



Energy Storage Solutions Brief

IOTech's edge software is helping the providers of Battery Energy Storage Systems (BESS) deliver safer, more efficient, profitable, and cost-effective solutions to their customers

IOTech Solution Benefits

- Seamless data acquisition / control with the lower-level Battery, PCS, Chillers, HVAC, F&G Systems and other vendor supplied systems
- Scales seamlessly from small <1MWh commercial behind-the-meter sites up to massive >100MWh grid-connected stationary storage sites, with no performance degradation
- IOTech's software normalizes proprietary vendor data into industry standard models, like Sunspec, abstracting away complexity
- By deploying its lightweight architecture directly at the edge, Edge Connect control layer reacts to BESS telemetry in microsecond-scale, empowering instant adjustments and failure mitigation
- Includes high performance PostgreSQL times series data historian / for long-term storage, analytics and reporting capable of handling billions of rows of data with ingress rates exceeding 100,000 data points per second
- Open APIs enable simple integration into 3rd-party software stacks like customer's proprietary Energy Management Systems (EMS), or Asset Management Systems (AMS)



IOTech's Edge Central enables suppliers to rapidly deliver optimized, fault-tolerant control solutions that leverage data insights across heterogeneous equipment to maximize BESS performance and value

Enabling Intelligent Battery Energy Storage Systems

Competitive advantage, innovation and product differentiation are fundamental to creating successful commercial offerings that resonate with customers and help BESS suppliers capture market share. Gathering, standardizing, and then exploiting the rich data held in the underlying battery, inverter and other equipment control systems allows BESS customers to optimize equipment performance, diagnose faults, and make informed decisions around charging vs. discharging and bidding for supply.

Meanwhile, BESS suppliers need to build and deliver these capabilities quickly, in a repeatable fashion, and in a cost-effective, non-proprietary way. They need to be able to choose and easily integrate energy products from a variety of equipment vendors, maximize energy density, and create the most appropriate overall hardware and software solution for each of their customers or customer sites.



IOTech edge software solutions are helping BESS suppliers to fully exploit the rich data held in the underlying battery, inverter and other equipment

Solution Description

The first step is to access all the field data such as voltages, currents, SoC, temperatures and more, held in for example each equipment vendor's battery / environment management or power control system. Several problems are immediately apparent:

- Each vendor maps and names the required data in subtly or often completely different ways. Some use SunSpec conventions, others do not or only partially comply
- While the vendors do provide data APIs, these often implement different OT protocols: while one might use Modbus, others may use different standards such as CANbus or DNP3
- There is a need to overcome the fragmentation of data across the 'islands' of automation provided by each vendor – and avoid over-reliance on their own, often proprietary and costly hardware / software control systems



IOTech provides ease-to-use software products and tools to help overcome barriers to adoption

IOTech Edge Central Platform for BESS

- IOTech have created a universal data API parser which can scan an equipment vendor's data specification and automatically create a data 'profile' or mapping of their data into a standardized, fully SunSpec compliant format
- Using Edge Central's management tools, the data profiles are then easily configured and deployed into Edge Central's 'smart connectors', which take care of both running the data mappings, and communicating over the appropriate protocols. The net result is that field data from across the BESS equipment is then quickly and efficiently available in a single format, in one place, and regardless of the heterogeneity of the vendors' underlying data and communications protocols. And, for commercial or other reasons, if one equipment vendor is swapped out for another, the system can be quickly reconfigured to communicate with the new vendor's systems
- IOTech's Edge Central software runs any commodity edge hardware gateway or industrial PC and can also run in virtualized environments if desired. It is a very cost-effective, open solution

Once the data is being securely accessed, translated, and ingested into Edge Central, we can then start to provide value-added activity with it at the edge, for example:

- Correlate and analyze data from various BMS, PCS, HVAC and other sources to ensure balanced, safe, and efficient operations of the overall BESS solution. Edge Central provides various tools such as scripting or a dedicated Node-RED rules engine to enable such functions
- Provide local data trends and alerts to field operatives to assist for example in fault diagnosis, maintenance and operations
- Develop and execute control logic functions across the underlying equipment
- Store the data tags as real-time and time series entries in the Edge Central Energy Browser / Historian for arbitrary querying or visualization via any graphics or BI tool
- Filter and stream selected data to a variety of endpoints: cloud applications, SCADA systems and back to local controllers where required



