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On the Radar: Vertiv provides microgrid and BESS to data centers

Summary

Catalyst

With the proliferation of artificial intelligence (AI) computing applications, there has been a rapid deployment of specialized hardware such as GPUs in servers, significantly escalating average rack power consumption and consequently driving up the energy usage of IT equipment within data centers over recent years. At the same time, as part of their commitment to corporate social responsibility and environmental sustainability, data center enterprises are increasingly compelled to integrate more new energy sources into their operations to mitigate carbon emissions.

This juxtaposition of trends presents a paradox, primarily manifested in the mismatch between the fluctuating peaks and valleys of energy demand and supply under complex energy supply conditions.

Vertiv™ DynaFlex BESS (battery energy storage system) addresses this challenge with its innovative energy storage solution, designed to bridge the gap between energy demand and supply. This offering empowers data center users to fully leverage the potential of a hybrid energy system that effectively combines grid power with renewable energy sources such as solar, wind, and hydrogen fuel cells. The implementation of these solutions not only facilitates a degree of energy independence for data centers but also enhances the flexibility of their energy systems, lowers energy costs, and ensures the reliability of backup power, thereby fostering a sustainable and efficient operational environment.

Omdia view

The paramount objective for data center users is to ensure the consistent and efficient operation of their IT computing infrastructure while concurrently striving to minimize expenses and carbon footprint. The escalating power consumption of IT equipment and the intricacies of energy supply have made this goal increasingly elusive. This context accentuates the critical role of energy storage in data centers.

In response to the emerging need, BESS offers standalone energy storage functionalities that can be scaled to tackle systemic energy efficiency and carbon emission reduction challenges across various energy scenarios. This positioning makes it a pivotal component in the evolving power infrastructure for data centers of the next generation.

The advent of microgrid and BESS systems has been pivotal in resolving these paradoxical issues within the data center market. Data center operators no longer need to build such energy storage systems from scratch; instead, they can opt for professionally designed energy storage solutions tailored specifically for data center environments by leading electrical manufacturers. This strategic approach has significant implications for cloud service providers, particularly those outside major markets, enabling them to achieve cost reductions and operational efficiencies through an optimized energy perspective.

Why put Vertiv DynaFlex BESS on your radar?

Data center users are acutely aware of the pressing need to reconcile their escalating power consumption with cost reduction and carbon footprint minimization objectives. Despite this industrywide challenge, the trajectory of growth remains unaltered, requiring user enterprises to reevaluate and innovate on traditional data center energy system designs to tackle current and future energy challenges.

Several leading cloud vendors have already embarked on self-research and deployment initiatives in response. However, the introduction of standardized products and solutions, such as Vertiv DynaFlex BESS and microgrid, plays a pivotal role in enabling the broader industry to enhance energy management practices, cut operating costs, and reduce carbon emissions effectively.

The Vertiv DynaFlex BESS solution notably lowers the technological barriers for data center operators transitioning to hybrid energy supply systems. For instance, the intelligent energy management system constitutes both the technical heart and a significant hurdle of BESS development. By providing access to a highly sophisticated BESS solution in the open market, it allows users to concentrate more on investments in IT equipment and core cloud services, thereby streamlining the path toward sustainable and efficient data center operations.

Market context

The evolution of data center power system architectures has been an ongoing process of refinement at a pace that has notably accelerated in recent times. This transformation is propelled by several key factors:

- **Carbon neutrality commitments:** In response to global efforts toward carbon neutrality, major players in the data center industry have set forth their own ambitious carbon reduction targets and technology strategies. Key focal points include phasing out diesel generators while maintaining backup resilience, upscaling the utilization of renewable grid power sources, and minimizing the power usage effectiveness (PUE) of data center facilities.

- **Escalating power demands:** The swift escalation of average rack power consumption, with projections for 2023 already exceeding 10kW per rack, presents a formidable challenge to existing power supply infrastructure and to cost control measures. To address this, there is a strategic shift toward harnessing green energy, enhancing the conversion efficiency of power systems, and augmenting the capacity of power delivery facilities.
- **Maturing energy storage technologies:** Technological advancements and cost-effectiveness in energy storage systems are reaching new levels of maturity. These technologies, which have proved effective in grid applications for peak shaving, load leveling, and storing excess electricity, are poised for broader adoption. Furthermore, the maturation of the lithium-ion battery supply chain, technology pathways, and cost management—largely driven by the electric-vehicle market—has set the stage for a more robust entrance into the energy storage market within data centers.

