A REPORT TO THE KRESGE FOUNDATION, SURDNA FOUNDATION, AND THE JPB FOUNDATION

A RESILIENT POWER CAPITAL SCAN

How Foundations Could Use Grants and Investments to Advance Solar and Storage in Low-Income Communities

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RESILIENTPOWER

A project of CleanEnergyGroup

ABSTRACT

This report, one in a series of reports by Clean Energy Group and Meridian Institute on advancing resilient power in low-income communities, seeks to address how foundations can best develop a portfolio of capital interventions—from grants to impact investments—that together would successfully scale up the solar+storage/resilient power market to benefit low-income populations and to advance their missions. It provides a capital scan of foundation opportunities and actions to guide foundation financial support for this market.

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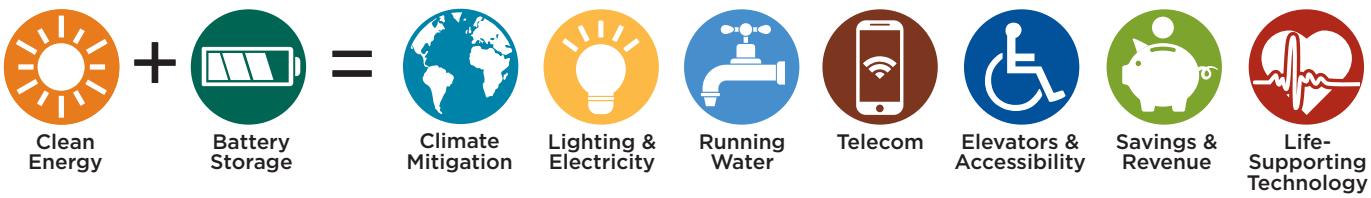

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Preface

SOLAR ELECTRICITY PLUS BATTERY storage (solar+storage) provides energy resilience, reduces electric bills, and provides a powerful means of integrating higher percentages of clean renewable energy into our grid supply.

But to date, solar+storage installations have largely targeted high-end commercial markets to reduce electric bills. With few exceptions, low-income markets have not yet benefited from these technologies.

The challenge is how to expand this quickly developing solar+storage market in ways that benefit low-income communities, affordable housing, and critical community facilities as well. What are the right investments, educational tools, technical assistance, and policy supports that are needed to drive the emerging market to help meet low-income needs?

In May 2016, The Kresge Foundation and Surdna Foundation (with additional support of The JPB Foundation) commissioned Clean Energy Group (CEG) to conduct a "capital scan" of grant and investment opportunities in the resilient power space. The resulting report is part of the Resilient Power Project, a joint project of the CEG (*www.cleanegroup.org*) and Meridian Institute (*www.merid.org*). 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 vulnerable populations.

For this report, CEG conducted over thirty interviews with market participants across the resilient power value chain, including solar+storage developers, affordable housing owners and advocates, NGOs, government officials, financial institutions, private foundations, and investors.

We have identified five categories of market barriers that must be addressed if this market is to serve low-income communities. These barriers, in turn, require a broad range of grant and investment interventions. Importantly, we identify these interventions based on the leveraged impact they can achieve in moving the larger market towards community resilient power projects.

The proposed interventions in this report are not provided as investment advice or as recommendations or solicitations to invest in any particular organization, project or financial security. The recommendations made in this capital scan are offered as being representative of the types of investments and grants that would help build the market for solar+storage technologies to benefit low-income communities. A full due diligence review of any specific investment opportunity exceeds the scope of this capital scan, and each foundation should rely on its own due diligence analysis before making an investment.

Executive Summary

BENDING THE ARC OF SOLAR+STORAGE TECHNOLOGIES TO SERVE LOW-INCOME MARKETS

THROUGHOUT THE COUNTRY, THERE IS A clean energy divide between the haves and the have-nots. The tremendous success of clean energy technologies like solar photovoltaics (PV) over the last decade has largely bypassed low- and moderate-income (LMI) communities. Now, the more affluent communities and large commercial companies around the country are installing energy systems using the combination of solar PV and battery storage (solar+storage) technologies for economic and resiliency benefits, assisted by generous public subsidies collected from all taxpayers and utility customers. Low-income customers have not been able to access these same benefits.

This clean energy and equity problem presents a timely opportunity to bend the arc of this successful technology trend to ensure that low-income communities share in these new technology markets.

It is unmistakable that solar and storage is entering a robust, market acceleration phase. For the first time, renewable technologies like solar are outpacing the installation of fossil fuel generation.[1] While the costs of solar are continuing to decline, battery storage also is expected to follow that low-cost trajectory.[2] Many expect the costs of battery storage to fall by half in the next four years.[3]

The "Holy Grail" of renewable technology—battery storage—is taking off like never before, to provide energy resiliency, reduce electric bills, and deliver the flexibility to allow for increased deployment of renewable power.[4] This is a remarkable success story. Some have even proposed this future as one of "free" energy, where communities can generate their own renewable power and, once the system is paid for, can continue to generate this power without future energy bills.

We also know that more storage in the power system allows for greater penetration of intermittent solar on the grid, reducing our reliance on fossil fuels and addressing climate change. And we have seen recently new studies showing how proper siting of storage can reduce emissions in low-income communities by displacing the need for gas peaker plants.[5] The environmental and health benefits of storage are just beginning to be realized.

But to date, solar and storage installations are mostly serving only the high-end commercial markets. Hundreds of solar+storage projects are now in the development pipeline in California and other states.[6] Commercial businesses, typical first adopters, are installing these technologies to improve their bottom line—mainly by combining solar+storage to reduce electric bills. The projects are largely economically driven, not done for environmental or public health reasons.

With few exceptions, low-income markets have not yet benefited from these technologies for any purpose, whether for reducing their power bills or decreasing emissions from local power plants. There are a few low-income community projects in development in New York, New Jersey, and California, for example, where favorable markets and subsidies exist. But there are probably fewer than fifty solar+storage projects in development across the country that benefit low-income communities.

We know that more storage in the power system allows for greater penetration of intermittent solar on the grid, reducing our reliance on fossil plants and addressing climate change.

That said, there is good news in this story about bridging the clean energy divide.

The market for solar+storage is growing at a rate that is comparable to that of stand-alone solar a decade ago. There are now over 1 million solar projects installed throughout the U.S. as of 2016.[7] Of course, this result took a decade of advocacy and policy support. But it is a very strong indicator for the continued growth of solar+storage projects, if similar support is provided.

What this means is that the solar+storage market in low-income communities and for markets like affordable housing do not need to be created from scratch. It means that the emerging market growth in high-end communities has created momentum that can support installation of solar+storage projects in low-income communities that need resiliency and utility bill savings now, not years from now.

To achieve greater equity, the challenge is this: the emerging and robust solar+storage commercial market has to be expanded to low-income communities, affordable housing, and critical community facilities.

It is undoubtedly a significant but not a daunting challenge. The opportunities for success are real. There are several reasons to be hopeful about this work.

Above all, storage will likely move faster through the conventional markets because of the existing infrastructure now available for solar projects. That is, solar companies are now moving into storage. Companies like SolarCity have said all future solar projects in a few years will have battery storage. Storage will be paired with solar in all future commercial projects.[8] That standard will be the status quo. The solar+storage market is not about "if," it's about "when" and "who."

In addition, the structural foundations for commercial solar+storage markets are not yet mature. The business models for these companies are still evolving. Although this is now a market that has targeted wealthier customers, there is no reason that the low-income market cannot grow along with it. In general, buildings serving low-income communities face many of the same utility rate structures and market opportunities as higher-end customers.

There are other reasons why this challenge is one that can reasonably be achieved to benefit low-income communities, but with hard work.

There is a pressing social consensus to make clean energy more equitable—a sound basis for improving future public support. Some states such as California have expressly indicated the need for greater equity in public incentives for clean energy projects.

Moreover, there are new policy and related tools that are beginning to move these technologies into broader markets. An important example is the new California law, "AB 693," which sets aside up to $1 billion in cap and trade funds for solar and storage in affordable housing projects over the next decade.[9] If implemented properly, this work could reach over 150,000 housing units in the state. Communities are now starting to dedicate funding for clean energy in low-income communities.

And we have begun to see more advocacy toward these ends. In particular, in 2013, in the wake of Superstorm Sandy, CEG and Meridian Institute created the *Resilient Power Project*[10] to accelerate market development of solar+storage technologies for resilient power applications serving low-income communities.

The Resilient Power Project works to provide new technology solutions in affordable housing and critical community facilities to address key climate and resiliency challenges facing the country:

To achieve greater equity, the challenge is this: the emerging and robust solar+storage commercial market has to be expanded to low-income communities, affordable housing, and critical community facilities.

Community Resiliency—Solar+storage can provide revenue streams and reduce electricity bills, enhancing equity and community resiliency through economic benefits and powering potentially life-saving support systems during disasters and power outages.

