



AI-powered innovation: from microinverters to energy storage

As renewable energy continues to grow and change, APsystems has become a leading name worldwide in Module-Level Power Electronics (MLPE) technology across multiple platforms. With a strong focus on AI integration, the company is redefining how solar energy is generated, stored and managed, offering intelligent solutions that span from microinverters to energy storage systems. At the same time, it ensures robust data privacy and protection, aligning with international standards such as EN18001 and GDPR. This article provides an overview of how AI technologies are pervading into APsystems innovation's strategy.

Founded in Silicon Valley in 2010, APsystems is celebrating its 15th anniversary this year, with over 7 terawatt-hours of clean energy produced through its 6 GW of systems installed in more than 156 countries.

Microinverters: smarter conversion at the module level

The company's microinverters, including the DS3 series, EZ1 or EZHI and QT2 series, are designed to optimize energy conversion at the module level. These devices are now enhanced with AI algorithms that enable real-time performance monitoring, predictive maintenance and dynamic load balancing.

AI models analyze data from each panel to detect anomalies, optimize energy output and reduce downtime. For example, the QT2 three-phase microinverter used in commercial and industrial (C&I) applications leverages AI to adjust power output based on real-time grid conditions and solar irradiance.

Energy storage: intelligent battery management

The APstorage ELS/ELT series is designed to work seamlessly with APsystems microinverters. AI plays a critical role in managing these storage systems through the BESS AI model, a deep learning algorithm that analyzes historical solar production and consumption patterns, considers regional electricity pricing, especially in time-of-use markets, and generates custom charge/discharge strategies for each household having a Dynamic Tariffs contract.

The AI Mode is designed to make the best decisions tailored to each home's priorities and needs to achieve the right goal at the right time: saving excess PV, taking advantage of periods of off-peak pricing to charge the battery and maximizing feed-in revenue by discharging into the grid during peak hours.

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This optimization process is performed while factoring in battery health by avoiding unnecessary charge and discharge cycles. Although it may not be the optimal solution in some cases, in the long run, the AI Mode can help users save costs and potentially generate additional income.

The AI Mode does not require any additional external hardware. It is designed to work intuitively and immediately with batteries and can be activated directly by the system owner through the EMA app. This means a homeowner with an existing PV system can easily add a compatible battery and significantly lower its electricity bills.

This results in optimized battery usage, reduced grid dependency and increased cost savings for users.

AI in system design: AP Designer

To streamline the planning and deployment of solar systems, APsystems developed AP Designer, an AI-powered design tool that uses

satellite imagery and 3D modeling, image recognition for rooftop and shading analysis and automated bill of materials (BOM) and simulation reports.

This tool significantly reduces design time while improving accuracy, making it invaluable for installers and solar professionals.

AI-driven customer support: APbot

Our technical customer support department is also being transformed through APbot, an AI assistant powered by large language models and retrieval-augmented generation (RAG). Currently in the testing phase with plans to be deployed worldwide before the end of this year, APbot will provide instant answers to technical and installation queries, troubleshooting support and post-sales assistance.

This ensures a smoother customer journey and reduces the burden on human support teams.

Data privacy and security compliance in APsystems platforms

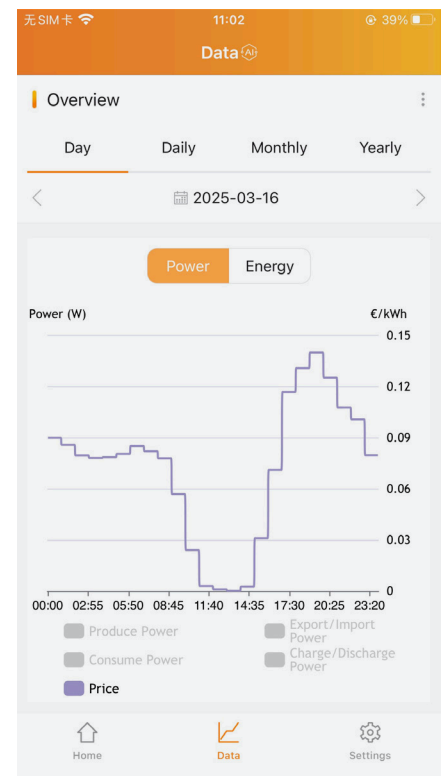
As the business expands its digital ecosystem, data privacy and security have become foundational pillars. The company adheres to EN18001 principles, focused on information security and operational safety and complies with GDPR and other global data protection regulations.

