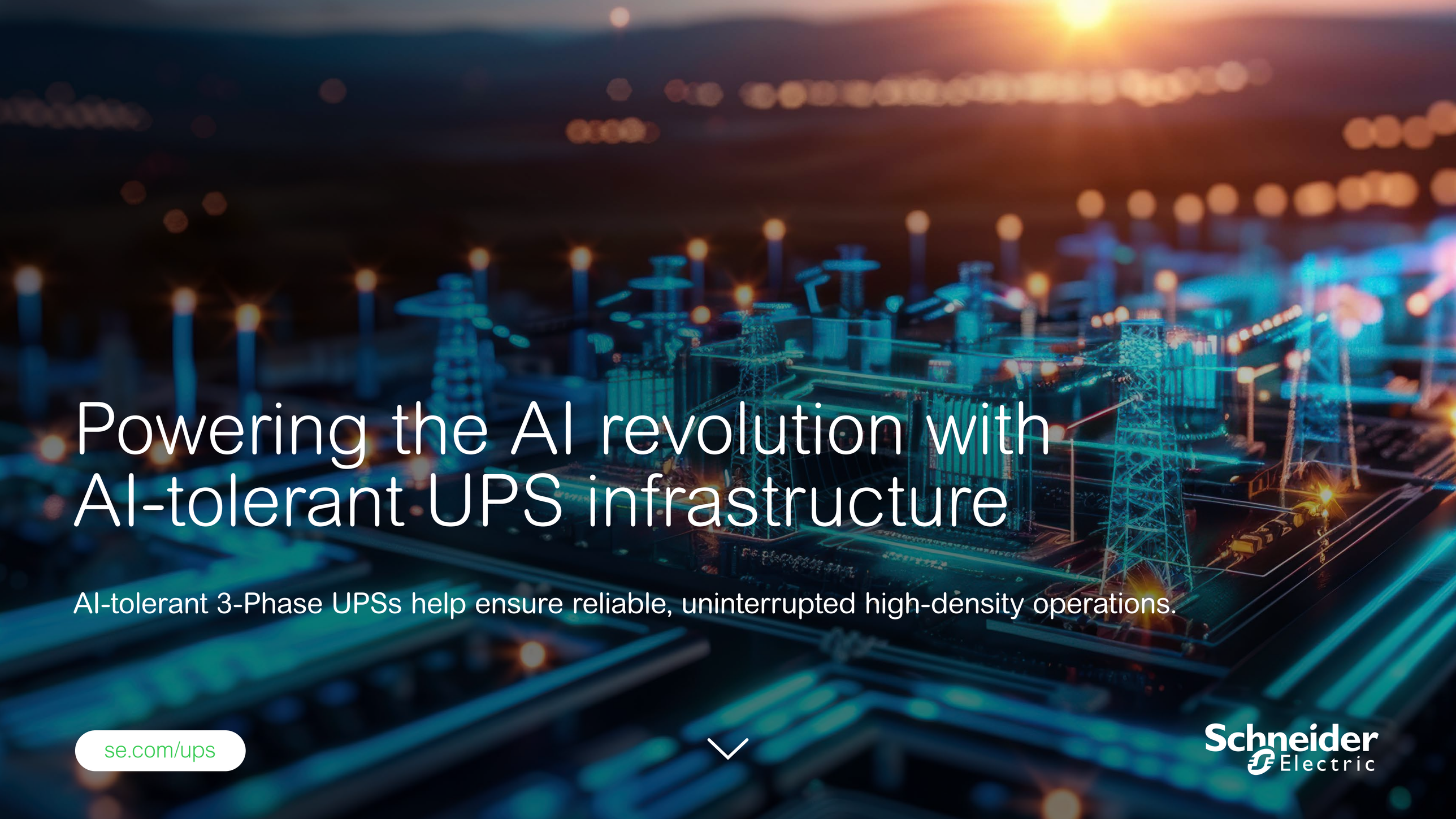

Powering the AI revolution with AI-tolerant UPS infrastructure

AI-tolerant 3-Phase UPSs help ensure reliable, uninterrupted high-density operations.