Climate Adaptation—Solar+storage systems can provide highly reliable power resiliency as a form of climate adaptation in severe weather, allowing residents to shelter in place during power disruptions.

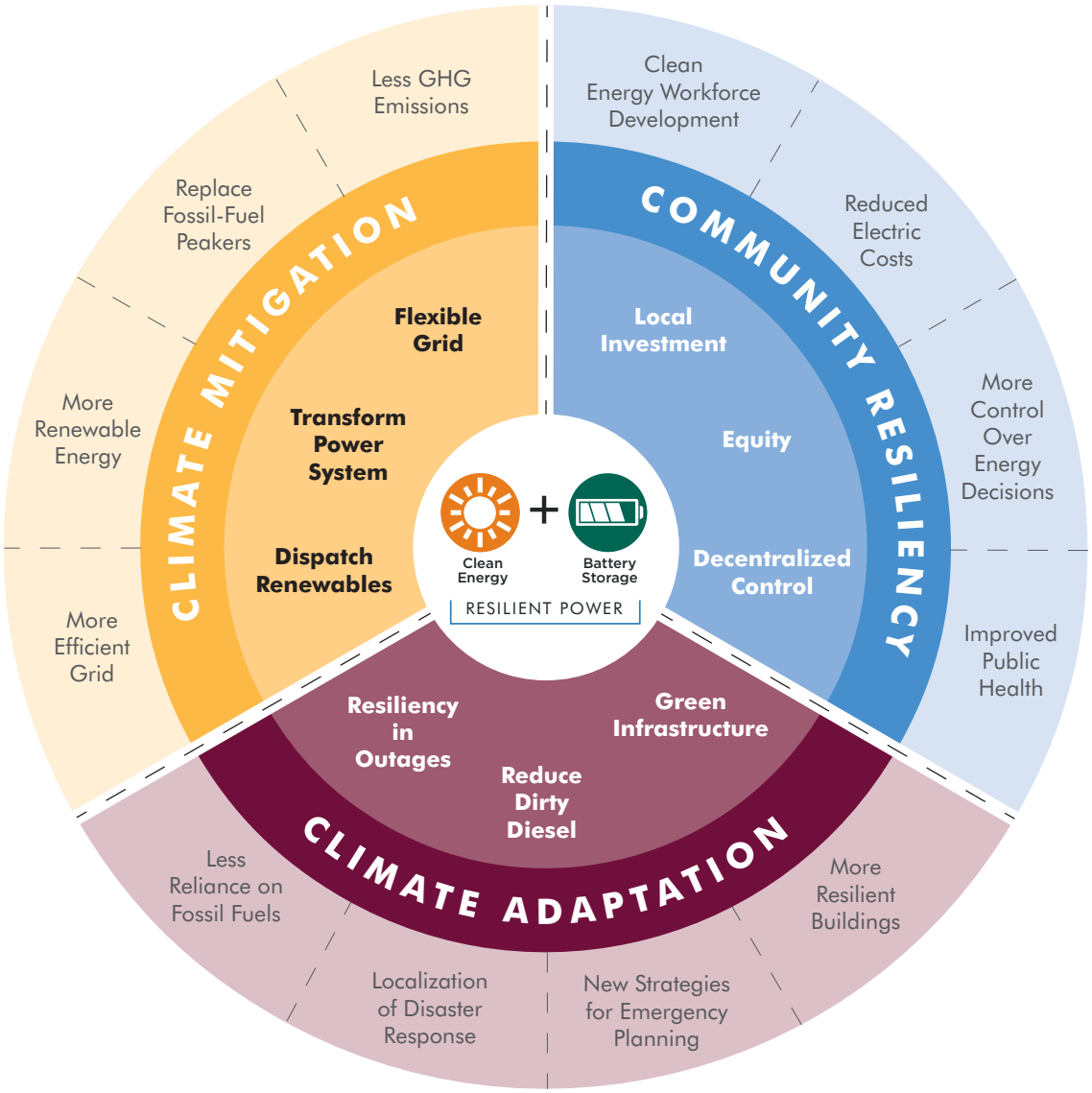
Climate Mitigation—Battery storage is an enabling technology and emerging market driver to increase adoption of solar PV for distributed, clean energy generation and to advance climate mitigation efforts.

Our work led us to understand this bottom line: that the solar and storage markets can be aligned with low-income community needs, if we have the right tools in place to make that happen.

But we also know that, currently, there is no systematic alignment of philanthropic funders or their grantees to bend this technology arc to ensure solar+storage reaches low-income communities. We have no consensus around the right investments, educational tools, technical assistance, or policy supports to drive the emerging market to help meet low-income needs.

And that gap brings us to this report. In May 2016, aware that foundation resources could play an integral role in

FIGURE 1
Benefits of Resilient Solar+Storage



aligning their interests in equity and clean energy with their missions to support sustainable communities, The Kresge Foundation and Surdna Foundation (with additional support of The JPB Foundation) commissioned CEG to conduct a "capital scan" of grant and investment opportunities in the resilient power (RP) space.

For these purposes, RP refers to the application of solar+storage technologies in affordable housing and community facilities.

Clean Energy Group's inquiry investigated a wide range of potential philanthropic interventions that could advance solar+storage in low- and moderate-income (LMI) communities for its environmental and social equity benefits. These interventions have the potential to accelerate the deployment of solar+storage to meet community and public needs, such as affordable housing, community facilities, and public buildings. As noted in this report, there are special barriers that constrain the development of the LMI market.

The Capital Scan project was designed to interview a range of parties to determine the gaps and investment opportunities to scale up the market for RP technologies with philanthropic interventions.

Over the last few months, CEG has conducted over 30 interviews with market participants across the RP value chain, including developers, advocates, service providers, technology companies, and financial institutions. In addition, these specific interviews are combined with information CEG has gleaned from participating as an advocate in this space and working with market players over the last three years.

Based on this information, CEG has reached several key conclusions about the opportunities for philanthropic interventions. In summary, we have identified five categories of market barriers that must be addressed if this market is to serve low-income communities.

These barriers, in turn, require a broad range of grant and investment interventions. Importantly, we identify these interventions based on the leveraged impact they can achieve in moving the larger market towards community RP projects. The investments that we identify should create significant social impact, not just individual company return.

The Capital Scan project was designed to interview a range of parties to determine the gaps and investment opportunities to scale up the market for RP technologies with philanthropic interventions.

(To be clear, we suggest types of grant and investment interventions that might be made to organizations and intermediaries that would impact a range of market participant groups. We are not recommending specific investments in particular companies and organizations.)

In particular, we have identified five market barriers to the deployment of RP technologies in low-income communities, based on our survey and in-depth interviews:

Barrier 1: *Need for an integrated development finance model to overcome finance gaps in this underserved market.*

Barrier 2: *Lack of internal capacity of portfolio owners, advocates, and public officials to develop RP projects.*

Barrier 3: *Insufficient energy data collection, policy research, and economic analysis to understand how to advance technology development in these markets.*

Barrier 4: *Need for additional capacity of technical services providers, project developers, and nonprofit intermediaries to reach low-income communities.*

Barrier 5: *Inadequate market rules, incentives, and regulatory policies to advance new solar+storage technologies in low-income markets.*

To overcome these market gaps, CEG proposes a wide range of grant and investment interventions—more than 50 interventions in all—than can be targeted to address a particular barrier. (It must be noted that more detailed analysis would be needed to support a definitive one-to-one set of recommendations on the impact of a specific intervention to address one or more of the barriers.)

The range of interventions, detailed more fully in the report, include the following:

Support New Tax Credit Aggregation Entity. There is a need for the creation of, outreach for, and initial administration of a new legal entity to aggregate multiple portfolio owners' solar+storage tax credits to create a scaled investment opportunity for investors.

Provide Credit Enhancement for Performance Risk. There is a need for credit enhancement for investors and building owners to reduce technology and performance risk (e.g., "performance loss reserve" to reimburse monetary losses from unrealized economic benefits).

Provide Working Capital. Provide working capital to fund predevelopment costs and bridge the payment of developers' fees that are often tied up in multiple projects.

Provide Long-term Capital. Provide 10-year term capital to take out construction financing (preferably with a 15-year amortization) and as a capital source for on-bill payment programs.

Create Online Project Software. Support the creation of an online software platform to assess the technical and financial feasibility of solar+storage in affordable housing and nonprofit-owned facilities.

Invest for LMI Expansion. Invest in existing companies active in RP project development in the commercial space to expand reach into LMI community markets.

Fund Leadership Awards to Owners. Provide funding ("Leadership Rewards") to portfolio owners through nonprofit intermediaries for offsetting the organizational costs and new predevelopment costs of first-time solar+storage projects (e.g., technical and legal review, doc prep, assembling additional development team members, compliance, etc.).

Fund LMI Advocates. Provide funding to advocacy organizations to provide information and training to LMI residents on issues regarding resilient power with the goal of increasing LMI participation in policy discussions.

