

## **ATESS On-Grid and Off-Grid Switching Solution: Ensuring Stable Power Supply and Seamless Transition**

In modern energy management, the stability and reliability of the power grid are of paramount importance. When abnormalities occur in the main grid, maintaining uninterrupted operation during the transition to microgrid mode is a pivotal challenge in the field of energy technology.

The ATESS HPS series, equipped with its advanced "On & Off-Grid Switching Logic," offers an exceptional solution to this challenge, delivering reliable and seamless energy management in the most critical scenarios. In critical scenarios, such as a hospital losing power due to grid instability, ATESS ensures a rapid, seamless transition to off-grid mode while maintaining stable operation of essential medical equipment in operating rooms—safeguarding lives and underscoring the critical importance of grid stability and reliability.

This white paper provides a comprehensive overview of the technical features of the ATESS HPS series and its advanced on & off-grid switching logic. It is designed to help you better understand how efficient power management solutions can enhance the stability and flexibility of energy systems.





*All-in-one ATESS HPS30-150 hybrid inverters*

## Overview of On-Grid and Off-Grid Modes

On&off grid switching logic is a control strategy for switching between on-grid mode (PQ control) and off-grid mode (VF control) in a microgrid system. It ensures the continuity and stability of the power supply in the switching process of the system to avoid equipment damage or power interruption.

The following is a detailed description of On & off grid switching logic for ATESS HPS series products:



## On-grid mode

- Definition:** The microgrid is connected to the main grid for operation.

- Characteristics:**

- The main grid is responsible for the main supply of electrical energy.
- Distributed energy sources in micro-grids (e.g., solar, battery) work in tandem with the main grid.
- Power and frequency are controlled by the main grid.

## Off-grid mode

- Definition:** The microgrid is disconnected from the main grid and operates independently.

- Characteristics:**

- Energy storage system in microgrid as the main power source.
- The microgrid needs to maintain voltage and frequency stability independently.

## On&Off grid switching logic

Switching logic is mainly divided into two scenarios: switch from on-grid to off-grid and switch off-grid to on-grid.

ATESS HPS series products use hardware SCR and leading software control technology to achieve reliable and seamless switching between on-grid and off-grid, ensuring stable system operation and greatly reducing the risk of energy interruption.



## **Switching Process: From On-Grid to Off-Grid**

When the main power grid experiences abnormalities such as a power outage or voltage fluctuations, the ATESS system automatically switches to off-grid mode. During this process, the system intelligently monitors the grid status in real-time and quickly disconnects from the main grid, ensuring stable operation of the connected equipment. Simultaneously, the local energy storage system takes over to provide power.

When switching from on-grid to off-grid mode, the ATESS system ensures the process is virtually unnoticeable—completing the transition in just 10 milliseconds. During this time, the system automatically adjusts to maintain an uninterrupted power supply, eliminating risks of equipment damage or power outages. This means users can enjoy a seamless energy experience, whether they are homeowners, businesses, or operating in remote areas, ensuring the continuous reliability of energy supply.

## **Switching Process: From Off-Grid to On-Grid**

When the off-grid system needs to reconnect to the main grid, the ATESS system performs a synchronization operation, ensuring that the voltage, frequency, and phase match those of the grid, thus avoiding current surges during connection. Using efficient synchronization control technology, the system quickly and stably integrates the power system with the main grid. This process is also very rapid, typically completing within 10 milliseconds, ensuring a smooth transition of equipment and preventing potential power interruptions and damage.



Phase locking is a key step in switching from off-grid to on-grid process, used to ensure that the off-grid system is consistent with the main power grid in voltage, frequency and phase. The phase-locking process usually relies on the Phase-Locked Loop (PLL) technology and the inverter's synchronization control logic.

ATESS's PLL technology outperforms competitors by offering faster response times, achieving synchronization within 10ms, compared to traditional energy storage solutions. This reduces the risk of voltage interruptions and equipment damage. ATESS also provides precise phase synchronization, maintaining a phase difference of less than 3° or less than 5°, minimizing current surges at grid connection. Additionally, ATESS uses dual-layer filtering (LC + software) to mitigate high-frequency noise, ensuring stable operation in fluctuating grid environments. These advantages enhance system stability, reduce downtime, and optimize energy management, particularly in remote or weak grid scenarios.