se.com/ups

Schneider Electric

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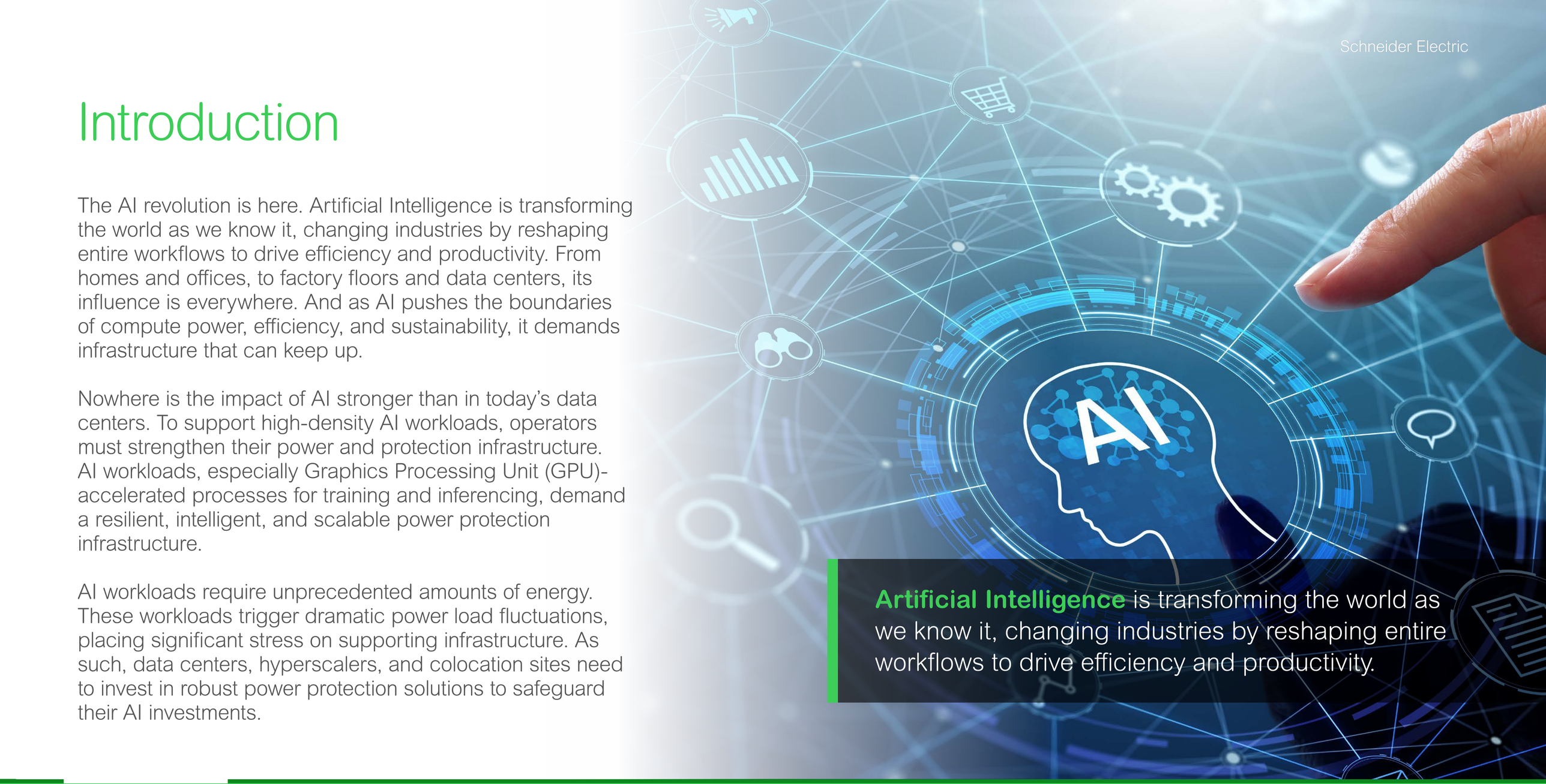
Introduction: The AI revolution is here

Introduction

The AI revolution is here. Artificial Intelligence is transforming the world as we know it, changing industries by reshaping entire workflows to drive efficiency and productivity. From homes and offices, to factory floors and data centers, its influence is everywhere. And as AI pushes the boundaries of compute power, efficiency, and sustainability, it demands infrastructure that can keep up.

Nowhere is the impact of AI stronger than in today's data centers. To support high-density AI workloads, operators must strengthen their power and protection infrastructure. AI workloads, especially Graphics Processing Unit (GPU)-accelerated processes for training and inferencing, demand a resilient, intelligent, and scalable power protection infrastructure.

AI workloads require unprecedented amounts of energy. These workloads trigger dramatic power load fluctuations, placing significant stress on supporting infrastructure. As such, data centers, hyperscalers, and colocation sites need to invest in robust power protection solutions to safeguard their AI investments.



Artificial Intelligence is transforming the world as we know it, changing industries by reshaping entire workflows to drive efficiency and productivity.

Robust power protection

It is not enough for data centers to be AI-ready. They must build AI tolerance into their operations, as AI training and inference models create unpredictable power fluctuations due to rapid starts and stops. The entire power infrastructure — from the uninterruptible power supply (UPS) units at the core of power protection solutions to the busways and switchgear — must deliver the capacity to handle these dramatic shifts without interruption.

Robust power protection solutions are essential to building AI tolerance. So operators need to make sure they pick the right UPS solutions for AI workloads. They need efficient, high-capacity 3-phase UPSs to handle substantial increases in load and rapidly changing dynamics without prematurely draining batteries.

Even before the AI revolution, UPSs have been critical to data center operations, ensuring continuity and protecting equipment from power spikes, brownouts, and surges that can damage hardware. With AI, the demand for highly efficient, reliable UPSs is greater than ever, enabling operators to protect their — and their customers' — AI investments.

Power requirements and AI load tolerance

New power requirements

Large data centers, such as hyperscalers, colocation sites, and facilities for large enterprises, traditionally consume an average of 20 megawatts (MW), but the power-hungry nature of AI workloads is driving consumption to 100 megawatts or more. Currently, there are plans for several 300 MW facilities.

As AI implementations begin, the power protection infrastructure must also grow and deliver more robust functionality. Operators need to account for these requirements as they plan new facilities. At existing facilities where AI workloads are being implemented, operators should review their power protection needs to ensure they can handle the more extreme dynamics of AI workloads.

