

Advanced Energy's Year of Transformation



2023 was a year of transformation for Advanced Energy. In engineering, operations and digital, AE emerged stronger from the post-pandemic surge and leapt forward – better leveraging its collective of leading technologists, brands and operations to serve its customers better. Supported by a 40+ years of history, in 2023 AE was more effective, agile and inventive than ever – developing smaller, more efficient and more capable power conversion, control and measurement solutions, while innovating an entirely new classes of products. 2023 was also a watershed year with the introduction of leapfrog new technology platforms, expanding manufacturing capacity (breaking ground on a new flagship factory as well as expanding its global factory network), and the launch of an entirely new multi-brand website where AE's customers quickly find what they are looking for with expanded design tools at their fingertips.

Extending Technology Leadership

Advanced Energy announced a record number of new products in 2023, including game-changing innovations (such as the eVerest™, eVoS™, Artesyn® NeoPower and iHP Liquid products) that enable a step function change in customer capability and, in some cases, that define wholly new technology generations in precision power. 2023's new products further advanced AE's leadership by bringing unique solutions to address emerging technical challenges in many important markets, such as semiconductor manufacturing, industrial automation, medical equipment, and hyperscale datacenters.

Transformational Technologies for Semiconductor Manufacturing

The emergency of the U.S. CHIPS and Science Act, European Chips act, and nearly daily announcements of new semiconductor manufacturing fab projects around the world shed an unprecedented spotlight on the semiconductor industry. The semiconductor industry also entered the “Angstrom Era,” where circuit features measured in angstroms (the diameter of an atom) are formed and complex 3D structures are required to make the most advanced (and valuable) “chips.” The resurgence of global interest in semiconductors ramped up pressure on the industry to develop process innovations faster than ever while maintaining critical high throughput and yield in chip production.

AE was the vanguard of semiconductor manufacturing precision power and extended its leadership with the game-changing eVerest™ RF generator, a transformational plasma power engine with high speed, multi-level pulsing control technology meeting the needs of next generation, Angstrom Era semiconductor manufacturing equipment.



eVerest™ RF generator

AE also introduced the leapfrog eVoS™ bias solution and Luxtron® FluorOptic® Thermometry (FOT) platform. eVoS ME is a revolutionary technology that enables new instantaneous, user-defined transition timing to optimize plasma etch and deposition kinetics. The innovation at the heart of eVoS is providing users a monoenergetic ion energy “knob” for etch tools to “drill” straight and true holes at unprecedented high aspect ratios (more than 1:100) in the most demanding 3D chip structures. The Luxtron M-1100 FOT high accuracy, multi-channel sensing platform extends etch operating windows ranging from cryogenic etch temperatures of -200°C to “hot chuck” temperatures of 450 °C with industry-leading accuracy of $\pm 0.1^\circ\text{C}$ and stability of $\pm 0.05^\circ\text{C}$. It is an enabling technology critically required in next-generation, Angstrom Era semiconductor deposition and etch processes.

Technologies such as AE’s eVerest and eVoS were made possible by uniquely deep, in-house expertise in high-voltage power system design that has been built up over many years within AE. This expertise has already earned AE a #1 position in the fast-growing applications of ion implant and e-beam and is now being increasingly integrated as a critical module driving other AE semiconductor precision power solutions.

AI Growth and the War for Watts

As generative artificial intelligence (AI), such as ChatGPT and Google Bard, became mainstream in 2023, it opened a world of new possibilities in everything from coding and graphics to creating music and videos. The increase in AI use was also a major driver for incremental data center capacity. AI leads to greater power consumption, where any increase in efficiency within data centers helps minimize electricity consumption and the costs associated with powering the cooling equipment. Power supply and power conversion systems in these circumstances have to have the highest possible efficiencies that are ultimately optimized for AI processing.



