Clean Energy for Resilient Communities:

Expanding Solar Generation in Baltimore's Low-Income Neighborhoods

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Summary for Policymakers

Report Prepared for The Abell Foundation
by Clean Energy Group

Robert G. Sanders
Lewis Milford

CleanEnergyGroup
Innovation in Finance, Technology & Policy

Clean Energy Group (CEG)

CEG is a leading national, nonprofit advocacy organization working on innovative technology, finance, and policy programs in the areas of clean energy and climate change. CEG also manages the Clean Energy States Alliance, a coalition of state and municipal clean energy funds. For more information about CEG, visit www.cleanegroup.org.

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The full report is available for download at http://www.cleanegroup.org/ceg-resources/

Report Summary

This report, prepared for The Abell Foundation, makes recommendations for expanding the use of solar generation for community development in Baltimore, Maryland.

The paper concludes that the best way to do that is to expand the use of solar photovoltaic (PV) with battery storage—to enable low-income populations to benefit from the long-term savings that can be realized through the use of renewable energy, and to protect vulnerable populations from the damaging effects of power outages in severe weather events.

This report is opportunistic. It tries to steer clear of a conventional approach that argues only for long and deep subsidies for solar to reach the poor, knowing that such an approach usually does not last. Instead, it calls for use of solar in situations where policy and market trends are already emerging—to protect the vulnerable from harm in the face of increasing extreme weather events, to attract companies to deliver clean energy services with new business models, and to use public funds wisely through new financing tools.

The report is designed to address several "divides" in clean energy and community development. We have a technology gap between poor and the well-off where the well-off get the technology benefits first. We have a public policy gap that has largely supported financing for solar among the better off but not the poor. And we have a philanthropic gap where foundations could do much more to advance clean energy to protect vulnerable populations from more frequent severe weather events brought on by climate change.

All gaps must be closed to better serve the most vulnerable citizens in most need of basic services like electric power, particularly when it is needed the most.

The Case for Resilient Power

Last summer a prolonged, 14-day, extreme heat event affecting Maryland, Ohio, Virginia and West Virginia immediately followed a series of powerful thunderstorms that knocked out electricity for 3.8 million people for up to eight days. Thirty-two people (12 of them from Maryland) died from excessive heat exposure, which was made worse by the loss of power.

This and other extreme weather events have created a call to action for deploying more resilient power in our many diverse communities.

Toward that end, the report rests on several assumptions:

- **Building stronger and more resilient local communities has always been at the core of community development.** Community development aims to overcome poverty and disadvantage by investing in the physical infrastructure of neighborhoods, building family income and wealth, improving access to quality education, and promoting social equity.
- **By increasing solar electricity generation, the negative health and environmental impacts resulting from the greenhouse gases and other pollutants emitted from fossil fuel electricity generation can be reduced.**
- **Increasing PV distributed generation provides an economic case** for the fixed, long-term price advantage of solar over fossil fuel-based generation with its volatile fuel prices.

- **New threats brought on by climate change are adding to the pervasive threats to community well-being**, and are especially deleterious to the most vulnerable among us—the poor, the elderly, and the disabled.
- **The definition of what a resilient community is and needs to be has changed** for the millions of people in Maryland who lost power and suffered widespread damage and harm during Superstorm Sandy and the derecho of 2012.
- **Extreme weather events and resulting power outages deprive a community of its most basic need**—the electricity that powers multiple levels of urban infra-structure and economic activity, and makes social interdependence possible.
- **Resilient communities need resilient power.** Without dependable power, a community can be brought to its knees, and the most vulnerable will suffer the most.
- **New technologies like solar with storage, with new financing tools, can be effective strategies to provide critical public facilities with more reliable power.** New businesses are emerging that can provide leasing and other financing options to bring these reliable technologies to broader markets.