Large data centers traditionally consume an average of **20 MW**

AI workloads are driving consumption to **100 MW or more**

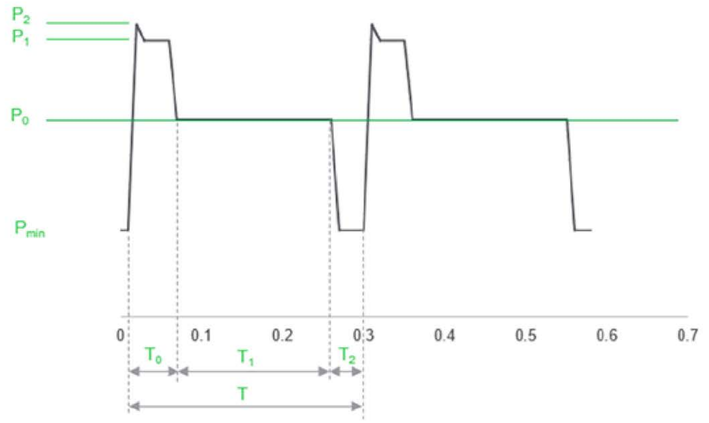
Currently, there are plans for several **300 MW facilities**

AI load tolerance

UPSs in AI data centers must be designed to seamlessly handle overload conditions and unpredictable power demands. UPSs should be sized properly to support AI loads with capabilities such as dynamic power management and controls for peak loads.

Dynamic power management allows UPSs to handle the rapid, fluctuating power spikes of AI workloads without suffering efficiency and performance loss. The start-pause-restart nature of AI workloads causes instantaneous peak power bursts. These dynamics require UPSs designed to tolerate dramatic load swings without using or degrading batteries — or unnecessarily triggering bypass operation, which is what happens when a UPS malfunctions or is taken offline for maintenance.

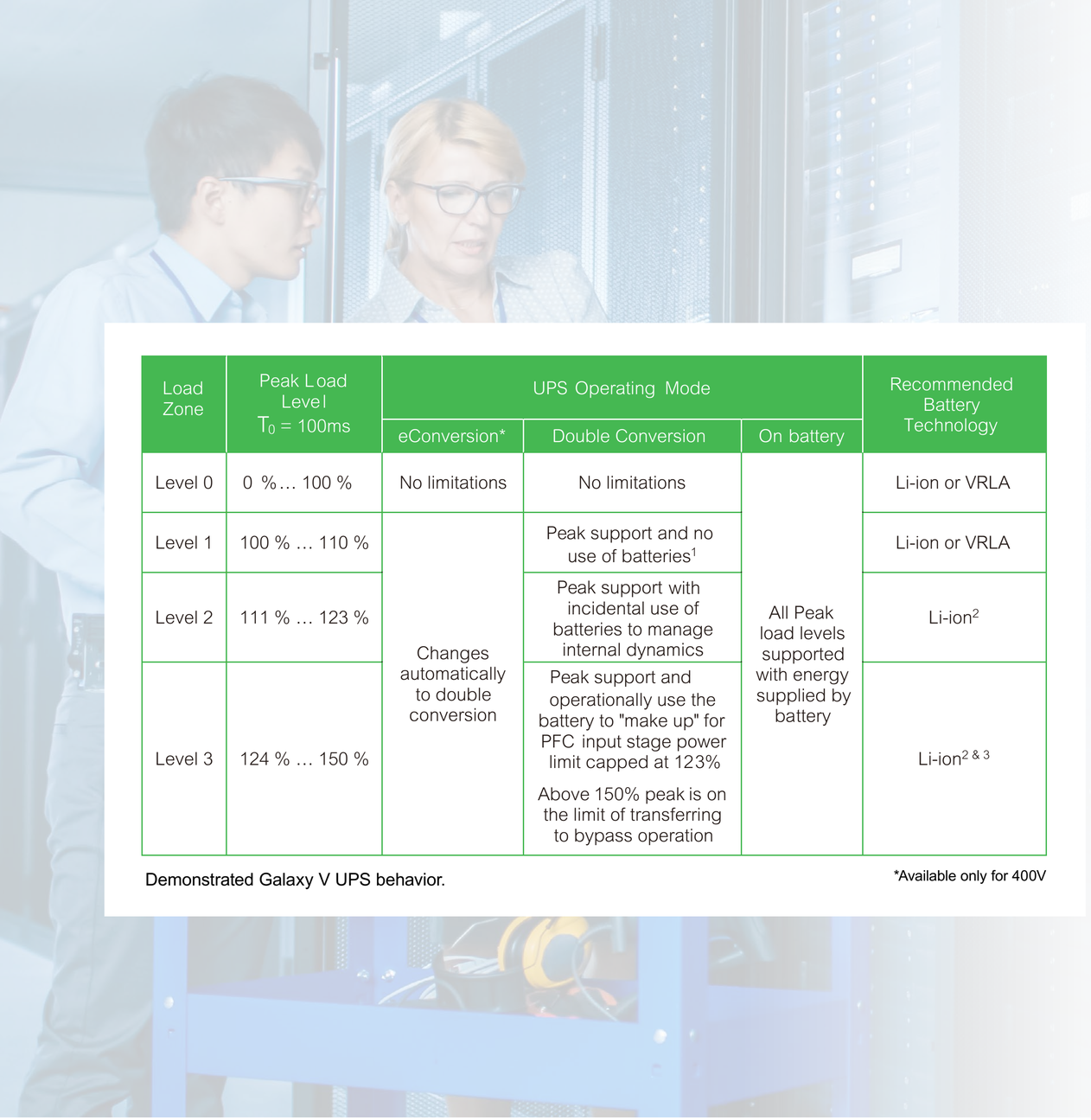
UPSs supporting AI workloads also must absorb peak loads using battery power to smooth input power dynamics and prevent costly overloads. In overload conditions, the UPS should be able to maintain input power at levels below those of output power. This capability smooths out power dynamics and protects equipment from rapid power swings on the UPS output.