Support LMI Policies. Support creation of policies that require a reduction in utility bills for tenants in housing where energy storage projects are deployed to provide benefits to utilities.

Support Design Standards. Support local advocacy groups and technical service providers to create and advance mandated design standards.

Create Community Mandates. Support mandates for communities to require installation of RP projects in community facilities.

CEG proposes a wide range of grant and investment interventions—more than 50 interventions in all—than can be targeted to address a particular barrier.

Standardize Deals. Support nonprofit intermediaries' efforts to streamline and standardize deal structures and documents (e.g., power purchase agreements (PPAs) favorable to both investors and portfolio owners), as well as underwriting standards, to facilitate the aggregation of financing for bundled projects of 1 MW and larger.

Develop Consensus Policy Tools. Develop a consensus model template for state and community-based energy storage and solar policies, a standard advocacy toolkit for incentives, mandates, and other regulatory measures.

Create Public TA Funds. Communities, states, and other public entities should develop "public technical assistance funds" or "TAFs" to help low-income community advocates and developers understand their needs for resilient power projects and to get objective, fair information about whether projects will work for their communities.

Support New Housing Incentive Programs. Work to inform new state and community incentive policy that would provide public incentives for solar+storage on affordable housing like in California's new Multifamily Affordable Housing Solar Roofs Program (AB 693).

Support New Community Incentive Programs. Work to inform the development of similar "AB 693" incentive programs for critical community facilities in states, which would provide a subsidy to reduce the upfront cost of solar+storage technologies in critical community facilities like schools, emergency shelters, and fire and police stations.

Overall, the task ahead is challenging, but it is doable with a dedicated NGO and philanthropic strategy. We were here about ten years ago when the solar industry and NGOs wanted to create a path for the widespread installation of solar projects across the country. Now, based on that joint work, a million projects dot the country. It is true that they are not yet equitably distributed, but that work still goes on.

We can follow some of the basic rules in the playbook that brought solar to the market and apply it to solar+storage in low-income communities. We know how to shape these markets toward social purposes. It requires education, analysis, advocacy, information, economics and good policy. We know how to establish a framework of institutions, financial models, policies, and other structures to accelerate adoption of these new clean energy technologies into the low-income markets.

The interventions we propose will begin to create the market architecture for this more equitable transition through triple-bottom line strategies. As with solar, and just as new markets and finance structures were created to promote affordable housing development decades ago, we need to create a similar framework of tools and interventions to create an equitable solar+storage market today.

The remainder of this report is structured as follows:

- A background section to highlight the market context for engaging in this survey
- A list of participants surveyed for this work
- A detailed analysis of the five market barriers identified in this report along with a parallel list of philanthropic interventions to overcome those barriers
- A summary of suggested next steps
- A capital scan matrix that summarizes proposed interventions, grouped by market participants, to address market and financial barriers (Appendix A)

We know how to shape these markets toward social purposes. It requires education, analysis, advocacy, information, economics and good policy. We know how to establish a framework of institutions, financial models, policies, and other structures to accelerate adoption of these new clean energy technologies into the low-income markets.

SECTION ONE

Solar+Storage Markets Are Expanding with High-End Customers

WHILE MARKETS FOR SOLAR+STORAGE have grown in the last few years, the gains have been largely in high-end installations on commercial projects. Large energy consumers such as Walmart and owners of data centers have been early customers of these technologies because solar+storage can reduce their electric bills.

Solar+storage technologies have become proven and accepted; and they are being adopted in areas where the right market structures and incentives are in place, such as in California and in the Northeast.

A number of positive trends drive solar+storage markets today. Costs are steadily declining, with lithium-ion battery costs falling 50 percent in 2014 from the previous year.[11,12] Many compare the storage market to where the solar market was 10 years ago.[13]

There are several key findings from CEG's overall work in this emerging solar+storage market:

There seems to be a growing consensus that lithium-ion batteries will be the technology leader in this emerging market. While other technologies may be specified for certain project applications (e.g., lead acid and flow batteries for longer durations and less frequent cycling), the leading companies such as Tesla, SolarCity, Sonnen, and Green Charge Networks have built their businesses on lithium-ion technology. This technology has been tested in commercial, industrial, and residential applications and is commercially feasible today.

Increasingly, solar+storage systems are being structured with third-party ownership and leased to customers. Design, installation, maintenance and operation of the systems are the responsibility of the third-party owner, so the technology and performance risks are not falling on customers, in most cases.

A number of positive trends drive solar+storage markets today. Costs are steadily declining, with lithium-ion battery costs falling 50 percent in 2014 from the previous year. Many compare the storage market to where the solar market was 10 years ago.

The leasing option for solar+storage is still targeted to commercial markets with specific electricity demand profiles (where demand charges are high), and to high-end residential customers. Third-party ownership has been deployed in utility-scale projects and larger municipal projects (e.g., water treatment facilities) and financed through existing credit facilities extended to publicly traded energy services companies (e.g., Schneider Electric).

For both purchase financing and third-party ownership financing for applications in low-income communities, there is still need for credit enhancement and other financial incentives for community facilities, for new and closely held companies, and for affordable housing developers (including public housing authorities) that want to install solar+storage for the many economic and resilience benefits it provides.

Electricity market structures and public incentives are the keys to market growth. Market rules are developing in many localities that allow owners of battery storage systems to realize significant cost savings from reduced electric bills, and to obtain revenue from participating in demand response markets and other revenue streams such as fast response, grid stability markets. Getting the market rules right is critical to being able

to access financing on commercially reasonable terms. And being able to stack multiple cost savings and revenue streams to the benefit of building owners and their tenants is critical to developing a robust pipeline of financeable solar+storage projects.

(In some emerging cases in California, this includes adding electric vehicle (EV) charging stations to the mix of solar and batteries, which provides another source of revenue through subscription services.)

The future value of solar depends on energy storage. Recent changes in net metering policies in California and Nevada have only underscored the importance of battery storage to maintaining and increasing the value of solar PV.

Storage is seen as a key enabler to increase solar penetration and to reverse any possible erosion of the value of solar due to pressure to weaken net metering policies and the so-called "value deflation," said to occur when the grid has to accommodate increased generation from stand-alone solar. The future value of solar depends on energy storage. Recent changes in net metering policies in California and Nevada have only underscored the importance of battery storage to maintaining and increasing the value of solar PV.

In California and elsewhere, community solar is considered a major strategy to extending the benefits of solar to low-income communities; now the development of "community" storage is an increasingly important part of that conversation. Large-scale developers and consumers understand the value of this technology combination; a leading developer stated that by 2020, all solar projects will have storage.[14]

Small combined heat and power systems (mCHP) can increase the amount and duration of critical power loads that solar+storage can economically cover during power outages. It is a companion technology that should be considered when designing resilient power systems in multifamily buildings and community facilities. However, large CHP systems for water treatment facilities, hospitals, and industrial parks are a mature technology application that has ready access to conventional financing and does not require additional foundation support.

Similarly, microgrids have been successfully financed and built for universities, industrial parks, and other projects that have adjacent facilities that are owned by the same entity. They have often been a means of deploying large CHP systems and consequently require a large thermal load to make economic sense. Unfortunately, many microgrid projects being currently being proposed involve multiple non-adjacent properties involving mixed uses and multiple ownership entities.

The considerable complexity of such projects (technical, legal and regulatory) has resulted in many of them getting bogged down and not being completed. The most promising microgrid opportunities for resilient solar+storage systems are likely to be found in upgrading existing micro-grids and using site screening tools to identify large anchor sites with predictable energy loads.

While all markets depend on strong economics for a new technology to succeed commercially, ***the value placed on the benefits of energy resilience are more geographically dependent—and in no case is the value of resiliency explicitly and successfully incorporated in financial or policy considerations.*** The Northeast, due to Superstorm Sandy and other weather-related disasters, is prime territory for resiliency, while there is less sense of urgency to implement energy resilience in other states.

That will change as economic and human impacts from severe weather, and the vital role that resilient solar+storage technologies can play in protecting vulnerable populations from the dangers of power losses, are increasingly recognized.

SECTION TWO

Solar+Storage Markets in Low-Income Communities Lag Behind

SOCIAL EQUITY CONCERNS REGARDING solar+storage are not yet driving significant activity in the low-income market. There remains a "clean energy divide" as resilient power technologies are still struggling to be deployed in projects serving low-income communities.

At the outset of this inquiry, we identified a low-income market plagued by many obstacles. We still believe these and others are prevalent today. But again, solutions to overcome them are available and depend on coordinated action to succeed.

While there are over 500 solar and storage systems installed in high-end markets in states like California—mainly for large commercial customer bill reduction purposes—there are virtually none installed in affordable housing in the state. In other states, affordable housing developers are beginning to explore solar+storage, but progress is still too slow.

The good news is that solar and storage projects are somewhat more common in community facilities like schools, at least in states like California where incentives are robust and similarly in Eastern states with post-Sandy incentive programs.

