Aging Infrastructure: A Report on Emergency Power Systems in Los Angeles County's Acute Care Hospitals


Prepared by

Powered for Patients

for the Los Angeles County EMS Agency

POWERED For Patients™
Advancing Backup Power & Power Restoration for Critical Healthcare Facilities

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Overview

In May 2019, the Los Angeles County (LAC) Emergency Medical Services (EMS) Agency retained the 501c3 non-profit Powered for Patients to lead a multi-phase emergency power resilience initiative focused on critical healthcare facilities that would span a four-year period.

The LAC initiative was launched to help ensure that LAC and its municipalities, along with its electric utilities and critical healthcare facilities, are employing best practices to minimize threats to emergency power and expedite government, utility and private sector response when threats to emergency power arise during power outages.

Following completion of the initial phase of work, a series of recommendations were made to bolster emergency power preparedness. Among the recommendations was the creation of a risk assessment of each hospital's emergency power system to identify facilities with a greater risk of mechanical failure and those where a loss of emergency power would present the greatest risk of an emergency evacuation.

To inform this risk assessment, a recommendation was made to conduct an in-depth census of emergency power systems in LAC's acute care hospitals. The census would not only inform the risk assessment but would also secure the data required by the U.S. Department of Health and Human Services (HHS) from the 80 acute care hospitals in Los Angeles County that receive funding from the HHS Hospital Preparedness Program.

The required HHS data for each hospital's emergency power systems is limited and includes available fuel onsite, the projected fuel burn rate when generators are operating at full load and the status of air conditioning connectivity to emergency power. Air conditioning is a key component of Heating Ventilation Air Conditioning (HVAC) systems. HVAC connectivity to emergency power became a vital data point when new federal requirements took effect in 2017 requiring hospitals to connect a portion of their air conditioning equipment to emergency power. The new rules reflected painful lessons from previous disasters when temperatures in hospitals and nursing homes during extended power outages grew dangerously hot, triggering patient fatalities in Louisiana and Florida. The new rule requires hospitals and nursing homes to prevent temperatures in patient care areas from exceeding 81 degrees during a power outage.

The LAC EMS Agency's emergency power census sought additional data to inform its facility risk assessments and to gain deeper insight into the characteristics, capabilities and potential vulnerabilities of the LAC hospital generator fleet, one of the county's most vital elements of critical infrastructure. The additional data collected included:

- Generator size, manufacturer and age
- The size and age of fuel tanks
- The presence of multiple utility feeds
- Details on any significant mechanical failures
- Additional detail about HVAC connectivity to emergency power

- The existence of quick connect devices to allow rapid connection of a temporary generator
- The names of each facility's generator service, fuel and rental providers

Collection of this data served a number of important purposes, including:

- Determining generator age and documenting any significant mechanical failures enabled the assessment for increased risk of mechanical failure.

- Identifying all single generator hospitals pinpointed the facilities with no redundant emergency power where patients face a greater risk of emergency evacuation should a generator failure occur during a power outage.

- The identification of generator size allows pre-disaster planning to identify which government generators collectively owned by LAC and the cities of Los Angeles and Long Beach are the best match for hospital generators that may need temporary replacement. This information will also prove helpful to FEMA and the U.S. Army Corps of Engineers should a Presidential disaster declaration trigger the deployment of FEMA generators to Los Angeles County hospitals.

- Obtaining more detailed information about the fuel system supporting a hospital's generators, including the size and age of fuel tanks and whether common tanks or dedicated tanks are used allows for identification of systems at risk due to aging tanks and more precise calculations of fuel burn rates. This critical information will assist in the risk assessment of facilities with limited onsite fuel capacity and in the deployment and potential rationing of limited diesel fuel during an extended power outage.

- Knowing if a facility has a secondary utility feed enables advanced coordination with the utility to ensure the fastest possible switch between feeder lines should a threat to emergency power necessitate a switch.

- Securing additional detail about HVAC connectivity to emergency power provides greater insight into a facility's ability to protect patients from dangerously high temperatures during extended power outages. For example, knowing that a facility's air handlers are connected to emergency power is helpful information but more important information is whether a facility's air conditioning chillers are connected to emergency power, and if so, to what extent.

- Knowing which facilities have quick connect devices in place allows government officials to identify the specific location where a temporary generator can be placed and the wiring details to connect a generator to a specific quick connect device. The existence of a quick connect device can dramatically accelerate the process of deploying a temporary generator to the facility. Additionally, a facility with a quick connect is less likely to need emergency evacuation, allowing government officials to focus limited

evacuation support resources on the facilities more likely to need this level of government assistance.