Recommendations

Recommendations to open clean energy opportunity to low-income communities and protect vulnerable populations by serving critical power loads include the following:

- **City officials should implement policies to advance distributed solar generation and support the deployment of solar with storage** as a resilient power application for critical facilities that provide services to low-income communities. To advance this goal, the following should be considered:
  - The city should incorporate solar PV with other high-performance energy measures in the design and implementtation of Baltimore City's 10-year plan to renovate or replace its 136 school buildings.
  - 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 should require that a portion of the 10 MW of solar generation that is to be developed in Baltimore under the Exelon/Constellation merger agreement be represented by projects that provide direct benefit for low-income communities.
  - A portion of casino local impact grants should be designated for solar PV community projects.
  - A "resilient power toolkit" and model resilient power zoning/planning ordinances for the state of Maryland and its municipalities need to be created.
- **The city of Baltimore and its development finance agencies should utilize existing bond financing and credit enhancement mechanisms**, as well as third-party ownership and financing structures, to develop solar on public buildings and nonprofit-owned facilities.
  - Given an early integrated design process, proceeds from the $1.1 billion bond issuance for the first phase of Baltimore City's public school construction and revitalization initiative can be used to fund solar and other high- performance

energy measures within normal budgets established for school construction.

- 501(c)(3) bond financing can be provided to large nonprofit institutions with "big box" real estate portfolios for building renovations and high-performance energy measures, including solar PV.
- 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 should support community initiatives to expand distributed solar generation as a community development tool.**
  - Parties should ensure that workforce development funds and job training programs are integrated with public funding of solar PV in low-income communities.
  - Bulk purchasing programs similar to DC SUN, which combines a consumer purchasing co-op model with consumer education for energy, should be considered for replication in Baltimore.

- **The state should enact legislation to support increased distributed solar generation benefiting low-income communities**.
  - The state legislature should increase or repurpose the system benefits charge to create an innovative public benefits fund to leverage private investment in renewable energy projects benefiting low-income communities.
  - Legislation should be reintroduced to enact community solar legislation in Maryland.

- **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 local philanthropic and policy communities should consider systematic strategies to advance resilient clean energy solutions in Baltimore, which would protect vulnerable populations from severe weather events.**

Resilient Communities and Resilient Power

Building stronger and more resilient local communities has always been at the core of community development. It aims to overcome poverty and disadvantage by investing in the physical infrastructure of neighborhoods, building family income and wealth, improving access to quality education, and promoting social equity.

Adding to the well-known and pervasive challenges to community well-being are new threats brought on by climate change, which can impact especially the most vulnerable among us—the poor, the elderly, and the disabled.

For millions of people in the Maryland area, Superstorm Sandy and the derecho of 2012 have now changed the definition of what a resilient community is and needs to be.

Resilient communities need resilient power. Without dependable power, a community can be brought to its knees. Extreme weather events and resulting power outages deprive a community of its most basic need—the electricity that makes the multiple levels of urban infrastructure, economic activity, and social interdependence possible.

All infrastructure systems are vulnerable to power disruptions, whether they are buildings, utilities, gasoline, health care, telecommunications, transportation, water and wastewater, food supply, solid waste—and public safety. All rely on electricity, which is the community's lifeblood.

We have learned from recent extreme weather events that a community without dependable and reliable power is a community at risk. The consequences of losing power are stark, especially for low-income residents, the elderly, and the disabled.

The damage and harm caused by 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, jobs, access to communication channels and information, and insurance to recover from the adverse impacts of extreme weather events.

These dangers are often forgotten after the immediate damage from these events is over. But public agencies concerned with the health and welfare of its most vulnerable residents must come to realize that these impacts are not inevitable; they can be prevented.

This brings us to our focus on solar and battery storage options, where the link between clean energy and resilient communities can be found. Clean energy, especially distributed solar with battery storage, can keep solar up and running in a power outage. Solar with storage can be a useful community development tool to create community power resiliency, while at the same time leveraging public and private investment in low-income communities. (See Box 1)

This paper will consider strategies that increase distributed solar power in Baltimore, with a focus on solar with battery storage.

There are several primary goals of this approach. One is that by increasing solar electricity generation we can reduce the negative health and environmental impacts resulting from the

greenhouse gases and other pollutants emitted from fossil fuel electricity generation. Another is the economic case for the fixed, long-term price advantage of solar, with no fuel costs. And another is to provide power resiliency.

We approach those goals with one question in mind when thinking about solar generation as a community development tool for inner cities like Baltimore: **What are the needs of low-income residents who must be served?**

When it comes to power, the answers are clear. They need reliable, low-cost power to serve their daily needs, chill their medicine, keep the lights on and elevators running in a storm—and that will stabilize their electricity bills.

This focus on power resiliency comes from an examination of what are the best strategies to provide low-income communities with access to the benefits of solar power. We could affirm those policies that say it is better to completely subsidize the technology for low-income households, using deep subsidy to essentially give the poor solar at little or no cost. That strategy depends on heavy subsidies over the long run, which can prove to be an unreliable and unsustainable approach.

