RESILIENT POWER

Financing for Clean, Resilient Power Solutions

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Abstract

This paper is part of a series of reports and concept papers that Clean Energy Group (CEG) will publish in the next two years on the issue of Resilient Power. Resilient Power is the ability of a community to provide clean, reliable energy in the face of power outages, an increasingly regular event due to severe weather. New resilient power technologies can provide electricity during outages, and also at other times so communities benefit fully from clean reliable energy.

Clean Energy Group's Resilient Power Project is designed to help states and municipalities with program and policy information, analysis, finance tools, technical assistance, and best practices to speed the deployment of clean, resilient power systems in their communities. An important focus of the project is to help vulnerable and low-income communities deal with power outages due to severe weather events, as they have suffered disproportionately in damaging storms like Superstorm Sandy and Hurricane Katrina. Installing clean energy technologies such as solar and storage in multi-family housing, assisted living centers, fire stations, and schools that serve as shelters can protect people from harm, reduce pollution, and strengthen community resiliency. This paper continues the fifteen-year effort of CEG to make resilient power a major part of disaster planning and energy policy, work that is now showing results in new state and local programs to fund resilient power across the country. But much more needs to be done.

Acknowledgements

This paper is a product of Clean Energy Group and part of a series of reports issued through the Resilient Power Project, a joint project of Clean Energy Group and Meridian Institute. This project works to expand the use of clean, distributed generation for critical facilities to avoid power outages; to build more community-based clean power systems; and to reduce the adverse energy-related impacts on poor and other vulnerable populations from severe weather events. This project has been generously funded by The JPB Foundation, The Kresge Foundation, and The Surdna Foundation. The views and opinions expressed in this report are solely those of the authors.

RESILIENT POWER

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Introduction

Since 1998, Clean Energy Group (CEG), a national non-profit organization, has worked to expand markets for clean energy technologies, including solar, land-based wind, offshore wind, fuel cells, energy storage, and biomass. In 2002, CEG created and now manages a sister organization, Clean Energy States Alliance (CESA), another nonprofit organization that helps state and municipal clean energy funds to work together to deploy tens of thousands of clean energy projects around the country.

As part of our work, Clean Energy Group has advocated for the use of advanced clean energy technologies in critical public and private facilities that need reliable power during power outages. Instead of depending on dirty and unreliable diesel generations, CEG has advocated for the use of clean, community-driven distributed energy sources like solar PV with battery storage to provide energy security and back-up power in the event of power emergencies.

In 2013, with support from major foundations, CEG launched a new national project—The Resilient Power Project—to advance the deployment of resilient power technologies in states and local communities. The project will help communities to better prepare for, and more quickly recover from, damages caused by power outages during destructive weather events, with installations of cleaner distributed energy sources.

Through the Resilient Power Project, CEG works to help communities install these systems in critical facilities such as police and fire stations, schools that serve as community shelters, multi-family housing, food banks, wastewater treatment facilities, and other locations that need power to keep communities safe when the grid goes down. The project is especially interested in ensuring that these new protective power technologies are deployed in low-income communities, which are particularly vulnerable to grid outages, and which are often overlooked when new, innovative technologies are adopted.

Resilient power, sometimes called "energy assurance," expresses a simple concept: it is the ability to provide needed power, independent of the grid. Because our electric grids are vulnerable to storms and other disasters, the ability to generate electricity to power critical facilities and infrastructure should the grid go down is paramount in emergency planning.

The Resilient Power Project will provide technical assistance on the technology options and on financing solutions that can make resilient power installations more affordable. It will not have the capacity to actually finance projects, but it will work with developers, state and local officials, and finance entities to help provide the best information about the financing options for clean-energy, resilient power projects.

This financing paper is another in CEG's series on resilient power.

The paper describes a broad range of financing mechanisms that are either just beginning to be used or that have a strong potential for providing low-cost, long-term financing for solar with energy storage (solar + storage). The goal is to identify financing tools that can be used to implement projects and that will attract private capital on highly favorable terms, thereby reducing the cost of solar and resilient power installations.

We look forward to helping communities to use these financing tools. We hope they can use them to fund resilient projects to protect people from the adverse impacts of power outages from severe weather and other threats to the grid.

Why We Need Resilient Power

Losing power is always an inconvenience, but in many cases it can be life-threatening. Hospitals, nursing homes, 911 call centers, emergency shelters, and other critical facilities need reliable, resilient electrical power to deliver their emergency services to the community when the surrounding power grid is down. Elderly and disabled citizens rely on electrically powered technologies in their homes, as power is needed for pumping water, running elevators, refrigeration for medicines, heating and cooling systems, and respirators. As our reliance on electricity has grown over the last century, so too must its reliability and resilience.

Clean, distributed energy technologies such as solar and high-efficiency technologies such as combined heat and power (CHP) and fuel cells, offer many advantages, including reduced pollution, decreased reliance on fossil fuels, and economic development. But with the addition of new technologies, such as energy storage and microgrids, resilient power systems can provide another major benefit: they can help keep the power on when the electric grid fails.

Electricity is the life-blood of communities. Without it, nothing works—not only lights but also heating and cooling, refrigeration, transportation, communications, and fueling. Tragically, during disasters, even critical services such as medical, police and fire, and disaster shelters cannot function properly without electricity.

Traditionally, critical facilities such as hospitals have used diesel-fueled backup generators, but these have several downsides. Diesel backup generators too often fail, as has been seen in several recent widescale outages. By some estimates, more than 60% of the region's diesel backup generators failed during Hurricane Sandy, leading to loss of life, hospital evacuations, and billions in damages.

Besides being polluting, diesel-powered generators require fuel deliveries that are not always possible during natural disasters, and they are often not properly maintained, which contributes to their high rate of failure. Furthermore, diesel generators represent sunk costs for equipment that sits idle 99% of the time.

By contrast, technologies such as solar power combined with energy storage and islanding technology can provide daily benefits to the host facility, including cost savings, and can be disconnected from the grid to continue supplying reliable, safe electricity to a facility when the grid goes down.

