

VIVIDCLOUD CASE STUDY

Battery Host Controller Breakthrough

Executive Summary

VividCloud partnered with Dynamic Grid, a Maine-based clean energy company, to build the software backbone of its containerized Energy Storage Solution, a production-grade controller capable of safely orchestrating up to 22 Toshiba Battery Management Units while presenting a single, vendor-agnostic interface to any SunSpec-compliant Microgrid Controller. The engagement centered on the Battery Host System Controller (BHSC), a Python-based embedded application that translates between Modbus/SunSpec and CAN bus protocols every 120 milliseconds, implements all nine Toshiba safety procedures, and enforces independent failsafe contactor control, all without any cloud dependency. Delivered over an 8-month engagement spanning assessment through full solution engineering, and validated by a custom emulator suite and 40+ automated tests, the result lets Dynamic Grid bring its battery storage product to market with any compliant Microgrid Controller and full confidence in its safety architecture.

Client's Key Business Objective

Dynamic Grid's Energy Storage Solution integrates Toshiba Battery Management Units, each overseeing up to 50 Cell Management Units, into containerized installations that scale from 2 to 20 BMU racks. Getting that battery fleet talking to a site's Microgrid Controller was the core obstacle: the Microgrid Controller communicates over SunSpec Modbus, while the Toshiba BMUs speak a proprietary CAN bus protocol, and no bridge existed between the two. Layered on top of that protocol gap was safety-critical complexity across nine distinct operational procedures – start, stop, power failure, overcharge, temperature faults, and more – that had to run independently of the Microgrid Controller in case it failed or went silent. Dynamic Grid needed a partner who could combine embedded software depth with electrical engineering experience to deliver a production-ready control system without locking its product to a single Microgrid Controller vendor.



Dynamic Grid is a clean energy technology company that develops advanced Distributed Energy Resource Management System (DERMS) solutions to help utilities, microgrids, and commercial buildings optimize energy generation, storage, and consumption. Powered by artificial intelligence and machine learning, the company's platform coordinates distributed energy resources, flexible loads, and energy storage within a secure, scalable system that improves grid performance, supports renewable energy integration, and enables more efficient energy management.

Industry: Grid Modernization

Location: Portland, Maine

Website: dynamicgrid.ai

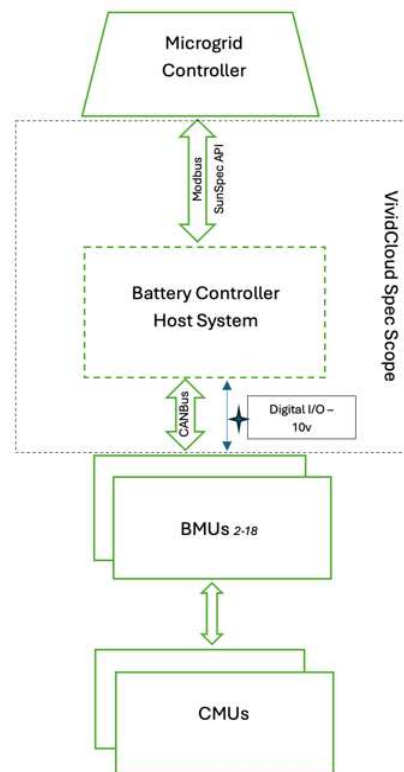
VividCloud Solution

VividCloud designed and built the Battery Host System Controller (BHSC), a Python application running on an Ubuntu-based industrial single-board computer that serves as the ESS's control brain – continuously monitoring both the Microgrid Controller and the BMU fleet and acting as the authoritative translator between them.

The BHSC presents itself to the Microgrid Controller as a SunSpec-compliant Modbus device, populating holding registers for Models 1 (Common), 802 (Battery Base), 803 (Li-ion Battery Bank), and 804 (Li-ion Strings) across multiple device instances that mirror the ESS's hierarchical structure. A dedicated CAN bus layer manages bidirectional communication with up to 22 Toshiba BMUs, parsing proprietary message frames and translating them into SunSpec register values every 120 milliseconds.

The BHSC represents each BMU in memory as a 'shadow,' modeled on AWS IoT device shadow concepts, holding the most recent copy of every CAN message type received. This decouples real-time CAN bus reception from the once-per-second SunSpec calculation cycle that averages state of charge across strings, aggregates current and power, and derives state of health, charge status, and event flags. Nine Toshiba procedures run as discrete state machines, while independent failsafe logic – monitoring overcurrent, overvoltage, temperatures above 54°C, and loss of Microgrid Controller heartbeat – can trigger contactor intervention regardless of what the Microgrid Controller is doing. Separate Modbus connections handle switchable BMU power distribution and independent DC bus voltage reporting.

Because BMU and controller hardware weren't consistently available, VividCloud validated the entire system against a custom emulator suite – BMU, Microgrid Controller, Fieldbus, and DC meter emulators – backed by 40+ unit test modules and a full system integration suite, so defects could be caught and resolved long before physical hardware integration.



Outcomes

- Production-ready Battery Host System Controller delivered over an approximately 8-month engagement spanning assessment through full solution engineering
- Real-time, vendor-agnostic protocol translation – BMU status polled every 120ms, with full SunSpec compliance letting any compliant Microgrid Controller integrate without software changes
- Multi-layered safety architecture – Toshiba procedure compliance, independent failsafe contactor control, and Microgrid Controller heartbeat monitoring – validated by 40+ automated tests and a full emulator-driven test harness before hardware was ever connected

Conclusion

The Dynamic Grid engagement reflects VividCloud's approach to embedded systems work: grounding every architectural decision, from the BMU shadow system to the procedure engine, in Dynamic Grid's real operating constraints rather than a generic reading of the spec. By contributing electrical engineering expertise alongside software – from SBC selection to power distribution design and cable harness layout – and by building a Modbus/CAN translation layer that keeps Dynamic Grid vendor-agnostic on the Microgrid Controller side, VividCloud helped de-risk both the technical and commercial path to market. The result is a production-ready, safety-compliant control system that Dynamic Grid's own team can maintain and extend without dependency on cloud services or a single integration partner.

About VividCloud

VividCloud is a software development company focused on cloud and IoT. AWS is our cloud platform of choice, and we are an Advanced Tier APN Services Partner.

We bring fully managed teams that free our clients from day to day oversight responsibilities.

VividCloud is based in Brunswick Maine.

Contact Us



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