Variable	Definition
P_0	Chip Thermal Design Power (TDP) e.g. 100%
P_1	Electrical Design Power Peak (EDP_{P1}) can be up to 150% of P_0
P_2	Instantaneous Peak rating with PSU overshoot
P_{min}	Min Chip load during AI training data load

Variable	Typical AI workload duration
T_0	50ms
T_1	200ms to multi second
T_2	0 to multi-second
T	250ms to multi-second

Characteristics of the AI Load profile in time domain



Load Zone	Peak Load Level T_0 = 100ms	UPS Operating Mode			Recommended Battery Technology
		eConversion*	Double Conversion	On battery	
Level 0	0 %… 100 %	No limitations	No limitations	All Peak load levels supported with energy supplied by battery	Li-ion or VRLA
Level 1	100 % … 110 %	Changes automatically to double conversion	Peak support and no use of batteries[1]		Li-ion or VRLA
Level 2	111 % … 123 %		Peak support with incidental use of batteries to manage internal dynamics		Li-ion[2]
Level 3	124 % … 150 %		Peak support and operationally use the battery to "make up" for PFC input stage power limit capped at 123% Above 150% peak is on the limit of transferring to bypass operation		Li-ion[2 & 3]

Demonstrated Galaxy V UPS behavior.

*Available only for 400V

Engineering for high-density operations

Schneider Electric has introduced AI-tolerant solutions to help data centers, hyperscalers, and colocation operators build their necessary AI capabilities. This includes expanding the Galaxy™ series of 3-phase UPSs with the Galaxy VXL UPS. These compact, modular 500-1250 kW (400/480V) 3-phase UPSs feature a robust, resilient design engineered specifically to handle the dynamic demands of high-density AI operations in colocation, hyperscale, and large data center facilities.

Rigorous load tests

Engineers at Schneider Electric's labs rigorously tested and validated the Galaxy VXL series to ensure its suitability for demanding AI environments. Using load profiles of real hyperscale customers, the tests simulated load dynamics and the expected peak levels of AI operations.

Galaxy VXL units were tested at temperatures of 40°C for 110% continuous overload capacity in double conversion mode. Double conversion ensures a stable power supply by converting incoming AC power to DC then back to AC. These tests surpassed standard practices, as most UPS providers test for 100% load capacity at no more than 25°C. The tests showed that Galaxy VXL delivers peak support up to 150%, making the UPSs ideal for AI-heavy applications.

Galaxy VXL units were tested for instantaneous load handling, proving they can manage load steps from 0% to 100% without battery degradation, which also helps guarantee uninterrupted power. To handle overload, the units use Schneider Electric's patented eConversion* mode, double conversion, and batteries to support overload when an application's power load exceeds 100%.

Testing your AI loads

Galaxy VXL and other Galaxy series solutions have been tested and validated to ensure support for next-generation AI compute demands. As AI loads evolve, Schneider Electric's innovation labs constantly test against newer AI loads to validate power protection solutions for your AI infrastructure.

*Available only for 400V

Scalability and space savings

Scalability and space savings

With the advent of AI, one of the biggest challenges facing data centers — whether hyperscale, colocation sites, facilities supporting large industrial or enterprise operations — is pressure to expand. Although AI adoption has been anticipated for years, the sudden boom in demand triggered by generative tools caught data center operators across the industry off guard.

Data center operators are now rushing to add capacity to meet the unexpected demand. But as they do so, they cannot just focus on current demand. They must also plan for future growth. So operators have a vested interest in making their investments future-ready by building scalability and flexibility into their plans.

It imperative to build scalable facilities and right-size the power protection infrastructure from day one. Right-sizing can be accomplished by deploying scalable high-density UPSs that deliver efficiency and reliability in a compact package. This way, operators can optimize AI data centers with UPSs that take up the least possible amount of space while providing the needed capacity for AI workloads. As AI workloads evolve, adding data center capacity will be an ongoing priority — at least for the foreseeable future.

Modular, scalable UPS architecture

One way data centers can future-proof AI infrastructure is to deploy modular, scalable, high-density UPSs. Modularity makes it much easier to add capacity to meet scalability requirements. Galaxy VXL UPS — with its ultra-high-density 125 kW, 3U power modules — features a scalable, modular architecture that allows technicians to easily add a power module whenever necessary. This is a similar approach to leveraging modular data centers to address AI infrastructure challenges.

With Galaxy VXL, adding modules is easy and safe thanks to Schneider Electric's Live Swap capability. Life Swap is a touch-safe process that lets technicians remove and add modules without shutting down a UPS unit. As such, Live Swap enables availability and business continuity while keeping technicians safe. To learn more about the Galaxy VXL and how it can enable AI modularity, access this AI reference design.