Solution Architecture

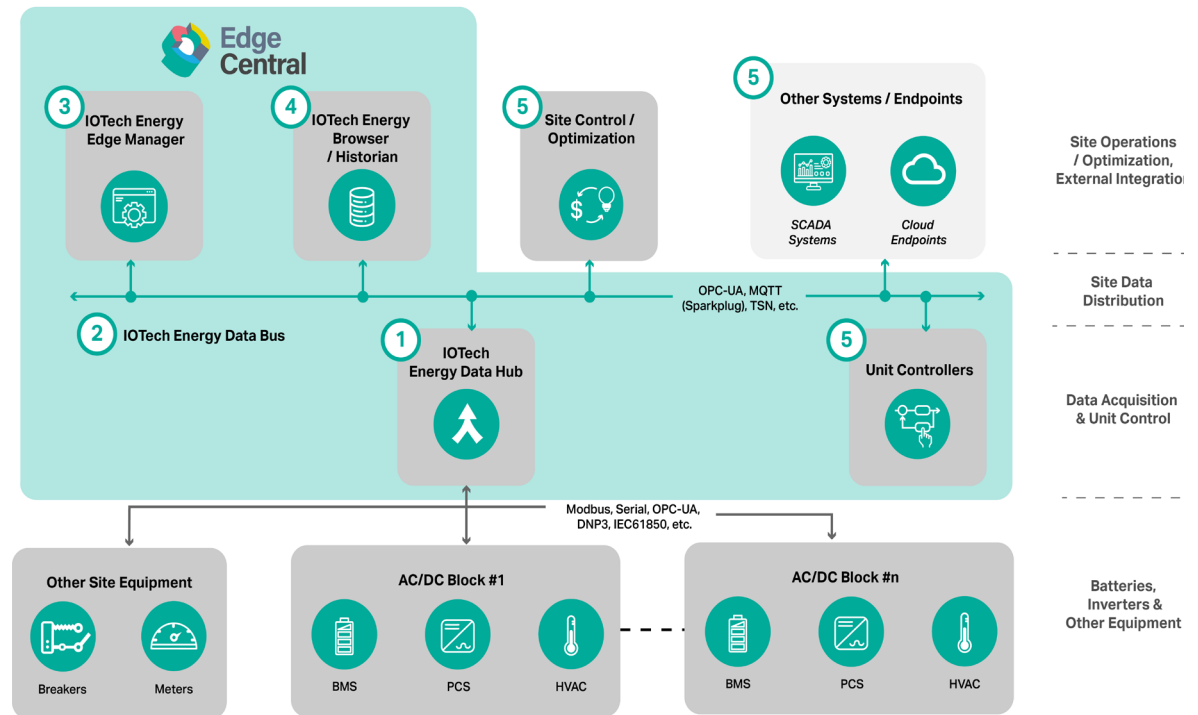
1. IOTech's Energy Data Hub provides highly performant connectivity for bi-directional communications / translation between vendor equipment and higher-level applications.

2. IOTech's Energy Data Bus enables site-wide data distribution infrastructure and external integration – real-time, robust and highly scalable, employing standard IT protocols such as MQTT Sparkplug and OPC-UA, and standard data models such as SunSpec.

3. IOTech's Energy Edge Manager easily configures and orchestrates the various system components of the solution, including the Energy Data Hub, Historian, and other applications. It can provision any hardware nodes, and then deploy, manage, update and orchestrate the applications which run on those nodes. All this is done at scale, meaning BESS suppliers can easily manage their software solutions across sites and their customer base.

4. IOTech's Energy Browser / Historian is a dedicated, highly scalable solution, based on leading OPC-UA and PostgreSQL database technology, to support both operator (SCADA) functions, and long-term data storage / mining, embedding of sophisticated analytics and decision support applications via easy plug-in of visualization tools and BI, e.g. Grafana, Tableau.

5. Other Applications such as Controllers or Energy Management Systems can be easily developed / integrated and deployed within the overall Edge Central infrastructure.