CSU3200ET

AE addressed this need with multiple approaches. AE's latest data center rack power conversion and DC-DC modules offer industry-leading efficiencies and AE has multiple power-shelf products that will support the fast growing, high efficiency 48V architecture. In 2023, AE also continued its work with the Open Compute Project (OCP), where its ORV3 48 V power supplies, operating with industry-leading efficiencies of 97.7%, are meeting power and form factor requirements of open data center architectures. AE also introduced the Artesyn® CSU3200ET ultra-high density 80PLUS® CPRS

Titanium efficiency power supply that is optimized for AI processing and other high-performance compute, network and storage demands. AE was the first company in the industry to receive the 80PLUS titanium efficiency certification for the 1,800 W 60 mm M-CPRS form factor. This product is capable of delivering powers of up to 3200 W with efficiencies as high as 96%.

Through the year AE invested in these technologies to provide solutions for the AI data center applications to meet or exceed the most stringent specifications and expectations for performance and quality.

Transformation & Progress in Industrial and Medical

In 2023, AE strengthened its position in the industrial and medical (I&M) markets, both with new product introductions (NPIs) and increased sales of its established portfolio of power and measurement solutions. As a result, AE saw year-on-year I&M revenue grow by 11%, gaining share and rising to an overall #2 market position in the medical power market.

In the last quarter of the year, AE introduced NP08 – the first in a series of Artesyn® NeoPower AC-DC configurable industrial and medical power supplies with best-in-class power density of 18 W/in³. With up to 4,000 W output power, this product delivers optimized, application-specific power conversion in a small form factor that is up to four times higher power density than conventional solutions.



NeoPower NP08

AE also established itself as the #2 supplier of medical power supplies following the integration of SL Power. Beyond leading the industry as one of the largest suppliers, AE uniquely serves its customers with a broad portfolio of medical power supplies, strong engineering teams, domain expertise across a wide range of power conversion technologies, deep applications knowledge, and its global network of Customer Experience Center. All the global resources that AE brings to the medical industry enables its customers to innovate faster, meet their budgets and advance their products.

At the same time, AE revamped its global I&M technical sales solutions capabilities to provide faster and reliable support for its customers. This included dedicated direct sales, a renewed focus on distribution partnerships and the addition of new, focused content, applications and design tools on its website.

The new AE website, launched in August 2023, is an interactive digital platform that offers rich content to support users seeking solutions for power, sensing and control product development. The site introduced design solutions and products that are easy to find on the website, designed for a single product or system need. Information on a wide range of applications and modifiable product solutions are easily accessible and intuitive search terms support relevant, robust results that elevate product development. Overall, the new website gives AE a completely new digital look and feel and offers an overall improved user experience to make access of information easy and fast.

Building Durable World Class Operations

In addition to making system solutions easily accessible through AE's digital and sales channel enhancements, AE focused on improving its world-class operations to deliver products on time and quality to its customers. In recent years, industry supply chains were disrupted and added headwinds to some markets. This only reinforced the importance of AE innovation with robust, resilient and flexible operations and robust worldwide supply chain solutions. AE prioritized investing in its operations even during foundational challenging times, to ensure it would be ready when markets moved upwards.

AE made several operational improvements during the COVID pandemic that improved its flexibility in addressing customer requirements. In 2023, as global supply chains started to recover, coupled with its operational improvements, AE was able to bring lead times down and built a strong and durable foundation for addressing the anticipated steep demand ramps that will appear as markets recover.

In the last year, AE continued to make progress to strengthen its operations and increase resilience. These investments include the expansion of AE's factory complex in Mexicali with plans to grow capacity four-fold in the next two years.



Mexicali



Thailand

In addition, AE announced the groundbreaking of a flagship manufacturing facility on the Laem Chabang industrial estate near Bangkok in Thailand. This new 500,000 sq ft facility will be capable of delivering up to \$1 billion in annual revenue at full production levels and is expected to employ roughly 2,500 engineers, technicians and operators. Initially, the primary focus will be on technologies for the semiconductor market and, over time, products for industrial and medical applications will be added.

One Advanced Energy

Over the years, Advanced Energy has built on its expertise and capabilities by strategically acquiring product lines and exceptional technologists to fill customer needs for highly engineered precision power and control solutions. AE has added outstanding precision power brands such as Artesyn, Excelsys, SL Power, TEGAM and UltraVolt.