For that reason, we find it is better to align new business models that may be ready to serve those markets without deep subsidy. We believe this strategy to be more promising.

That leads us to focus on power resiliency as a way to tap into emerging business and technology markets for solar battery storage. That approach would give community buildings and schools and other facilities more power protection in the event of severe weather events. We think this approach makes more business, political, and economic sense for the communities of concern. Moreover, while there is an important environmental benefit, such an approach is directed to doing a basic job of government and public policy: to protect citizens from harm.

Two governors, from Massachusetts and from New York, have announced their support for just this approach by committing significant new funding to resilient power systems totaling $80 million in the month of January 2014 alone.

Governor Deval Patrick has committed more than $50 million to help communities in Massachusetts prepare for and protect themselves from the increasing number of destructive storms and rising sea levels associated with climate change. Most of the money, about $40 million, will be disbursed as grants to help cities install backup power systems using clean technologies such as advanced batteries that store energy from solar panels.[1]

In New York, the state will establish the “New York Prize,” a $40 million competition aimed at jump-starting at least 10 “independent, community-based electric distributions systems” across the state. The projects will operate in conjunction with the grid most of the time. But during emergencies, the microgrids will be able to disconnect from the grid and power themselves, providing islands of resilient power for hospitals, police departments, fire stations, gas stations and other critical services.[2] These proposed microgrids are seen as "the means to increase reliability and give local communities more control of their energy systems, while also allowing for the adoption of clean and efficient distributed energy sources such as solar or combined heat and power."[3]

Developing resilient power broadens the value proposition for solar and addresses the point that solar projects often have higher up-front costs than many competing energy options. The challenge is to find ways to provide greater value—such as power protection for vulnerable populations—to justify that added cost for solar with battery storage.

Following this market-based approach, this report is designed to explore some basic issues:

- How solar technologies can help the poor, the disabled and the elderly with their day-to-day lives, especially in the face of threats from more frequent extreme weather events in the future;
- How solar, configured with battery storage, can help protect lives by keeping the elevators running and the air conditioner on in senior centers and housing during a power outage;
- How clean resilient power can help reduce the risk of heat stroke and hypothermia in vulnerable populations during power emergencies and extreme weather events;
- How public facilities like schools can be powered by solar power with battery storage, or other forms of clean energy generation, to serve as emergency shelters;
- How cities can ensure that critical public facilities like shelters, emergency centers, and police and fire stations are equipped with more reliable power to withstand the next storm;
- How public policies and utility support programs can be targeted to provide opportunities in low-income communities for distributed solar generation and community power resiliency; and
- How these new measures to protect vulnerable populations from power outages also provide a public health benefit by reducing the environmental impacts of conventional electricity generation on low-income communities.

There is a related issue of social equity that is concerned with which neighborhoods are more likely to install solar PV and who is left behind. One commentator has remarked:

> *"As rooftop solar has become more popular among homes and businesses, installation costs have fallen, decreasing by almost 30 percent since 2007. Yet even with the lower cost, solar is still too costly for many homeowners and business owners. And, while there has been a boom in solar installation companies …in recent years, most do not target low-income households."*[4]

This strategy, which focuses on resiliency, is consistent with trends in Maryland policy. Governor O'Malley was appointed to the President's Task Force on Climate Preparedness and Resilience, which was created to "provide recommendations to the President on removing barriers to resilient investments, modernizing Federal grant and loan programs to better support local efforts, and developing information and tools we need to prepare."

Maryland also has been a leader in the solar resiliency field, an area of innovation that can be further advanced in Baltimore.

Recently, the state provided support for the installation of 402 kW of solar PV with battery storage in Laurel, Maryland. This kind of development could be replicated to power Baltimore's hospitals, community centers, large nonprofit service organizations and public schools to serve critical loads in community facilities in the event of grid power outages.

Finally, this resilient power approach, which relies on solar storage technology, stands in contrast to standard practices that are used today to protect against power outages resulting from extreme weather events. We tend to rely exclusively on diesel-powered standby generators to provide emergency power. But conventional generators have had poor reliability track records, require fuel that can be difficult to obtain following a storm, contribute to local and regional pollution, and emit harmful

greenhouse gasses, including carbon monoxide, which is hazardous in enclosed spaces.

