ENERGY SECURITY & EMERGENCY PREPAREDNESS

How Clean Energy Can Deliver More Reliable Power for Critical Infrastructure and Emergency Response Missions

An Overview for Federal, State and Local Officials

Photo: Jim Watson/AFP Collection/Getty Images

Prepared by Clean Energy Group

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Introduction

As Congress and the states take up energy issues in the aftermath of the massive power failures following Hurricanes Katrina and Rita, they should consider one crucial option for energy security—call for the installation of new, more reliable forms of on-site electricity generation at mission critical, public safety facilities.

Emergency preparedness and effective response depend entirely on the reliability and quality of a first responder's energy supply. If primary grid power goes down, so too can "911" and state emergency communication centers, first responder stations, hospitals, control centers, traffic signals, public transportation, as well as vital infrastructure like water pumping and filtration systems.

The effectiveness of critical facilities and their ability to carry out their mission during an emergency is dependent on the reliability of their secondary or backup power systems. Today many of our most important critical facilities feature some of the latest 21st century equipment, but rely on 19th century backup technology—namely diesel generators—with limited staying power and average power quality.

Diesel generators have a history of failure in disaster situations, including the July 1999 power outage in New York City and the massive power outages in the eastern United States in August 2003. After Hurricane Katrina, downed power lines and flooding made it impossible to deliver diesel fuel to smaller generators that would ordinarily serve as backup power with the grid down. Without electricity, the region was not able to function. Without power, the emergency response system broke down. The result was a public safety crisis with tragic human consequences.

This is a problem that could be prevented in the future. One solution is this: As Congress and the states take up energy issues in the aftermath of the massive power failures following Hurricanes Katrina and Rita, they should consider one crucial option for energy security—call for the installation of new, more reliable forms of on-site electricity generation at mission critical, public safety facilities.

Solar photovoltaic (PV) or fuel cells can operate independent from the grid and can continue to provide electricity when the grid goes down. While these installations will not solve all future emergency power problems—massive flooding can overwhelm equipment no matter how it is powered—these additional measures could make a life-saving difference.

Greater development of diverse, on-site clean power production is the key to assuring stable, high quality and long-term power to "harden" critical facilities. Fuel cells running on natural gas or bottled hydrogen can provide high-quality "24x7" power to uninterruptible electronic and communications systems, as well as provide heat to a facility; PV arrays can supply power to keep traffic signals running and lessen the chance that first responder deployment will be hampered by severe traffic congestion.

Smaller-scale, on-site clean energy technologies are not widespread because they cost somewhat more than conventional power and are relatively new to the marketplace. But interest in them is growing. So far, several states have funded these technologies mainly for environmental reasons; they are cleaner than conventional generating systems. But now some states see solar PV, fuel cells, and even wind power in a new light, as a basic foundation for emergency preparedness and public safety.

However, most government buildings, whether federal, state or local, have no such additional power protection. Moreover, neither the federal government nor most states have any clear policy in place to require greater use of these more reliable systems. We now know that the cost of such inaction is great.

At a minimum, states should consider requiring that critical public facilities install on-site clean energy generation to reduce the risk from power failures. States now require public safety measures for backup power, fire pumps and ventilation; many of the same systems that fail when the power goes down. As a basic public safety measure, state

legislatures could expand power protection to immediately require installation of newer, more reliable and redundant forms of clean power technologies in mission critical facilities.

The federal government could help ensure greater energy security by requiring that its own mission critical facilities use on-site clean energy generation. It could direct the use of these technologies in any federally funded reconstruction of critical public buildings in the Gulf. It could also assist Gulf states to pay for these technologies through a funding partnership.

To keep costs down, new energy security policies should be flexible and adaptable. At first, they could cover only certain emergency power needs in critical facility buildings such as communications, computers and emergency lighting, not entire buildings. They also could include incentives so the private sector is motivated to install greater levels of power protection in private buildings with critical functions, such as hospitals and university laboratories.

While the upfront costs of on-site clean energy systems are higher than most diesel generators, the human and economic costs of depending solely on conventional systems for public safety are now painfully unacceptable. In the future, we cannot afford to rely on the same old energy systems that failed us when we needed them the most.

Moving Forward

Working together with the Clean Energy Group, several state clean energy funds are interested in exploring options and forming a strategic partnership with legislators and other state, local and federal officials to bring about much needed changes in energy security.

Collective action will strengthen state-based efforts and ensure greater energy reliability for emergency response missions. There are many options for a state-by-state approach; whether mandatory or voluntary, it is clear that something should be done.

This document is intended to give state, local and federal officials a snapshot of what state clean energy funds and others are already doing to harden critical infrastructure, and demonstrate the potential to further enhance emergency preparedness measures through on-site clean energy projects.