Reduced footprint

Galaxy VXL units provide a reduced footprint, saving valuable data center space for revenue-generating equipment. Compared to the industry average, Galaxy VXL UPS takes up 52% less room than other units. This frees up valuable floor space for additional compute or customer equipment — unlocking revenue potential per square meter, thereby enabling more flexible AI rack deployment.

Galaxy VXL is a footprint saver, well-suited for confined spaces, without compromising power and performance.

Redundancy and reliability

Redundancy and reliability

Resiliency, availability, and reliability are top priorities in all data center operations, especially as a wide array of businesses increasingly depend on real-time and near-real-time application functionality. With AI workloads, preventing issues that reduce availability and reliability is more critical than ever — and challenging.

As noted earlier, AI workloads are prone to rapid, dramatic power load swings, making AI-tolerant UPSs essential to AI data center operations. One feature contributing to a UPS's AI tolerance is redundancy through parallel configuration options (N+0, N+1). Parallel configuration enhances redundancy and reliability while minimizing the impact on the UPS battery during peak AI loads.

Parallel configuration enables seamless load shift from a failing unit to one that still works, preventing interruptions. Galaxy VXL UPS features an extra power module for N+1 internal redundancy. This protects the load and multiplies system availability by 10 without adding footprint. It also optimizes uptime, providing a wide input tolerance window (+/-15%) before the UPS has to switch to battery power.

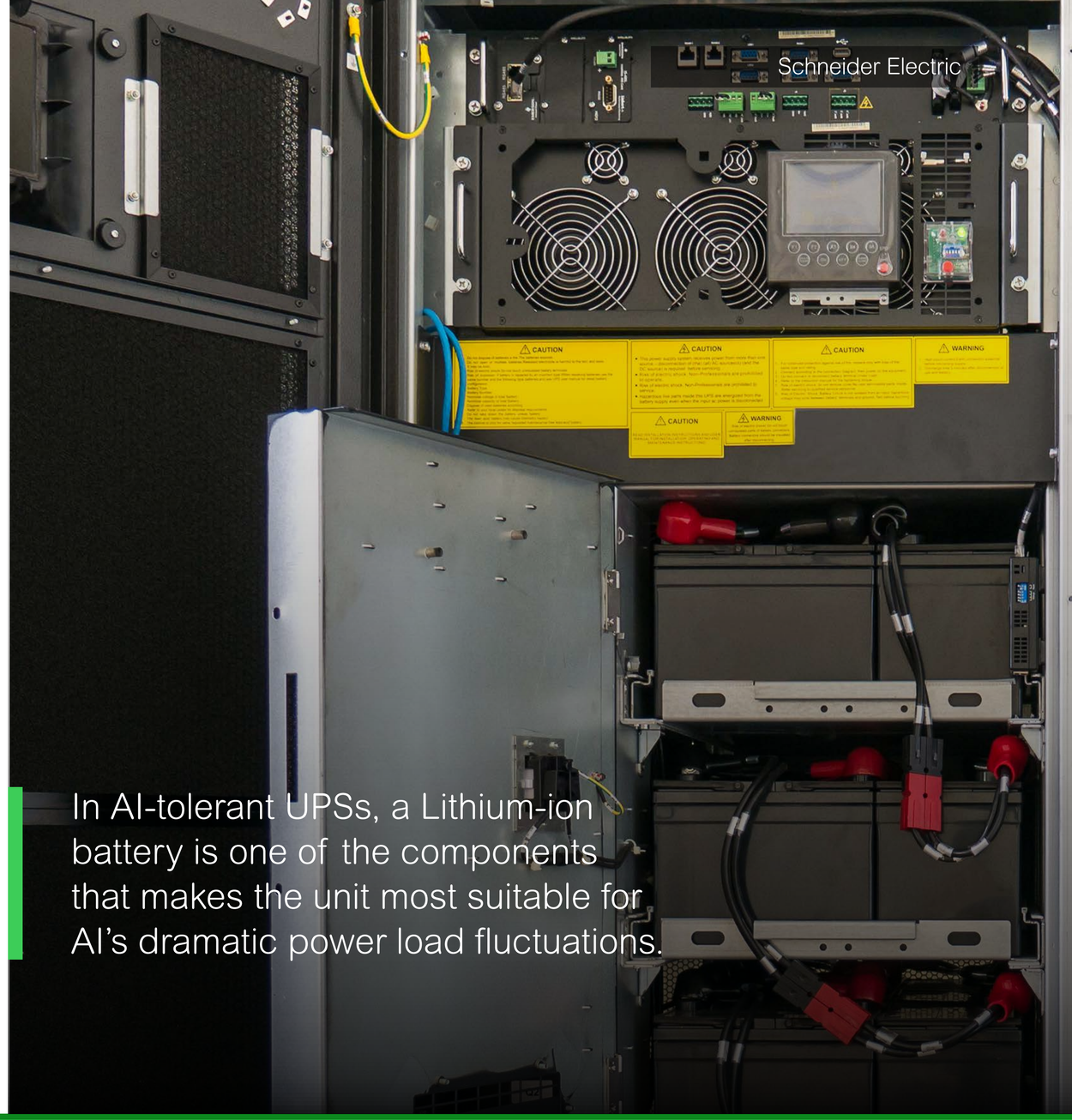
Modular design enables N+1 redundancy which multiplies by 10 the system's availability, with no extra footprint.