There are other distributed generation technologies such as fuel cells and combined heat and power systems that use natural gas and require on-site applications for the considerable heat they generate. Those solutions, while promising, are often much more expensive than solar with energy storage options, and are targeted to very specialized applications like hospitals and data centers, limiting their use in wider resilient power applications.

BOX 1

Resilient Power and Solar Storage

Resilient power is the provision of electricity to critical infrastructure, so that needed services can be maintained when a natural disaster knocks out portions of the electric grid. These critical services include food, water, shelter, heating and cooling, medical and emergency services, communications, and fueling. Facilities that can provide these services include hospitals, nursing homes, community buildings, schools, shelters, distribution centers, gas stations, and cell towers, among others.

A PV system generates electricity when the sun shines. If a cloud happens to come between the sun and the PV modules, electricity generated from the PV system will fall quickly. One way to deal with this problem is to add battery storage to the PV system. Now, when local generation of electricity exceeds local demand, the excess electricity is first used to charge the battery. When the battery is fully charged, excess power is exported to the grid.

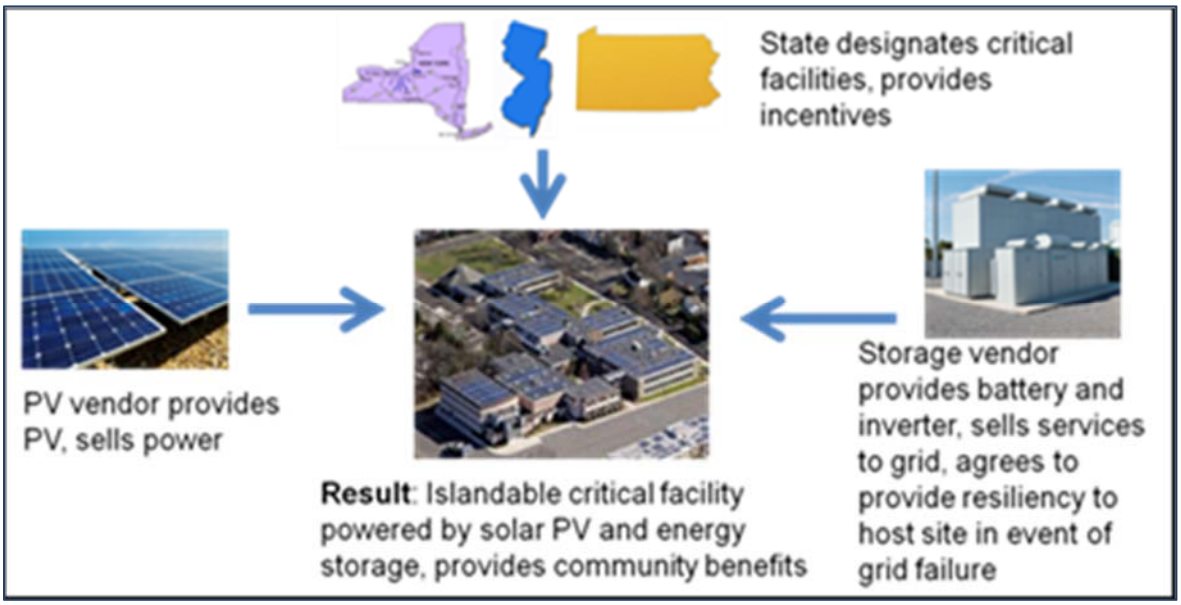
It is important to note that a grid-connected PV system cannot, by itself, provide electricity during a power outage—a fact too few know. However, solar PV with a battery storage component can provide power if the grid goes down.

Solar energy storage refers to combining solar PV with battery storage. In order to provide a resilient power benefit to a local facility, special switches are added that can isolate (or 'island') the PV/battery-storage system in case of a grid failure. When the larger grid goes down due to a natural disaster, a switch is thrown that decouples the local circuit and allows it to continue to function as an isolated unit. In this scenario, the local facility would need to drop non-essential load, keeping only its critical loads powered, in order to extend the life of the battery's charge.

For example, a university's critical loads might include lighting and HVAC equipment in buildings designated as community emergency shelters. Other loads, such as non-critical buildings (libraries, computer labs, theaters, etc.) would not be powered. The PV system would continue to charge the battery and power critical loads when the sun was shining, and the battery would power critical loads when there was not enough solar power.