We hope you will join us in this call to action.

Lewis Milford
Allison Schumacher
Clean Energy Group

Several states are already collaborating to support reliable on-site generation to decrease our dependence on the country's vulnerable grid and secondary power systems. These states have clean energy funds that collectively hold almost $4 billion to invest over the next decade in clean energy projects and companies in their states. See *www.cleanenergystates.org*.

Photo courtesy of J.R. Finkle, SOL, Inc.

After Hurricane Katrina, donated solar street lighting was installed by SOL, Inc. at Louisiana's State Police Headquarters, the hub of recovery operations for the State Homeland Security Office and Emergency Operations Center.

Critical Facilities that Benefit from Clean Energy Security

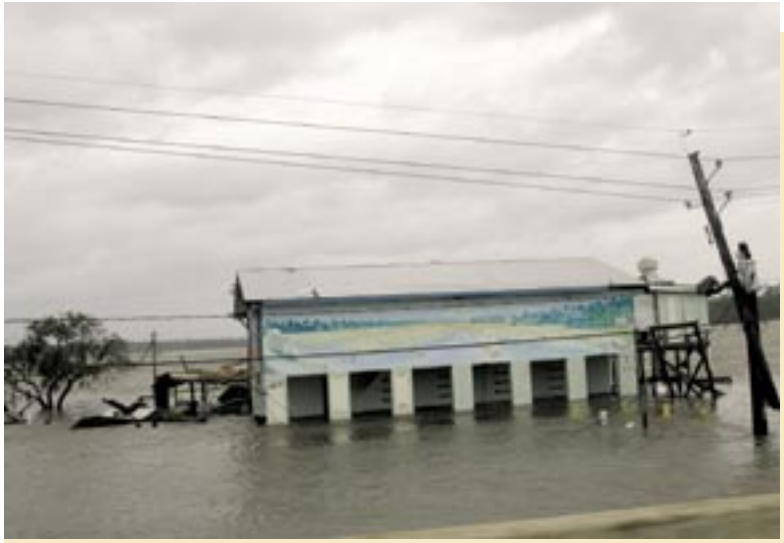
- **First Responder Stations**
- **"911" Call Centers**
- **Hospitals**
- **State DHS Command Centers**
- **Emergency Shelters**
- **State Emergency Communications Infrastructure**
- **Cellular Telecommunications**
- **Critical Roadways**
- **Airports**
- **Public Transportation Services**
- **Water Pumping and Filtration**
- **Bridges, Railways, Tunnels, Pipelines and other Infrastructure**

Security Applications for Clean Energy

Energy protection at critical facilities can be delivered without relying solely on the antiquated electricity grid. Many state clean energy funds are supporting on-site clean energy power projects at critical facilities to minimize dependency on centralized power in times of emergency.

There are several clean energy technologies—like solar photovoltaics (PV), fuel cells, wind power and advanced battery systems—that can be used to harden critical infrastructure. Some applications include:

- **Building and facility backup power**
  Either whole building or critical circuits for telephone systems, web and wireless communications, space heating and cooling, computing, and lighting, for first responders (police, fire, health), government, and general welfare services (in some cases, private business).
- **Emergency response (in field)**
  "Drop and plop" fuel cell generators, on-site powering for field phones, computers, and health units.
- **Low-power protection**
  Cameras, nuclear and biological sensors, perimeter protection including motion detectors, electric fences and lighting.
- **Infrastructure area support**
  Backing-up critical support services at minimal working levels in anticipation of prolonged outages: water and sewage pumps, highway signal lights, critical "cold chain" (refrigeration) units for food, vaccine, laboratory testing, even radio and television services for the general population, and fuel pumps for transportation fuels.
- **Transportation**
  Lighting, backup power for traffic signals and safety lights, cameras, gate and toll access control, and communications for highway, port and tunnel, railway, waterway and airport surfaces.
- **Telecommunications**
  Backup and primary power for cellular towers and repeaters, utility SCADA systems, and remote networks which include telephone switching, field radios and WIFI.



Hurricane Katrina, Mississippi, August 2005. Severe flooding caused power outages across the Gulf Coast and made it impossible in many areas to deliver emergency supplies and diesel fuel for mission critical backup power. The massive blackout following the hurricane demonstrated all too well the depth of our nation's dependence on the grid and our vulnerability to malfunctions with conventional diesel backup systems. The lack of basic power, lights and communications throughout the Gulf Coast made emergency response missions extremely difficult if not impossible. Some "911" emergency calls went unanswered for days. Many hospitals and other critical emergency services experienced failures with their backup diesel generators, or ran out of diesel when fuel supply deliveries were impossible due to the flooding, with fatal consequences.