Benefits of Lithium-ion batteries

When it comes to reliability and redundancy, the type of battery used by the UPS can make a significant difference. Traditionally, UPSs have been equipped with VRLA batteries that have a lifespan of three to four years. In recent years, Lithium-ion batteries have become more common in power protection equipment.

These newer-generation batteries deliver multiple advantages, such as longevity and compactness. Lithium-ion batteries typically last up to three times longer than their VRLA counterparts. Their compact design enables a much smaller footprint, delivering substantially higher power density in less rack space. Lithium-ion battery cabinets occupy about 30% of the space of VRLA batteries. This footprint savings allows data center operators to allocate more real estate to revenue-generating systems.

In AI-tolerant UPSs, a Lithium-ion battery is one of the components that makes the unit suitable for AI's dramatic power load fluctuations. Llithium-ion batteries enhance reliability, increase availability, and help to reduce TCO and maintenance costs. Galaxy VXL UPS is available with either VRLA or Lithium-ion batteries, but it's highly recommended that those equipped with Lithium-ion batteries be deployed to support demanding AI workloads.



In AI-tolerant UPSs, a Lithium-ion battery is one of the components that makes the unit most suitable for AI's dramatic power load fluctuations.

Cooling and thermal stability

The AI ecosystem, with its much higher compute and power demands requires new approaches to cooling. Data center infrastructure traditionally has relied on air cooling systems for cooling and thermal stability, but AI chipsets generate far more heat than legacy systems.

So data center designers are turning to another heat-dissipation method — liquid cooling. Liquid cooling is much more effective than air cooling in high-density environments because liquids are better thermal conductors than air.

While liquid cooling will not replace air cooling altogether, it will likely handle up to 80% of heat dissipation in AI data centers. Besides heat dissipation, liquid cooling delivers other benefits. It is much quieter than the fans and other equipment used in air cooling and consumes less energy, which helps improve the data center's power usage effectiveness (PUE).

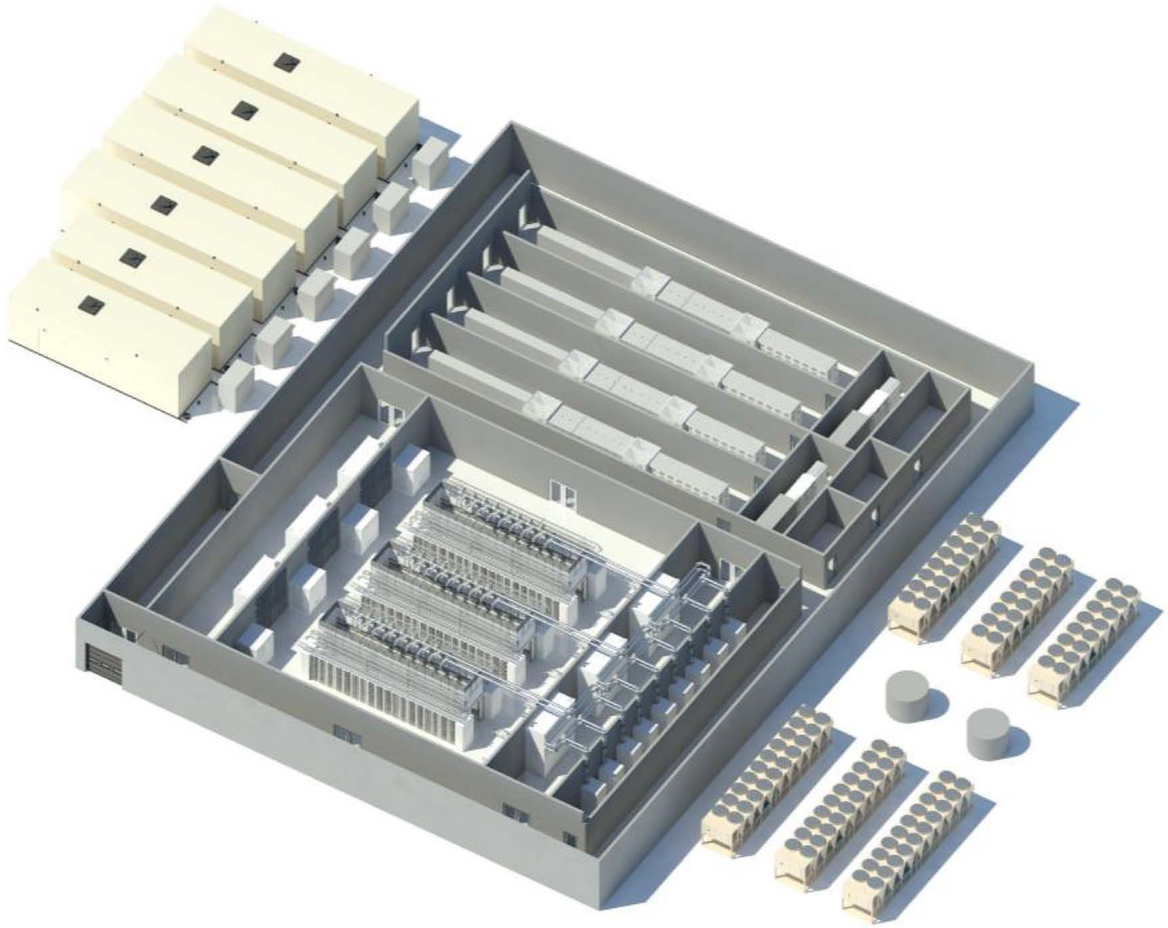
Liquid cooling will likely handle up to **80% of heat dissipation** in AI data centers.