The abovementioned factors have led to the integration of microgrids and centralized battery energy storage systems (BESS) into data center operations. By combining energy storage with renewable energy microgrids, data centers stand to gain significant advantages in enhancing power supply stability, curbing energy consumption, and unlocking additional revenue streams.

From an environmental perspective, data centers conventionally resort to diesel generators as a contingency power source during extended power outages, leading to Scope 1 carbon emissions that are environmentally damaging. The integration of new energy grids and the necessity for seamless transitions between various energy sources have made online BESS an appealing solution, mainly because of their ample storage capabilities and operational versatility. Serving as an energy reservoir, the online BESS ensures a stable and secure power supply to data centers by mitigating fluctuations and bridging gaps in energy provision.

Regarding energy efficiency, when data centers are interconnected with both renewable and traditional grids, energy storage serves as a buffer against mismatches between power generation and demand. This improves the stability and utilization of renewable energy sources, enabling peak shaving and valley filling, thus cutting down on electricity costs, minimizing energy waste, and reducing overall carbon emissions. Even without direct access to renewable energy, energy storage can leverage time-of-use cost differences within the traditional grid to drive down the final cost of electricity.

Beyond meeting internal power needs, larger-scale energy storage facilities at data centers can be harnessed to generate extra income through participation in grid services markets. For instance, during periods of surplus production or low demand, data centers can sell excess stored energy back to the grid to aid in grid regulation. Such a model has a well-established precedent in smaller-scale distributed renewable energy plants such as home rooftop solar installations. In the context of data center microgrids augmented with BESS, where energy density is higher, this approach has even greater potential to reduce the overall electricity costs incurred by data centers.

Microgrid and BESS product overview

The Vertiv DynaFlex BESS is a meticulously engineered microgrid energy storage solution, tailor-made for mission-critical applications with an emphasis on data center environments. Key attributes of the Vertiv DynaFlex BESS include the following:

- **Ultra-fast power switching:** Boasting a near-instantaneous switching time of just 2 milliseconds, the power conversion system operates with imperceptible seamlessness. This feature ensures swift and real-time transitions between various energy sources, which is paramount to maintaining a stable power supply from multiple power feeds in mission-critical settings.
- **Advanced lithium-ion battery technology:** Leveraging proven Li-ion battery performance, reliability, and cost-effectiveness that has been established in the electric-vehicle industry, the Vertiv DynaFlex BESS integrates these batteries. Addressing safety concerns within the data center sector, this solution incorporates a sophisticated battery thermal management system designed to significantly mitigate the risk of thermal runaway incidents.
- **Continuous online energy management:** Unlike diesel generators traditionally used as long-duration backup power sources, which are activated only during emergencies and typically constrained in their everyday usage, the Vertiv DynaFlex BESS remains fully engaged and interconnected with both the grid and the facility's loads. It actively contributes to daily power stability by providing continuous regulation services. This round-the-clock functionality enhances operational resilience and directly supports sustainability goals, not just ensuring backup resilience but also optimizing overall energy efficiency and grid interactions.

Moreover, to cater to diverse deployment scenarios with varying scales, Vertiv DynaFlex BESS offers the following product options featuring distinct specifications:

- **Vertiv DynaFlex 1000:** This variant is designed for grid-scale deployments and constitutes a large-scale battery energy storage solution.
- **Vertiv DynaFlex 500:** Tailored for medium-sized applications, it serves as a midrange battery storage system that meets intermediate capacity requirements.
- **Vertiv DynaFlex 250:** Aimed at small-scale installations, this model provides a fringescale battery storage solution that is compact but efficient.

Despite their size differences, all Vertiv DynaFlex BESS systems share a common architectural framework comprising the following core components:

- **Storage module (SM):** Each module integrates not only batteries but also an essential battery management system (BMS) and auxiliary equipment. Utilizing LFP batteries as the storage medium, these modules are capable of providing backup power for one to six hours.
- **Balance of system (BOS):** Focused on system safety management, BOS encompasses monitoring devices, thermal control equipment, fire protection systems, and more. Its primary function is to ensure the safe operation of key components such as batteries and inverters.
- **Power conversion system (PCS):** Handling the critical tasks of energy conversion and switching, PCS includes inverters, switches, circuit breakers, and an energy management system (EMS). It delivers exceptional responsiveness with a switchover time of just 2 milliseconds and supports a broad power range of 1–100MW.

