# Lessons in emergency power preparedness:

## Planning in the wake of Katrina

**> White Paper**

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Providing your business with electrical power in the event of a utility outage is the role of every standby power system – whether it's a backup generator to keep the lights and computers running in a small office or a multi-generator power system for a manufacturing plant. For short outages, it's important to keep your standby generator properly maintained, exercised and supplied with clean fuel.

When rare catastrophic outages happen, some additional issues come into play, such as:

- Having your generator in a safe location protected from possible storm damage or flooding.
- Having sufficient fuel supplies for extended running or a plan for refueling.

From regional blackouts in the Northeast to earthquakes in the West to hurricanes in the Gulf and on the East Coast, there are numerous examples of how both manmade and natural disasters test the mettle of standby power systems. Of course, the most recent example of one of these catastrophic events was Hurricane Katrina. Power systems that survived and power systems that failed both provide lessons for dealing with future emergency power preparedness.

### Katrina slams New Orleans

On August 29, 2005, Hurricane Katrina descended on New Orleans, pummeling the city with wind, rain and a significant storm surge. As was typical with powerful storms, scattered power outages triggered hundreds of standby power systems installed at hospitals, commercial businesses and government buildings across the region. Under ordinary power outage conditions, these generators would operate on their on-site diesel fuel supply, which typically provides about 24-48 hours of running time. And, under normal circumstances, if they were needed to run longer, facility managers could simply put in a call for refueling. But Katrina was no ordinary storm, and New Orleans was no ordinary city.

According to a recent summary by the Federal Emergency Management Agency (FEMA), "Hurricane Katrina was the single most catastrophic natural disaster in U.S. history. The storm devastated a 90,000-square-mile area, which is roughly the size of Great Britain. The storm also resulted in the largest displacement of Americans in our nation's history, forcing more than 270,000 into shelters after landfall." Although the levees protecting the city of New Orleans were presumably designed to withstand a hurricane such as Katrina, they in fact did not. Their failure and resultant flooding of 80 percent of the city to depths as much as 20 feet proved more damaging to the city's infrastructure than the actual force of the storm.

The result was that many standby generating systems located in basements and ground-floor levels failed immediately due to flooding. Generators that were not flooded soon ran out of fuel due to the inability of refueling trucks to deliver diesel fuel. Many other power systems failed to start altogether due to lax maintenance. The only power systems that functioned properly were those that had been properly maintained and located above the floodwaters, or which also had sufficient fuel supplies or were in a part of the city accessible to refueling trucks.

**Three Cummins Power Generation generators at a Jefferson Parish canal pumping station were located above the maximum high-water level and continued to operate as long as they had fuel.**

## Ahead of the storm

The power generation group for Cummins Mid South is housed in Kenner, Louisiana, about 10 miles from downtown New Orleans. The office was not affected to any great extent by the storm, with the exception of some wind damage, but there was no flooding. This office is responsible for Cummins Power Generation power system sales in Louisiana. Although a great many calls came into the office to secure rental power generators ahead of the storm, most of the company's rental equipment was already in the field in Florida, Alabama and other Gulf states in the wake of previous hurricanes.

The office also got a lot of calls from customers who were trying to get ready for the storm. They wanted to get their generators checked out and make sure that everything would come online when utility power was interrupted. For customers who had recently purchased new standby power equipment, there was a rush to get those systems installed and commissioned ahead of the storm. As a major Cummins Power Generation distributor, the office had an emergency plan that was designed to kick in at such times. One of the provisions was to line up technicians from around the region to handle emergency service calls from customers. Under the plan, technicians would be pulled from other states to help out, and additional rental generators, fuel and other resources would be lined up as needed and as available. Locally, the Cummins Mid South office in Kenner had to be boarded up as the storm hit, and operations were eventually moved to the Morgan City office. It was not until a week after the storm that the facility and equipment in Kenner were available again.

## Lessons learned from Katrina

While it is nearly impossible to predict and plan for a complete collapse of a region's infrastructure, there are a number of steps that facility operators can take, in light of lessons learned, to minimize standby power system failures during future disasters. Vulnerable areas of the country include the Gulf Coast, Florida and Eastern Seaboard due to hurricanes; the Midwest due to major winter storms and tornadoes; the West Coast due to potential earthquakes; and any region that is prone to flooding. At this time, no changes in the National Electrical Code have been proposed to deal with the problems encountered during Katrina and its aftermath.

**Generator location –** Where a generator set is located often makes a significant difference in whether it functions as designed when disaster strikes. At times of flooding, generators located in basements and at ground level may fail almost immediately due to the rising water. One Cummins Power Generation customer in New Orleans did have the generator elevated on a five-foot stand, but it still got flooded out when the water level was more than eight feet high. In coastal areas, tidal surges during storms are another concern. If a generator is located 19 feet above the ground and the tidal surge is 20 feet, it is still going to get flooded out.