But overall, the penetration of solar+storage in the LMI market in both housing and critical facilities is much too small to meet larger social needs.

We need to remember that solar+storage technologies can provide two new types of benefits to the LMI markets. First, combined they can substantially reduce electric bills of people in need, at significant levels (more on that below). Second, solar+storage can provide resilient power by allowing for buildings to operate with stored solar electricity when the power goes out, an increasing problem in climate induced severe weather events, as we saw in Superstorm Sandy.

At the same time, the advocacy community working on equity, housing and community resiliency has not yet focused fully on the economic or resilient opportunities from fully integrated systems that include energy efficiency, solar and battery storage. (The recent plan submitted by low-income and housing advocates in the CA AB 693 proceedings is the first such integrated effort, a potential model for future advocacy.)

So it is not surprising that—without that advocacy pressure for more integrated systems—government officials and housing owners have not responded to this unmet need.

Similarly, this early market suffers from a lack of the kind of policy support and incentives that were put in place years ago to create the conditions that have led to the significant growth of stand-alone solar. That is, the policy support for solar and storage in low-income communities is lacking and needs to be established.

Indeed, the lack of LMI solar+storage projects is reminiscent of what occurred in the early solar markets ten to fifteen years ago. Initially, that new clean energy technology first appeared in high-end markets, where customers had good credit histories and where technology providers (then mostly energy efficiency ESCOs or new solar upstarts) could make early sales.

It is only recently that solar markets have opened to LMI customers, but that penetration of stand-alone solar in LMI communities is still low. So it is not surprising that solar+storage is even smaller in market size.

In important respects, the high-end commercial market for solar+storage has far outpaced advocacy and philanthropic efforts to shape that technology trend to meet LMI markets. That is, the mainstream press and large customers now see the solar+storage market as the next new clean energy revolution, but it is still a novelty in the LMI market and in related advocacy efforts.

Until recently, there has been little recognition in the foundation, government, or advocacy communities about the transformational impact that solar+storage technologies could have on LMI energy equity issues. It has the ability to reduce bills for tenants in affordable housing that is equivalent to, and in many cases can exceed, energy efficiency savings.

It can increase resiliency in community facilities, and reduce greenhouse gas emissions and reliance on diesel generators in low-income communities. The breathtaking opportunities of this technology combination are only beginning to be realized.

The accompanying charts tell this astonishing and under-recognized story. Figure 2 shows how solar+storage can dramatically reduce affordable housing electric bills—*virtually eliminating total electric bills for affordable housing projects.*

Figure 3 shows how the energy savings of solar+storage compare with conventional energy efficiency measures in a typical housing project. In many cases, the economic benefits of energy efficiency for portfolio owners—perhaps an electric bill costs savings of 20 percent—are dwarfed by the additional bill savings of solar+storage that can further reduce total developer and tenant bills by an additional 70 percent. (These benefits can be expected in critical community facilities with similar utility tariff structures.)

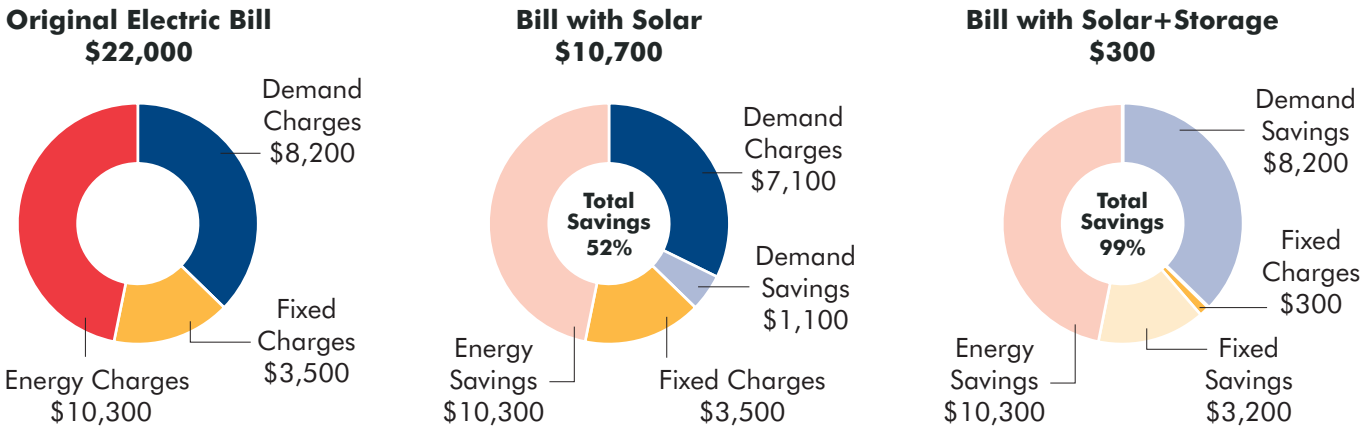
Now it is true that the most dramatic savings can be achieved in places like California where incentives are available for solar+storage systems, utility demand charges are high, and federal ITC tax credits can be combined with existing storage incentives.

Solar+storage incentives and favorable utility tariffs are not available everywhere, but they are showing up in more and more states. So work must be done to reduce the upfront capital costs and achieve these benefits across the country, especially in those states where policies and project economics are relatively favorable.

As a result of all these barriers and other limitations, and despite this new information, many specific market gaps exist in the LMI market. The reasons for this are noted below:

FIGURE 2

Impacts of solar and Solar+Storage at Multifamily Affordable Housing in California



SCE3 building original electric bill, electric bill and savings after deployment of solar, and electric bill and savings after deployment of solar+storage. Solar eliminates energy consumption expenses and lowers demand charges, saving $11,400. The addition of battery storage eliminates demand charge expenses and lowers fixed charges, saving an additional $10,300 per year.

FIGURE 3

Impacts of Clean Energy Technologies at Multifamily Affordable Housing in California

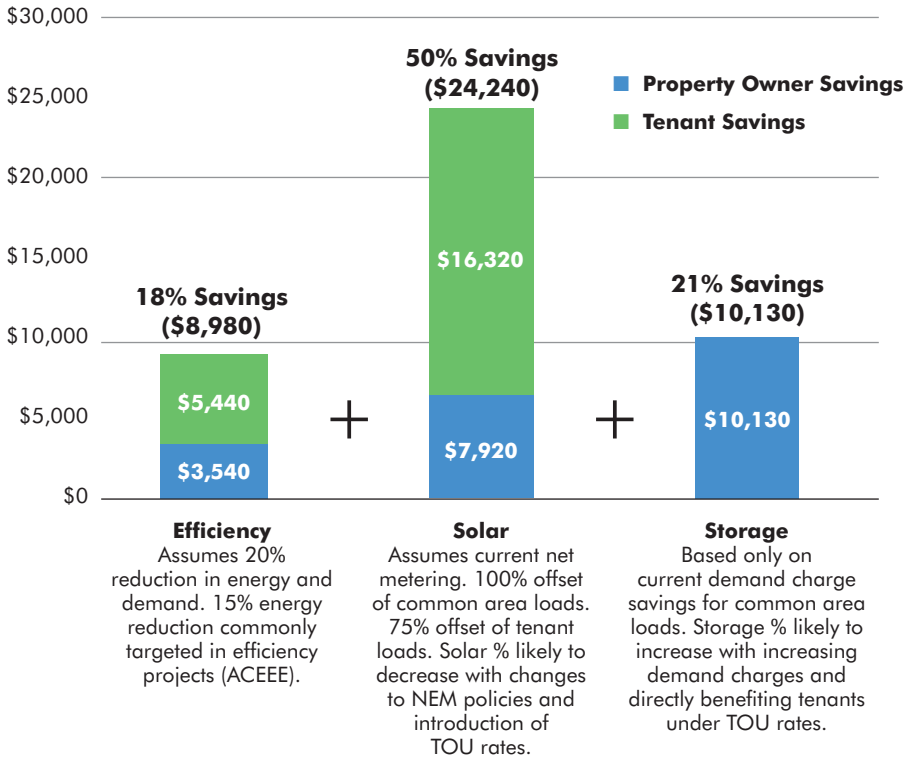
EXAMPLE

50-Unit Multifamily Affordable Housing in Southern California

Total Annual Electricity Bill for Owners and Tenants
$48,800

Total Annual Electricity Bill Savings from Efficiency+Solar+Storage
$43,350

Total Annual Electricity Bill Savings with all three technologies combined
89%



- There are too few completed projects in the LMI space for other interested building owners to evaluate. That lack of replicable completed projects makes scale hard to achieve.
- There are insufficient performance data. Building owners and lenders want to be able to analyze a track record of successful project development and operation over time.
- Further, there is too much uncertainty regarding how project pro formas compare with actual operations, which will be relevant to financial under-writing and PPA and energy service contract terms for these systems.
- Optimal configurations of battery storage systems with solar PV are still being worked out in different applications to meet the needs of different market segments (e.g., multifamily affordable housing, school-sited emergency shelters, and community healthcare facilities).
- One-off transactions using different energy storage technologies and system components result in higher transaction costs.
- There are capacity constraints and consequently a need for technical assistance for building owners interested in developing a resiliency solution.
- Low-income resiliency projects tend to be relatively small, disaggregated, and tailored.
- Significantly, no integrated development finance model exists to support installations of these technologies in community or housing projects in low-income areas. Solar+storage enhances "energy democracy" and allows the tenants in buildings to share directly in the benefits of combined community solar and community storage systems.
- And there are too few dedicated solar+storage developers like Bright Power in this space that focus on community and other public facilities, including affordable housing. There is a need for more experienced technical service providers to help analyze and support projects in underserved market segments like affordable housing and community facilities.