Data collection and use

Only the minimum necessary personal data is collected, including usernames and contact details, device IDs and system performance data, installer information and alarm logs. This data is used strictly for service provision, such as system monitoring, performance optimization, and customer support.

Data storage and encryption

All user data is stored on Amazon Web Services (AWS) servers in Europe, ensuring compliance with EU data residency requirements. Key security measures include





end-to-end encryption of sensitive data, anonymization of stored information and encrypted backups and secure access protocol.

Data sharing and access control

Personal data is not shared with third parties unless required by law or government authorities, explicitly authorized by the user, or when it is necessary for service provision, e.g. sharing with installers.

Installers can access user data only through EMA or API platforms, and only for systems they are authorized to manage.

The APsystems API is governed by strict licensing terms. Users must obtain written

consent from individuals whose data is accessed, use the API only for internal business purposes and avoid selling or redistributing data in downloadable formats.

The API license also includes Standard Contractual Clauses (SCCs) for international data transfers, ensuring compliance with GDPR, UK GDPR, and the Swiss DPA.

Data security measures and organizational controls

To protect user data, several measures have been implemented, such as incident response protocols for data breaches or regular security audit and updates aligning with EN18001's focus on operational safety and risk

management, ensuring that both physical and digital infrastructures are secure.

A smarter, safer energy future

APsystems is not just a hardware manufacturer, it is a technology innovator at the intersection of AI, solar energy and data privacy. By embedding AI across its product line, from microinverters to storage systems, and ensuring robust data protection through EN18001-aligned practices, it is setting a new standard for the solar industry.

Whether you're a homeowner seeking energy independence or a business optimizing your energy footprint, APsystems offers a smart, secure and scalable solution for the future of clean energy.



APsystems QS2 Microinverter: power, precision and performance

As solar technology continues to evolve, the demand for smarter, more powerful and more adaptable microinverters has grown. APsystems, a global leader in Module-Level Power Electronics (MLPE), has responded with the QS2 microinverter, a next-generation solution tailored for modern photovoltaic systems using high-power modules. With its quad-input design, independent MPPTs, and advanced safety features, the QS2 is engineered to deliver maximum energy harvest, system flexibility and long-term reliability.

The QS2 microinverter is a single-phase, quad-input device capable of supporting four high-power PV modules simultaneously. It delivers a total output of 2200 VA, making it ideal for both residential and small commercial rooftop installations. This configuration reduces the number of inverters needed per installation, lowering hardware and labor costs while simplifying system design.

Independent MPPT for each panel

Each of the four input channels is equipped with its own Maximum Power Point Tracking (MPPT). This allows the QS2 to optimize the energy output of

each panel independently, even in cases of partial shading, different orientations or tilts, or mismatched panel performance.

This feature ensures maximum energy harvest and system resilience under real-world conditions.

Encrypted Zigbee wireless communication

The QS2 uses Zigbee mesh networking for wireless communication, offering several advantages over traditional PLC (Power Line Communication) including faster data transmission, improved signal stability and encrypted communication for enhanced cybersecurity.

This enables real-time monitoring and remote diagnostics via APsystems' EMA platform or mobile apps, giving users 24/7 access to system performance data.

Advanced safety features

Safety is a top priority in rooftop solar installations, and the QS2 is designed with multiple protective features including low DC Input Voltage (<60V) that reduces the risk of electric shock and arc faults, integrated Safety Relay which supports rapid shutdown compliance and multiple grounding options to meet diverse regulatory requirements.

These features make the QS2 compliant with the latest electrical safety standards

and suitable for installations in regions with strict codes.

Rugged and weather-resistant design

The QS2 is built to withstand harsh environmental conditions:

- **IP67-rated enclosure:** Dust-tight and waterproof
- **Fully encapsulated electronics:** Protected by silicone sealant for thermal management and durability
- **Operating temperature:** Designed for full power operation in extreme heat and cold

This ensures long-term reliability and minimal maintenance, even in challenging climates.

Flexible installation and backward compatibility

The QS2 is compatible with previous APsystems models like the DS3 and QS1, making it ideal for system upgrades or mixed installations.

Certified for the main European countries including the United Kingdom, the QS2 is expected to be available in Q4 this year. Like its entire range of microinverters, the QS2 comes with a 12-year standard warranty and an extension up to 25 years.

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