This simple system becomes more cost-effective when additional revenue streams from grid services are factored in. Owners of solar battery storage equipment could earn significant revenue 24 hours a day by selling ancillary services to the grid, such as frequency regulation services. It could also engage in electricity arbitrage, buying cheap power at off-peak times and discharging it during peak demand times, when it is most valuable. Because grid-damaging natural disasters occur infrequently, this greatly improves the cost/benefit calculation for the PV/storage system. If the grid were to go down, the PV/battery-storage system would island just as before, providing valuable critical services to the community at large.

New third-party battery companies are beginning to take advantage of the revenue streams made possible by the Federal Energy Regulatory Commission (FERC) orders requiring fair compensation for grid services. These companies provide the battery and inverter free of charge, collocated with a PV or wind generator. Their business models are based on the provision of grid services—services that energy storage systems like batteries can provide very quickly and accurately. Such new business models could make it much easier for customers to add storage to existing solar systems, or to build storage into new systems, through what are essentially leasing or PPA arrangements similar to the third-party models that have made PV much more accessible and popular.



Source: Solar Grid Storage

For more information on solar energy storage and resilient power, see:

http://www.forbes.com/sites/peterdetwiler/2014/01/17/solar-grid-storage-finding-value-in-grid-frequency-regulation/,

http://theenergycollective.com/lewmilford/297551/solar-storage-new-resilient-clean-energy-technology

http://www.cleanenergystates.org/assets/Uploads/RPP-Webinar-Presentations-Energy-Storage-New-Markets-and-Business-Models.pdf

Box 2

What Can Stakeholders Do?

City

- Require that a portion of the 10 MW of solar generation to be developed in Baltimore under the Constellation / Exelon merger agreement directly benefit low-income communities.
- Prioritize resources for the development of solar resilient power projects to reinforce the critical facilities identified in the DP3 plan.
- Implement new bond financing models (such as the Morris Model) to finance solar on government buildings, including schools, libraries, fire/police and other government services.
- Collocate solar with other bond-financed projects – schools, utility infrastructure upgrades, economic development and public housing bond issuances.
- Target affordable and elderly multifamily housing and large nonprofit institutions serving low-income communities (Blind Industries, Goodwill, etc.) as a strategy for meeting the 10MW solar generation goal for Baltimore under the Constellation/Exelon merger agreement.
- Designate a portion of casino local impact funds for solar PV and energy efficiency community projects.

State

- Establish or repurpose a system benefits charge to create an innovative public benefits fund to leverage private investment in CE projects benefiting low-income communities.
- Enact community solar legislation in Maryland.

Utilities

- Require that a portion of the 10 MW of solar generation to be developed in Baltimore under the Constellation / Exelon merger agreement directly benefit low-income communities.
- Target large nonprofit institutions serving low-income communities (Blind Industries, Goodwill, etc.).

Nonprofits and community organizations

- Support the expansion of the GRID Alternatives program model to Baltimore, in partnership with Civic Works' existing energy weatherization and job training programs.
- Create bulk purchasing programs similar to DC SUN, which combines a consumer purchasing co-op model with energy consumer education.

Foundations

- Provide catalytic funding support to:
  - Create a working group that serves as a learning network on policies, programs and finance strategies to create a more resilient power system.
  - Identify new planning tools to address resilient power issues in a systematic way.

Endnotes

[1] See: http://www.bostonglobe.com/business/2014/01/14/state-give-for-backup-power-systems-coastal-protection-climate-concerns-grow/aAhGixnTxshzoBEEGFDqgN/story.html

[2] See: https://www.greentechmedia.com/articles/read/new-york-plans-40m-in-prizes-for-storm-resilient-microgrids

[3] "New York State Smart Grid Consortium Applauds Gov. Cuomo's Vision for Community-Based Energy Solutions," January 8, 2014 press release of New York State Smart Grid Consortium, a group including state agencies, universities and research labs, utilities and smart grid vendors, http://nyssmartgrid.com/wp-content/uploads/NYS-Smart-Grid_State-of-the-State-Response_FINAL_010814.pdf

[4] See "Greening the Hood: Is Clean Energy Reaching Poor Communities?" http://newamericamedia.org/2013/11/greening-the-hood-is-clean-energy-reaching-poor-communities.php

Clean Energy Group
50 State Street, Suite 1
Montpelier, VT 05602
www.cleanegroup.org

info@cleanegroup.org