Overall, there is a lack of standardized information about how solar+storage can be applied to this sector (other than the material CEG has developed through its work with technical services providers, portfolio owners and state clean energy resilient power programs).

CONTINUED ON PAGE 18

Are Solar+Storage Projects Economic

A simple question that many ask about solar and storage projects is whether they are "economic" today in low-income markets. Because if they are not "economic" today—if they don't produce a reasonable and profitable return on investment in affordable housing or community facilities–then why waste the time trying to get projects done with additional foundation support?

Clean Energy Group (CEG) has examined that question in conjunction with its Resilient Power Project, which seeks to expand solar+storage technology deployment to benefit low-income communities. (See *www.resilient-power.org*.)

Before CEG conducted this capital scan, we prepared two studies on the economics of solar+storage in multifamily affordable housing: Closing the California Clean Energy Divide: Reducing Electric Bills in Affordable Multifamily Rental Housing with Solar+Storage (*www.cleanegroup.org/ceg-resources/resource/closing-the-california-clean-energy-divide*), which builds on our previous report, Resilience for Free: How Solar+Storage Projects Multifamily Affordable Housing from Power Outages at Little or No Net Cost (*www.cleanegroup.org/assets/2015/Resilience-for-Free.pdf*).

In the Closing the California Clean Energy Divide report, CEG retained Geli, a San Francisco firm that is one of the country's leading software firms for energy storage economic analysis on commercial C&I projects, to conduct the storage economics analysis on multifamily affordable housing. The economic analysis that Geli prepared for the California report found the same positive economics that support the many completed C&I projects.

Both reports showed that, depending on rate tariffs, market rules, and local incentives (which matter a great deal), solar and storage projects are "economic" in affordable multifamily housing now—just as they are "economic" in conventional markets: by using a combination of solar and storage technologies to reduce consumption and demand charges, resulting in dramatic bill reductions.

In that same way that hundreds of solar+storage projects have been completed for commercial customers (Walmart, Walgreens, UPS, 7Eleven, Safeway, Kaiser Permanente) to reduce utility demand charges, which represent a major portion of their utility bills, these projects are economic today in low-income markets. The economic case for solar+storage as a proven technology for reducing utility bills have been substan-tiated by the work of project analytics companies (Geli), project developers (Schneider Electric, SolarCity, Sonnen, Sunverge) and counterparties/strategic investors (Panasonic, GE, Constellation).

But even though these projects are "economic" in low-income communities, there is no guarantee they will be adopted in affordable housing and community facilities projects without additional foundation investment interventions through PRIs, MRIs, or grants.

We know this based on a working knowledge of an extensive body of research into market barriers in low-income markets to the adoption of new clean energy technologies like energy efficiency and solar. That work has shown that otherwise "economic" projects in conventional upscale markets are not adopted in low-income or similarly constrained markets due to a variety of market barriers, which are detailed in Section 4 of this report.

For energy efficiency projects, these barriers range from a lack of data about multifamily retrofit performance, to a lack of programs specifically targeting multifamily buildings, to a lack of financing. See Multifamily Energy Efficiency: Reported Barriers and Emerging Practices (ACEEE), *http://aceee.org/files/pdf/resource/epc_%20multifamily_housing_13.pdf*).

For solar projects, barriers range from high upfront costs, to access to financing, to nonalignment between owner and resident regarding the economic benefits and incentives of a project. (See Low Income Solar Policy Guide (GRID Alternatives et al.), *http://docketpublic.energy.ca.gov/PublicDocuments/16-OIR-02/TN210817_20160322T171526_LowIncome_Solar_Policy_Guide.pdf*).

One of the findings in this above cited Low-Income Solar Policy Guide is that:

> "In order to bring low-income participation in solar to scale, the low-income market sector will need to provide competitive and vibrant industry opportunities. This market sector will not develop or scale under the same incentive structures designed for the general market. In fact, without targeted, intentional incentives for investments, the low-income solar market will unlikely develop or scale at all."

It is fairly well accepted in the policy and foundation world that those barriers in turn need to be overcome by policy and foundation intervention like PRIs or grants to move even "economic" projects into these LMI markets like affordable housing or community facilities.

The capital scan simply extends this long line of empirical research and applies it to the new emerging solar+storage LMI market.

CEG took the current favorable economic analyses of solar+storage projects—and the slow uptake of their adoption—as the starting point for the capital scan. That is, if projects are economic now, why are they not moving more quickly into this market and what can foundations do about it? That is the basis for the capital scan and the recommendations it makes

Over time lease financing and other third-party ownership financing structures are expected to become as important to battery storage as they have been to stand-alone solar. This will likely increase the availability of lease financing options for public facilities and residents in low-income communities. But for now, lease financing is still credit-driven, and credit enhancement will be needed to extend lease financing as an option for energy storage in low-income communities (much as it is today for stand-alone solar).

Moreover, it is clear that there is inadequate regulatory and policy support to encourage energy storage and resilient power in the LMI market. Targeted incentives are starting to emerging, such as the passage of AB 693 in California where it is expected that up to $1 billion in cap and trade funds will be dedicated to solar and storage in affordable housing over the next ten years. But more must be put in place around the country to bring down the costs in LMI markets.

And no similar "AB 693 type incentive" is available to help support community resilient projects, a major policy and incentive gap that must be bridged if municipalities and the NGO community are to participate in the economic and environmental benefits of local resilient power projects.

Oddly enough, adding to the impetus in favor of storage are negative changes to solar policy around the country. In many states, there are calls for reducing the value of net metering and increasing demand charges and other fixed utility bill charges—policy changes that would make solar less economically valuable and could have unintended consequences on low-income utility bills across the country. Battery storage is uniquely able to offset those bill impacts for LMI markets going forward.

Some good news is that foundations can have a major impact in spurring change in this space. They can work together on the solar+storage market in the LMI space, along the lines outlined in this paper. All foundations with an interest in clean energy and equity can find something to support in this capital scan, from grants to investments in areas like information gathering, data support, company expansion and policy.

In addition, there is something else foundations can do that is not outlined in this paper, but it is part of overall efforts to build the solar+storage market. There is a philanthropic synergy between LMI foundation funders and climate funders that can be developed through a shared interest in expanding solar and storage markets. Solar+storage has the potential to bring about amazing economic and resiliency benefits to LMI constituencies in affordable housing and community facilities. At the same time, working to expand solar+storage markets is also the key to dramatic greenhouse gas emissions (GHG) reductions by expanding solar markets and enabling the power grid to accommodate much larger amounts of renewable energy to replace fossil fuel generated power.

That overlap between LMI foundations and climate foundation should be recognized and addressed with coordinated strategies that promote solar+storage for economic, equity and climate purposes.

There is no conflict between clean energy equity advocacy in LMI markets and technology-driven climate advocacy for storage. Arguing for more robust solar+storage markets joins the two strategies, combining equity and climate concerns.

We are seeing an increasing interest from project developers and portfolio owners in obtaining technical assistance and flexible capital to evaluate and implement resiliency projects. These project opportunities are located throughout the country, but the technical and capital resources tend to be local and tied to specific states and utility territories. There is a need to support the regional and national expansion of technical and capital resources and to coordinate these efforts to engage federal agencies and leverage private capital.

To mesh these efforts, consideration should be given to creating a dedicated multi-foundation strategy to advance these integrated technologies (energy efficiency, solar, and battery storage) in both the low-income sector *and* in the climate sector. From the perspective of an NGO in both areas, it seems that these different foundation strategies for equity and for climate are walled in their own silos, and apparently not working all that well together. This is unfortunate and fails to build on the strength of each effort to bolster and educate the other. Once the opportunities are understood, a synergistic solar+storage advocacy to advance both LMI equity and related climate mitigation efforts should be explored.

