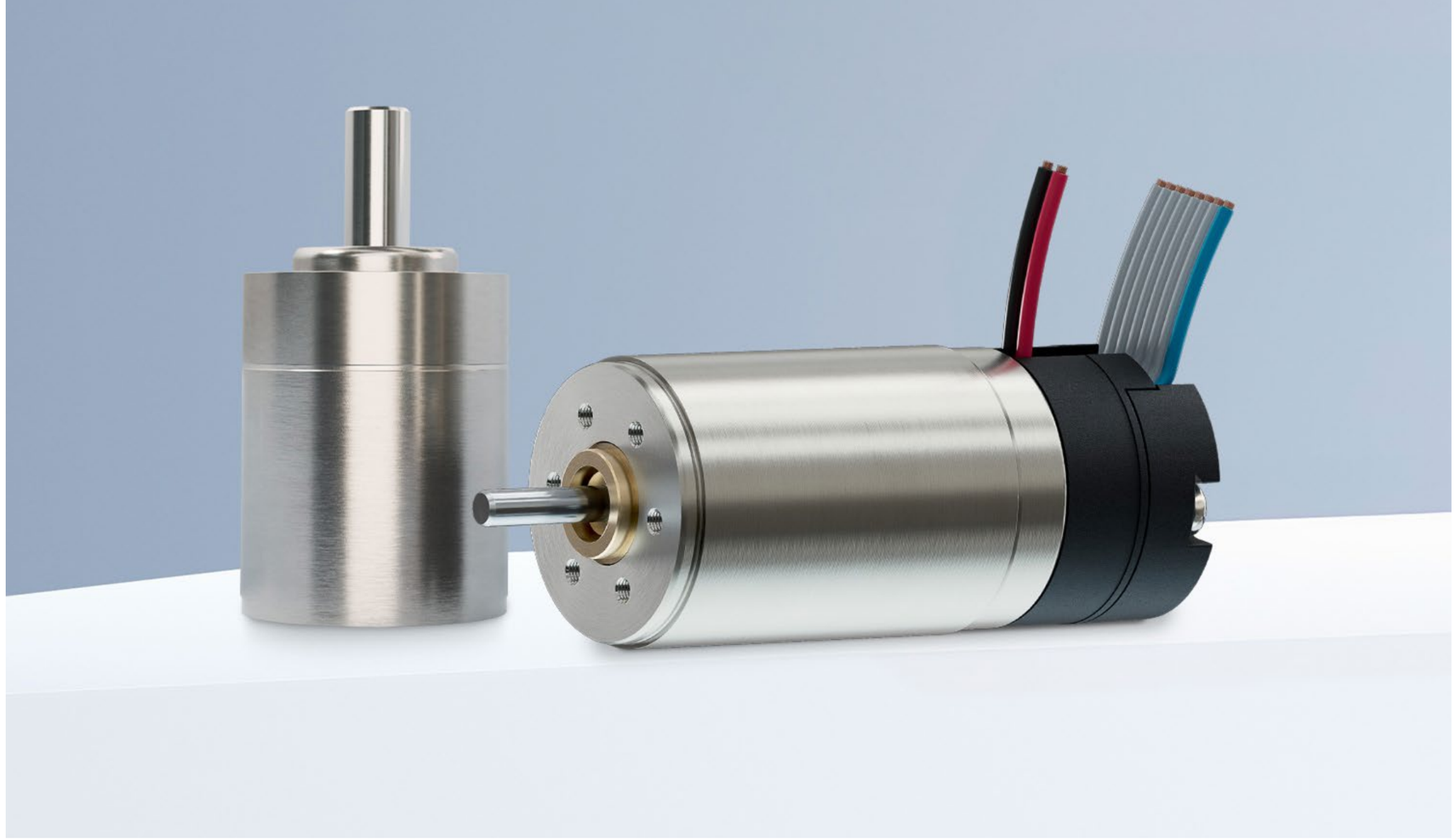
PERFECT SYNERGY FOR MAXIMUM PERFORMANCE



New motors, gearhead and encoders with Ø 16 mm for the FAULHABER product range.

New highlights for complete solutions in drive technology: With the new size of the SXR motors, the powerful motor of the new GXR family, the high-precision encoder and the matching gearhead, FAULHABER presents products that are perfectly matched to one another, come from a single source and are all diameter compliant with Ø 16 mm. This combination enables optimal efficiency, maximum dynamics and absolute precision ideal for high-tech industries and challenging applications in industrial automation, robotics and medical technology.

New to the product range: DC-motors in the GXR and SXR families
The new brushed motor 1627 GXR with copper-graphite commutation impresses with its high power and a wide range of equipment options that enables it to meet the requirements of modern drive solutions. It offers flexible voltage variants from 4.5 V to 24 V and different bearing configurations. The motor can also be individually adjusted – from modifications on the front and rear shafts to options for use in vacuum or high-temperature environments. Optimized rotor balancing ensures smooth operation and contributes to the motor's durability. The hexagonal winding technology which has a high copper filling factor and an optimized proportion of straight lines and the high-quality magnets ensure temperature stability and improve overall performance.

These are also features of the new size in the precious-metal-commutated SXR family the existing 1218 and 1228 SXR is now joined by new version in the size 1627 SXR. It has an outstanding power to volume ratio and is ideal for high-tech applications. All components in the SXR and GXR families are RoHS compliant and the electrical connections offer a variety of configuration options.

It is easy to combine the GXR motors and SXR motors with the metal planetary gearheads in the GPT family. In particular, the new, diameter-compliant 16GPT is ideal for challenging applications with limited installation space. The optimized construction allows high speeds, enabling use of the motor's entire speed range. In addition, the stable design ensures that extreme forces can be transferred reliably and large loads can be managed without a problem.

Another ally: the new magnetic encoder IEX3
With the latest chip technology, the IEX3 and IEX3 L offer a high resolution and positional accuracy that typically reaches 0.3°. Equipped with a wide voltage range both 3.3 V for battery-powered applications to 5 V are possible and a temperature range of -40 to 100 degrees Celsius, the encoder is both flexible and robust. The IEX3 (L) is available with or without a line driver and is both extremely compact and easy to maintain ideal for use in combination with the new FAULHABER SXR and GXR motors.

Thanks to the seamless matching of the components, developers and engineers benefit from a compact, powerful and reliable complete solution that opens up new possibilities for modern drive systems.

www.faulhaber.com

MORE INFORMATION

CRITICAL MANUFACTURING NAMED AS A REPRESENTATIVE VENDOR IN 2025 GARTNER® MARKET GUIDE FOR MES

Critical Manufacturing was named a Representative Vendor in Gartner's May 2025 MES Market Guide, highlighting its role in advancing digital manufacturing with AI and IoT.

