15 Choose Reliable Backup Power & Prioritize Needs

I. Summary

Issue:
Few backup power systems are large enough to serve a whole building, forcing most buildings to make difficult choices about what equipment to back up.

Recommendation:
Prioritize which electrical equipment will run on backup power so buildings can remain habitable during extended blackouts. Because cogeneration and solar power systems are always in use, they can be more reliable than generators that are only turned on during emergencies.

II. Proposed Legislation, Rule or Study

1. Where practical, the following loads should be evaluated for extended operation. Starting with Tier 1, the loads are organized by types of electrical equipment that should be given the highest priority for backup power use.

   Tier 1: Egress
   - Exit signs and egress illumination

   Tier 2: Extended life safety
   - Fire alarm and smoke/carbon dioxide detectors (battery backup instead of generator)
   - Common corridor and stairwell lighting
   - Essential security equipment such as electric locks
   - Fuel pump systems for generators

   Tier 3: Water
   - Sump and sewage ejector pumps
   - Domestic water booster pumps
   - Building Management System (for critical loads shown on this list)

   Tier 4: Parking Egress
   - Parking egress (lifts and lighting)

   Tier 5: Convenience power for building occupants
   - Charging stations equipped with current limiters
   - Community room

Tier 6: Small critical heating loads
- When possible, heating systems and all ancillary equipment required to generate and distribute heat for space conditioning. This may include control panels, burners, boilers, circulators, condensate pumps, vacuum pumps, gas boosters, fuel pumps, combustion air dampers and fans, and inducer fans.
- Domestic hot water equipment and all ancillary equipment required to generate and distribute domestic hot water. This may include control panels, burners, boilers, recirculation pumps, gas boosters, fuel pumps, and inducer fans.

Tier 7: Improved habitability
- Elevator car operation
- One convenience receptacle in living units, such as for refrigeration
- Air conditioning
- Main telecommunications room

2. When designing and evaluating the feasibility of backup power, buildings should consider the following options as alternatives to a traditional, standby generator:
   - Cogeneration
   - Solar photovoltaic (PV) systems
   - Central battery systems integrated with either cogeneration or PV systems

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III. Supporting Information

Expanded Issue and Benefits:

During Superstorm Sandy, large portions of New York City were left without power for extended periods, leaving many residential buildings within the blackout zones uninhabitable. Some backup generators that were in place did not operate properly when turned on and others operated inefficiently. Greater backup or "standby" power in residential buildings could have mitigated many of the habitability challenges faced by these buildings during extended power outages.

This proposal recommends that buildings (i) prioritize which electrical systems should be on backup power and (ii) consider the use of cogeneration or solar photovoltaic systems as alternatives to generators, potentially in combination with large electric batteries.

Many of the electrical loads recommended for prioritization in this proposal are not addressed by life safety requirements and have very different power requirements. For example, determining instantaneous power supply requirements for an elevator operating continuously during an emergency egress condition is fundamentally different than designing a system including battery storage that can be used to meet elevator load requirements for a few minutes out of every hour during a multiday blackout.

For all but the largest residential buildings, a combination of relatively modest cogeneration systems with battery systems could meet a significant portion of the common area loads for an extended period. Cogeneration and/or PV systems dedicated to powering certain common area systems are potentially more reliable during power outages than backup generators since they are operating continuously, rather than only being turned on during emergencies. Solar photovoltaic PV systems with batteries also could supply critical loads for smaller buildings for an extended period of time.

Implementation:

CHP and PV are very mature technologies with widespread market penetration in NYC.

The integration of large batteries in buildings has been established to varying degrees in the following applications: (i) the use of lighting systems with central batteries; (ii) the use large scale batteries in off grid remote buildings; (iii) the use of large scale batteries in buildings with controls to optimize peak demand reduction and minimize utility costs; and (iv) the use of large scale batteries with a continuous back up power source (CHP unit, diesel generator, etc.) for the operation of critical building systems during extended blackouts.

A NYSERDA funded research study is being conducted by Steven Winter Associates to examine the application considerations and benefits of large battery systems in NYC residential and commercial buildings. A primary goal of this study is to provide the market with better data to support easier screening of these opportunities in buildings.

Cost:

This proposal does not mandate a building owner to perform any work. Therefore, cost is dependent on the building and the standby loads chosen by the building owner for extended operations.

Solar PV costs have dropped significantly in recent years and substantial government incentives are available. Many companies will also cover the full up front cost of solar PV (though not batteries) through leasing programs.

Owners should be aware that in some cases financing of CHP systems is available through 3rd parties and/or CHP equipment vendors. Because the electrical and thermal outputs of CHP systems are metered, the technology lends itself to “shared savings contracts” or “power purchase agreements” whereby a third party installs, maintains and purchases the gas used by a CHP system and charges the owner for the useful energy output of the CHP system. In such cases, the owner’s net operating costs will either stay constant or slightly decrease. From a resiliency standpoint, pursuing such a strategy allows for the primary component of an emergency generator system to be installed with no impact on capital or operating budgets. Note that the reconfiguration of existing site wiring to allow the CHP system to be connected to critical loads would likely still be a cost that the owner would have to bear.

There is no such financing alternative for traditional (non CHP) emergency generators because they do not result in a positive revenue stream.

Spurred in large part by the Electric Vehicle market, a drop in battery costs in recent years has opened up the potential to integrate banks of batteries in buildings in combination with smart load monitoring control systems to release energy at optimal times. There are two potential revenue streams that can result from the integration of such batteries in buildings: (1) reduced electric demand charges from Con Edison associated with the use of batteries to shave peak demand; and (2) participation in NYISO demand curtailment programs whereby batteries enable buildings to reduce load during critical 4-5 hour periods during peak summer conditions with no impact on comfort. This revenue stream is only applicable to larger buildings that can curtail at least 100 kW of demand for 4-5 hours. As a result of these relatively predictable revenue streams, there is also the potential to utilize 3rd parties to finance large electric batteries, although this market is not as mature as the one for CHP systems.

No cost estimation was provided for this proposal.

Sources:

1. http://aristapower.com/
2. http://demandenergynetworks.com/pressroom/latest/128-barclay-tower-becomes-world-s-first-intelligent-energy-storage-powered-high-rise