SECTION THREE

Capital Scan Interviews

OVER THE LAST FEW MONTHS, CLEAN ENERGY GROUP has conducted over thirty interviews to identify more detailed barriers to expanding clean, resilient power technologies into the low-income community. This work has allowed us to deepen our understanding of this market with a group of experts, advocates, and practitioners in this space. The following companies and organizations were interviewed in the preparation of this report:

- ACEEE (James Barrett)
- AF Mensah (Adje Mensah)
- Arup (Russell Carr)
- Beneficial State Bank (Kat Taylor)
- Bright Power (Henry Misas)
- California Housing Partnership Corporation (Wayne Waite)
- Center for Social Inclusion (Anthony Giancatarino)
- Center for Sustainable Energy (Ben Airth)
- Community Power Network (Anya Schoolman)
- Connecticut Green Bank (Bert Hunter)
- Disability Rights Advocates (Sid Wolinsky)
- Elevate Energy (Anne Evens)
- Energy Foundation (Dan Adler)
- Enterprise Community Partners (Julia Shin, Tom Osdoba)
- Geli (Andrew Tanner)
- The Kresge Foundation (Kim Dempsey, Sean Feng)
- LINC Housing (Samara Larson)
- Mary Reynolds Babcock Foundation (Sandra Mikush)
- Massachusetts Department of Energy Resources (Kara Sergeant)
- NAACP (Jacqueline Patterson)
- Nathan Cummings Foundation (Sharon Alpert)
- Perella Weinberg Partners (Chip Krotee)
- Powertree (Stacey Reineccius)
- Preservation of Affordable Housing (Toby Ast)
- Promise Energy (Andy Mannle)
- San Francisco Department of the Environment (Kacia Brockman)
- SolarCity (Francesca Wahl)
- Sonnen (Olaf Lohr)
- Surdna Foundation (Alison Corwin)
- Tesla Energy (Sarah Van Cleve)
- The Point CDC (Danny Peralta)
- Urban Ingenuity (Bracken Hendricks)

Examples of Investment Vehicles

Program Related Investments

Provision of Capital

- Provide capital for a *predevelopment loan pool* (0 percent for up to 2 years to fund 75 percent of predevelopment costs; can be forgiven if the project does not go forward).
- Provide a *working capital facility* to finance predevelopment costs and bridge the payment of a portion of developers' fees that are often tied up in multiple projects.
- Provide a source of *five-year project financing* (or alternatively, credit enhancement) so third-party project developers can prove out the utility and community resiliency benefits of solar+storage until utilities can gain approval to own the systems themselves.
- Provide a source of *10- to 15-year permanent capital* to take out construction financing and fund on-bill payment programs, PACE and prepaid PPA financing structures.

Credit Enhancement

- Provide credit enhancement to lenders/investors for project developers and building owners to reduce project completion, technology & performance risks, structured as:
  - *"Performance loss reserves"* to reimburse monetary losses from unrealized economic benefits.
  - *Loan loss reserves, subordinated debt facilities and guarantees* to leverage additional capital for projects financing, as well as facilitate utility contract payment agreements. The guarantees and reserves would burn off over the term of the financing subject to performance.

Mission Related Investments

- *Place MRIs through fund managers* with a track record in clean energy investments.

Grants Supporting Financial Interventions

- Support the creation, outreach and initial operations of *a new or repurposed legal entity to aggregate multiple portfolio owners' solar+storage tax credits* to create a scaled investment opportunity for investors.
- Fund *50 percent of a more generous underwriting fee (3–5 percent)* paid to lenders at closing (the balance to be paid by borrower) to incentivize lenders.

SECTION FOUR

Barriers and Interventions

THROUGH THIS WORK, WE HAVE developed the first, comprehensive assessment of the obstacles to offering clean energy, solar and storage technologies in low-income markets—and how matters of equity and fairness can be solved by leveraging significant foundation support to attract additional capital and scale efforts in those markets.

Our investigation informs the actions needed to penetrate these markets and get to scale—these markets are now stymied by a host of market, regulatory, and financial barriers.

We have identified a set of five barrier categories.

BARRIER 1: Need for an integrated development finance model to overcome finance gaps in this underserved market.

BARRIER 2: Lack of internal capacity of portfolio owners, advocates, and public officials to develop projects.

BARRIER 3: Insufficient energy data collection, policy research, and economic analysis to understand how to advance technology development in these markets.

BARRIER 4: Need for additional capacity of technical services providers, project developers, and nonprofit intermediaries to reach low-income communities.

BARRIER 5: Inadequate market rules, incentives, and regulatory policies to advance new solar+storage technologies in low-income markets.

For each broad barrier set, we propose a comprehensive list of foundation interventions for consideration in the sections that come next. The interventions proposed include a broad suite of philanthropic actions, including grants, program related investments (PRIs) and mission related investments (MRIs).

Each of the proposed investment interventions falls at different points on a series of continuums:

- Lower vs. higher financial risk
- Short-term vs. long-term capital
- More capital intensive vs. less capital intensive
- The degree to which interventions achieve high leverage and high impact (i.e., efficiency of program related capital)
- System level impact vs. local individual project impact
- Direct investment or via third-party intermediaries

The above evaluation continuums are a useful frame for foundation staff to consider when conducting a thorough due diligence analysis of prospective investments in conjunction with their investment analysis teams.

What is clear from this investigation is that at this early stage of the market, there is a special need for deeply subordinated dollars or grants to encourage partnerships between project developers, portfolio owners, CDFIs, and green banks so that pipelines of financeable projects can be assembled.

And as noted at the outset, these interventions are generic in scope and do not identify specific organizations or companies that should receive those investments. Those decisions should come at the next stage of this inquiry, after careful consideration by foundations consistent with their established due diligence processes.

Each of the five barriers listed below is discussed in the context of the findings of this inquiry. The proposed foundation interventions for each of the five barriers have been selected for their potential to address existing financing, policy, knowledge and capacity gaps and leverage considerable new investment and resources. Quotes from various interviewees are also included in each section.

Also it should be noted that the barriers and interventions are set out in groups, not paired one to one. At this time, the

nature of the survey did not support such a direct connection, and we did not want to convey a false sense of precision about this work at this stage. And further, such a structure would have made for more difficult narrative flow for a reader trying to understand this complicated work in the first instance. In any case, additional work with foundations, their investment officers and others is needed to reach that investment level granularity.

The barriers and interventions are described in detail below.

Barrier 1

Need for an integrated development finance model to overcome finance gaps in this underserved market

Commercial customers and utilities are developing solar, wind, and energy storage projects at scale, which has resulted in banks and other institutional investors actively seeking to finance these projects.

But deploying solar+storage technologies in LMI communities is something new. It raises a host of financing concerns that must be de-risked in order to bring needed capital into the space.

These risks include:

- The usual credit underwriting concerns of sufficient equity investment
- Reasonable assurance of repayment from project operations
- The project completion track record of the development team
- The operation and maintenance of the resilient power system
- The financial performance of the project over time
- Uncertainty regarding how project *pro formas* compare with actual operations

These risks and uncertainties affect the ability to readily source both purchase financing and third-party ownership PPAs and lease financing for project developers and portfolio owners.

Need for Flexible Capital

We found many portfolio owners, project developers, and financing entities resolved to develop and finance projects, if new sources of flexible capital and other support could be accessed. In one interview, we were told that $15 million of 10–15-year permanent financing is needed for California projects financed under a major vendor's construction finance facility. There is also a need for low-cost permanent capital to finance Chicago projects through on-bill financing.

And although California projects can be financed primarily from Low Income Housing Tax Credit (LIHTC) and Investment Tax Credit (ITC) investor capital and state incentives, a source of permanent loan capital at favorable rates is still needed to complete project financing for prospective AB 693-funded multifamily affordable housing projects in California.

Need for Aggregated Tax Equity

Another challenge for portfolio owners is sourcing tax equity investment for solar+storage projects. There is a need to aggregate and package tax credits for investors and debt for multifamily affordable housing solar+storage projects in California and elsewhere. At present, there is no dedicated sponsoring legal entity to aggregate multiple portfolio owners' solar+storage tax credits, thereby creating a scaled investment opportunity for investors.

Currently, institutional investors look to the sponsor/aggregator to take all risks, including any losses related to project abandonment or delays. Because conventional commercial project sponsors can provide essentially 100 percent investor indemnification, robust pipelines, strong counter-parties, attractive economics and timely execution, ITC investors have little incentive to focus on LMI markets.

One approach for providing this financing may be to provide credit enhancement to a green bank or CDFI to backstop a hybrid commercial fund that can also accommodate LMI transactions.

Need for Growth and Working Capital

Project developers that are focused on LMI markets also have difficulty finding sources of growth/working capital. There is no ready source of predevelopment funds to identify, recruit and assess potential sites ($10K per property). There is no ready source of working capital that is available to bridge a portion of the developer's fee.

Similarly, there is no available source of preferred stock, subordinated debt and other performance-based mezzanine financing structures as a source of growth capital for project developers, solar+storage companies and technical service providers looking to expand and bend their companies' operations toward the LMI market.

Conventional Capital Not Available for These Risks

Conventional sources of capital are not well suited to address these emerging market credit needs. The kinds of capital identified above all represent credit risks that conventional sources of capital typically are unwilling to take.