Critical Manufacturing, a leader in advanced Manufacturing Execution Systems (MES) and a subsidiary of ASMPT, has been recognized as a Representative Vendor in the May 2025 Gartner Market Guide for MES report. Gartner's key industry report says *"MES solutions are foundational to digital manufacturing. The MES market is adapting as the existing vendor community pivots to newer technologies like AI and IoT to keep pace with startups. Manufacturing strategy leaders should use this research to navigate the evolving MES market."*

Francisco Almada Lobo, Critical Manufacturing CEO. said: "*In recent years we have been recognized three times as a Leader in the Gartner Magic Quadrant™ for MES report and we are now equally proud that this research and advisory firm has listed us as a Representative Vendor in its May 2025 Market Guide for MES.*"

Gartner states this recognition is based on "*inquiry volumes, market presence and the ability to cover the core MES use cases and features*".

Added Almada Lobo: "*Our MES platform helps manufacturers increase efficiency, productivity, and agility in their production processes. However, to support the evolving requirements of customers, the system is subject to continuous improvement as we push the boundaries of MES innovation and collaborate with our partners and customers in support of best-practice manufacturing.*"

Recent enhancements to Critical Manufacturing's MES include its continued roadmap on semiconductor production requirements, such as substrate mappings, complex product lows, and multilevel packaging. Low-code capabilities have extended into its enterprise integration and event-handling services. Along with the platform's DevOps Center, customers, integrators, and partners can also publish their own apps that leverage the data platform.

A number of key recommendations conclude the report, stating that manufacturing strategy leaders need to consider more than just production requirements when evaluating vendors. For instance, when appraising project scope with a vendor, Gartner suggests potential MES users should ensure they fully understand their low-code or API offerings as a way to augment the system through a decoupled approach.

It is Critical Manufacturing's belief that low-code capabilities are a key differentiator of its MES platform, enabling the easy adaption of workflows and interfaces in line with the specific needs of customers. This approach is a key part of Critical Manufacturing's Industry 4.0 solutions, allowing for quicker updates, changes, and the addition of new functionality without extensive capital expenditure

A further market recommendation of the Gartner 2025 Market Guide for MES is to evaluate vendors for vertical solutions if the potential user prefers a more standard approach to MES and wants to reduce the need for customization. In the opinion of Critical Manufacturing, vertical solutions provide a notable distinction of its MES, in particular the platform's specific attributes for discrete industries such as semiconductor, electronics, medical device, and industrial equipment. Serving as a true Industry 4.0 hub, this advanced MES solution provides manufacturers in these demanding sectors with a dedicated platform for digital transformation success.

www.criticalmanufacturing.com

MORE INFORMATION

SPECTRUM INSTRUMENTATION ANNOUNCES FOUR NEW HIGH-PERFORMANCE AWGS

The new AWGs deliver output rates up to 10 GS/s with exceptional 16-bit vertical resolution and bandwidths reaching up to 3.9 GHz.

Spectrum Instrumentation announces four new high-performance Arbitrary Waveform Generators (AWGs), marking a significant milestone in the company's product portfolio. Designed for demanding applications in radio frequency (RF) and microwave signal generation, the new AWGs deliver output rates up to 10 GS/s with exceptional 16-bit vertical resolution and bandwidths reaching up to 3.9 GHz. The new products are aimed at engineers and scientists working in cutting-edge fields such as wireless communications, radar system development, quantum research, and aerospace testing.

Designed for demanding applications in radio frequency (RF) and microwave signal generation, the new AWGs deliver output rates up to 10 GS/s with exceptional 16-bit vertical resolution and bandwidths reaching up to 3.9 GHz. The new products are aimed at engineers and scientists working in cutting-edge fields such as wireless communications, radar system development, quantum research, and aerospace testing.

"*This launch represents a major leap forward for us,*" said Oliver Rovini, CTO of Spectrum Instrumentation. "*It's the first time we've entered the high-bandwidth space, and we're doing it with a product line that sets new standards in quality and capability. With these new AWGs, we're giving our customers a tool that enables next-generation innovation.*"

The new flagship AWGs are available as PCIe cards with up to 10 GB/s streaming, as well as stand-alone NETBOX units with easy control via Ethernet, connecting directly to laptops, PCs or company networks. The new instruments are ideal for integration into automated test systems. Key features include:

- Output rates up to 10 GS/s for ultra-fast signal generation
- 16-bit vertical resolution to ensure exceptional signal fidelity
- Analog bandwidths up to 3.9 GHz, enabling true-to-life reproduction of wideband RF & microwave signals
- Single-Ended or Differential outputs with up to 4V output swings
- Multi-channel synchronization for complex signal simulations across multiple outputs
- Up to 8 GSample memory per channel for flexibility in waveform generation

These features make the new AWGs particularly well-suited for applications that demand high signal quality over wide bandwidths, such as testing of communication standards like 5G and 6G, simulating radar echoes, or generating waveforms for experimental physics and quantum systems.

In addition to their powerful hardware, the new AWGs are supported by Spectrum's comprehensive software suite, including drivers for Windows and Linux, as well as programming examples for languages like C/C++, Python, MATLAB, and LabVIEW, plus Spectrum's SBench 6 software for interactive operation. These new flagships include a 5-year warranty, free lifetime software/firmware updates, and support directly from Spectrum's design engineers.

www.spectrum-instrumentation.com

MORE INFORMATION

DC POWER CONNECTORS FROM AMPHENOL GEC

TME now offers Amphenol GEC's PowerLok power connectors, ideal for EV, hybrid automotive, and renewable energy applications, including energy storage systems.

TME's product range has been expanded to include PowerLok™ power connectors from Amphenol GEC. This is a new offering from a renowned supplier, primarily aimed at manufacturers and electrical engineers focused on EV and hybrid automotive industries. Additionally, the presented products are also suitable for renewable energy installations, especially energy storage systems.

Although all introduced products belong to the same family, this offering should be divided into two groups: PowerLok™ G2 plugs and sockets, and PowerLok™ 4.0 G2 connectors.

PL18X-301-50-2-5
1-pin plugs

PL182X-301-50-2-5
2-pin plugs

PL082X-61-10-2
Panel sockets

PL183X-301-50-2-5
3-pin plugs

Self-locking PowerLok™ 4.0 G2 connectors have a more compact design.

PowerLok™ G2
These products, are high-performance electrical connectors made using aluminum alloy. They can conduct currents up to 300A at a nominal voltage of 1kV DC. They offer a wide range of configurations, including straight and angled versions. The assortment includes both wire-mounted plugs (cross-sections up to 150mm^2) and panel-mounted plugs. A single connector can have 1, 2, or 3 pins. At the same time, the body design ensures complete insulation and shielding of contacts to protect operators and minimize interference.