UPS protection for cooling systems

Like the high-density servers used for power-intensive AI workloads, Cooling Distribution Units (CDU) and the associated infrastructure used in liquid cooling need UPS protection. Schneider Electric's AI-tolerant Galaxy VXL systems have the required capacity to protect the CDU and cooling infrastructure from downtime. This is a critical requirement because the cooling systems, in their function of supporting AI infrastructure operations, cannot stop. Without proper UPS protection, a cooling unit can be damaged or burn out because of a power surge.

AI data center reference design

In collaboration with NVIDIA, Schneider Electric has introduced a new data center reference design that supports liquid-cooled, high-density AI clusters of up to 132 kW per rack. Optimized for NVIDIA's GB200 NVL72 and Blackwell chips, the design streamlines planning and deployment with proven, validated architectures. The design also addresses the critical role and unique challenges of deploying liquid cooling at scale. Access the new data center reference design for high-density AI. For those located in North America, access the reference design here.



Schneider Electric and NVIDIA launch a high-density, liquid-cooled data center design for GB200 NVL72.

Power usage effectiveness (PUE) and sustainability

Power usage effectiveness (PUE) and sustainability

Until recently, data center operators didn't focus as much on electrical efficiency, but that has changed due to corporate and regulatory mandates to decarbonize operations. Power use optimization in the data center helps with compliance and allows operators to drive higher power densities and install more IT equipment in less space.

Today there is a strong emphasis on PUE in the data center, especially with the implementation of AI workloads. All data center equipment, from IT servers to cooling systems to UPSs, impact PUE. To optimize power use, reduce waste, and lower operational costs, operators need to deploy efficient equipment to support a smarter, greener AI infrastructure.

Highly efficient UPS

The Galaxy VXL series features overload capabilities to handle the dramatic fluctuations of AI workloads without power disruptions. Galaxy VXL UPS is also highly efficient, which contributes to data center power optimization. Thanks to Schneider's patented eConversion mode, Galaxy VXL units harness power that would be wasted in most UPSs, allowing the unit to be 99% efficient with loads of up to 100%. eConversion* boosts UPS efficiency, reducing energy consumption by three times that of double conversion.

In overload conditions, Galaxy VXL units automatically switch to double conversion mode. This helps data center operators better manage power consumption and achieve reductions in PUE. From a decarbonization standpoint, this means the UPS can help AI data center operators achieve sustainability leadership without compromising performance.

Environmental Data Program

Sustainability is a top priority for data center operators. Schneider Electric promotes sustainability through the Environmental Data Program that seeks to minimize environmental impact by boosting energy efficiency and optimizing resource utilization.

Our products use recycled materials whenever possible in manufacturing, and the products themselves are recyclable. They are also designed to last longer in order to reduce e-waste. From a data center operator's standpoint, the high-density, compact form factors of the Galaxy series also helps drive efficiencies and promote better energy management and use of space.

*Available only for 400V

Security and compliance

Along with power availability, cybersecurity is a top challenge for data center operators as they implement AI infrastructure. AI poses new cyber risks for data centers, with hackers looking to manipulate AI models and data to deliver inaccurate and potentially dangerous results to unsuspecting users.

The added risks mean that data center and colocation operators and hyperscalers have to add cyber defense layers to protect the AI infrastructure. AI defenses include regular audits, robust encryption for data at rest or in flight, and ongoing monitoring of data to spot anomalies and signs of manipulation and malicious activity.

Future-ready power for AI needs

Ongoing protection

Schneider Electric works closely with colocation data centers and hyperscalers to secure data and the power infrastructure. Galaxy VXL UPS is equipped with a Secure Network Management System (NMC) System (SNS), designed to protect connected devices against unknown threats and comply with changing regulations.

Activated through a subscription, SNS enables remote monitoring and alarming, visibility across the power protection infrastructure, and preventive maintenance.

Cybersecurity breaches often occur as a result of weaknesses in the infrastructure, and firmware vulnerabilities are a common culprit. Schneider's Secure NMC System helps prevent firmware breaches by protecting devices with the most recent security updates and consistently achieve compliance with the highest cybersecurity compliance level (IEC 62443-4-2).

Learn more about SNS

End-to-end AI services and support: Beyond hardware

AI solutions are entering the market at an accelerated rate, challenging organizations to deploy the expertise to plan, install, manage, and maintain the technology. Schneider Electric recognizes that some organizations require assistance in these areas. We have put together a comprehensive suite of AI Infrastructure Services designed to help data center and colocation operators and hyperscalers right-size their AI infrastructure solutions and future-proof their AI investments.

EcoCare

The services are available through Schneider Electric's EcoCare, a subscription-based program that helps keep UPSs up and running through advanced analytics and AI models. Members get priority access to technical experts, digital tools, and insights to optimize data center operations performance, minimize downtime, and extend equipment lifecycles. AI-focused services cover installation, cooling, software integration, and green energy solutions tailored for AI.