Commercial banks and other lenders are often said to be risk-averse. But more accurately, their business is to manage and control for known risks. They avoid technology risk because it is a big unknown to them. They value strong performance track records (both in terms of successful project development and project operation over time), reasonable assurance of repayment from operations, a strong second way out (good collateral at liquidation values) and recourse to some strong balance sheet—i.e., some strong entity needs to stand behind the transaction.

They also like to see transactions of a large enough size—or pipelines of transactions that are profitable and properly structured—so that it's worth the brain damage to figure out something that is entirely new to them. When underwriting any new technology or market opportunity, credit enhancement becomes a very important tool.

Right now, no one is providing dedicated credit enhancement to commercial banks, CDFIs, or green banks to leverage these needed sources of capital. Guarantees and "performance loss reserves"—dollars that would reimburse monetary losses from unrealized economic benefits of the solar+storage technologies—are not available to reduce technology and performance risk for financing entities, portfolio owners and project developers.

BARRIER 1

Quotes from Interviewees

"PRIs must be as flexible as possible to be useful. Foundations should be willing to take some losses."

"It takes money to find the prospects."

"Beware of innovation that promotes a solution looking for a problem."

"There is a need for an aggregated investment vehicle for foundation MRIs. It is a serious problem in the philanthropic space."

"We need more foundations with experience in economic development to see this problem as a systematic market creation enterprise, to establish the financial, technical, and policy structures like we did with the affordable housing sector a few decades ago."

Similarly, there are no guarantees that could reduce merchant market risk and enable project developers to enter into utility contract payment agreements for projects benefiting both utilities and community facilities. Guarantees and loan loss reserves would enable more investors to fund commercial and civic PACE projects with uncomplicated capital stacks and cooperative existing lenders. The key to leveraging and deploying additional capital from public and private sources is greater flexibility in how foundation funding can be structured in a wide range of transactions that meet the needs of LMI project developers and portfolio owners. Tightly restricted capital that is limited to a specific loan product, use of proceeds or type of borrower will be difficult to deploy in a timely way, resulting in high administrative costs and low financing income for the participating lender.

An additional word is needed regarding CDFIs. CDFIs can potentially play a significant role in financing integrated energy solutions for LMI markets. But at this time few CDFIs have the expertise and resources to underwrite a pipeline of these transactions.

Foundation support is needed to cover the additional underwriting and servicing costs associated with new integrated energy transactions in LMI communities. Even where there is government-sourced long-term capital that is available, the capital's covenants may make it impossible to deploy the public funds without additional credit enhancement. Enterprise Community Loan Fund, for instance, has encountered this problem when trying to deploy its long-term FHLB credit facility to finance PACE and other resiliency financing transactions.

MRI Challenges

The challenge for making mission-related investments (MRIs) in this market is that the fiduciary standards required of these investments generally militate against making illiquid, below market and unrated or non-investment grade investments. It is also difficult to direct the use of funds for desired impacts when investing in a publicly traded security. Furthermore, there are no established intermediaries at this time that are focused on packaging project type investments in this space. There may be greater opportunity for MRIs in emerging and rapidly expanding companies connected to solar+storage.

However, this remains an "infrastructure and "bending the technology arc" challenge—to create new structures and orient existing financial institutions and advisors to the emerging opportunity for foundations to make MRI-type investments in projects and companies in this space. That said, there are existing fund managers and advisors who are likely to be interested in identifying MRI prospects in this market.

Lack of Project Pipelines

For many reasons, it is difficult at this stage of the market to build robust pipelines of financeable projects. One challenge is marketing effectively to so many small property owners. It is important to broaden marketing and business development efforts in order to combine pipelines of projects spanning various market segments (including commercial), not just 100 percent LMI projects, which pooled transactions are then credit enhanced to meet the needs of investors.

There is a special need to develop a pipeline of municipal and publicly owned resilient power projects (e.g., police and fire facilities, emergency shelters, schools, etc.). To do so, though, requires outreach, education and third-party technical services to generate awareness and evaluate the financial and technical feasibility of specific projects. Once public decision makers understand the case for resilient power solutions for their critical public facilities and have decided to proceed with projects, then there are multiple financing options that may be available, including tax-exempt and taxable bonds for capital improvement projects and school bonds.

BARRIER 1

PROPOSED INTERVENTIONS

The following interventions have been designated as grants (G), program related investments (P) and mission related investments (M).

- **Support New Tax Aggregation Entity**
  Support the creation, outreach, and initial operations of a new or repurposed legal entity to aggregate multiple portfolio owners' solar+storage tax credits to create a scaled investment opportunity for investors. (G)

- **Provide Credit Enhancement**
  Provide credit enhancement for lenders/investors, project developers and building owners to reduce technology and performance risk (e.g., "performance loss reserve" to reimburse monetary losses from unrealized economic benefits). (P)

- **Facilitate Utility Contract Payments**
  Provide credit enhancement (loan loss reserves, guarantees, performance and investor rate of return guarantees) to backstop utility contract payment agreements. (P)

- **Cover Predevelopment Costs**
  Provide expanded and dedicated funding for predevelopment costs for identifying, recruiting and assessing potential sites (e.g., evaluating the properties and pulling the permits). Requires approximately $10K per property, and could be structured as revolving grants to be recovered at time of closing on project financing and used again for other projects. (G)

- **Provide Working Capital**
  Provide working capital to fund predevelopment costs and bridge the payment of developers' fees that are often tied up in multiple projects. (G, P)

- **Provide Leveraged Grants**
  Provide grants that leverage federal (e.g., FEMA) and state (e.g., NYSERDA) grants for project implementation. (G)

- **Support Business Models**
  Support analysis and pre-development costs to create business models and value sharing with utilities interested in solar+storage in LMI communities to defer capital investments in transmission and distribution. (G)

- **Provide Project Financing**
  Provide a source of five-year project financing or credit enhancement so third party project developers can prove out utility and community resiliency benefits of solar+storage until utilities can gain approval to own the systems themselves. (P)

- **Provide Long-term Financing**
  Provide 10-year term capital to take out construction financing (preferably with a 15-year amortization) and as a capital source for on-bill payment programs. (P)

- **Provide Debt Service Reserves**
  Provide debt service reserve funds to support initial projects of strong portfolio owners. (P)

- **Support PACE**
  Provide credit enhancement and/or capital to support commercial and civic PACE and prepaid PPA financing structures for aggregated multifamily affordable housing (including public housing) and nonprofit-owned community facilities projects. (P)

- **Provide Predevelopment Loan Pool**
  Provide capital for predevelopment loan pool (0 percent for up to two years to fund 75 percent of pre-development costs, can be forgiven if the project does not go forward). (G, P)

- **Provide Revolving Grants**
  Alternatively, structure funding for predevelopment costs as revolving grants that are refunded at time of closing on project financing or forgiven if the project does not move forward. (G)

- **Work with Banks and CDFIs**
  Provide a source of capital for subordinated debt, guarantees or first loss reserves to enable commercial banks, CDFIs, and green banks to participate in solar+storage projects. (P)

- **Fund Underwriting Fees**
  Fund 50 percent of a 3 percent underwriting fee paid to lenders at closing (the balance to be paid by borrower). (G)

- **Support C-PACE**
  Provide credit enhancement to C-PACE investors using loan loss reserves or subordinated financing. (P)

- **Provide Marketing Pipeline Support**
  Provide marketing support to identify and aggregate prospects into a viable pipeline. (G, P)

- **Select MRI Fund Managers**
  Place MRIs through fund managers with a track record in clean energy investments. (M)

- **Fund Education Efforts**
  Fund efforts to educate lenders and investors regarding the economic case for solar+storage, as well as available risk mitigation strategies. (G)

For property portfolio owners, organizational capacity is a big issue. Right now, few portfolio owners have the technical capacity to fully understand new energy systems like solar+storage, nor do they have the additional bandwidth and resources needed to adequately evaluate new technologies and then advocate internally to incorporate them into new projects.

Barrier 2

Lack of internal capacity of portfolio owners, advocates, and public officials to develop projects

New Technology Adoption Threats

Uncertainty, competing investment needs and opportunity costs all work against new technology adoption. The more sophisticated portfolio owners have energy managers who benchmark their properties and track portfolio energy data. But owners rarely are able to take it to the next step. Portfolio owners need help interpreting the data and making it actionable.

Different Motivations

One aspect of the reluctance to incorporate new technologies into development plans is an ongoing difference of motivations that exists between development staff and asset managers within housing development organizations.

New technologies like solar+storage are easily "value engineered" out of development budgets at the last minute. Long-term savings and other operating benefits that are important to asset managers have to compete with the priorities of development staff. And it is the project development fees that development staff generate that defray the organization's overhead expenses and help build its balance sheet.

Education and Training

At a basic level, staff also needs education and training on clean energy and related technologies and their application to multifamily affordable housing and community facilities. Development and asset management staff do not know the additional considerations, approvals and development costs that are associated with these technologies, or how the technologies actually perform over time in terms of reliability and cost savings. Many portfolio owners are still unaware about the economic and resilience benefits of solar+storage. These are major impediments to projects being implemented.