The main applications of these products are power trains in hybrid and fully electrified vehicles: in passenger cars, trucks, buses, as well as agricultural machinery and off-road vehicles. Given such demanding applications, the products are made to a protection class reaching IP67, i.e., high water resistance and full dust tightness that could impair the conductivity of connections. Complete water resistance is achieved when the connectors are mated.

PowerLok™ 4.0 G2
Unlike the connectors described above, the PowerLok™ 4.0 G2 sub-series is intended for powering accessories and components in vehicles (sensors, actuators, servomechanisms, etc.). Their electrical parameters are therefore slightly lower (currents 5…60A, wires up to 10mm^2), but their bodies are also smaller in size. Here too, high protection class reaching IP69 after connection is ensured. It is worth noting that all PowerLok™ connectors also feature wide thermal tolerance and can operate in temperatures ranging from -40°C to 125°C.

Amphenol GEC PowerLok™ connectors characteristics

Type of connector	DC power
Connector type*	male or female
Spatial orientation*	straight or angled
Mechanical mounting*	on wire, on panel, flange (4 holes)
Mechanical durability	100 cycles
Operating temperature	-40...125°C
Protection class*	IP2X, IP67, IP69
Polarization*	2X, 3X, U, V, W, X, Y
Number of pins*	1…3
Rated current*	60…300A
Wire cross-section*	4...150mm^2
Rated voltage	1kV

*Depending on the model

www.tme.com

MORE INFORMATION

MORE INFORMATION

MITSUBISHI ELECTRIC AUTOMATION ADDS MULTI-NETWORK CAPABILITY TO MELSERVO-J5 SERVO AMPLIFIER

The MELSERVO-J5 Servo Series now supports EtherNet/IP and EtherCAT, enabling seamless network switching without extra hardware.

Mitsubishi Electric Automation has announced new functionality for its MELSERVO-J5 (MR-J5) servo amplifiers to support multiple networks. This feature is now available through a firmware update, allowing users to upgrade their product without purchasing new hardware.

The product allows customers to enhance their existing EtherNet/IP control systems with the quality and performance technology of MR-J5. It seamlessly integrates with existing controllers, reducing setup time and lowering total cost of ownership. Pre-configured instructions and compatibility with popular controllers such as ControlLogix® and CompactLogix™ enhances ease of use.

"*This servo solution is intended to offer customers increased flexibility. With Mitsubishi Electric's multi-axis and Common DC Bus amplifiers, it can reduce customers' electrical panel footprint,*" said Dan Zachacki, Product Manager, Servo & Motion at Mitsubishi Electric Automation.

The MR-J5 multi-network servo amplifier was originally available with EtherCAT compatibility. Now, the same EtherCAT-compatible product can unlock EtherNet/IP functionality, making it a versatile solution for various applications.

us.mitsubishielectric.com

MORE INFORMATION

SIGNAL HOUND RELEASES THE VNA400, 2-PORT, 40 GHZ VECTOR NETWORK ANALYZER - NOW IN STOCK AND AVAILABLE TO ORDER

Signal Hound

High-performance, USB-powered 40 GHz VNA delivers fast, precise measurements—ideal for lab, production, and field use.

Signal Hound – manufacturer of accessible, versatile, precision test equipment – announced the release of the highly anticipated VNA400 to its expanding product line. This high-performance, USB-powered vector network analyzer is in stock and available to Order Now. The 2-port, 40 GHz VNA400 utilizes a combination of high dynamic range and ultra-fast measurement to unlock data-rich, system-level analysis. The VNA400 boasts a wide range of capabilities, making it a perfect fit for the lab, the manufacturing facility or out in the field. A fully featured VNA software suite is included with this product.

"Signal Hound provides high-quality, precision instruments to users across the globe. This VNA is a result of our continued evolution, and it will open access to users pursuing greater advancements in their RF design and verification processes," said Harrison Osbourn, CEO. *"This is the first USB-powered, 40 GHz VNA on the market. We have applied our innovative approach to all aspects of this new product, and it is going to be an ideal tool for RF professionals throughout the industry."*

With a power consumption of just 15 watts, this versatile test and measurement device is nimble and compact. It does not require an external power adapter for operation and is powered entirely by a PC. It delivers outstanding performance that rivals units that are much more costly. Vector network analyzers are critical for pre-manufacturing testing. With this release, Signal Hound now offers a complete suite of test and measurement analysis solutions from spectrum analyzers to vector signal generators and now, vector network analyzers. With so many measurements and wireless connections that need testing ahead of manufacturing, reliable tools like the VNA400 can save time and resources when bringing products to market. Precision measurement, powerful software and optimized workflow make the VNA400 a valuable companion for numerous uses.

VNA400 Applications:

- Cable & Antenna Testing
- Return Loss/VSWR Measurements
- Filter Tuning
- Manufacturing Quality Control
- Field Use Through the Ka Band
- SMT Component Evaluation
- Impedance/Group Delay Measurements
- Research & Development

The VNA400 2-Port VNA operates at a frequency range of 40 MHz to 40 GHz, it is USB-powered, features sub-Hz resolution and is fully automated through SCPI. With a standard operating temperature range of -4°F to 122°F (-20°C to +50°C), the VNA400 weighs 4 lbs. (1.81 kg) and measures 10.8" x 6.2" x 1.5" (274mm x 157mm x 38mm).

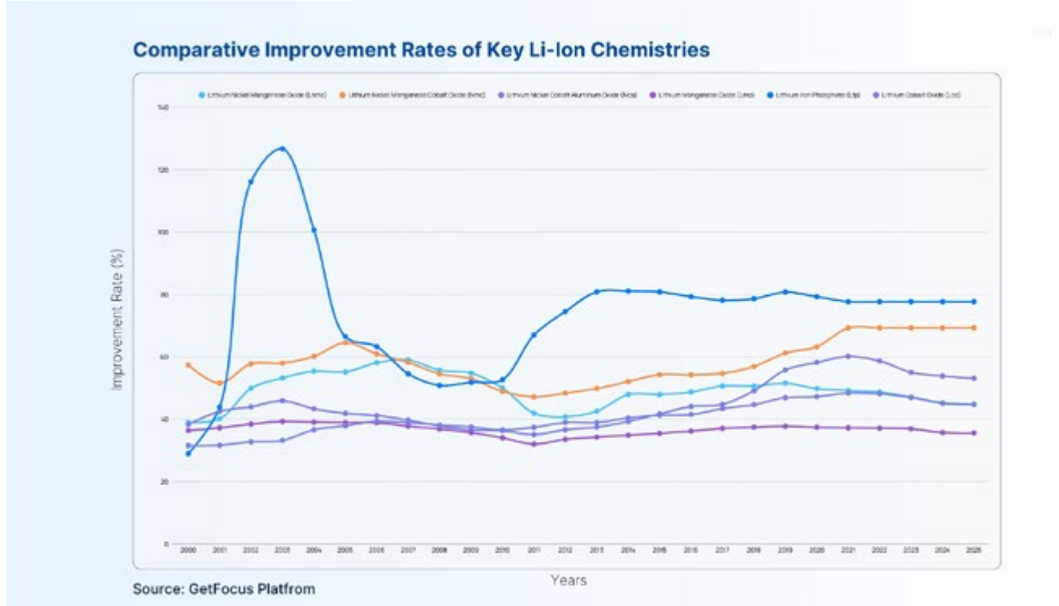
Visit VNA400 Vector Network Analyzer to learn more and order the VNA400.