Among the recommendations from Phase I of the LAC EMS Agency emergency power resilience initiative was creation of the LAC Emergency Power Industry Working Group to provide a formal structure for enhanced pre and post-disaster coordination between county government and the generator service, fuel, and rental industry. This coordination can facilitate faster response by government officials in addressing obstacles impeding the ability of service, fuel, and rental providers to meet the needs of healthcare clients. It can also accelerate the process of determining whether to deploy a private sector generator or government generator to an impacted facility. Capturing the names of each facility's generator service, fuel, and rental providers through the census will facilitate the active coordination envisioned by the Working Group.

Beyond fulfilling the important needs identified above, the LAC hospital emergency power system census has enabled a first-of-its-kind, in-depth analysis of the county's hospital generator fleet, providing county officials with important insight into system strengths and vulnerabilities.

Key Findings

Among the most significant findings of the census is a seriously aging generator fleet among Los Angeles County's 80 hospitals that participate in the HHS Hospital Preparedness Program.

Among the 271 generators collectively owned by the HPP hospitals, 87 generators, or 32.10%, are 30 years old or older. In recent years, there has been significant investment in new generators at Los Angeles County hospitals, with 48 new generators deployed over the past 10 years. However, the rate of new generator deployment would have to dramatically accelerate in order to bring all generators in the fleet into the recommended age range. The expected useful life of a generator is approximately 30 years of age.[1]

The table below provides a detailed breakdown by age grouping among the 271 generators captured in the census.

Age Range	# of Generators	% of Total
0 to 9 years	47	17.34%
10 to 19 years	69	25.80%
20 to 29 years	68	25.00%
30 to 39 years	32	11.80%
40 to 49 years	40	14.76%
50 to 59 years	9	3.32%

[1] See the Generator Life Expectancy Table on page 14 of *Roadmap to Resiliency*, a white paper co-authored by Powered for Patients and the American Society for Healthcare Engineering. https://www.poweredforpatients.org/wp-content/uploads/2017/03/Roadmap-to-Resiliency-ASHE-Powered-for-Patients-White-Paper.pdf

60 to 69 years	**6**	**2.21%**

The findings of the LAC emergency power system census are believed to mirror the reality across the U.S. Resource limitations have led hospitals to continue operating generators in some cases many years beyond the recommended useful life. Currently, no federal, state or local laws or safety codes limit the age of hospital generators as long as a generator can pass required tests, which include monthly starts and running the generator for a four-hour period every three years. However, these test conditions do not reflect the real challenge an older generator would face if called upon to run continuously for days during an extended power outage.

Single Generator Hospitals with No Redundant Emergency Power Draw Closer Scrutiny

As the LAC EMS Agency monitored the findings of its ongoing emergency power system census, the agency identified hospitals that rely on a single generator, and thus have no redundant emergency power, as higher risk facilities that warranted closer attention.

An added risk factor for many of the single generator hospitals in LAC is generator age. Among the 14 single generator hospitals that participate in the Hospital Preparedness Program, nine facilities, or 64 percent, rely on generators over 30 years of age, more than double the percentage of generators over 30 years of age across the entire fleet. Among these nine facilities, three have generators between 50 and 59 years of age and one relies on a generator over 60 years of age. The table below provides a detailed breakdown by generator age among the 14 single generator facilities.

Age Range	# of Generators (among 14)	% of Total
0 to 9 years	2	14.2%
10 to 19 years	1	7.1%
20 to 29 years	2	14.2%
30 to 39 years	2	14.2%
40 to 49 years	3	21.4%
50 to 59 years	3	21.4%
60 to 69 years	1	7.1%
	Total Number of Hospitals 14	

To address the elevated risk associated with a generator failure in these single generator hospitals, the LAC EMS Agency has offered funding to these facilities to deploy an advanced generator monitoring technology that provides 24/7, automated, real-time notifications to designated individuals anytime emergency power is activated or faces a mechanical problem while operating. The system's real-time warning will enable accelerated response by service providers and faster deployment of a government generator should one be needed, both of which can help minimize the risk of an emergency evacuation. As of September 2021, two of the

fourteen eligible facilities had deployed the Power P.I.O.N.E.E.R. Tool. P.I.O.N.E.E.R. stands for Power Information Needed to Expedite Emergency Response.

(See *LA County EMS Agency Turns to Technology to Tackle Aging Hospital Generator Fleet* for additional details).

Additional Findings of Emergency Power System Census

In addition to alerting county officials about an aging hospital generator fleet, the recently completed census highlights the wide range in emergency power system size across the county's 80 HPP hospitals, not only in the number of generators but in the amount of backup power produced by these generators. This should not be surprising given the equally wide range of hospital sizes as measured by licensed beds, ICU beds, and operating rooms.