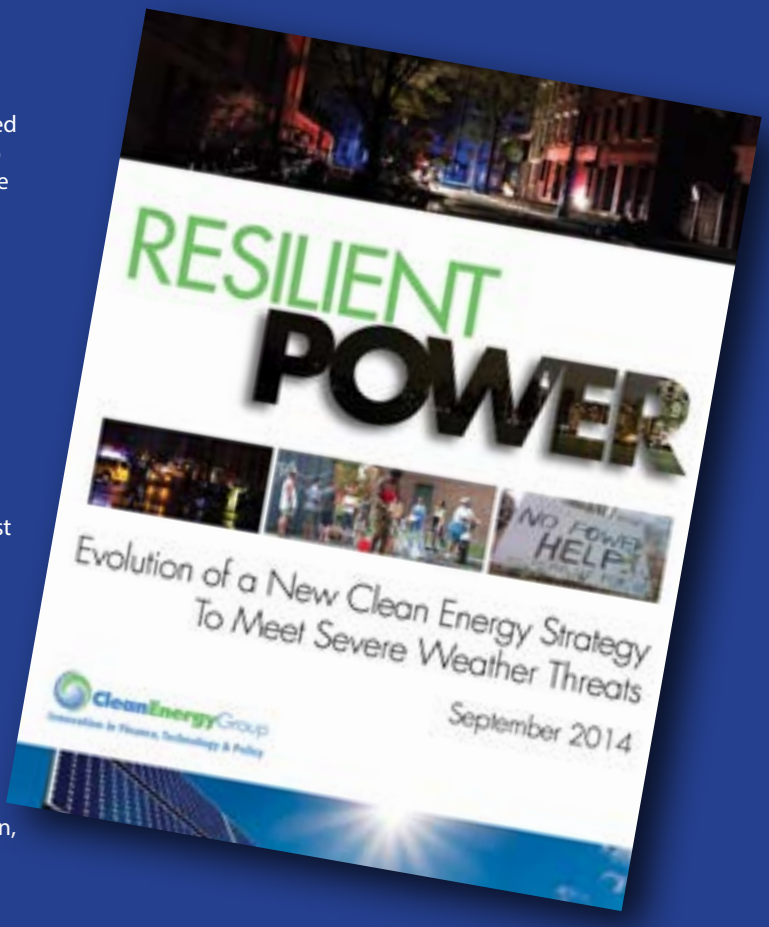
Storms, floods, and other natural disasters have become both more frequent and more damaging. Our ability to deal with these challenges depends on our capacity to adapt to our changing environment and prepare for these events. The technology needed to make electric power more resilient in the face of extreme weather events is available now—our challenge is to adapt and to adopt clean, resilient power quickly.

Clean Energy Group released a paper about the progress of resilient power efforts since the New York City blackouts in 1999 to Superstorm Sandy. The paper goes on to announce the launch of the Resilient Power Project and describes the importance of new technologies like solar PV with energy storage to provide resilient power as weather patterns become increasingly volatile and longer power outages become more frequent.

The paper, *Resilient Power: Evolution of a New Clean Energy Strategy to Meet Severe Weather Threats*, outlines the dangers that power outages can pose to our most vulnerable populations, the failures of traditional backup power sources, and the opportunities to develop distributed energy systems with clean and dependable energy technologies.

The report can be downloaded at **http://www.cleanegroup.org/assets/Uploads/Resilient-Power-Project-Evolution-Report.pdf.**

The recording from an accompanying webinar can be found at **http://www.cleanegroup.org/ceg-resources/resource/clean-energy-group-webinar-an-introduction-to-resilient-power.**



The Need for Clean, Resilient Power Finance

The Resilient Power Project works with states, communities, developers, utilities, NGOs, advocacy groups, and community stakeholders to deploy clean, resilient power solutions to power critical services in communities when the grid goes down. New technologies such as solar + storage could provide the solution to power critical services and replace diesel generators that often fail.

Some of these clean energy applications will require significant energy storage capacity to cover essential electric loads for heating or air conditioning, refrigeration, lighting, and communications at hospitals, water treatment facilities, community food banks, and distribution centers.

But other smaller, community-level facilities require only modest storage capacity and can be combined with energy efficiency measures, as well as solar thermal and other technologies. For example, affordable housing and assisted living projects need only a limited amount of resilient power for critical lighting, air conditioning/refrigeration and medical/communications equipment. In buildings with resilient power systems, residents can shelter in place in times of extended power outages and reduce the demand on overwhelmed first responder and emergency shelter services.

Existing buildings and critical facilities could be retrofitted with small battery storage systems, combined with small on-site generation; or these systems could be configured into the building designs for new construction projects. In this way, new community-based, appropriately scaled resilient power installations will be able to protect low-income, elderly and disabled populations—the people who have the greatest difficulty coping with and recovering from the destruction caused by extreme weather events and related power outages.

A key obstacle to implementing resilient power technologies has been access to capital on terms that make projects economically feasible.

This paper provides an overview of several clean energy finance strategies for low-cost, long-term financing of resilient, clean-energy technologies. It explores how conventional financing options—such as bond financing, credit enhancement, and public and private ownership structures—can be applied to resilient power projects.

States and localities have a strong record of investing in distributed clean power generation; they are now looking for ways use those same technologies to reduce the vulnerabilities from power outages. Leadership by the states to deploy new resilient power solutions has been significant and essential at a time when public funding is limited.

Some states have leveraged federal dollars designated for disaster relief and low-income communities to address resilient power needs and opportunities. In the past year alone, nearly half a billion dollars in new state program funding has been designated to finance resilient power just in the Northeast alone.

For example, in the wake of Superstorm Sandy, New Jersey issued a preliminary framework in April 2014 to create a $200 million Energy Resilience Bank using post-Sandy community development block grant (CDBG) funds to finance CHP, micro-turbines, and solar PV with battery storage installations.[1]

The new resilience bank will make direct loans and grants, but can also provide credit enhancement for bond issuances and other private financing participations. Although the initial priority is to protect clean water and wastewater treatment facilities from power outages, other critical facilities could also be funded, including hospitals, emergency response facilities, municipal town centers, correctional facilities, transportation and transit, public housing and regional high schools that can be used as shelters in case of emergency.

This is a model that other states should track and evaluate for possible replication.

In addition to New Jersey's funding for resilient power, in the past two years nearly $800 million has been deployed by the states for clean energy and energy efficiency finance, a significant portion of which is still available for credit enhancement for bonds and other investments that might involve clean resilient power technologies.[2]

This represents good progress, but much more work needs to be done if we are to meet the many finance challenges we face. There is a need to identify dedicated funding to provide states and municipalities with technical assistance provide them with the expertise to install new, resilient power technologies, as well as to leverage and provide credit enhancement for essential private investment in large-scale resilient power projects.

We must move beyond state grants and loans and begin to make use of innovative financing models that are available to municipalities to fund infrastructure and critical facilities. It is at the municipal level where the rubber meets the road, in terms of disaster planning and technology deployment.

We must also ensure that our most vulnerable populations are considered in resiliency planning. The damage and suffering caused by powerful storms are always compounded by poverty. Low-income areas have more difficulty responding and recovering from the destruction caused by extreme weather events and related power outages. They often lack the income, savings, access to communication channels and information, and insurance to recover from the adverse impacts of extreme weather events.

Resilient power can be the difference between security and disaster for vulnerable populations, but resilient power technologies will not be deployed unless communities have a way to finance them. This need is addressed by the tools detailed in this paper. CEG believes that everyone deserves to have power protection regardless of income.

New Jersey Creates the First Energy Resilience Bank to Support Resilient Power Projects

In July of 2014, New Jersey created the nation's first Energy Resilience Bank (ERB). The ERB is an important step to create new public financing to support local, distrib-uted resilient power projects that can provide continuous power before, during, and after severe weather events like Hurricane Sandy.