Photo: Courtesy of Gene Dailey/American Red Cross

Providing Solutions — Clean Energy Applications

The following examples show how states are going beyond conventional backup power systems to provide 21st century clean energy solutions for critical facilities.

Photo: MRET

A fuel cell at the U.S. Coast Guard Air Station at Cape Cod, MA.

First Responder Stations & Call Centers

During the massive blackout in New York City in August 2003, the NYPD Central Park Police Station remained in operation because it is powered by an on-site fuel cell that is grid-independent. Other first responder stations across the country are beginning to adopt this model —by using clean, distributed generation to power and heat their facilities. For example, New York just completed the largest fuel cell project in the nation at the Verizon 911 call center in Long Island, and the East Anaheim Police Department and Community Center in California has installed a fuel cell system to provide power for its operations.

Hospitals

Hospitals need a secure, resilient power supply to continue to operate critical equipment in times of emergency. The Connecticut Clean Energy Fund (CCEF) sponsored a fuel cell installation at the Saint Francis Hospital in Hartford, CT. The fuel cell system provides automatic power for certain operating rooms, independent of the grid, in case of grid failure. It also provides low-cost supplemental power and heat for the hospital under normal operating mode.

Coast Guard

Coast Guard and other border protection facilities need reliable backup or independent power supplies to carry out their missions. The Massachusetts Technology Collaborative Renewable Energy Trust provided funding for a fuel cell installation at the U.S. Coast Guard Air Station at Cape Cod. The station can operate independent of the grid in emergency situations, and the fuel cell also provides power and heat for the facility for daily operations.

Train Stations and Airports

The New York State Energy Research & Development Authority (NYSERDA), in conjunction with the New York Power Authority, Metropolitan Transit Authority and Con Ed, is sponsoring a new project to use fuel cells at Grand Central Terminal to operate significant portions of the terminal on a grid parallel basis. The system will have the capacity to reconfigure to provide backup power in the event of a grid disruption and has the potential to be replicated in other highly dense, grid congested areas. Airports are also adopting on-site clean power systems—the air traffic control communications center in Long Island plans to install a fuel cell in 2005, and the Illinois Clean Energy Community Foundation is supporting the design and planning phase for a fuel cell and combined heat and power system at the Rockford airport in IL.

Emergency Centers

According to the Department of Energy, under an extreme national disaster scenario, schools could provide a safe haven for 25 to 50 million citizens, up to 9 to 18 percent of the U.S. resident population. Several state clean energy funds support on-site clean energy projects at schools that serve as emergency shelters. If grid power is down, many of these facilities will have at least partial power to conduct emergency

While not grid-independent, the Michael E. Capuano school in Somerville, MA is a green building and has on-site photovoltaics and a demonstration wind turbine.

Photo: Wayne Soverns, Jr. of HMFH Architects, Inc.

management operations and meet community needs. Through support from the Connecticut Clean Energy Fund, the South Windsor High School in Connecticut is home to a fuel cell that provides a portion of the school's primary power under normal operations and provides grid-independent power when the school is used as an emergency shelter. The Michael E. Capuano school in Somerville, Massachusetts was constructed as a green building with on-site grid-tied renewable technologies with funding from the Massachusetts Renewable Energy Trust.

State Emergency Communications

The Sustainable Development Fund of Pennsylvania provided support for the installation of a PV array at the residence of Pennsylvania Governor Ed Rendell. The PV system provides a portion of daily primary power for the residence and ensures reliable backup power for critical state government services in the event of grid disruption.

The Governor's residence in Pennsylvania uses a photovoltaic array for some primary load and emergency backup power systems.

Photo: PA Department of Environmental Protection

Prevailing Conventional Technology—The Diesel Generator

Many critical facilities rely on conventional diesel generators for backup power during emergencies. Because these generators often lie dormant for long periods of time, they are prone to mechanical failure. Other problems include dependency on delivery of additional diesel fuel supplies for continued operations, maintenance requirements, noise pollution and local air quality regulations that might restrict hours of operation due to emissions associated with diesel fuel. In a March 2005 report to Congress, the Department of Defense conducted a cost comparison between diesel generators and renewable technologies and concluded, "Economic analysis supports on-installation power generation from renewables. Detailed analyses show that power generated from renewable resources is frequently less expensive on a simple payback basis than additional (equivalent) supplementary diesel generation. This is largely because renewable sources also provide no-cost energy when there is no emergency and backup generators lie dormant. Over time, these renewable investments provide a payback whereas conventional diesel generation just continues to accumulate cost."