www.signalhound.com

MORE INFORMATION

MORE INFORMATION

GETFOCUS UNLOCKS EARLY SIGNALS OF TECHNOLOGY DISRUPTION, GIVING R&D TEAMS A DECISIVE EDGE



GetFocus

AI-Driven Technology Forecasting Enables R&D Organizations to Make Informed Decisions in a Fraction of Traditional Time.

R&D teams face immense pressure to make swift and effective technology investment decisions. Traditional methods often fall short, overwhelmed by the sheer volume of emerging technologies. GetFocus offers a revolutionary approach, employing AI to analyze global invention data and forecast technological futures based on technology improvement rates (TIR). Inspired from research developed at MIT, GetFocus moves beyond trend monitoring to deliver actionable, quantitative insights.

This data-driven methodology allows for the early identification of potential technology disruptors. For example, GetFocus' data indicated that Lithium Iron Phosphate (LFP) batteries began showing signs of emerging as a dominant technology as early as mid-2000, based on their accelerating improvement rates. This crucial early signal significantly preceded the technology's broad industry adoption for electric vehicles starting around 2010. This demonstrates GetFocus' capability to predict major technological shifts years in advance.

www.getfocus.eu

MORE INFORMATION

ALTECH PRESENTS DO-1 UNIVERSAL MONITOR FOR MODBUS DEVICES

This solution enables enterprises of all sizes to easily monitor, collect and analyze their equipment and process data without any subscription fees or licenses.

Altech Corp

Altech Corp, a leader in industrial automation solutions, announces the release of its DO-1 universal monitor for Modbus devices. Compact yet powerful, the DO-1 connects to up to 128 Modbus RTU/TCP devices. It supports integration with both new and legacy Modbus networks, taking advantage of the protocol's widespread use across industries to enable fast, efficient data monitoring without incurring the high costs associated with more complex IIoT systems. By removing the traditional barriers to entry, this solution opens the door to valuable operational insights that were previously inaccessible, particularly for small- and medium-sized companies.

Monitoring and Alerting
The DO-1 includes web-based software that facilitates configuration and supports the creation of custom dashboards to visualize data. It also supports individual alert or event settings with email notifications, enabling users to receive real-time alerts about the status of their monitored systems.

Data Collection and Analysis
DO-1 monitoring devices offer robust data collection capabilities that allow users to extract filters for data to Excel or CSV files for analysis and reporting. The series is equipped with a real-time clock with 30-day battery backup, ensuring continuous operation.

Connectivity and Storage
Devices support dual power input and offer 5 gigabytes (GB) of internal data storage with the option to expand up to 128 GB using an external SD card. Connectivity options include WiFi, with Bluetooth available as an optional feature.

Key features of the DO-1:
- No subscription fees or licenses.
- Do-it-yourself configuration without programming knowledge.
- Works with any Modbus sensor or measuring device regardless of brand.
- Tracks temperature, humidity, pressure, vibration, energy usage and more.
- Local data storage ensures complete data privacy.
- Optional DIN rail adapter for easy installation.

The DO-1 is a versatile solution for many applications, such as energy monitoring in commercial buildings, machine condition monitoring, server room and data center supervision, liquid level monitoring in tanks and reservoirs, and much more.

Learn more at: www.altechcorp.com

MORE INFORMATION

CONVEYING THE BENEFITS OF AIR AMPLIFIERS

Air conveyors (sometimes known as pneumatic conveyors) have the potential to operate in two modes, offering vacuum (negative) and pressure (positive) conveying. Vacuum conveying uses compressed air to 'suck' bulk material like grains or pellets through a closed system of pipes. In contrast, pressure conveying (achieved by reversing the air flow) 'pushes' bulk material through the pipeline. The optimal technology supporting this capability is an air amplifier and, with its recently introduced ZHV series, SMC has a powerful performer.

Air conveyors are popular for moving dry bulk materials like powders, granules, or pellets between different locations, such as from a truck to a silo. Product examples extend from cement, flour, and sugar to pharmaceuticals and cosmetics. However, every material is different. Understanding the requirements of the specific material that needs conveying will help safeguard product quality and process efficiency.

The optimal way to create a flexible process suitable for different products is to ensure the system can perform both vacuum and pressure conveying. Vacuum conveying has certain advantages in that there is no contact between the compressed air and the material in transport, ensuring zero contamination. Furthermore, the product suffers no exposure to heat generated in the air compression process. However, the distance that can be covered with this method is limited. For longer pipelines, pressure conveying typically becomes the preferable option.

Go with the flow

Historically, air conveyors use either a compressor or blower to achieve the necessary high suction (vacuum) or discharge (blow) flow rates, but these come at the cost of high compressed air consumption.

Today, a better approach is possible by introducing the SMC ZHV energy-efficient, compact and lightweight air amplifier, which can function as either a blow-off or vacuum unit depending on the direction of the output port. The ZHV uses the Coandă effect to amplify the supply flow rate, driving cost savings through an efficient solution that lacks nothing in performance: the blow air flow generated is four times the air supply (up to 11,000 l/min ANR), while the vacuum air flow generated is three times the air supply (up to 8,000 l/min ANR).

Notably, the flow rate is fully adjustable simply by altering the nozzle position in accordance with the specific requirements of the air conveying process. Turning the nozzle clockwise increases the flow, subsequently elevating the vacuum pressure or discharge flow rate (depending on mode of use). Similarly, turning the nozzle anti-clockwise decreases the flow, which has the effect of reducing the vacuum pressure or discharge flow rate.

Blow air consumption away

Air amplifiers are not expensive devices. SMC has already seen projects that generated a return on investment (ROI) in less than eight months thanks to annual savings in air consumption.