This innovative approach would be financed through use of $200 million of New Jersey's second Community Development Block Grant-Disaster Recovery (CDBG-DR) allocation. The New Jersey Board of Public Utilities (NJBPU) approved a sub-recipient agreement with the New Jersey Economic Development Authority (EDA) to work jointly in the establishment and operation of the ERB. According to the Governor Christie's announcement, "the ERB will support the development of distributed energy resources at critical facilities throughout the state …to minimize the potential for future major power outages and increase energy resiliency."

The ERB will make direct loans and grants, but can also provide credit enhancement for bond issuances and other private financing participations. Although the initial priority is clean water and wastewater treatment facilities, other critical facilities could also be funded, including hospitals, emergency response facilities, municipal town centers, correctional facilities, transportation and transit, public housing and regional high schools that can be used as shelters in case of emergency.

With this effort, New Jersey has created what could become a national model to finance resilient power projects to deal with severe weather events. This is especially important as severe weather creates havoc in the power sector, where power outages harm businesses, threated lives and disrupt vulnerable groups from recovering. After Superstorm Sandy, more than 8 million people were without power, causing hundreds of millions of dollars of damage, disrupting lives for the elderly, the poor and the disabled.

For more information, CEG's hosted a webinar on the NJ ERB; details and the webinar recording can be found at **http://www.cleanegroup.org/ceg-resources/resource/clean-energy-group-webinar-new-jersey-s-energy-resilience-bank.**

Innovative Financing Models for Resilient Power

Once a community or housing developer decides to incorporate resilient power technologies into a building or housing project, one of the key challenges will be coming up with the financing to install the equipment.

Municipalities and states have a broad range of financing options supporting clean resilient power deployment. They fall into four categories: bond financing, clean energy financial institution initiatives, credit enhancement, and public and private ownership structures.

With these finance options, states and municipalities can reduce the cost of financing their projects by leveraging public and private funds on favorable terms. For example, many schools also serve as an emergency shelter during an extended power outage. A municipality can finance a solar + storage system to power the school/shelter's critical loads when the power grid is down by using one or more of these tools to get the job done. It can use the proceeds from a variety of bonds to finance the project. It can enter into power purchase and/or leasing agreements with third-party companies that maintain and operate the systems at no up-front cost to the school. And in many states, they can obtain direct loans or credit enhancement (loan guarantees, loan loss/debt service reserves) from their state's clean energy fund or "green bank."

The more information and examples about how these four finance options can be used to finance resilient power projects are explained in more detail below.

BOND FINANCING

General obligation bonds
Morris Model
501(c)(3) bonds
Housing bonds
School construction bonds
Disaster recovery/climate resiliency bonds
Commercial/municipal PACE bonds

PUBLIC AND PRIVATE OWNERSHIP STRUCTURES

3rd party ownership with PPA
Municipal improvement districts
Utility ownership

CLEAN ENERGY FINANCIAL INSTITUTIONS

State Energy Resilience Banks
Warehouse credit facility
West Coast Infrastructure Exchange model

CREDIT ENHANCEMENTS

Public benefit funds
U.S. DOE Loan Guaranty

BOND FINANCING

Clean Energy Group has been a strong advocate for bond financing as one of several key approaches to financing clean energy. For 100 years, the nation's state and local infrastructure finance agencies have issued trillions of dollars' worth of public finance bonds to fund the construction of the nation's roads, bridges, hospitals, and other infrastructure—financing that literally built America. Now, as clean energy subsidies from Washington dwindle, these agencies are increasingly interested in financing renewable energy and energy efficiency projects.

Currently, most public authorities are only just beginning to issue bonds for financing clean energy projects, even though bond issuers have accumulated extensive experience in accessing capital markets to finance infrastructure projects at scale. The challenge is therefore to apply these proven bond finance tools to clean energy to greatly scale up investment in clean energy infrastructure.

Below we list several strategies to employ bond instruments to fund resilient power installations in different settings.

General obligation bonds for resilient power on critical public facilities

Many municipal, county and state officials are keenly aware of the need to incorporate resilient planning practices in their capital improvement plans. As these public entities upgrade their public schools, water treatment plants, and other essential public infrastructure, they can incorporate resilient power projects in their capital budget plans, financed with municipal bonds that are backed by the credit and tax revenues of the public entity.[3] This is the approach that the NYC City Controller has taken in recently announcing New York's multi-billion dollar "Green Bond Program" to finance post-Sandy reconstruction efforts and other infrastructure investment. See box on page 10.

Morris Model (private developer/public bond/ public facilities)

The Morris Model, so-named because it was first developed in Morris County, NJ, is a financing option in which a public entity issues a government bond at a low interest rate and transfers that low-cost capital to a solar developer in exchange for a lower power purchase agreement (PPA) price. It can substantially reduce the cost of solar power to the government entity.

Using this model, the Morris County Improvement Authority issued pooled bonds, backed by both project revenues and a county guarantee. Each of these bonds were used for renewable energy improvements made to multiple public facilities at the same time. Solar panels, owned and operated by a private developer, were installed on the public facilities, and the panels were then leased back to the public. Project revenues arose from a PPA. Additional financing for the project was added through federal tax incentives and New Jersey's Solar Renewable Energy Certificates (SRECs). The development and project performance risk resided with the private developer.

While this model was originally developed to support the deployment of solar PV, it could be adapted to support various types of resilient power technologies and applications. For more information about the Morris Model, see http://www.cleanegroup.org/assets/Uploads/2014-Files/CEBFI/cebfi-model-morris.pdf.

501(c)(3) bonds (nonprofit-owned hospitals, schools and other facilities)

Qualified 501(c)(3) bonds may be used to finance capital improvements (including solar + storage) for properties owned by nonprofit organizations, including buildings owned by state universities and hospitals. The principal advantages of these bonds are low interest rates and the attractiveness of the debt to lenders and investors.

Critical facilities that could qualify may include hospitals, universities, low-income housing and assisted living facilities. More information on what types of facilities and institutions would qualify can be found on the IRS website at: http://www.irs.gov/publications/p557/ch03.html.

Housing bonds (low income/elderly)

Developers, whether for-profit or nonprofit, can access tax-exempt housing bonds to finance or refinance the acquisition and rehabilitation of an existing low-income or elderly housing project, or for the construction of a new project, provided the developer sets aside all or a portion of the units for tenants who have very low, low or moderate income. In addition to affordable multifamily housing, these bonds can also be used to integrate clean resilient power in assisted living facilities that provide supportive services to the elderly, the disabled and the chronically homeless—vulnerable populations that are disproportionately impacted by extended power disruptions.[4]

School construction bonds

Schools are often identified as critical facilities due to their ability to provide emergency shelter. They can often accommodate solar PV easily, with or without storage, due to the large amount of rooftop or other on-site space that is available for installation of solar panels. As an example, a Florida initiative placed solar PV panels and batteries in more than 115 public schools that serve as emergency shelters during storm-related grid outages.[5] Schools can finance resilient power measures with low-cost school construction bonds by integrating these systems in the project design. And many school districts interested in net-zero schools (i.e., school buildings that generate as much energy as they consume) can use solar + storage to achieve net-zero energy use and provide resilient power benefits to the larger community. Many net-zero schools have been financed primarily with conventional school construction bonds, indicating that these low-cost, long-term bonds can effectively finance clean energy improvements when effectively integrated with school construction projects.