As more facility operators have become aware of this vulnerability to flooding, there has been a move to place generator sets on platforms, on upper building floors or on rooftops. Rooftop locations can be vulnerable to the wind, but the Cummins distributorship in Louisiana

**This platform installation takes advantage of a unique space created by a retaining wall in an urban area.**




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was not aware of any outdoor generator installation that suffered wind damage to the enclosure. Modern ISO-style generator set enclosures normally provide protection to 100 mph winds, and generator enclosures are available with wind ratings up to 150 mph.

**These generators are located on a high superstructure in an area where flooding is likely during severe weather.**

For new installations, Cummins Power Generation recommends putting the standby generator system in an indoor location for maximum protection. If the facility is in a flood-prone area, make sure the generator set and its control systems are elevated above the highest expected flood level. Each facility manager will have to assess the risk of a standby power system failure and make the appropriate investment in system design.

**Rooftop installations, when possible, represent one solution to elevating a standby generator above flood waters in low-lying areas.**

**Fuel choice –** The traditional fuel of choice for standby power systems is diesel. Diesel is relatively safe to store and economical, and diesel-fueled engines have an unsurpassed record of dependability and durability. However, when a power system is called upon to run for extended periods, fuel re-supply is an issue. And if severe infrastructure damage prevents getting additional fuel, then the standby power system will eventually fail when the fuel runs out.

According to anecdotal data gathered by FEMA, natural gas supplies continued to be available during and after Katrina. Of the standby power systems that were fueled with natural gas, most seemed to function without interruption. Other evidence suggests that natural gas was shut off to some regions. Nonetheless, this has prompted facility operators to consider natural gas as a standby power system fuel for future applications. It should be noted that in regions of the U.S. prone to earthquake damage, natural gas lines are often broken or otherwise disrupted during earthquakes, making natural gas in those regions unreliable and/or dangerous during natural disasters. There are also performance and maintenance differences between natural gas engine generators and diesel generators to consider.

**Fuel re-supply –** Facility managers should have standing agreements with fuel suppliers that can re-supply fuel during an extended outage. Facilities that tried to purchase diesel fuel on the spot market after Katrina found it either prohibitively expensive or simply not available. Cummins Power Generation had to dispatch a fuel truck from Jackson, Mississippi, just to supply the service trucks for Cummins Mid South. In the flooded areas of New Orleans where generators were still running, re-supply was not possible due to high water.

Under those circumstances, there was no good solution once the fuel had run out. Storing large quantities of diesel fuel on-site is an option, but the fuel would have to be properly treated to extend the life of the fuel, because diesel tends to deteriorate over time. If there is sufficient warning that a disaster is approaching, temporary diesel tanks can be brought in to provide extended running time.

**Maintenance –** While the storm and floodwaters were the major causes of standby power system failures, poor power system maintenance was also a cause. Dead starting batteries, old diesel fuel and improperly maintained electrical equipment all contributed to power system failures that had little to do with the storm.




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**About the author**

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Diesel standby generators are extremely reliable devices, and although they require minimal maintenance compared to other kinds of building systems, neglect can lead to loss of electrical power when one can least afford it. Many facilities contract with local service companies and generator distributors to do routine maintenance such as oil changes, battery checks and testing. Facilities should also exercise the generator set for about 30 minutes under load each week to make sure the system is functioning as designed. Not only does this exercise make sure all systems are working, it also tends to use up diesel fuel so it doesn't get too old. By replenishing the diesel fuel supply on a regular basis and properly treating it, facility operators can be assured of a fuel supply that is free from contaminants and deterioration.

## Conclusions

Natural disasters are not always predictable in terms of where they strike or their intensity. In Gulf Coast regions subject to hurricanes, storm surges and flooding, generator sets should be located indoors on upper floors or on rooftops. If generator sets must be located outdoors, they should be mounted on an elevated platform above the highest expected water level. Fuel re-supply agreements should be negotiated in expectation of extended outages. In areas prone to severe flooding during storms, facility managers should consider contracting for temporary fuel storage tanks in anticipation of extended outages. In some areas, natural gas engine generators may be a viable option for standby power. Generator set maintenance is of critical importance for any type of outage. If facility operators are not able to perform the required maintenance on a regular basis, the maintenance should then be contracted out to a distributor that represents the manufacturer.

Standby power systems provide a good way to keep facilities safe, comfortable and functioning during a disaster or in its aftermath – provided that planning has been appropriate for the potential infrastructure damage. Katrina proved disasters that severely impact a region's infrastructure of buildings, highways and energy supplies present the most difficult of challenges. To cope better with future disasters, facility managers should focus on making their standby power system less vulnerable to wind, floods and disruptions in fuel supply.

For additional technical support, please contact your local Cummins Power Generation distributor. To locate your distributor, visit www.cumminspower.com.

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