



## Power Generation

# THE DATA INDUSTRY'S TOP SECRET WEAPON

**Who** Co-location and enterprise data centers  
**What** Standby power systems with multi-unit *mtu* generator sets providing critical power in the event of a utility outage  
**Where** Throughout North America

Search engine, e-commerce, banking, software and social networking companies have been promising continuous uptime for more than a decade because they have to—it's what their customers expect. And backed by standby generator sets from Rolls-Royce, they've made good on that promise. Today, as 24/7/365 access to data becomes a requirement for almost every business aiming to compete in the global economy, the world's leading co-location and enterprise data centers are continuing to rely on their top secret weapon: *mtu* power generation solutions from Rolls-Royce.

To cope with costly power failures or even brief nuisance outages, data centers equip themselves with layers of backup power systems that include emergency standby generator sets. And to keep the power—and data—flowing through their mission-critical facilities, the world's leading co-location and enterprise data centers rely on *mtu*.

### The world's leading data centers rely on Rolls-Royce

The biggest names in data reliability have chosen **mtu** emergency standby generator sets from Rolls-Royce several important reasons. These include:

- Generator sets that offer high reliability, rapid response to changes in load, superior fuel economy and low emissions
- Critical-power generator set packages that are configured, tested and certified at the factory
- A sales team that listens, pays attention to detail and delivers solutions that meet or exceed specifications—on time and on budget

A customer service network that includes more than 300 distributor and service center locations throughout North America

Every company assesses its risks differently, and this can affect the design of the standby power system, the amount of redundancy and the operational parameters. Following are examples of how four major data centers are using **mtu** emergency standby generator sets.

#### Internet services firm

Well known for its search engine, Web portal and email service, this company has online offerings available in dozens of languages, which attract hundreds of millions of users each month. The company has installed hundreds of **mtu** generators that form the core of its backup power system at several facilities. Each generator set provides up to 3,250 kW of emergency power for a grand total nearing one gigawatt. Like those of many other firms, the company's power scheme includes layers of redundancy. Multiple utility feeds provide the first line of defense; if there is an outage from one substation feed, the second one will automatically take over. Next, UPS systems instantaneously take over if the utility feeds fail, and will provide power until the standby generator sets start.

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Many companies use generators running in parallel. However, this company has opted on a few project sites to use individual generator sets to back up different segments of the load. In these unique installations, every generator set in the system is kept in sync with a "reference source," which is either another generator set or another utility feed. By maintaining a minimum phase angle (five to 30 degrees) difference between the operating source and the reference

source, power switchovers are instantaneous and produce no disrupting transients. In this case the goal was to reduce complexity and single points of failure in the standby power system without reducing reliability.

#### Software developer

With yearly revenues in the tens of billions of dollars, this major software development firm also offers popular online services and entertainment products. Rolls-Royce has supplied **mtu** gensets to four of this firm's data centers. After development and construction of two major data centers where the supplied equipment had challenges handling the load characteristics, the software company turned to **mtu** for a solution at a new facility. The innovative data center is pioneering the use of multiple computer server modules housed in ISO containers. Designed for fast installation, the containers are ready for immediate use upon connection to power, air conditioning and networking equipment.

This new facility uses 11 MTU 2,800 kW generator sets powered by **mtu** 20V4000 engines. For enhanced reliability, also included are dual battery banks and chargers, as well as dual fuel/water separators with special valves that allow users to change fuel filters without having to shut down the generator.

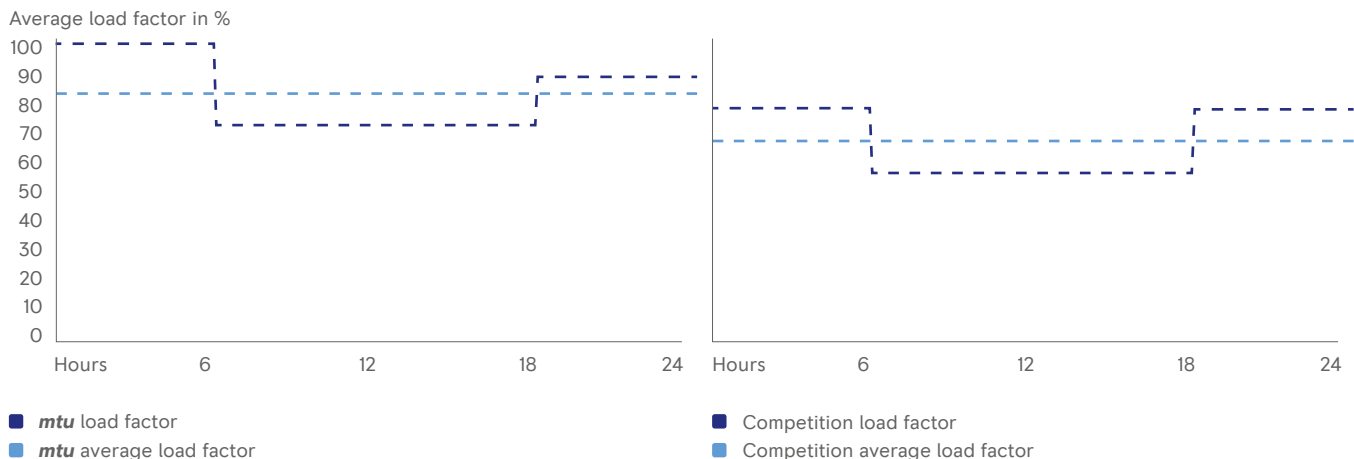
The standby power solution includes alternators that are substantially oversized and feature a subtransient reactance of only 8.3 percent in order to accommodate the high level of nonlinear load. In addition, the **mtu** generator drive engines feature 25 percent greater cylinder displacement, giving the engines much more reserve capacity than other generator drive engines of similar horsepower.