The largest emergency power system consists of 10 generators with a combined power of 8.59 megawatts, supporting a facility with over 500 beds, including more than 50 ICU beds, and 20 operating rooms. At the other end of a spectrum is a 100-bed hospital with 5 ICU beds and 3 operating rooms, supported by a single 100 kW generator.

The most common-size generator fleet among the hospitals is two generators, representing 24 facilities or 30.37% percent of hospitals. A two-generator facility diminishes the concern associated with single-generator facilities that have no redundant emergency power, however, two generator facilities also present risks. In most cases, two generator facilities cannot shift emergency power from one of its two generators if the other has failed. This scenario could leave critically important hospital functions without a source of backup power.

The second most common size is the single generator system, present in 14 facilities, representing 17.72% of the hospitals. The third most common size is a three-generator system, present in 12 facilities, representing 15.18% of the hospitals. The following table shows the most and least common generator fleet sizes as measured in number of generators.

Number of Generators Per Hospital Fleet	Number of Hospitals by Fleet Size	Percentage of Total
2	24	30.37%
1	14	17.72%
3	12	15.18%
5	9	11.39%
6	7	8.85%
4	5	6.32%
9	2	2.53%
7	3	3.79%
10	2	2.53%
8	1	1.26%

HVAC Connectivity to Emergency Power

Another notable finding in the survey was the number of hospitals that do not have air conditioning connected to emergency power. As referenced above, the CMS Emergency Preparedness Rule, which went into effect in 2017, requires some elements of a hospital's air conditioning system to be connected to emergency power to ensure that temperatures in patient care areas do not exceed 81 degrees during a power outage.

Among the hospitals that reported on HVAC connectivity to emergency power, 18, or 26.47 percent, have no air conditioning connected to emergency power. 50 hospitals, or 73.52 percent, have some portion of their air conditioning connected to emergency power.

For facilities with partial or no air conditioning connected to emergency power, spot coolers connected to electrical outlets supplied by emergency power can be used to maintain safe indoor temperatures during a power outage. However, this approach may prove difficult in preventing temperatures from rising above 81 degrees, especially in larger facilities.

Fuel Capacity

When it comes to fuel capacity for emergency power systems, there is a significant range in the number of days facilities could operate their generators before needing to refuel. The county's largest emergency power fuel system has a 200,000-gallon capacity, enough fuel to keep the facility operating on emergency power for more than seven consecutive days.

At the other end of the spectrum, one hospital only has enough fuel capacity on site to run its generators continuously for 22 hours. The vast differences in fuel capacity will require more frequent refueling of hospitals with smaller fuel capacity, a process that could become challenged in a severe fuel shortage.

Conclusion

The recently completed emergency power system census undertaken by the LAC EMS Agency has provided an unprecedented look at the state of hospital emergency power systems in the nation's most populous county. The census identified single-generator facilities whose lack of redundant emergency power puts patients at greater risk of evacuation should emergency power fail during an outage. This finding led county officials to provide funding for single generator hospitals to deploy advanced technology to enable 24/7 automated, real-time monitoring of any threats to emergency power during a power outage.

The census provided other valuable information that will enhance pre-disaster planning and post disaster coordination between government officials, hospitals and their generator service providers.

Among its most important contributions, the census shed light on the serious problem of an aging hospital generator fleet. Addressing this threat will require a significant investment to enable an acceleration in the pace new generator deployments. Eliminating all generators over 50 years of age among Los Angeles County's 80 HPP hospitals would require the deployment of 10 new

generators. Replacing the 42 generators between 40 and 49 years of age would require four-times the investment. With the data from this census now available, policy makers and hospital executives can better assess the level of investment needed to reduce the risk to patients during power outages.

About Powered for Patients

Powered for Patients is a 501c3 non-profit created after Hurricane Sandy to help safeguard emergency power and expedite power restoration for critical healthcare facilities impacted by disaster. It accomplishes this mission by fostering increased collaboration and information sharing among government, utilities and critical healthcare facilities and their generator service providers. Powered for Patients also works to address the challenges facing individuals who depend on life-support equipment in their homes during power outages. Since 2014, Powered for Patients has received multiple rounds of federal funding to advance its mission.

Powered for Patients has developed important relationships with key federal agencies and organizations representing local, county and state emergency managers, public health officials and energy assurance officers, including ASTHO, IAEM, NACCHO, NASEO and NEMA.

Powered for Patients is led by its founder, Eric Cote, who is supported by a Board of Directors and a team of National Advisors. More information about Powered for Patients is available at www.poweredforpatients.org.