STANDBY POWER

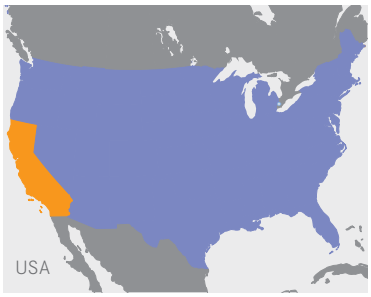
ENERGY-EFFICIENT DATA CENTER ACHIEVES 2N RELIABILITY

MTU ONSITE ENERGY GENERATOR SETS PROVIDE CRITICAL BACKUP

// **Who:** Vantage Data Centers

// **What:** Six 3,000 kW MTU Onsite Energy standby generator sets provide 18 MW of mission-critical emergency power

// **Where:** Santa Clara, California, USA



Large data centers can be big power users due to racks and racks of computer servers and the critical air conditioning and ventilation equipment required for cooling. However, when a data center can improve its overall energy efficiency, it not only reduces operating costs but also the requirements for its emergency standby power system, which can in turn make it affordable to size the system for full 2N redundancy (twice the number of generators for a given load). That's what Vantage Data Centers did at their new data center campus in Santa Clara, California, using novel energy-saving techniques and emergency standby generator sets from Tognum brand MTU Onsite Energy. For Vantage's 73,000-square-foot expansion facility called V2, the company specified six MTU Onsite Energy generator sets that provide a total of 18 MW of standby power for the facility's 9 MW load.

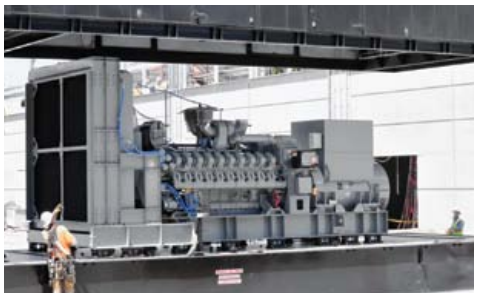
Energy efficiency is central to Vantage Data Centers' business model. According to Greg Ness, chief marketing officer, Vantage Data Centers, the company "develops highly efficient and customizable data centers that significantly reduce IT infrastructure, cooling costs and carbon emissions so customers can substantially reduce their total cost of operations." While the company's customers include leading players in social networking, social commerce, online social gaming, cloud storage and video game development, the V2 facility has been leased to a single tenant.

Unique cooling system saves energy

The heart of Vantage's energy-saving design is the facility's cooling system. Ness says that the V2 facility incorporates an energy-efficient "penthouse" cooling design that uses filtered outside air flowing down on the racks of servers. By also lowering the static pressure inside the building, the velocity of the cooling air is reduced, cutting year-round power consumption by a significant amount.

One of the measures of data center efficiency is Power Usage Effectiveness (PUE). PUE is defined as the total facility power consumption divided by the total IT equipment power consumption. A PUE of 1.0 would mean that all of the facility's power would be consumed by the IT equipment with no power used for cooling, chillers, pumps or fans – an ideal but unobtainable goal. Vantage's V2 facility has a PUE of 1.12, putting it in the forefront of data centers. According to the

A photo of an empty server floor at one of Vantage's Santa Clara data center buildings, taken soon after construction and before tenant move-in.



One of six MTU Onsite Energy 3,000 kW generator sets that supply emergency standby power to building V2, this unit is being installed in a weather-tight enclosure located outside the data facility.

Uptime Institute (a third-party organization focused on improving data center performance and efficiency), typical data centers have average PUEs above 1.9, and some even have a rating as high as PUE 3.0 – meaning that two-thirds of a facility's power consumption would be used for cooling and only one-third for the IT equipment. In addition, finding operational efficiencies has significant implications for sizing of the emergency standby power system: The lower the overall energy needs are, the more redundancy you can afford to build into your emergency standby power system. The result is much higher redundancy and reliability for no more investment – a critical factor for data centers that need to maintain near-100 percent uptime.