Disaster recovery and climate resiliency bonds

In September 2014, New York City Comptroller Scott Stringer announced a truly significant advance in the area of financing for resilient infrastructure. Stringer released a multi-billion dollar "Green Bond Program for New York City" that is likely to become a model for the country. In the green bonds plan for NYC, Stringer proposed to use bonds issued by the city to finance post-Sandy reconstruction efforts and other infrastructure investment. This would likely include water and power infrastructure projects such as public housing and wastewater facilities. The plan notes that a large portion of the city's capital infrastructure needs, perhaps up to $25 billion, could be financed through these green bonds.

This move is part of a trend to use infrastructure financing for new clean energy and power resiliency purposes. Rather than simply rebuilding grid infrastructure to pre-storm standards, this financing model could also be used to finance resilient power projects to counteract potential harm from future power outages that could impact critical services.[6]

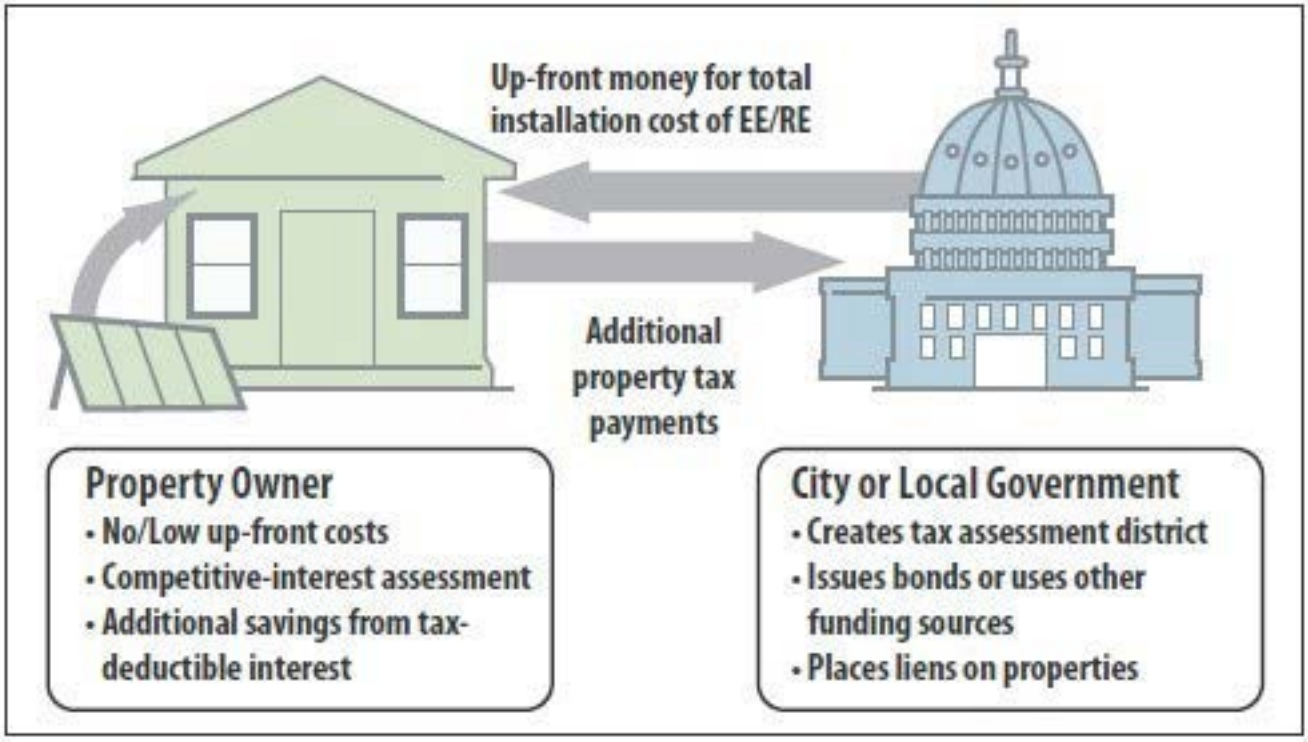
Similarly, in July 2014, the Louisiana Public Service Commission announced the authorized sale of approximately $315 million of bonds by a Louisiana community development authority to help finance restoration costs from Hurricane Isaac as well as to fund reserves for future storms. The financing is meant to re-establish utility storm escrow accounts to pay for the contractors, vendors, and materials necessary to restore service following future storms. It also will avoid or mitigate utility rate increases when compared with conventional financing methods; the savings is estimated to be more than $150 million on a net present value basis.

Commercial/municipal PACE bonds

Property Assessed Clean Energy (PACE) programs allow municipalities to finance clean energy building improvements, which are then repaid through an assessment added to the building owner's property taxes. While residential PACE programs have encountered headwinds because of Federal Housing Authority concerns about the priority of mortgage liens, commercial PACE programs have been advanced in many states. To date, PACE enabling legislation has been adopted by 31 states and the District of Columbia. Once a state adopts enabling legislation, municipalities within the state can establish their PACE programs, which can be defined to include clean resilient power technologies.

In addition to commercial and industrial facilities, municipal buildings have qualified for PACE financing in states that permit non-tax property assessments and payments. For example, in Ohio, the Toledo Port Authority PACE program has funded improvements at a number of municipal buildings belonging to the city of Toledo. In this instance, PACE financing could be used to implement resilient power projects on the publicly owned critical facilities that must have reliable power, especially during extended power outages. For more information about PACE programs, see http://pacenow.org/.

Figure 1: How PACE Financing Works



Source: NREL

CLEAN ENERGY FINANCE INSTITUTIONS

Clean energy resilient power is a new and unfamiliar energy concept to most traditional lenders. Many conventional lenders are reluctant to finance new technologies that lack an extensive track record of operating and financial performance. So how do resilient power projects begin to build that track record of successfully financed transactions?

Public purpose financial institutions can play an important role in providing flexible financing that enables new projects to be built. These clean energy financial institutions include a range of entities. "Green banks" use state clean energy funds to leverage private capital to deploy as loans, leases and equity investment for clean energy projects and enterprises.

Other finance programs have been established as partnerships between a state clean energy fund and a state development finance agency. A recent example is the New Jersey Energy Resilience Bank, which is managed by both the NJ Board of Public Utilities and the NJ Economic Development Authority. Other states have created virtual green banks by using their clean energy funds as credit enhancement to establish formal clean energy financing programs with third-party lenders (e.g., community development finance institutions, community banks, state finance agencies bond authorities).

All of these financing approaches create access to long-term, flexible financing priced at or below market interest rates—something that is critical to accelerating the creation of resilient power projects.