While the output pressure of an air amplifier is less than a common air nozzle, the volume of air is higher to deliver a similar outcome. Importantly, an air amplifier needs less input pressure to achieve the same air flow, permitting users to reduce system pressure and enjoy the associated savings in energy consumption and carbon emissions. Use cases show that it is possible to save up to 70% in air consumption without any compromise in results.

The ZHV, which is the successor to SMC's previous ZH-X185 (and is completely interchangeable), outperforms alternative products from other suppliers by around 20%.

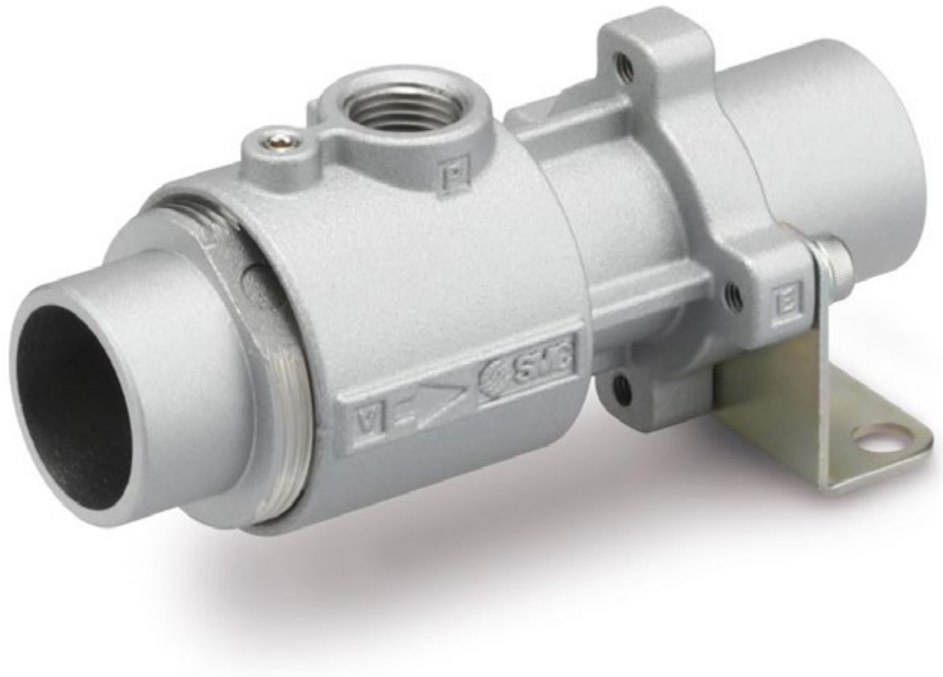
Size matters

Changes from the previous-generation product include a far more compact and lightweight design, making it ideal for machine builders and manufacturing plants under pressure to reduce machine size. The optimised profile of the SMC ZHV offers a reduction in internal volume of up to 50%, depending on the model selected, while weight is up to 50% less. ZHV series air amplifiers also retain many advantages of the ZH-X185, such as a large passage diameter to suit several other potential applications, like collecting chips and swarf during the machining of metal or resin workpieces.

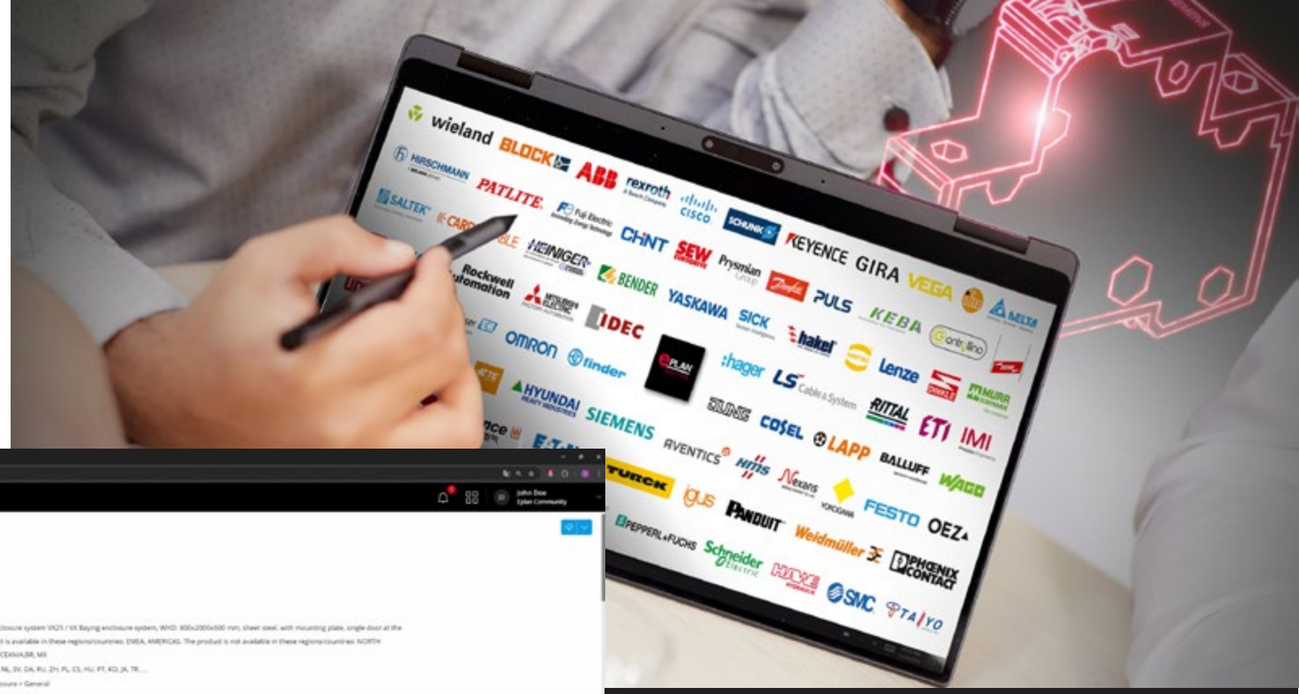
The easy-to-install ZHV is air driven (no electricity required) with only one supply port, while the absence of moving parts makes for maintenance-free operations. To ensure optimal selection in line with the requirements of the specific air conveyor, always seek the advice of an SMC specialist.

