Response to Energy Storage Systems

by Lieutenant Paul Rogers

Integrating more energy from renewable sources enhances efficiency. The push toward a clean energy future is motivating increased storage development throughout the United States. This new energy source, Energy Storage Systems (ESS), has many benefits. However, with every new technology comes new challenges, including the hazards and risks to first responders. Fire departments, including the FDNY, increasingly are being asked to collaborate with the green industry to develop standards and regulations around these new technologies.

This article focuses on ESS, which rapidly is being introduced into New York City in existing and new construction high-rise commercial/residential buildings and soon will reach other municipalities because of its rapid expansion. As urban populations increase, needs for electrical power become more urgent and, therefore, it is critical to continue to modernize a robust and resilient electricity delivery system. Energy storage systems will improve the operating capabilities of the grid, as well as mitigating infrastructure investments. Additionally, ESS can address issues with the timing, transmission and dispatch of electricity, while also regulating the quality and reliability of the power generated by traditional and variable sources of power.

This burgeoning ESS program in NYC is drawing attention from the private, as well as the public sector. Consolidated Edison (Con Ed) must reduce its power consumption. NYC is building at a rapid pace and this expansion is placing intense demands on electrical power, creating increasing risk that the power sources available today may be unable to produce enough energy during the peak hours of the business day in the future.

Con Ed has developed a program enabling building owners to apply for funding to purchase batteries with the qualification that commercial landlords manage the battery installations inside their buildings so the peak load is reduced during daylight peak consumption time. These batteries recharge at night when power is readily available and will use the stored energy during daytime peak hours when demand is high. These batteries have clear benefits. However, this emerging technology presents a precarious and potentially hazardous situation for fire departments that do not have standard operating procedures (SOPs) or guidelines (SOGs) to deal with them.

Energy storage systems (ESS) are the rapidly expanding technology being introduced to high-rise commercial and residential buildings.

Risks to first responders

Battery chemistry--Depending on the individual specifications of the landlord, the ESS may differ from one building to another. It is never recommended to have two or more different chemistries in the same location or even within the same building. There are more than 80 chemistries available from which consumers can choose. These chemistries may be a derivative of chemistry; for example, lithium-ion has different variations. Each chemistry has its own set of challenges, including corrosives, reactive metals, toxic gases, hydrogen and thermal runaway, which occurs when a battery cell heats up as a result of a defect and the adjacent cells ignite. The propagation continues until the whole battery kindles and is on fire. That battery will heat up the adjacent batteries until the module/rack/string and, finally, the whole system becomes engulfed in flames.

Electrical issues--If these batteries fail, the FDNY would be called in for fire suppression within the battery systems. Typically, the Fire Department shuts down electrical power prior to operating. The problem in this case is that even if the power is shut down, *stored* energy remains inside the system with the potential to injure or even electrocute a first responder.

For example, if water is one of the suppressing options, members must be aware that there is a danger of electrical current flowing back to the Firefighter's nozzle--a process known as "electrical leakage," thereby increasing the risk of injury to the first responder. Initial testing results demonstrate that keeping a safe distance (de-

pending on the voltage) and using a fog pattern (rather than a straight stream application) set at 30 degrees are recommended and preferable. All testing done by fire protection engineers and the military suggests that when Firefighters place an additive, such as foam, wetting agents or other suppressive agents into the attack line, the additive creates increased electrical conductivity in the water, increasing the risk of electrical injury.

Buildings

Due to the lack of codes or standards for these kinds of systems and their current use, there is no guideline for fire protection. The system's location within the building should be in an area to which the general public has no access and will not interfere with building evacuation routes. This location may be difficult in older structures, but easier in new construction. For battery systems that give off hydrogen gas, hydrogen sensors should be placed in the battery room or the immediate location of the batteries. Consider ventilation for chemistry that produces flammable and potential toxic gases as a byproduct of normal battery operations. No combustible materials should be stored in the battery storage rooms. Also, post signs that warn first responders to the kinds of dangers involved; i.e., *Warning: Battery Storage Room Electric Hazard/Corrosive Hazard*.

NYC requires that someone from the building, such as a building engineer or maintenance supervisor, take a Fire Department examination to demonstrate proficiency in the building's battery storage system operation. Successfully passing the Fire Department examination provides building personnel with a three-year certificate of fitness (C of F) license for safe operations of a battery system. This C of F holder is required to be available for Fire personnel when there is a fire or emergency involving the building's battery systems.

Emergency storage systems (ESS) can address issues with the timing, transmission and dispatch of electricity, while also regulating the quality and reliability of the power generated by traditional and variable sources of power.

Some municipalities may need to think about placing these batteries in a separate room to contain the system. This room containment is sufficient in new construction, but the idea of building a separate room within an existing structure could be cost-prohibitive to the owner, thereby thwarting the much-needed program of energy storage and peak demand shaving. The fire service must straddle that fine line with the industry and protect its Firefighters from serious injury or death. We will never eliminate all the risks associated with these energy storage systems, but the risk can be reduced by using innovative techniques in collaboration with stakeholders.

Training and SOPs

Although the clear benefits to this technology have been identified, there are many gaps between energy storage technology and the fire service. Fire departments have been responding to these situations lacking guidance and SOPs. This situation compels first responders to adopt a defensive posture at these operations. When life safety situations are at stake, this dynamic can create increased risk and impact the outcome of the fire/emergency.

The National Fire Protection Association (NFPA) 472, Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents, does not address this kind of emergency. The author's research revealed that the fire service needs to partner with the key ESS stakeholders on research and development programs in this area, as well as advance standard testing protocols and accepted regulations and procedures for first responders involved in ESS events.

Members are urged to review **Fire Prevention Matters** columns, "Green Energy: Storage Battery Technology, parts I and II," by Assistant Chief Ronald R. Spadafora, Chief of Fire Prevention, in the 3rd/ and 4th/2015 issues of *WNYF*, respectively.

Considerations for fire or emergency response operations

- Ascertain locations of emergency shutoffs for the ESS.
- Because it is unclear what kind of chemicals come off these energy systems when they burn (possibly degrading members' bunker gear), NFPA 1971, Standard on Protective Ensembles for Structural Firefighting and Proximity Firefighting, may need revision.
- Know the system voltage prior to starting operations.
- Identify the battery chemistry prior to developing an incident action plan (IAP).
- After identification, understand the chemistry's potential dangers and risks.
- Be aware of and prepared for potential battery cell explosions.
- During emergencies without fires, seriously consider heat propagation and monitor for it with a thermal imaging camera.
- To reduce the risk of electrical leakage, fog nozzles are necessary when using water as an extinguishing agent.
- Stored energy must dissipate before overhaul begins.

Technology is evolving faster than fire protection demands

FDNY must familiarize members with this next generation energy storage technology. The fire service must be agile and adapt quickly to the accelerating deployment of ESS throughout New York City. New technology brings new responsibilities and the fire service must embrace this challenge. Working with the industry and requesting cooperation from ESS stakeholders are critical in managing the risks of these new power sources. As new battery chemistry continues to emerge in the ESS sector, these challenges may become more hazardous for Firefighters.

The Bureaus of Operations and Fire Prevention proactively are working with the Department of Buildings engineers and national testing/code organizations on ESS. Testing and information-sharing are essential to the development of SOPs/SOGs. These data help members learn and grow. The Department must be vigilant to its new surroundings and new technologies. FDNY must continue to be proactive and stay above the curve to protect Firefighters and ensure the most effective and safest response.

About the Author...

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