Power Generation

ENERGY-EFFICIENT DATA CENTER ACHIEVES 2N RELIABILITY

Who	Vantage Data Centers
What	Six 3,000 kW MTU 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 Rolls-Royce. For Vantage's 73,000-square-foot expansion facility called V2, the company specified six Series 4000 generator sets from Rolls-Royce to 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,

A Rolls-Royce solution

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 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 MTU emergency standby generator sets from Rolls-Royce for the V2 data center based on superior load acceptance and transient performance. The open protocol design of the control systems integrated well with the paralleling switchgear that Vantage 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

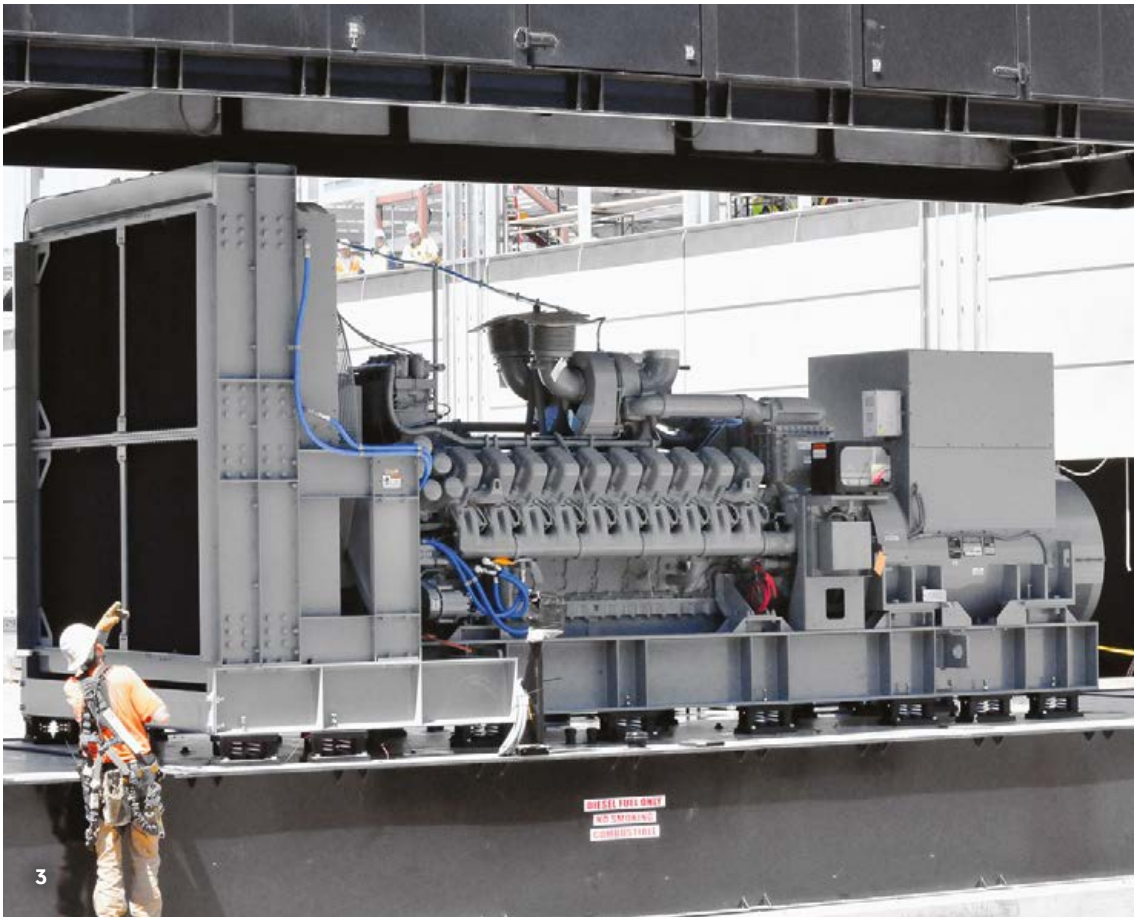
1 A photo of an empty server floor at one of Vantage's Santa Clara data center buildings, taken soon after construction and before tenant move-in.

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

3 One of six MTU 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.


1


2


3

approximately 20 percent more cylinder displacement than other engines of similar horsepower. The design provides more reserve torque, which helps the generator set absorb full load in one step and recover quickly. In addition, the higher level of displacement boosts fuel efficiency and reduces stress on engine components. 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 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.

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.

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.

Rolls-Royce provides world-class power solutions and complete lifecycle support under our product and solution brand MTU. Through digitalization and electrification, we strive to develop drive and power generation solutions that are even cleaner and smarter and thus provide answers to the challenges posed by the rapidly growing societal demands for energy and mobility. We deliver and service comprehensive, powerful and reliable systems, based on both gas and diesel engines, as well as electrified hybrid systems. These clean and technologically advanced solutions serve our customers in the marine and infrastructure sectors worldwide.

A Rolls-Royce solution

08 232 (77 3E)