State Energy Resilience Banks

Many of the same states that have created resilient power programs also have established clean energy finance institutions. Whether called Green Banks or Energy Resilience Banks, these finance institutions are focused on creating finance products for clean energy to reach scale. In July 2014, New Jersey formally approved the creation of the first-in-the-nation Energy Resilience Bank (see Box on page 4). This innovative approach is funded with $200 million of New Jersey's second Community Development Block Grant-Disaster Recovery (CDBG-DR) allocation. The ERB is an important step to create new financing to support local, distributed resilient power projects, which protect against the power outages that occur after severe weather events like Superstorm Sandy. The ERB will make direct loans and grants, but it can also provide credit enhancement for bond issuances and other private financing participations. Although the initial priority is clean water and wastewater treatment facilities, other critical facilities will also be funded, including public housing, hospitals, emergency response facilities, municipal town centers, correctional facilities, transportation and transit, and regional high schools that can be used as shelters in case of emergency.[7]

Warehouse credit facility

One important role of existing clean-energy finance institutions would be to aggregate and "warehouse" resilient power financing transactions, which would then be securitized for sale to private investors, providing liquidity to the loan originators and further reducing the cost of capital. To date, close to a half billion dollars in state and federal money has been put in place to finance resilient power projects across the Northeast. These state and federal resilient power funds are primarily designed to be deployed for a broad range of grant and loan transactions. What is missing is an integrated finance approach for resilient power projects that structures grants and credit enhancement to support the aggregation and financing of a pipeline of projects by multiple loan originators. In this way, a portfolio of individual transactions – originated by multiple lenders and sharing a similar structure and underwriting standard – can be assembled (or "warehoused") for sale in the financial markets.

West Coast Infrastructure Exchange model

The West Coast Infrastructure Exchange is a model based on the success of Partnership British Columbia (a business planning and procurement management to advisory services company) to provide transaction analysis, bidding, structuring, and management services for public project owners in British Columbia.

As local and state governments plan and finance the next generation infrastructure, some states are looking closely at innovative ways to evaluate new infrastructure projects in terms of their life cycle costs. This approach awards contracts based on long-term the innovative design/procurement method called Design-Build-Finance-Maintain ("DBFM"). This method is also referred to as Performance-Based Infrastructure because the third-party development team designs and builds a project to meet the performance requirements specified by the public owner. Throughout this process, the pubic asset is never privatized and remains 100% public-owned.

Green Bonds

With recent announcements from New York and New Jersey, we now have two emerging finance models to fund community level, climate resilient infrastructure. That's good news, as we must raise billions of dollars in needed investments to shore up threatened public infrastructure and install cleaner resilient power technologies in critical facilities around the country.

New York City's multi-billion dollar "Green Bond Program" is likely to become a model for the country.

NYC Comptroller Stringer proposes to use bonds issued by the city to finance post-Sandy reconstruction efforts and other infrastructure investment. This would likely include water and power infrastructure projects in places like public housing and wastewater facilities.

The plan notes that a large portion of the city's capital infrastructure needs, perhaps up to $25 billion, could be financed through these green bonds. The NYC plan (**http://comptroller.nyc.gov/wp-content/uploads/documents/Green_Bond_Program_-September.pdf**) does a great job of outlining the progress that cities and other public entities already have made in using green bonds to finance infrastructure.

To learn more, please see CEG's blog post on the plan at **http://www.cleanegroup.org/blog/emerging-finance-models-for-resilient-infrastructure/**.

CREDIT ENHANCEMENT

Credit enhancement is another term for these financial risk reduction methods. Credit enhancement simply refers to the various means used to improve the credit worthiness of a project or company and reduce its cost of borrowing. Through credit enhancement, the lender is provided with additional reassurance that the borrower will honor its financial obligation. That can be done through the pledge of additional collateral, the purchase of insurance, a third-party guarantee, establishing a cash reserve account, or some other financing tool.

Credit enhancement reduces the risk of default. That increases the overall credit rating of a project. In turn, that brings down the cost of capital needed to finance projects and companies. Credit enhancement is a key mechanism used to finance public infrastructure; it is used to strengthen thousands of transactions every day by reducing financial risk for lenders.

Resilient power installations can also benefit from using credit enhancement tools. Several examples are given below on how this might work.

Public benefit funds (also called system benefit charges)

State public benefit funds (PBFs) are created by placing a small surcharge (system benefits charge, or SBC) on electric customers' bills, which can then be invested by the state to support clean energy deployment. Twenty-three states and the District of Columbia have established clean energy funds to support and invest in clean energy projects and programs in their states, ranging from less than $1 million to more than $200 million annually.

States with a clean energy fund may wish to carve out a portion of the fund to support clean resilient power development. Or a state may decide to increase its SBC to provide additional funds that could be earmarked for resilient power projects. States without a clean energy fund that wish to support resilient power development could institute a fund expressly for this purpose. This would typically be addressed by the state's public service commission.

States are beginning to use their SBC funds to provide credit enhancement to back bonds that attract significant private investment. For instance, Hawaii has created a program to finance clean energy projects by combining utility on-bill repayment for participating customers with bond financing, which has been credit enhanced with the utility surcharge (SBC). By doing so, it can access the capital markets with an investment grade security that does not require the state's general obligation guaranty.[8]

U.S. DOE Loan Guaranty Program

In July 2014, U.S. Department of Energy's Loan Programs Office issued a Renewable Energy and Efficient Energy Projects Solicitation, which would make up to $4 billion in loan guarantees available to support innovative, renewable energy and energy efficiency projects. The solicitation seeks applications for projects that cover a range of technologies, and lists five eligible technology areas.[9]

The first of these described technology areas is advanced grid integration and storage. The guaranty program could be used by states and localities that want to access private investment on favorable terms for their microgrid and resilient power programs and aggregate projects (statewide and perhaps regionally) into one or more requests for guaranty.

How to Reduce Risk and Increase Clean Energy

"Reduce Risk, Increase Clean Energy: How States and Cities are Using Old Finance Tools to Scale Up a New Industry," is a 2013 report prepared by Clean Energy Group and the Council of Development Finance Agencies that identifies several financing strategies at the state and municipal level that can be adapted and implemented to accelerate the clean energy deployment.

With tried and true financial instruments, clean energy projects can access low-cost, long-term capital markets, and investors will be able to purchase investment grade securities that meet their financial and environmental requirements. Across the country, state and municipal leaders have begun to embrace a finance innovation for clean energy: the use credit enhancement—at the state and local level—to support bonds and other debt instruments by reducing financial risk.

Credit enhancement, simply put, is a means to reduce the financial risk of a project, to make the lender more secure that they will be repaid on their investment. Not flashy but often complicated to explain to those outside of finance, they have been used in virtually every other sector to raise capital to scale. They are the bridge, the linchpin financial instrument, to get projects to capital markets.

Just as America financed its public infrastructure, its roads and bridges and airports, the clean energy sector is following suit. It is moving from an emerging industry strategy that was driven solely by the need to reduce technology and production costs, to one that must reduce risk—especially financing risk.