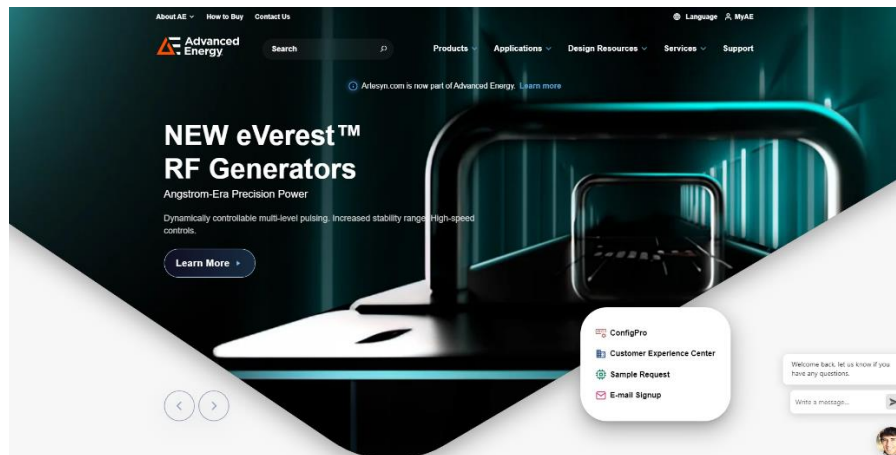


iHP Liquid Cooled

But Advanced Energy is more than a sum of its parts. Thanks to the integration of these businesses, AE brings additional value for customers by offering a wider choice of complementary technologies and services. One important area of value to customers includes developing new products with cross-brand modules, such as adding a liquid cooling option to the proven iHP series of intelligent, digitally configurable power solutions. The iHP Liquid product development benefited from AE's long history of liquid cooling combined with Artesyn's strong capability in high-density, highly efficient and low noise products to produce a solution that provides accuracy, resolution and stability as either a programmable voltage or

current source for a wide range of industrial, lighting/horticulture and semiconductor applications.

Another key example of integration is AE's updated state-of-the-art website. With "One AE", customers see AE's many product lines and solutions that can be used in their applications.



Since its launch, the AE website has doubled the number of online visitors and tripled engagement to features such as intuitive navigation, smart search, application-centric navigation that guides visitors to a host of rich, design-oriented content and the ability to create a customized user journey that includes a personalized dashboard. Real-time stocking information and seamless connectivity to distribution partners further simplifies the purchasing process. And more new features, including eCommerce, are coming in early 2024.

2024 and Beyond

In a world where companies must balance demanding processes with both environmental sustainability and the need to keep operating costs as low as possible, there is an ever-greater need for precise and high efficiency power delivery, control and measurement.

For more than 40 years, Advanced Energy has been engineering solutions that address this need, and moving forward, will continue to deliver the standard, configurable and custom products and services that its global customers across a wide range of industries demand.

What to expect in 2024?

Solid and steady performance through business cycles gives AE the ability to continue to invest in new products and technologies, improve customer experiences, and add improvements in manufacturing capacity that will drive future growth ahead, where other peers have dramatically cut R&O and operating timelines.

The technology industry will continue to evolve with accelerating pace, requiring innovation to fuel this growth. From making angstrom-level lines within chips to giant hyperscale data centers that consume the equivalent electricity of a metropolitan city, and critical applications in between, Advanced Energy's precision power and control innovations are enabling its industries and customers to innovate faster and be more effective.

At the same time, AE's journey in continuous improvements, from ramping up operational readiness with scalable, best-in-class manufacturing to its digital transformation with several website enhancements – including eCommerce, new configuration and design tools and personalization options—the unified One AE team is here to provide the best-in-class service and support to its customers.

New products, new digital features, market share growth in key industries and operational excellence are all in the horizon for Advanced Energy in the coming year – from one transformative year to another, Advanced Energy is leading the way in highly engineered precision power and control solutions.

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