#### Online retailer

Design philosophies vary among e-commerce companies about what is needed to provide an acceptable level of reliability. This Fortune 500 company, one of the world's leading online retailers, chose **mtu** standby power for several of its data centers. This company was willing to explore value engineering options in order to reduce the cost of the project, and Rolls-Royce helped design a more value-oriented standby power system without sacrificing the overall mission of the facility.

The company has many data center locations, and its strategy is to share redundancy between data centers in addition to having power redundancy within data centers. This means that if utility power is lost at one data center and the emergency standby system also fails, the data load is seamlessly shifted to another online data center. In addition to having enhanced power reliability, these so-called "decentralized data centers" offer faster data communication speed and improve the customer experience.

## Average load-factor explained



### Data center operator

A leading U.S.-based owner and operator of co-location data centers used by technology companies needed an emergency standby power system with exceptional reliability. It turned to **mtu**. Specifications for this company's standby power system were influenced more by performance than by price, due to the high cost of downtime for the firm. Its reliability goal was 99.99999 percent, which equates to one four-second outage annually.

Rolls-Royce provided a new system that includes a lineup of **mtu** 2,250 kW generator sets integrated into a single system. In addition to helping the firm meet its reliability requirements, the generator sets were designed with oversized alternators to handle the high nonlinear loads caused by the UPS systems and variable-frequency drives.

Rolls-Royce customized its generator sets in other ways to meet the company's special requirements. For example, the firm asked for and received units with an extremely fast seven-second starting time. In addition, Rolls-Royce supplied generator sets that met the strict emissions standards of the state Department of Environmental Quality.

### Many advantages for mission-critical applications

Rolls-Royce offers highly reliable **mtu** products and provides a unique approach to maximize customer satisfaction. To the benefit of risk-averse data center designers, Rolls-Royce takes a very conservative approach to designing and rating its generator sets. For example, **mtu** generator-drive engines are designed with more cylinder displacement per rated horsepower than alternative products.

As a result, **mtu** generator sets are certified at an 85 percent average load factor over 24 hours, significantly higher than the 70 percent average load factor required by ISO 8528. Other generator set manufacturers may only meet the ISO load-factor minimum, which means that the average load factor that can be sustained by most generator sets over an extended power outage is only 70 percent of the nameplate rating. Since **mtu** gensets can handle 15 percent higher average loads than competing products, users may be able to specify fewer generator sets for data center applications, depending on the size of the installation.

For instance, a 2,000 kW generator set operated at 70 percent load factor can only supply an average 1,400 kW over 24 hours, while an **mtu** 2,000 kW generator set rated at 85 percent load factor can supply 1,700 kW. In larger installations, this means that nine **mtu** generator sets operating at 85 percent load factor would be equivalent to 10 standard generator sets operating at 70 percent load factor. The **mtu** displacement advantage also results in lower engine stress, reducing maintenance intervals and extending engine life. With more reserve capacity than competing products, **mtu** engines offer exceptional transient performance as well, stabilizing more quickly after loads are applied or removed.

Another feature that gives **mtu** gensets a competitive edge is their advanced common rail fuel injection, which helps engines with 3,000 hp or higher output meet the U.S. Environmental Protection Agency's Tier 2 emissions requirements.

An important customer service difference that sets **mtu** systems apart from their competitors concerns the role of distributors. For mission-critical installations like data centers, competitors rely on their distributors to make modifications to the generator sets in the field. The results vary, depending on the capabilities of the distributor. By contrast, Rolls-Royce's **mtu** data center packages are supplied directly by the factory. These packages also include factory warranties and support, so customers have to deal with only a single source.



Rolls-Royce also takes a different approach to the factory acceptance test (FAT), by demonstrating to the customer that system design and manufacturing meet project requirements. Most specifications call for such a test, but only Rolls-Royce offers it in a factory setting. Customers witness the FAT at the company's state-of-the-art manufacturing plant and test facility in Mankato, Minnesota; this gives customers an up-close look at the manufacturer that they wouldn't get if the testing were done at a distributor's site.

### Conclusion

Over the last decade, the world's leading search engine, e-commerce, banking, software and social networking companies have relied on standby **mtu** power systems from Rolls-Royce to keep their mission-critical data centers online when the utility power fails. And as access to uninterrupted data becomes a requirement for almost every business aiming to compete in the global economy, many of the world's leading co-location and enterprise data centers are also turning to Rolls-Royce.

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Critical data centers consume prodigious amounts of electric power to run servers and the air conditioning needed to get rid of heat the servers produce. This means backup power systems must be designed to handle considerable loads.

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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.