

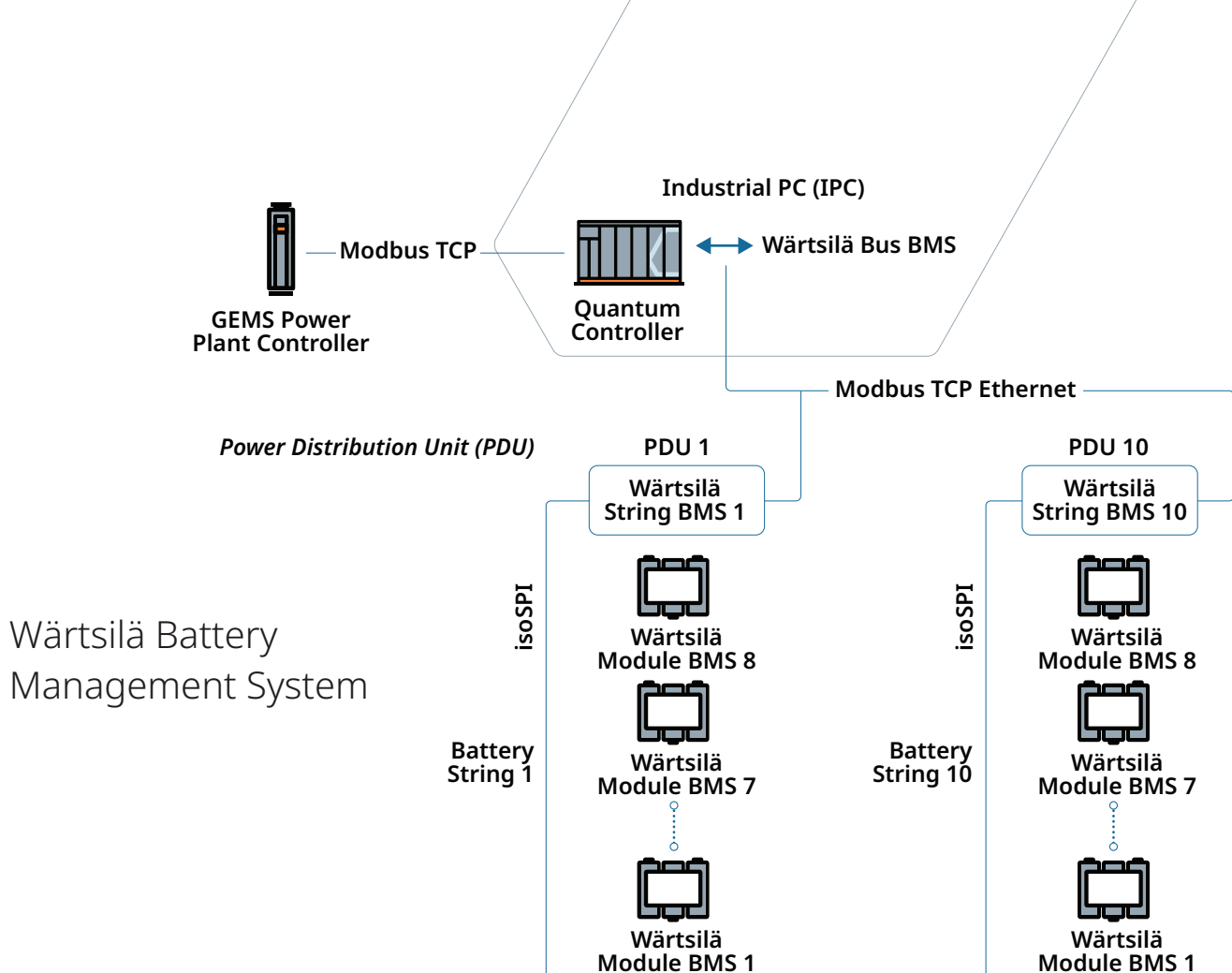


# The Wärtsilä Battery Management System (BMS)

Bringing industry-leading cybersecurity, accuracy, and asset longevity to your BESS investment