In addition to these core hardware elements, Vertiv DynaFlex BESS also encompasses comprehensive engineering, procurement, and construction (EPC) services, which cover every aspect of project execution from construction and management to configuration and related support services.

Company information

Background

Vertiv Holdings Co (NYSE: VRT) is a US-based mission-critical infrastructure provider with global presence, founded in 2020 through a business combination with GS Acquisition Holdings.

Vertiv's history began in 1946 when Ralph Liebert founded Capitol Refrigeration industries. In 1965, Liebert Corporation formed as the first manufacturer of computer room air conditioning, and in 1983 it acquired Programmed Power Corporation, expanding the UPS business. In 1987, Emerson acquired Liebert Corporation, and in 2000 Emerson Network Power was formed, followed by various acquisitions including Avocent in 2009. In 2016, Vertiv was launched as a standalone business as part of the acquisition by affiliates of Platinum Equity Advisors of the Emerson Network Power group of businesses.

Current position

Vertiv is one of the leaders in data center infrastructure. Its products and services include critical power, thermal management, rack enclosures, monitoring, and management. The following brands are part of the portfolio: Albér™ (battery monitoring), Avocent® (IT management), Chloride® (industrial power), Cybex™ (IT management), Energy Labs™ (commercial and industrial thermal), Geist™ (Rack PDU), Liebert® (AC power and thermal), and NetSure™ (DC power).

Future plans

The goal is to bring in best practices from across the industry, including hyperscale cloud service providers, and make them accessible to a wider market. The future software enhancements are expected to improve user experience and ease of deployment. The vendor also plans to leverage data collection, analytics, and AI to optimize and automate various management functions. Vertiv is committing important resources and engineering talent to R&D.

Key facts

Table 1: Datasheet: Vertiv

Product/service name	Vertiv™ DynaFlex BESS	**Product classification**	Battery energy storage system
Version number	n/a	**Release date**	November 2023
Industries covered	Mission-critical environments where power plays a critical role	**Geographies covered**	Currently North America and Europe, Middle East & Africa
Relevant company sizes	All	**Licensing options**	n/a
URL	www.vertiv.com/	**Routes to market**	Mixed
Company headquarters	Columbus, Ohio, US	**Number of employees**	20,000+

Source: Omdia

Analyst comment

The traditional architecture of data center physical infrastructure is grappling with a pivotal challenge stemming from the escalating power density of IT facilities and the integration of new energy sources into the power supply network. In response, various vendors are actively innovating and optimizing data center power systems, focusing on enhancing power conversion efficiency and minimizing conversion stages. However, despite these advancements, the fundamental issue persists—a mismatch between periods of high load (and correspondingly high power expenses) and low load (with lower power costs), exacerbated by the gradual retirement of diesel generators as dependable long-duration backup power.

Over the coming 5–10 years, the widespread deployment of centralized battery storage systems in data centers is expected to burgeon because of expected cost reductions in energy storage technology, improved reliability, and the increasing penetration of renewable energy grids within data center architectures. These purpose-built, centralized battery solutions will not only serve to mitigate peak demand and balance energy consumption throughout the day but will also increasingly assume the role of extended backup power during critical times.

Data center electrical solution providers such as Vertiv are poised to capitalize on this burgeoning market trend by leveraging their extensive expertise in both digital infrastructure and electrical engineering to design easy-to-deploy, integrated energy storage facilities for data centers. It is reasonable to project that such storage systems will undergo continuous refinement and optimization, leading to a proliferation of innovative solutions designed to deliver reliable, cost-effective electrical resilience essential to the rapid expansion of IT facilities.

Appendix

On the Radar

On the Radar is a series of research notes about vendors bringing innovative ideas, products, or business models to their markets. On the Radar vendors bear watching for their potential impact on markets as their approach, recent developments, or strategy could prove disruptive and of interest to tech buyers and users.

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