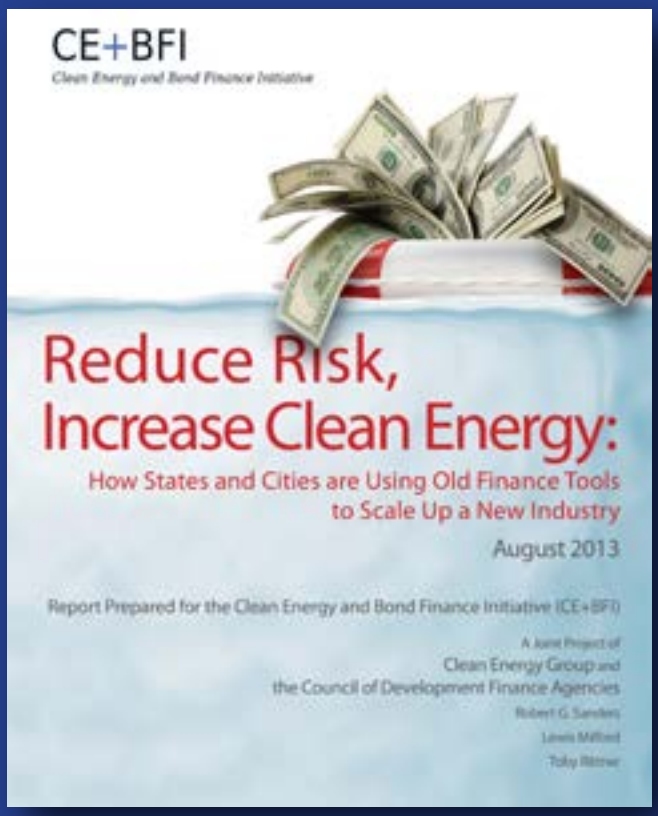
The goal of these innovations is to firmly establish credit-enhanced, clean energy bonds as a new asset class for institutional investors who could begin to invest in clean energy assets that have the equivalent credit risk/return profile as any other similarly rated asset.

The paper also makes some recommendations for how other states and cities can advance the use of bonds for clean energy and also proposes a new federal strategy to accelerate state-level financial innovation in clean energy.

Most important is the need to reduce risk at each step of the finance value chain, from project development through the bundling and sale of securities to the institutional investor.

Credit enhancement is the key to the public infrastructure finance world; it is used to strengthen thousands of transactions every day by reducing financial risk for lenders. The construction of the nation's roads, bridges, hospitals, airports—virtually every large infrastructure project in America—relies on credit enhancement. This is a new challenge for the clean energy sector. It means moving away from the heavy reliance on tax equity driven, one-off transaction way of financing clean energy, with its attendant high transaction costs. Instead, financing clean energy has to start looking more like the bond market for other traditional infrastructure projects, and that's how we will get to scale.

This report can be downloaded at **http://www.cleanegroup.org/assets/Uploads/2013-Files/Reports/CEBFI-Reduce-Risk-Increase-Clean-Energy-Report-August2013.pdf.**



PUBLIC & PRIVATE OWNERSHIP STRUCTURES

Ten years ago, the decision whether to install solar PV hinged on a calculation of whether there were sufficient subsidies and tax credits to justify coming up with the remaining cash or financing needed to buy and install a solar PV system. But then companies such as SolarCity began providing lease financing that required no upfront cash from the customer. This third-party ownership model is largely responsible for the tremendous growth in residential solar development over the past decade. Can the leasing model—a third-party ownership model—accomplish for energy storage what it has already done for residential solar PV installations?

Third-party ownership models

Third-party ownership of a clean energy system, using lease financing or a power purchase agreement (PPA), has proven to be a powerful means of deploying solar PV, and the same structure can be used for resilient power projects. Under one model, the resilient power project is developed and owned by a third party, usually a private company, and financed through a PPA with the host facility (e.g., where a solar + storage system is installed). The PPA sets the financial terms under which the host purchases power generated by the system from the third party, often at a fixed rate that is lower than the local retail rate for the electricity. This allows the host facility to obtain a resilient power system at little or no up-front cost, generally at an energy cost savings for the duration of the PPA.

The developer, as a for-profit entity, can take advantage of state and federal tax incentives that may not be available to the host (for example, if the host is a public entity) and pass those cost savings through to the host by means of a lower PPA price. Equally important, it transfers development and performance risk to the private developer.[10]

Municipal improvement districts

A municipality may create an energy improvement or resilient power district that contains a number of critical facilities where resilient power is needed. Such a district may include special zoning to enable resilient power technologies. The district may also have bonding authority, which can be used to create a loan fund to support project development. This sort of district would be similar to a municipal lighting or sewer district, but its focus would be to enable the deployment of resilient power technologies where they are most needed.[11]

Utility-owned and financed microgrids with resilient power

Under current Maryland law, the Public Service Commission allows electric distribution companies (EDCs) to own and operate microgrids and energy storage systems. They can then sell power and services from their distributed generation and storage facilities into the wholesale power markets and to retail microgrid customers. EDCs are also able to assess a "Microgrid Service Charge," with PSC approval, on microgrid customers and can petition the Public Service Commission to include a portion of public purpose microgrid costs in the rate base.[12]

In Vermont, Green Mountain Power (GMP), a utility based in Rutland VT, has applied this model to their Stafford Hills Project. In August 2014, GMP broke ground on the country's first solar microgrid located on a brownfield landfill. With 7,700 solar panels that can generate 2 MW of power backed up by a 4 MW battery storage system, the solar microgrid will power a public emergency shelter and provide clean, distributed generation and resilient power to an urban community that suffers frequent power outages due to storms.[13] See CEG's blog on this project at http://www.cleanegroup.org/blog/solar-energy-storage-resilient-power-in-vermont. Utility-owned and rate-based microgrids are another way for communities to access resilient power technologies and benefits .

GMP Energy Storage Project – Stafford Hills, Rutland, Vermont

Green Mountain Power, Vermont Public Service Department, Clean Energy States Alliance, and the US Department of Energy participated in the groundbreaking ceremony in August 2014 for new solar + storage microgrid project in Rutland, Vermont. The Stafford Hills project is being developed and funded by Green Mountain Power, in collaboration with Dynapower, GroSolar and Solar Grid Storage. The project's energy storage component is co-funded by a unique federal-state-NGO partnership involving the state of Vermont, the US Department of Energy, Office of Electricity, and the Energy Storage Technology Advancement Partnership (ESTAP), a project managed by Clean Energy States Alliance and Sandia National Laboratories. This project is unique in several ways:

- It incorporates 7,722 solar panels, capable of generating 2.5 MW of electricity, helping GMP to reach its goal of making Rutland, VT the Solar Capital of New England, and helping Vermont to reach its renewable energy goals;
- It incorporates 4 MW of battery storage, both lithium ion and lead acid, to integrate the solar generation into the local grid, and to provide resilient power in case of a grid outage;
- It will provide resilient power to a Rutland school that serves as a public emergency shelter (additional critical facilities may be similarly supported by this microgrid in the future);
- It will provide clean, distributed generation and resilient power to an economically challenged, urban community that is targeted for revitalization, and that suffers frequent power outages due to storms;

*Source: Green Mountain Power

- It is one of the first exclusively solar-powered microgrids in the US, and the first to provide full back-up power to an emergency shelter on the distribution network;
- It is the first solar+storage microgrid to be developed on a landfill site, contributing to brownfield redevelopment efforts in Rutland, VT;

This project puts Vermont in the forefront of the new movement toward microgrids, energy storage, and grid modernization. Solar + storage and microgrid technologies are poised to revolutionize the electric grid, bringing clean, resilient, locally-generated power to communities all over the world. These systems strengthen grids and can keep critical facilities, such as emergency shelters, firehouses and fueling stations, operating when the grid goes down. With this project, Vermont takes a giant step toward addressing its resilient power needs, as well as meeting Vermont's clean energy and emissions reduction goals.