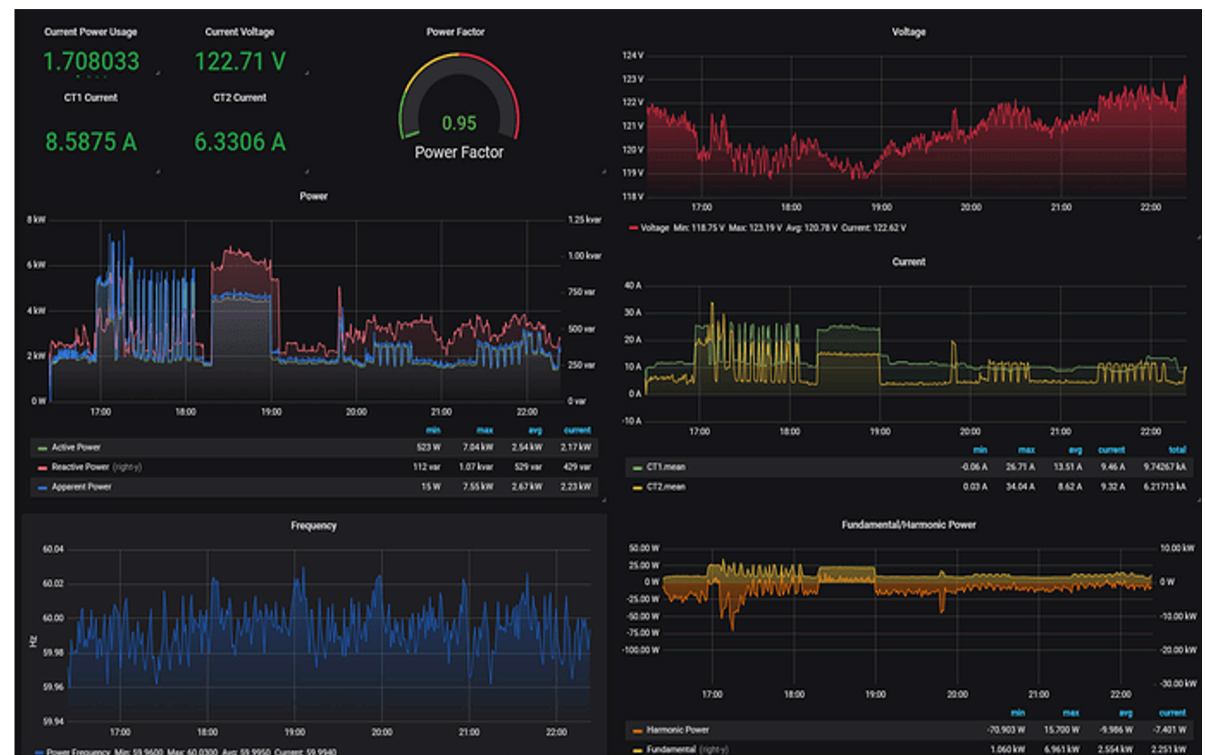


Edge Products for BESS

IOTech's BESS solutions are built on our market-leading Edge Central software platform. It provides a suite of capabilities implemented as a set of microservices that can be deployed natively, containerized and/or virtualized. Our simple configuration tools allow users to easily select which components to deploy for each use-case, including standard components (for example OT protocol connectors) provided with the product, as well as user defined components.

The key platform features include:

- Core data components including publish-subscribe bus, data logging and local storage
- Device services / connectors / exporters including out-of-the-box support for integration with multiple OT device and IT endpoints including Modbus, OPC-UA, MQTT, PROFINET, Ethernet/ IP, EtherCAT, DNP3 REST/HTTP and more
- Embedded leading open-source tools for data visualization and storage (OPC-UA, PostgreSQL / InfluxDB, Grafana), and business rules definition / execution (Node-RED)
- Extensive Graphical tooling to configure and monitor the platform and software components. SDKs to support user-defined developments are also included
- Can be deployed on commodity x86 (64 bit) and ARM (32 and 64 bit) architectures, running a range of Linux as well as more specialized RTOS variants



Example Grafana BESS Dashboard





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