The growing prevalence of battery energy storage systems (BESS) has brought forth increased scrutiny around cybersecurity, performance, and long-term asset management. As these solutions become increasingly critical to grid function with the deployment of renewable energy, additional developments are needed to ensure that they remain secure, optimised, and well-managed. To meet the demand for safe and reliable solutions, Wärtsilä's Quantum BESS portfolio will now be equipped with a U.S. designed and engineered battery management system (BMS). Equipped with cutting-edge cybersecurity features, superior state-of-charge (SoC) accuracy, and the flexibility that comes with continuous improvements, the Wärtsilä BMS sets a new standard for cybersecurity and performance. The Wärtsilä BMS also gives you the peace of mind that comes with knowing that your system is fully engineered by world-class engineers, backed by Wärtsilä's supreme reputation for quality, and adaptable for years to come.



## Wärtsilä Battery Management System




### Introduction

As the global demand for energy storage continues to rise, BESS owners and operators increasingly rely on BESS to optimise energy generation, increase renewable energy penetration, and enhance grid reliability—all while generating revenue. System failures can lead to loss of power for industrial and residential users and result in heavy fines to system owners. As BESS applications continue to grow in complexity and projects grow in capacity, the

importance of reliable and sophisticated software and hardware has never been greater.

Maintaining stringent cybersecurity standards is another concern as BESS systems scale. Since systems are only as reliable as they are safe, the Wärtsilä BMS was designed with cybersecurity at the forefront, to ensure that critical safety functions (e.g., sensing and responding to over-temperature and over-current events) are responded to promptly and robustly.

**Recognising these needs, Wärtsilä developed a next-generation battery management system, the Wärtsilä BMS, that offers:**

-  **Enhanced cybersecurity:** safeguarding your battery assets at every level.
-  **Superior SoC accuracy:** ensuring optimal performance and maximised tradable energy.
-  **Continuous improvement capabilities:** facilitating software upgrades to ensure long-term system optimisation and performance.



## Cybersecurity: safeguarding critical infrastructure

In the modern digital world, cybersecurity is critical for the protection of both physical and digital assets. The Wärtsilä BMS is the gateway between the battery cells in a BESS and the greater controls software, Wärtsilä's GEMS Digital Energy Platform, making it a crucial point to protect from interference. Wärtsilä's BMS is fully designed and engineered in the United States by Wärtsilä's team of expert engineers. It is also equipped with a cutting-edge dual-core processor, with safety functions operating on a dedicated core. This design guarantees unparalleled reliability and ensures that safety features remain impervious to any software interference. This additional layer of protection at the hardware level enhances the existing safeguards already implemented in the GEMS software.

### Key features of the Wärtsilä BMS cybersecurity protections:

The key cybersecurity features of the Wärtsilä BMS act as an enhanced layer of protection against physical and digital threats. These features include:

- ✓ **Manufacturing transparency:** The Wärtsilä BMS is fully engineered in the United States, where the Wärtsilä team has complete control over the design and procurement of all components, ensuring greater accountability and security.
- ✓ **Certified for functional safety:** The Wärtsilä BMS is certified to UL 61730-1 Annex H. This standard guarantees that the system delivers functionally safe responses in the event of the critical safety operational violations: overtemperature, undertemperature, overcurrent, overvoltage, and undervoltage.
- ✓ **Hardware-level control:** In response to a critical safety operational event, the Wärtsilä BMS automatically prohibits both charge and discharge by opening the contactor relays to disconnect batteries from the DC Bus, effectively preventing any potential adverse operational condition from escalating.

- ✓ **Dedicated functional safety core:** The Wärtsilä BMS partitions one CPU core purely for functional safety activities. This core accepts signals directly from cells and is impervious to other functions of the BMS, preventing unsafe conditions from manifesting even if compromised.