Vantage selected emergency standby generator sets from MTU Onsite Energy for the V2 data center based on performance, according to Steve Homan of Valley Power Systems, the local MTU Onsite Energy distributor that supplied the generator sets. "MTU Onsite Energy generator sets were selected based on superior load acceptance and transient performance – the ability of these generator sets to be hit with full load and then quickly recover voltage and frequency," says Homan. "One of the reasons for this performance advantage was that we found that the open protocol design of our generator control systems worked well with the paralleling switchgear that Vantage had selected."

Standby generators feature high-displacement engines

The six 3,000 kW generator sets are located outdoors in individual weather-tight enclosures with sound attenuation. Each generator set features an MTU 20V 4000 generator-drive engine with approximately 20 percent more cylinder displacement than other engines of similar horsepower. "The greater displacement supplies more reserve torque and is one of the reasons the MTU Onsite Energy generators can absorb full load in one step and recover quickly," says Homan. "The greater displacement also reduces fuel consumption and reduces stress on the engine's internal parts, improving reliability and longevity." Each generator set is also equipped with dual starter motors and dual best batteries for additional starting reliability.

"We initially deployed these six standby generator sets for V2, but we plan on having a total of ten generator sets when the building is complete," says Jennifer Fraser, director of design construction for Vantage Data Centers. "The facility is designed for growth, and the self-contained generator sets are located outdoors so we can incrementally increase the number of generators more easily." To comply with local environmental ordinances, the generator enclosures are sound attenuated to a maximum 73 dBA. In addition, each generator-drive engine is outfitted with a diesel particulate filter (DPF) to capture any soot in the exhaust in order to comply with California's strict air quality rules.

Redundancy ensures reliability

Like most mission-critical data centers, the V2 facility has redundancies in its power supply to prevent loss of data or service during utility outages. According to Fraser, the facility has utility feeds from two different substations in addition to static UPS (Uninterruptible Power Supply) systems and emergency standby generators. In the event that one utility feed fails, the second feed would automatically take over and supply the facility. If both utility feeds fail, the UPS system would supply power to the servers while all six generators start, reach rated voltage and frequency, parallel with each other and take over the load. All six generators would remain online for the duration of the utility outage. With the 2N design, in the unlikely event that one or more of the generators did not start, there would still be enough standby power to supply the load. The generators are supplied with enough fuel for approximately 24 hours of operation before resupply is necessary.

Southern California is also earthquake country, and all of the enclosures and the MTU Onsite Energy generator sets have been seismically certified by an independent testing laboratory to withstand an earthquake. "All of Vantage Data Centers' projects are designed to the International Building Code seismic standard and carry a critical facility importance factor of I=1.5," says Fraser. Facilities that carry an I=1.5 rating have life-safety or mission critical issues that require emergency standby generator sets that can survive an earthquake and still operate normally.

Reliable communications between the generator sets and the paralleling equipment was a key factor in selecting MTU Onsite Energy.

Commissioning verifies design

The V2 emergency standby power system went through a rigorous commissioning process to make sure all the components performed as designed. During this process, the generator sets are connected to a load bank to simulate the building load and a utility power interruption. It is especially important during this test to verify that the various controls and microprocessors on the generator sets, the transfer switches and the paralleling switch gear communicate reliably. According to Homan, "The commissioning went so well that Vantage and their onsite engineer said it was one of the best commissioning tests they had ever witnessed."

The design approach used by Vantage Data Centers is a model for energy efficiency, as well as power reliability and resulting business continuity. Through innovative design of building and mechanical systems, plus careful integration of emergency standby power systems, Vantage will be able to supply the growing data center needs in their region at the highest level of reliability.

Photos courtesy of Vantage Data Centers

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MTU Onsite Energy is a brand of Rolls-Royce Power Systems AG. It provides diesel and gas-based power system solutions: from mission-critical to standby power to continuous power, heating and cooling. MTU Onsite Energy power systems are based on diesel engines with up to 3,400 kilowatts (kW) power output, gas engines up to 2,150 kW and gas turbines up to 50,000 kW.