Emerging Markets for Resilient Power Technologies

In recent years, new business models have been developing rapidly around resilient power installations. These models have come about because of the new technology combinations and revenue streams that are made available through regulatory mandates that encourage the development of more reliable grids, energy storage capacity, and resilient energy systems.

Both solar PV and battery storage technologies have fallen in price in recent years, and projections indicate that solar + storage systems will reach parity with grid-purchased electricity in the near future for many areas of the United States.

However, solar + storage projects can become even more cost-effective when additional revenue streams from their provision of ancillary grid services are factored in. Owners of solar generators plus battery storage equipment could earn significant revenue by selling additional services to the grid, such as demand response and frequency regulation services. Because grid-damaging natural disasters occur occasionally, while solar + storage systems operate daily, the emerging markets for these services greatly improve the cost/benefit calculation for a PV with storage system.

Markets for such services are improving in part due to a series of orders issued by the Federal Energy Regulatory Commission (FERC). These orders have caused a number of significant changes, including:

- Energy storage is entitled to interconnection procedures that are just, reasonable and nondiscriminatory.
- Regional Transmission Organization/ Independent System Operator (RTO/ISO) tariffs have been changed to include energy storage resources as a means of increasing competition in the power markets, a key FERC goal.
- RTOs/ISOs need to pay sellers for frequency regulation services, which include performance payments for faster and more accurate response to dispatch signals.

New third-party battery companies are beginning to take advantage of the revenue streams made possible by FERC orders. These companies provide a battery and inverter through a leasing arrangement, with no up-front cost, and they can be co-located with PV or other distributed generation systems.

These new business models can make it much easier for customers to add storage to existing solar PV systems, or to build storage into new systems, through leasing or PPA arrangements similar to the third-party models that have greatly expanded the deployment of solar PV.

Resilient Power for Vulnerable Communities

A recent report from the Center for American Progress, *Heavy Weather: How Climate Destruction Harms Middle- and Lower-Income Americans,* finds that "on average, counties with middle-and lower-income households were harmed by many of the most expensive extreme weather events in 2011 and 2012." The report reinforced what we already knew: vulnerable communities, including the elderly, disabled and economically challenged, are more vulnerable than the general population to destructive storms and the power outages they create.

For the elderly and disabled, flooding, heat waves, ice and snow storms, and other natural disasters may present life-threatening challenges—and the lack of resilient power in retirement homes, assisted living facilities, and public shelters can exacerbate the problem. For example, if elevators are not running, these people may not be able to use the stairs to evacuate their homes or to access shelters. If shelters don't have resilient power to provide heat and air conditioning, refrigeration for medicines, and to recharge electronic medical and mobility devices, the elderly and disabled may not be able to shelter there.

By providing appropriately sized resilient power, vulnerable multi-family housing residents would be able to shelter in place during extended power outages, which would in turn reduce demands on overwhelmed first responder and emergency shelter services. Community-based, small resilient power installations would protect low income, elderly and disabled populations—the people who have the greatest difficulty responding and recovering from the destruction caused by extreme weather events and related power outages.

Financing resilient power may be more challenging in low-income neighborhoods, but the need is greater as well. Clean Energy Group is committed to helping municipalities find ways to deploy resilient power to serve vulnerable populations. Please see a paper Clean Energy Group prepared for the Abell Foundation, "Clean Energy for Resilient Communities: Expanding Solar Generation in Baltimore's Low-Income Neighborhoods," at http://www.cesa.org/assets/2014-Files/Clean-Energy-for-Resilient-Communities-Report-Feb2014.pdf.

Resilient Power and the Disabled

The importance of resilient power for vulnerable populations was underscored in November 2013, when a federal court ruled that New York City did not do enough to protect the disabled during Hurricane Sandy. While praising the city generally for its post-Sandy relief actions, the court found that the city violated the Americans with Disabilities Act by not providing resilient power to public shelters, thus failing to provide equal access for people with disabilities. This was the first such ruling in the country.

People with disabilities often depend on access to electricity for mobility and medical devices. For many, an emergency shelter is a safe spot for refuge only if the elevator is working in the buidling they need to leave or enter, if refrigeration is available for medicines, and if electricity can be provided for electronic medical devices and wheelchairs—meaning the shelter must have electric power even when the surrounding grid does not.

This ruling highlights the existing legal obligations of public agencies across the country. If upheld, it could have significant national implications for how cities plan to protect the disabled during disasters and, by extension, how they plan to protect the general population.

This is no small problem. According to the most recent census, almost 20% of the total U.S. population, 73 million people, are considered disabled. And among the elderly, the percentage of disabled rises to 30-40 percent.

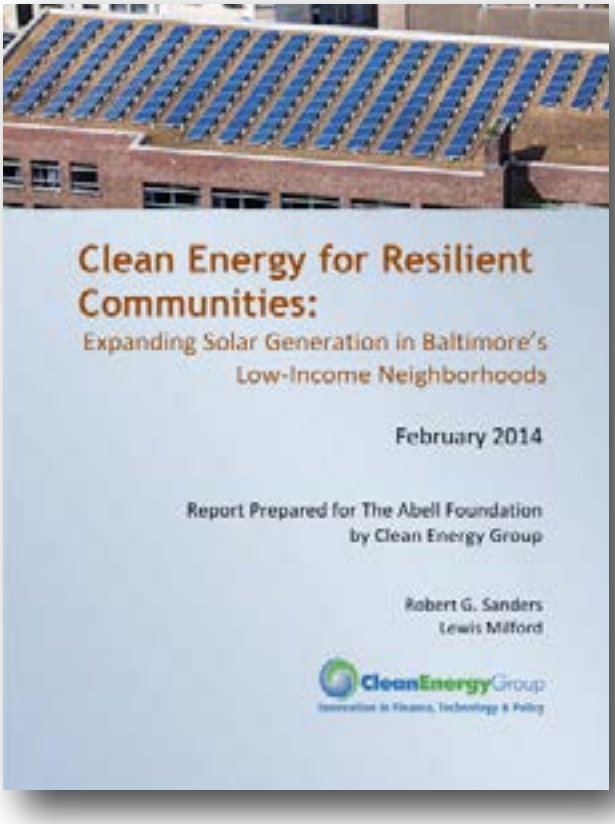
Much has been written about how climate emergencies in the future will disproportionately harm these vulnerable populations. Now, for the first time, those warnings are backed by legal obligations that cities and states ignore at their peril.