These features are additional safeguards to the existing protections provided by Wärtsilä's GEMS Digital Energy Platform:

- Wärtsilä's **GEMS Power Plant Controller** features tamper-resistant physical security, password-protected access to BIOS and all databases, and high-availability/fail-over mechanisms. The GEMS Power Plant Controller has also been certified to IEC 62443 4-1 and IEC 62443 4-2 cybersecurity standards. IEC 62433-4-1 outlines strict processes for the secure development of industrial automation and controls systems, while IEC 62433-4-2 outlines technical control system component requirements for the GEMS Power Plant Controller. This compliance has been certified by an external auditor, Exida.
- Wärtsilä's GEMS Power Plant Network is designed to IEC 62443-3 and incorporates cybersecurity best practices such as security zone separation and network traffic permissions to provide top-tier protection.
- Wärtsilä's **GEMS Fleet Director** incorporates perimeter firewall, strong end-to-end encryption, tamper-proof logging, stringent Role-Based Access Control, and zero-trust design elements to provide state-of-the-art software protections.

This robust cybersecurity framework ensures that our customers' BESS assets are best protected from cyberattacks while maintaining smooth BESS operations.



## Superior state-of-charge (SoC) accuracy

State of charge (SoC) is a critical metric in battery management that directly impacts the performance, efficiency, and profitability of your BESS. Accurate SoC monitoring is particularly important when looking to maximise the value of your assets through advanced bidding and energy trading.

### Benefits of enhanced SoC accuracy:

- ✓ **Optimised bidding capacity:** With improved SoC accuracy, the Wärtsilä BMS helps you bid with confidence. You can capitalise on the maximum tradable energy without the risk of overbidding or underperforming.
- ✓ **Extended battery life:** Accurate SoC monitoring also prevents overcharging and overdischarging, thereby improving battery lifespan and keeping capacity high for the full lifespan of the battery.
- ✓ **Real-time feedback:** Instantaneous feedback from the Wärtsilä BMS allows for dynamic adjustments in real-time, providing you with a more responsive and adaptive system.

This enhanced SoC accuracy allows you to unlock the full potential of your BESS, ensuring not only better financial performance through optimised trading but also a longer system lifespan and reduced operational risks.



## Continuous improvement and future upgrades

Energy storage technology is evolving rapidly, and a static system can quickly become outdated. To ensure that your asset remains competitive over the long term, the Wärtsilä BMS supports continuous improvement and future upgrades. While a traditional system is designed to the best contemporary practices and only upgraded in response to pressing challenges, the Wärtsilä BMS is designed to adapt to new innovations, software features, and evolving battery technologies throughout the 20-year (or longer) lifespan of your asset.

### Key features for future-proof technology:

- ✓ **Seamless upgrades:** With the Wärtsilä BMS's robust hardware infrastructure, software upgrades are seamlessly integrated into existing systems, ensuring that you are always able to capitalise on learning and optimisation from the full fleet of Wärtsilä's 130 global BESS sites.
- ✓ **Long-term performance optimisation:** The Wärtsilä BMS's ability to be remotely updated allows for continuous improvement, ensuring that your BESS is always operating at peak performance and that it will retain its full operational potential throughout its lifespan.
- ✓ **Incorporation of emerging recommendations:** As new battery management algorithms and lifetime best practices emerge, the Wärtsilä BMS offers the opportunity to improve commissioned sites to utilise the latest advancements in performance, efficiency, and safety for your BESS. An investment in the Wärtsilä BMS acts as a key to these innovations to keep your BESS at the forefront of the energy storage market.

The flexibility to upgrade and improve the Wärtsilä BMS system over time ensures that your investment remains protected, and your BESS continues to operate optimally for its full lifespan.

## | Conclusion

The Wärtsilä BMS brings a new level of sophistication to energy storage management. By prioritising cybersecurity, enhancing state-of-charge (SoC) accuracy, and offering the ability to upgrade and adapt to new technologies, the Wärtsilä BMS ensures that you can maximise the value of your BESS throughout its lifespan.

As the role of energy storage becomes ever more pivotal in our global energy framework, the Wärtsilä BMS stands out by offering unmatched security, precision, and longevity. This system isn't just about meeting your current needs—it's about anticipating your future demands.

Discover how the Wärtsilä BMS can optimise your energy storage system and drive the success of your next-generation projects. Contact our team to learn more.