The plan delivers 24/7 remote monitoring by experts with comprehensive knowledge of a customer's specific environment. Remote monitoring helps reduce on-site activities by up to 50% and keep systems up to date through:

- 24/7 remote monitoring and alarming from our Connected Services Hub, allowing us to identify and address anomalies before they disrupt operations
- Premium access to technical experts, both on site and remotely

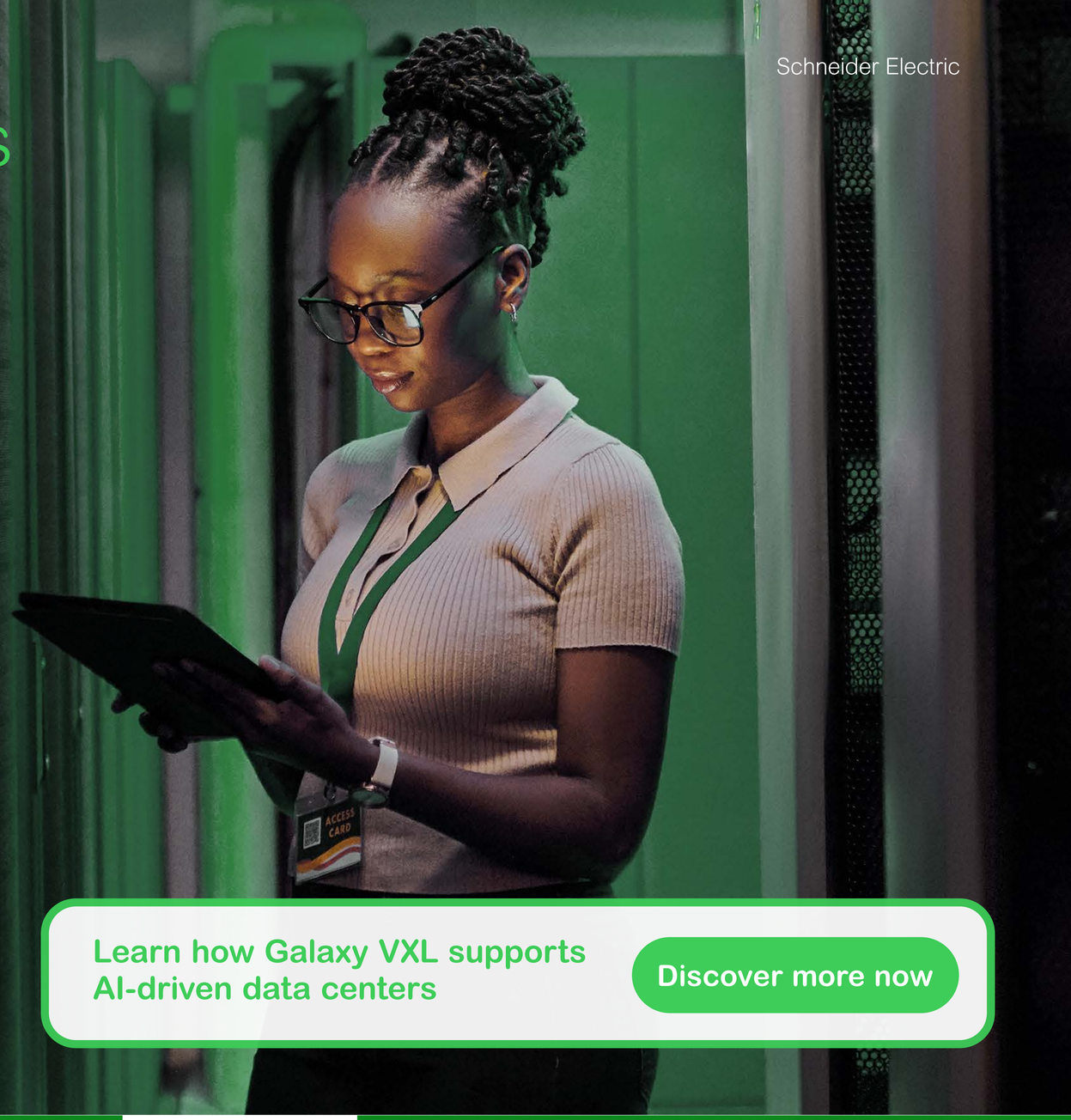
Contact your Schneider Electric representative for availability.

Future-ready power for AI needs

The high-density requirements of AI workloads are pressuring data center and colocation operators and hyperscalers to expand fast. As operators look for ways to meet demand, one area they must pay close attention to is the power protection infrastructure. Schneider Electric leads the way in providing AI-tolerant UPSs to help safeguard multimillion-dollar AI investments.

Our Galaxy VXL solution is an ideal choice for AI infrastructure thanks to:

- Proven performance: Galaxy VXL is rigorously tested for next-generation AI compute demands, ensuring they can support dramatic, rapid power load fluctuations without interruption.
- Scalability and flexibility: A modular, flexible design enables power protection infrastructure to grow alongside AI infrastructure, whether in data centers, colocation facilities, edge computing sites, or hyperscale sites.
- Efficiency and sustainability: Galaxy VXL is highly efficient and compact, enabling businesses to leverage their AI investments while remaining energy-conscious and cost-effective.



Learn how Galaxy VXL supports AI-driven data centers

Discover more now

To learn more about Schneider Electric
AI-Ready UPS Infrastructure, visit

se.com/ups

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