More info: https://www.smcusa.com/products/zhv-vacuum-flow~172972

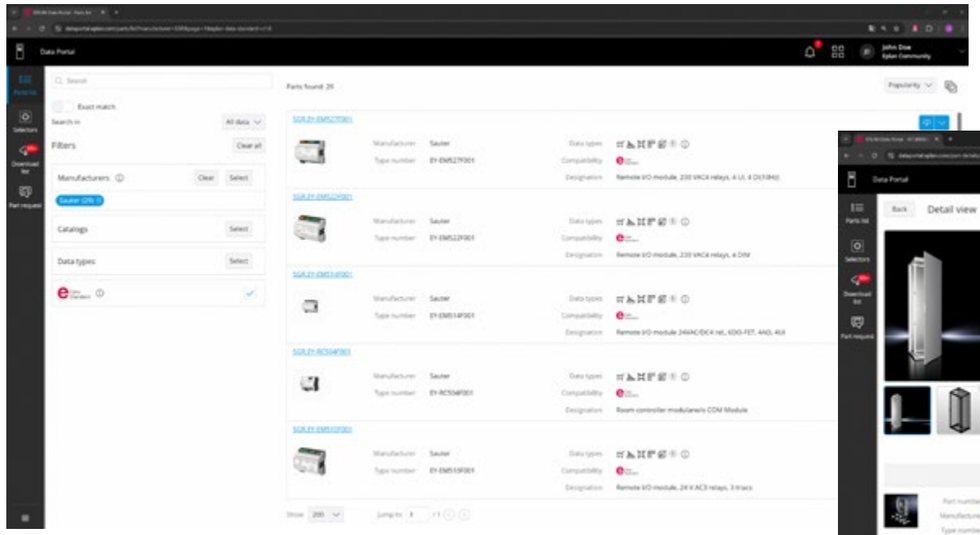
Contact: sales@smcusa.com



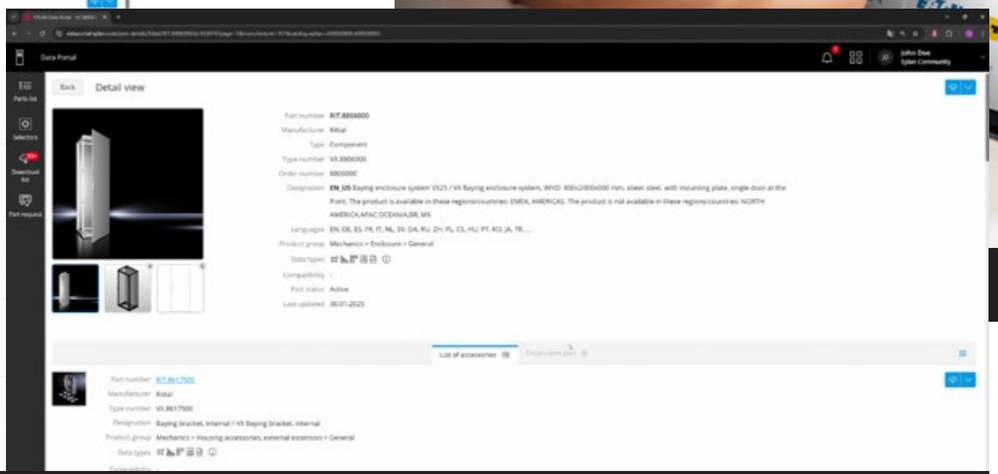
NEXT MILESTONE ACHIEVED FOR THE EPLAN DATA PORTAL



Around five hundred manufacturers are represented in the Eplan Data Portal – and the numbers keep rising.



Sauter recently added to the Eplan Data Portal its ecos504/505 range of products for integrated room automation.



Rittal has stored around 7,300 devices in the Eplan Data Portal.

Data isn't just the driver for project planning and design. The Eplan Data Portal offers users access to high-quality product catalogues from a continually growing pool of renowned component manufacturers.

The portal has now passed the mark of more than two-million sets of static device data from around five hundred manufacturers! By using integrated configurators, users have far more than four million data sets at their fingertips. It's a nearly limitless and ever-increasing variety of components that can quickly and easily be integrated into projects – and the data quality is naturally top notch.

More than four million device data sets available means an enormous amount of variety for projects. However, it isn't just the quantity, but rather the quality of the data. "*Quantity and quality is something that goes hand in hand for us,*" says Eplan Head of Content Quality Management Rainer Ackermann. "*We have high expectations for the quality and completeness of the data sets so that we can offer our users the greatest possible added value. That's also why we continue to work on the Eplan Data Standard, or EDS.*" Manufacturers are also striving to meet these expectations of providing data sets that are as comprehensive as possible. This can include components for control cabinets, the 3D representation of a device, dimensions for drilling patterns, connection diagrams as well as commercial data, device numbers and text descriptions.

Siemens Energy Automation and Building Technology Integrated

Siemens has been represented in the Data Portal with energy automation and building automation products for many years. Now, protection and automation devices from the Siprotec 5 family have been added. Protection, automation, and monitoring of the power grid are essential for a resilient network. "*We need a secure and reliable power supply to establish a sustainable infrastructure and achieve our net-zero goals,*" explains Stefan Werben, Portfolio Manager of Siprotec Medium Voltage Products at Siemens, adding: "*We are pleased that we can now additionally support those customers who have chosen Eplan as their engineering platform to efficiently realize their projects in the construction, operation, and expansion of plants.*"

Sauter, a leading technology manufacturer in the field of building automation, system integration and building services, headquartered in Basel, Switzerland, and Freiburg, Germany, recently added to the Eplan Data Portal their ecos504/505 range of products for integrated room automation. "*The positive feedback from our customers as well as from within our own company has motivated us to provide even more device data in the Eplan Data Standard,*" says Sauter Head of Marketing and Product Management Peter Schoenenberger.

Data depth ensured – even globally

A majority of the device data stored in the portal – 1.4 of more than 2 million components – are already available in the Eplan Data Standard. The EDS increases and guarantees the quality of the data sets so that they can be used efficiently – ideally from engineering through to production. Rittal has around 7,300 devices stored in the Eplan Data Portal – around 5,600 of them in the Eplan Data Standard. These include control cabinets, control cabinet accessories, Blue e+ climate control devices and more. There are almost no limits globally speaking as well: If a device data set is created using ECLASS as a step file in an IEC format (the European standard), the Eplan software automatically also supports the NFPA device data set (the American standard). With this multi-standard support in one single data set, macros can also be saved in accordance with various standards that the Eplan Electric P8 software then recognises automatically. Furthermore, modifiable data from configurators and selectors of various manufacturers can also be used. These have linked their product catalogues directly with the Eplan Data Portal.