> *A key finding of the New York City 2003 blackout report to Mayor Bloomberg states, "Many City offices and private sector functions did not have sufficient backup power in place, including key agencies such as the Departments of Health and Mental Hygiene, Sanitation and Transportation, neighborhood firehouses…and certain functional areas of hospitals. A small percentage of emergency generators failed to operate, either failing to initiate power generation, or ceasing to operate during the blackout due to mechanical failure or exhaustion of fuel supply…. Potential fuel delivery delays due to congestion in the streets were avoided due to the use of police escort services, but a "lockdown" situation may have caused additional delivery problems."*

This photosimulation shows the planned wind farm at the Atlantic County Utilities Authority (ACUA) wastewater treatment facility.

Photosimulation: Shane Smith, ACUA

This 10-kw PV array at a vocational high school in Illinois was installed with support from the Illinois Clean Energy Community Foundation.

Photo: Bob Romo

Mobile Emergency Command Centers

Mobile command centers utilize independent, portable power supplies to conduct critical missions. The Massachusetts Green Energy Fund provides support to companies like Konarka, a producer of low-cost solar power generation products. Konarka uses photovoltaic nanotechnology to make products such as portable, electric-generating buildings for the U.S. military, and other equipment such as unmanned vehicles and portable power devices for electronics like laptops and cell phones. This technology has numerous applications for carrying out emergency response missions.

Wastewater Treatment Facilities

Through support from the New Jersey Board of Public Utilities Clean Energy Initiative, the Atlantic County Utilities Authority wastewater treatment plant will soon be home to five wind power turbines. In addition, the wastewater facility will receive a new PV installation later this year. The combination of wind and solar power will allow the plant's operations, at times, to be completely run by clean, on-site generation.

Advanced Battery Storage

Advanced battery systems can store power for on-demand use during emergencies or power shortages. The California Energy Commission

funded an advanced battery storage initiative to capture and store wind power for use during grid disruptions. This project assists the California Independent System Operator with short-term storage and grid-management software to respond to grid problems.

Getting the Lights On for Katrina Recovery Operations

Eighteen solar lighting systems were installed at the Louisiana State Police Headquarters following Hurricane Katrina. These systems provide lighting for the hub of the state's hurricane recovery efforts, including camps for out-of-state police assisting in recovery missions.

The approach of Hurricane Rita interrupted installation efforts of 42 additional systems; all 60 systems were donated by SOL, Inc. and a consortium of investors.

Photos courtesy of J.R. Finkle, SOL, Inc.

Conclusions

Following Hurricane Katrina, Daniel Yergin, the Pulitzer Prize-winning expert on energy, wrote that Katrina should result in a new form of "energy security" that, among other things, requires "more emphasis on redundancy, alternatives, distributed energy and backup systems." His message echoes years of public and private calls for more dispersed energy systems, advice that has been largely ignored.

The examples given here of state clean energy fund projects demonstrate how clean energy applications are already working in the field to support critical facilities. However, until further steps are taken to ensure widespread use of these on-site clean energy technologies, emergency preparedness will remain vulnerable.

We are interested in joining forces with officials and legislators at the state, local and federal levels to address this problem, with the goal of increased deployment of on-site clean energy generation technologies and systems for critical public safety facilities. We want to work together to create smarter, more resilient power systems for critical infrastructure and emergency response missions.

We hope you will join us in this effort to improve energy security and strengthen emergency preparedness.

Clean Energy Group
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The views expressed in this publication are those of Clean Energy Group. This document does not constitute an official position of the Clean Energy States Alliance (CESA).

Recommendations for Action

Federal

- Require federal mission critical facilities to use clean energy technologies
- Direct use of on-site clean energy technologies in reconstruction of critical public buildings in the Gulf
- Develop federal-state partnerships to fund installations and facilitate joint procurement

State & Local

- Investigate local opportunities to use on-site clean energy technologies at emergency shelters, first responder stations and critical infrastructure
- Legislatures could require installation of on-site clean energy technologies at state mission critical facilities
- Create state incentives to support use of clean energy technologies at public facilities
- Establish incentives for private sector to install new on-site clean energy protection at hospitals, university laboratories and other critical private buildings

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Clean Energy Group (CEG) is a nonprofit organization established in January 1998 to increase the use of cleaner energy technologies in the U.S. and abroad through creative financing, business partnerships, public policy and advocacy.

CEG works with state and nonprofit officials from around the U.S. that are responsible for over $4 billion in new clean energy funds. CEG manages the Clean Energy States Alliance (CESA), a new nonprofit organization assisting these funds in multi-state strategies. A key project of CESA is the Public Fuel Cell Alliance, a state and federal fuel cell and hydrogen infrastructure collaboration. CEG also works with public officials in Europe interested in trans-Atlantic efforts to build clean energy markets.

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