Credit: Melpomene/Bigstock.com

How Cities Can Use Solar Energy to Become More Power Resilient

In a blueprint for how a city could become more "power resilient," Clean Energy Group produced a report in February 2014, *Clean Energy for Resilient Communities: Expanding Solar Generation in Baltimore's Low-Income Neighborhoods*. The report shows how the city of Baltimore and other communities could use clean energy to create a more reliable electric system that protects vulnerable citizens during power blackouts. The report was written by CEG for The Abell Foundation, a leading private foundation in Baltimore. It is a first-of-its-kind, city-specific analysis of what a community can do to use solar and energy storage technologies to protect the low-income community from power outages.

The damage and suffering caused by powerful storms are always compounded by poverty. Low-income areas have more difficulty responding and recovering from the destruction caused by extreme weather events and related power outages. They often lack the income, savings, access to communication channels and information, and insurance to recover from the adverse impacts of extreme weather events.



Some of the report's recommendations for opening clean energy opportunities to low-income communities, and protecting vulnerable populations by securing critical power loads include the following:

- Critical facilities identified in Baltimore's Disaster Preparedness and Planning Project (DP3) report should be evaluated for their suitability for resilient solar power with battery storage.
- The city of Baltimore and its development finance agencies should utilize existing bond financing and credit enhancement mechanisms to develop solar with storage on public buildings and nonprofit-owned facilities.
- Third-party ownership—financed with power purchase agreements (PPAs) or lease-financed—should be considered for solar PV on public schools, libraries, police/fire stations, and other public buildings.
- The city and the state should explore their legal obligations to provide greater power resiliency to ensure that the elderly and the disabled are able to access emergency services during severe weather events. This is based on a recent federal court ruling holding the city of New York liable for violations of the Americans with Disabilities Act by not providing reliable electricity during Superstorm Sandy, resulting in the disabled not being able to equally access disaster relief.

The full report can be downloaded at **www.cleanegroup.org/assets/Uploads/2014-Files/Clean-Energy-for-Resilient-Communities-Report-Feb2014.pdf**.

Conclusion

New public resources combined with innovative, new financing models—as well as with established finance tools used in new ways—are beginning to be applied to resilient power for critical facilities and infrastructure.

In the coming years, we expect states and municipalities will begin to address barriers to resilient power deployment through additional funding programs. These programs will tackle technical, policy, financial and market barriers.

Markets for resilient power will continue to develop, and resilient power will become an established and accepted part of any state or local resiliency plan, along with committed funding, technical support, and program assistance.

Clean Energy Group will continue to work closely with states and localities to address the technical, policy, and financial barriers to implement resilient power projects. Those who wish to follow this progress are encouraged to use the resources found at http://www.resilient-power.org.

RESILIENT POWER
A Project of Clean Energy Group

Endnotes

[1]See http://www.nj.gov/dca/divisions/sandyrecovery/pdf/NJ%20Action%20Plan%20Substantial%20Amendment%202%202%20final.pdf

[2]The $800 million in state-supported bonds and finance program funding includes the initial $218 million capitalization towards the announced $1 billion NY Green Bank; $125 million in funding for Alaska's Sustainable Energy Transmission and Supply Development Fund (SETS), and other state-supported bonds and financing programs in CA, CT, HI, IL, MA, NY and OH.

[3]See http://www.cdfa.net/cdfa/cdfaweb.nsf/ord/a29a508ba91c423b882579360067f74a

[4]See http://www4.eere.energy.gov/wip/solutioncenter/finance_guide/content/tax_exempt_bond_financing_nonprofit_organizations_and_industries

[5]SunSmart E-Shelter Program, http://www.fsec.ucf.edu/en/education/sunsmart/index.html

[6]See http://www.cleanegroup.org/blog/emerging-finance-models-for-resilient-infrastructure/#.VC2L1Y10yUk

[7]See http://www.nj.gov/dca/divisions/sandyrecovery/pdf/NJ%20Action%20Plan%20Substantial%20Amendment%202%202%20final.pdf

[8]"Reduce Risk, Increase Clean Energy," Clean Energy & Bond Finance Initiative, August 2013, http://www.cleanegroup.org/assets/Uploads/2013-Files/Reports/CEBFI-Reduce-Risk-Increase-Clean-Energy-Report-August2013.pdf

[9]See http://energy.gov/sites/prod/files/2014/07/f17/Renewable%20Energy%20and%20Efficient%20Energy%20Projects%20Solicitation%20FINAL.pdf

[10]See http://www.seia.org/policy/finance-tax/third-party-financing

[11]See http://www.lexology.com/library/detail.aspx?g=81aac2fa-3d0b-46e8-aac4-ca8835223adc

[12]"Maryland Resiliency Through Microgrids Task Force Report," http://energy.maryland.gov/documents/MarylandResiliencyThroughMicrogridsTaskForceReport_000.pdf

[13]See http://www.cesa.org/assets/2014-Files/GMP/GMP-PR.pdf

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President and founder of Clean Energy Group

Lewis Milford is president and founder of Clean Energy Group (CEG) and founder of the Clean Energy States Alliance (CESA), two national nonprofit organizations that work with state, federal, and international organizations to promote clean energy technology, policy, finance, and innovation. For Clean Energy Group, Mr. Milford directs the Clean Energy Finance Project (www.cleanegroup.org/ceg-projects/clean-energy-finance/) and the Resilient Power Project (www.resilient-power.org) as well as other projects involving natural gas and renewable power. Mr. Milford is also a nonresident senior fellow at the Brookings Institution. He works with many public agencies and private investors in the United States and Europe that finance clean energy. Mr. Milford is frequently asked to appear as an expert panelist at energy conferences throughout the United States and Europe. His articles on clean energy have appeared in many publications including The New York Times, The Boston Globe, The National Journal, The Huffington Post, and Solar Today. He has a J.D. from Georgetown Law Center and is a Phi Beta Kappa graduate of Rutgers College. LMilford@cleanegroup.org

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Clean Energy Group

Clean Energy Group (CEG) is a national, nonprofit organization that promotes effective clean energy policies, develops low-carbon technology innovation strategies, and works on new financial tools to advance clean energy markets. CEG works at the state, national, and international levels with stakeholders from government, the private sector, and nonprofit organizations. CEG promotes clean energy technologies in several different market segments, including resilient power, energy storage, solar, and offshore wind. Above all, CEG also works to create comprehensive policy and finance strategies to scale up clean energy technologies through smart market mechanisms, commercialization pathways, and financial engineering. CEG created and now manages a sister organization, the Clean Energy States Alliance, a national nonprofit coalition of public agencies and organizations working together to advance clean energy through public funding initiatives.

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Innovation in Finance, Technology & Policy

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