Development continues

Less visible but at least as important is the continued development of the data quality in the Eplan Data Portal. This year the focus is on preassembled cables. To ensure that machine cabling works as efficiently as possible with the new Eplan Cable proD solution, 3D data for the connectors is also being successively introduced. Technically speaking, functional improvements are also on the horizon: The Eplan Data Portal will be able to be directly integrated into local device management with the upcoming release of the new Eplan Platform 2026. This will again even further simplify selecting components and accelerate project planning and design work.

www.eplan.com

MORE INFORMATION

EMERSON RECEIVES AWARD FOR EXCELLENCE IN ENERGY EFFICIENCY AT MILWAUKEE FACILITY

Left to right: Doug Presny, CleanTech Partners; Joe Pater, Wisconsin Public Service Commission; Paul Kling, Focus on Energy; John Schuster, Emerson; Bob Axtell, Emerson; Bill Bolhuis, Franklin Energy; Chris Larson, Chris Jansen, Wisconsin State Senator, District 7; Jim Garbowski, WEC Energy Group. (Courtesy of Emerson)

EMERSON

Wisconsin state energy efficiency program recognizes company's Appleton Group foundry for outstanding commitment to saving energy.

Emerson today announced that its Appleton Group iron casting facility has received a 2025 Energy Excellence Award from Focus on Energy®. The award recognizes companies in Wisconsin that go above and beyond basic energy efficiency solutions, both within their own organizations and those they support. As one of 11 recipients, the South Milwaukee foundry proves how energy-efficient industrial facilities can reduce costs, contribute to a healthier environment and strengthen local economies.

"*Emerson's foundry shows that even energy-intensive operations can be leaders in energy efficiency,*" said Erin Soman, managing director of Focus on Energy. "*This award isn't just about saving energy – it's about people coming together to think differently about how we use energy and what that means for Wisconsin's future.*"

Focus on Energy is the statewide energy efficiency and renewable energy program for businesses and residents in Wisconsin. It offers a range of rebates and incentives for energy-saving technologies as well as services that help organizations reduce energy use and costs.

The Appleton foundry, which manufactures electrical fittings, enclosures and other cast products for electrical infrastructure, has worked with the Focus on Energy initiative since 2017. In that time, the partnership has made it possible for the foundry to identify, evaluate, design and implement many successful energy efficiency and utility cost-savings projects.

These updates include new controls on its makeup air units, the replacement of channel furnaces with cordless induction melting furnaces and the replacement of over 800 fluorescent lights with Appleton industrial LED fixtures. Combined, the energy improvements save the facility over 10,000 megawatt-hours (MWh), 65,000 million British thermal units (MMBtu) and $1 million in energy costs annually. The team also identified nearly $350,000 in energy-related incentives throughout this period.

The foundry team's commitment to optimizing energy efficiency has cut the facility's total energy consumption and emissions by about a third since 2017, drastically reducing its own emissions and operating expenses. These reductions are especially significant given that the century-old foundry had been among the largest energy-consuming facilities across all of Emerson.

"*The Energy Efficiency Excellence award highlights the dedication of our team to improve our own environmental impact, support our cost reductions in Wisconsin's energy system and work with external organizations to move toward a more sustainable future,*" said John Schuster, plant manager at Emerson's discrete automation business. "*What we've achieved in South Milwaukee is a success story for the Emerson portfolio, as well as for the castings industry overall. It's an honor to be acknowledged in this way.*"

For more information about Appleton electrical solutions from Emerson, please visit
https://www.appleton.emerson.com/en-u

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HUTCHINSON PLANT IN CHÂTEAU-GONTIER ACHIEVES AEROEXCELLENCE BRONZE LEVEL

Hutchinson is proud to announce that its O-Ring manufacturing site in Château-Gontier-sur-Mayenne has reached bronze level by AeroExcellence, the universal standard for operational excellence recognized by the aerospace and defence community.

After obtaining the EN 9100 aerospace certification in 2021, the Château-Gontier plant was evaluated according to the AeroExcellence framework launched by the French Aerospace Industries Association (Gifas).

The AeroExcellence assessment is a mark of confidence for partners and customers, ensuring that processes meet the most stringent aerospace and defence requirements in terms of operational excellence, the environment and cybersecurity.

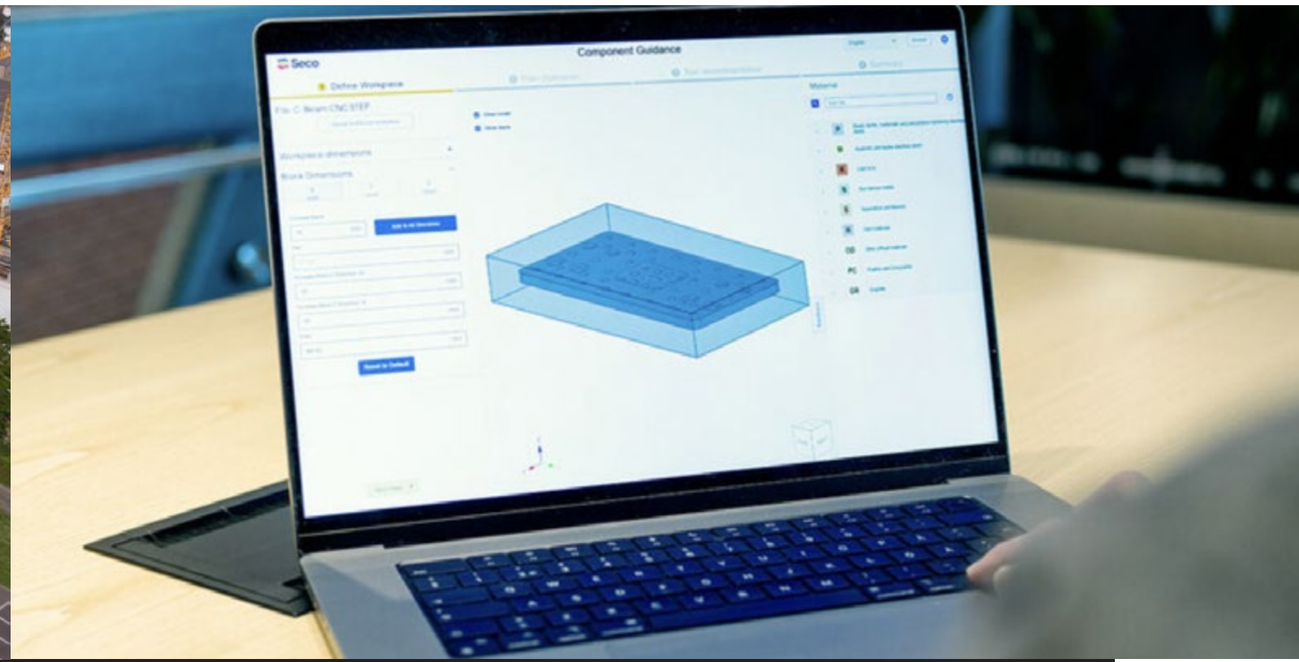
This rigorous assessment took place from Tuesday 22 to Thursday 24 April 2025 and focused on organisational and resource management, planning and logistics, supplier management, industrialisation and quality, and production excellence.