## **ATESS Technology: Pioneering Seamless Energy Management**

ATESS is at the forefront of energy management innovation, delivering solutions that prioritize stability, efficiency, and reliability. With state-of-the-art technology, we offer seamless transitions between on-grid and off-grid operations, ensuring uninterrupted energy supply in all situations. Our systems are meticulously designed to meet the dynamic demands of modern energy infrastructure, with a focus on applications where reliability is critical.

### **Intelligent Controller**

Our intelligent control logic and rapid-response algorithms facilitate swift transitions, minimizing downtime and enhancing system efficiency.



## **Energy Storage System Support**

In off-grid operation, the energy storage system maintains stability and ensures power balance, providing continuous energy supply even in remote areas.

## **Inverter Synchronization Technology**

ATESS ensures precise synchronization of voltage, frequency, and phase, guaranteeing smooth integration and stable performance across various energy sources.

## **Power Grid Fault Monitoring**

Real-time monitoring of the main power grid enables our system to execute switching logic immediately, preventing potential energy disruptions and safeguarding essential equipment.

## **Case Study**

The ATESS On & Off-Grid Switching Solution is essential for ensuring stable power supply in critical environments, particularly hospitals facing high-impact loads. Hospitals must handle rapid power fluctuations to maintain life-saving equipment and services. This is particularly important for equipment like CT scanners, MRI machines, and operating room devices, which require stable, uninterrupted power despite short-term high power demands.





*An ariel view of Mueang Khong in Chiang Dao District*

In the case of Banmai Hospital in Chiang Mai, Thailand, like many facilities in the area, struggled with frequent power interruptions, especially during the rainy season from June to October. These outages disrupted patient care, jeopardized vaccine storage, and led to equipment failures, increasing costs and operational downtime. Key challenges included:

- **Vaccine storage risks:** Frequent power cuts forced the relocation of temperature-sensitive vaccines, increasing spoilage risks.
- **Equipment damage:** Repeated outages caused mechanical failures, escalating repair costs and downtime.
- **Patient care disruptions:** Unreliable power hindered the hospital's ability to maintain critical oxygen supplies, leading to costly patient transfers.

ATESS's solution, featuring HPS hybrid inverters and advanced energy storage, enabled seamless transitions from on-grid to off-grid mode within 10 milliseconds. This ensured that critical equipment, such as oxygen supply and surgical systems, remained operational without disruption, even during grid failures.





*The HPS30 and battery systems installed in the Banmai Hospital*

The solution's impact was profound. The hospital now enjoys reliable power, secure vaccine storage, and reduced energy costs—cutting electricity bills from THB 3,000–5,000 to under THB 500 monthly. This reduction allows for reinvestment in patient care, enhancing the overall resilience and healthcare service quality in the region.

ATESS's advanced On & Off-Grid Switching Technology ensures hospitals can effectively manage high-impact loads and avoid costly downtime, safeguarding both equipment and patients' lives.

## **Conclusion**

ATESS's On&Off Grid Switching Solution is designed to ensure a reliable and stable power supply, whether the microgrid is connected to the main grid or operating independently. With





advanced synchronization technologies, rapid switching capabilities, and built-in safety features, ATESS solution helps maintain seamless energy flow while safeguarding equipment and ensuring that energy needs are met in all scenarios. The ATESS HPS series has been successfully deployed in a wide range of applications, including industrial parks and remote villages. Whether addressing grid fluctuations or supporting off-grid operations, the HPS series consistently demonstrates exceptional stability and reliability, making it a trusted solution for critical energy needs. With ATESS technology, you can ensure reliable, continuous power supply for your critical operations—whether you're dealing with power grid instability or operating in off-grid environments.

To learn more or schedule a free technical consultation, visit [atesspower.com](http://atesspower.com). Partner with our team to explore how these innovative technologies can be tailored to meet the needs of your project.