"*We are very proud to have reached the Bronze level in the AeroExcellence evaluation. This result reflects the dedication and hard work of the teams to achieve excellence in all aspects of our business. We will continue to innovate and improve our processes to contribute to a high level of excellence in the Aeronautics sector and to meet the expectations of our customers and partners.*" said Ludovic Duval-Arnould, Industry Sales Manager at Hutchinson.

www.oring.hutchinson.fr/en

MORE INFORMATION

SECO COMPONENT GUIDANCE PROVIDES TAILORED ON-DEMAND TOOLING RECOMMENDATIONS



Seco Component Guidance provides instant, tailored tool recommendations via 3D model uploads, using cloud-based calculations for fast results without the need for high-performance PCs.

Optimal recommendations delivered instantly
Seco Component Guidance uses advanced feature detection technology to analyze user-uploaded 3D part models. The application automatically identifies pockets, holes, edges and other part features, then provides tooling recommendations catered to the part's specific design.

"*Component Guidance is a powerful tool that takes full advantage of the latest in technology,*" said Seco Product Manager Erik Ekqvist. "*The software can significantly streamline the procurement process. It will also prove a valuable tool in ensuring estimate accuracy, as manufacturers bidding on a new part can very quickly determine the associated tooling needs and costs.*"

Prioritizing cost efficiency
When determining tooling recommendations, Seco Component Guidance automatically identifies opportunities to produce multiple features with the same tool. Plus, the system takes a user's purchasing history into account, allowing it to minimize costs by giving precedence to tools that are already on hand.

www.secotools.com

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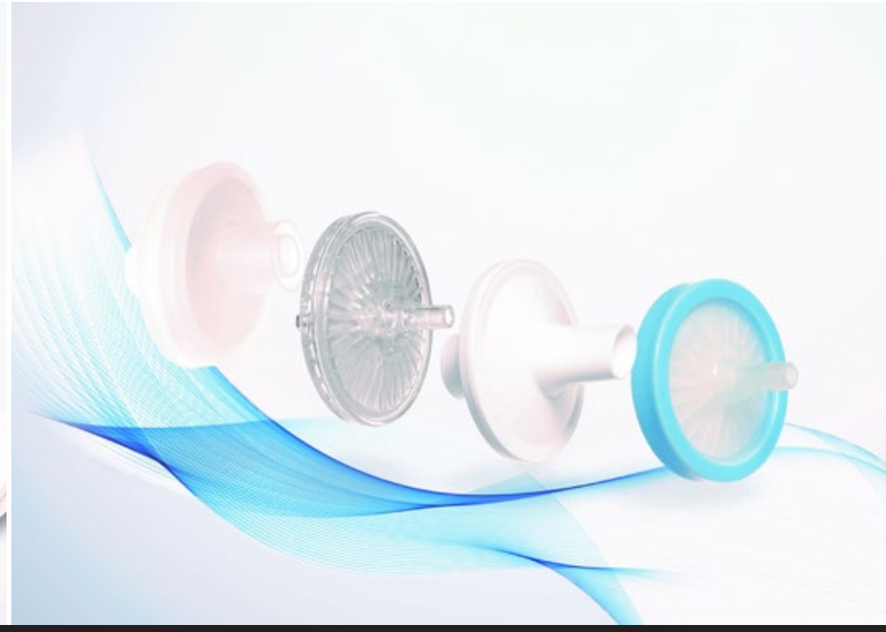
HENGST FILTRATION HAS SUCCESSFULLY COMPLETED THE ACQUISITION OF THE BRITISH MEDICAL FILTRATION SPECIALIST



Brett Smyth (Managing Director International Filtration Solutions) and Oliver Nabrotzky (Group Vice President Hengst Filtration).

Safe respiratory protection for every working environment
Safe airways. Reliable protection. Medical technology with responsibility.

International Filtration Solutions (IFS) will expand the company's technological expertise in the healthcare sector.

Münster/Preston. The Hengst Group continues to advance its strategic development with a clear mission: to create innovative solutions for a cleaner and healthier future. With the full acquisition of UK-based International Filtration Solutions Ltd. (IFS) – comprising Medical Filtration Solutions Ltd. (MFS) and Air Filtration Solutions Ltd. (AFS) – Hengst is significantly strengthening its expertise in the field of Health Care Filtration.

MFS is a well-established provider of patient-focused medical filtration solutions. The company designs and manufactures breathing, anaesthesia, and insufflation filters that utilize advanced filter media to ensure safe, efficient, and customizable performance for clinical use. These solutions are engineered to reliably remove airborne particles, pathogens, and harmful gases, supporting high standards of patient care.

AFS complements the portfolio with a wide range of respiratory protection solutions, including particle masks, half and full-face masks, as well as powered air-purifying respirators that are effective against gases, vapors, and particles. The company is also a leader in the development of antimicrobial filter media and innovative technologies

"*With the acquisition of IFS, we are sending a clear signal: Hengst is investing in the future – in technologies that protect lives, make processes safer, and enable sustainable solutions,*" says Oliver Nabrotzky, Group Vice President at Hengst Filtration. "*We look forward to setting new standards in Health Care Filtration together with our new colleagues and global partners.*"

Brett Smyth, newly appointed Managing Director of IFS, also sees great potential in the partnership: "*IFS brings a strong portfolio of market-leading respiratory and medical filtration products into the Hengst Group. The integration opens up exciting new opportunities – especially through access to global markets and Hengst's technological strength. For our team, this is a fantastic opportunity to grow and thrive as part of a global filtration leader.*"

Hengst Filtration's respiratory masks offer comprehensive protection in a variety of working environments. Our masks are equipped with high-quality filter materials that provide reliable protection against harmful aerosols, gases, and particles. They comply with all relevant standards, such as DIN14683 and EN149:2001+A1:2009, and are available in several sizes. For particularly dusty areas, we offer reusable masks with a filter efficiency of up to 99.999%. These masks are ideal for use in industry, where they serve as personal protective equipment to enable safe breathing when working in polluted environments. Our product range includes particle masks, half and full masks, as well as fan and compressed air breathing protection systems that can be customized to your needs.

In addition, our respiratory masks are easy to use and offer a high level of comfort thanks to their ergonomic design. This makes them an ideal choice for everyday use to protect your health and that of your employees.

Hengst Filtration develops high-performance filter solutions for patient-oriented medical technology, including ventilation, anesthesia, and insufflation filters for safe and efficient patient care. The integration of International Filtration Solutions (IFS) has expanded this portfolio in a targeted manner with respiratory protection solutions such as particle masks, half masks, full masks, and innovative antimicrobial filter media.

Our mission: to protect health, make processes safe, and contribute to a clean and healthy future with intelligent filtration.

https://www.hengst.com/

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