New Markets

We are at the beginning of the market development for this technology in meeting LMI and public needs. Consequently, completed projects that demonstrate the new technology's efficacy for community needs are of critical importance to portfolio owners.

Demonstration projects allow portfolio owners to work through the development issues specific to new technologies and provide performance data that portfolio owners and financing entities require, accelerating the growth of project pipelines for solar+storage. These initial projects reduce risk to the owner by funding the assembling of a development team of technical service providers, utility representatives, and others to design and implement the project. And it helps secure buy-in from portfolio owners, which is the biggest issue for solar+storage project developers.

Steep Learning Curve

Even with favorable funding for initial projects, there is a very real learning curve that creates uncertainty and financial costs for property owners. Resources are needed to fund the unavoidable missteps, delays, and costs associated with incorporating new technology solutions. And importantly, timely and reliable information from indepen-dent third parties is a critical resource for owners wishing to move forward with projects.

NGOs, Equity and Energy

Similarly, advocacy organizations need extensive education and support to understand and address equity concerns in clean energy development. LMI residents or developers may not be clear about the connection between issues of environ-mental justice and energy resilience.

This lack of awareness and engagement is not helped by the usual exclusion of LMI residents in solar+storage policy discussions, with the notable exception of the AB 693 proceedings underway in California.

Limits in Government Agencies

As large portfolio owners themselves, municipal and state governments are faced with many of the same challenges that affordable housing and community facility property

owners encounter when considering solar+storage. There is no dedicated source of funding to support energy resilience in public buildings. Although there are sustainability offices in many cities, there is no one whose job it is to design and implement resilient power projects for city properties.

Understaffed Agencies

To complicate the picture, municipal planning departments are frequently understaffed and unable to prepare applications for federal funding for resilient power projects (i.e., FEMA grants). They are also challenged to identify local match funding, which is required to leverage federal grants. Even when the interest is there, they often lack the resources to conduct workshops and other education and outreach activities to community groups on energy resilience and equity issues.

BARRIER 2
PROPOSED INTERVENTIONS

The following interventions have been designated as grants (G), program related investments (P) and mission related investments (M).

- **Fund a Developers' Working Group**
  Fund the creation of (and support owner participation in) a "Developers' Working Group on Solar and Storage in Affordable Housing." (G)

- **Fund Leadership Awards**
  Provide funding ("Leadership rewards") to portfolio owners through nonprofit intermediaries for offsetting the organizational costs and new predevelop-ment costs of first-time solar+storage projects (e.g., technical and legal review, documentation preparation, assembling additional development team members, compliance, etc.). These resources would pay for staff time, scoping expenses and other predevelopment costs. (G)

- **Support Incentives by Housing Agencies**
  Support a national strategy to have state housing finance agencies incorporate incentives (voluntary points) in their qualified allocation plans that encourage property owners to implement energy high performance measures, including solar+storage. (G)

BARRIER 2
Quotes from Interviewees

"Developers don't want to be the first. Most developers want to be second or third, not first."

"Even if the clean energy were free, the developers wouldn't have the bandwidth to work on new projects."

"The irony is that the capital is out there, but the market conditions need to develop for LMI communities to access it—and it will not happen on its own."

"Property owners need to be convinced."

"Pilots [demonstration projects] really do work through the issues."

- **Support Community-Led Research**
  Support community-led research and workshops that demonstrate the feasibility, and create awareness, of how solar+storage can benefit low-income communities. (G)

- **Fund Training to LMI NGOs**
  Provide funding to advocacy organizations to provide training to LMI residents in issues regarding resilient power with the goal of increasing LMI participation in policy discussions. (G)

- **Fund the Creations of a Muni Group**
  Fund the creation of (and support owner participation in) a "Municipalities' Working Group on Community Solar and Storage." (G)

- **Fund Implementation Grants**
  Provide "Leadership Implementation Grants" to municipalities to leverage other sources of funding for solar+storage demonstration projects, with the goal of proving out a portfolio-wide resilient power model to be financed through the conventional capital budget process. (G)

- **Support Green Ombuds/person**
  Overall, there is a need for some form of "green public ombudsman/woman" either public or NGO structured. This entity can help coordinate, perhaps on a state or community level, the resources, information and other support needed to get these projects done. (G)

Right now, in few communities or states is any dedicated staff devoted to ensure these projects get done in LMI communities. It is no one's job. Because it is no one's job, few projects get done, or when they do get done, it is due to the herculean effort of many individuals working informally to achieve success.

That is not a recipe for making great progress or scaling up this market. Just as foundations have funded generalist "sustainability officials in cities" they should consider a more dedicated effort to fund positions that focus on clean energy and equity issues—these issues are complicated enough that generalists often cannot make sufficient progress to make projects happen.

Barrier 3

Insufficient energy data collection, policy research, and economic analysis to understand how to advance technology development in these markets

In this early market for solar+storage, the most pressing need is for more reliable information. At present, there is a lack of data—and analysis of that data—on many key issues important to growing the mainstream and the LMI markets.

At a minimum, the following data, policy research, and economic analysis are missing from the market:

Lack of Building Data

Many if not most affordable housing developers and community facilities do not have a sophisticated sense of how their buildings use energy. They lack energy modeling and few understand the ramifications of their utility bills—like whether they face demand charges that can be reduced by battery storage.

Project Information Lacking

There is insufficient dissemination about how the hundreds of solar+storage systems in operation now work—their building economics, performance, and maintenance issues. There is no publicly available database of solar+storage building data now available in the U.S., even though many of these projects are subsidized with public dollars.

No Reliable Reference Cases

Without that database of information, building owners and developers that want to install new solar+storage systems have no reliable reference for comparing costs and technology performance to make intelligent energy decisions.

No Project Software

In addition, there is no existing software that now can be used to objectively assess whether to install solar and storage systems; at present, this is an individual consulting arrangement by providers that can have a bias toward certain systems or financing arrangements.

Insufficient Modeling

Without this data, there is insufficient analysis and optimization of the economic case for hybrid systems—those including energy efficiency and solar+storage, as well as small scale CHP—from both modeling and actual building project performance data.

No Market Validator

Right now, no party (other than Clean Energy Group) has the job of "market validation" to show how solar+storage will do what it claims to do.

Undercuts Demand

Then, without that data and optimization information, we do not know the level of demand for financing programs to deploy capital in a timely way.

No Lab Market Tracking

Similarly, unlike in the solar area, no federal energy lab is now tracking market trends in the space, to understand where policy and research should target interventions.

Policy Undermined

Without this level of data and analytical support, state policy development is hampered.

No Federal Strategy

Similarly, there is no federal policy strategy on data gathering or analysis in the solar+storage space, which makes it difficult to develop intelligent federal policy around market development and policy strategies.

Like Solar, So We Know What to Do

This absence of public data is common in early markets. The same thing occurred in the solar market. But we now know how the data and analytical capacity developed in the solar market and that can be duplicated today in the solar+storage market. It's simply a question of making the financial commitment to fund those efforts to accelerate the market with those new tools.

BARRIER 3

PROPOSED INTERVENTIONS

The following interventions have been designated as grants (G), program related investments (P) and mission related investments (M).

There are numerous grant and investment opportunities to build out the data gathering and analytical capacity needed in this space. If the LMI market is to take advantage of the emerging economic and resiliency benefits of solar and storage, greater investment in this front end work is needed to create the information infrastructure for this market to grow and prosper.

Here are some key interventions that a foundation could pursue to address these informational barriers.

- **Support Portfolio Owners**
  Support should be provided to portfolio owners so they can have their properties evaluated for comprehensive energy upgrades that combine solar+storage technologies with efficiency measures that achieve demand charge reduction and energy resilience. Although many portfolio properties are benchmarked against one another,

BARRIER 3

Quotes from Interviewees

"How can property owners make sophisticated decisions on things like solar and storage without key building energy use data?"

"Affordable housing portfolio owners do not have sufficient usage data to make good judgments on new technology like solar and storage. Even in markets like California, it can be costly and difficult to obtain tenant interval data to fully assess the economic benefits of these new systems."

"Even if we have building energy data history, most owners don't know how to use it."

"It's not difficult to create a public purpose software platform with sub-domains for affordable housing and community facilities that building owners could use to decide whether to install solar and storage systems."

"It's also not difficult to build a national data platform for building owners to use to evaluate comparable building profiles and better understand how to optimize for solar and storage."

few are analyzed using 15-minute interval utility data, and rarely do new construction and rehab projects undergo full building energy modeling. Technical service providers can interpret these data and turn them into actionable project proposals that portfolio owners can then consider and prioritize for implementation. (G)

- **Support Public Data**
  Both foundations and governments should jointly support a *public data platform of solar+storage systems in operation*, with real time information about project costs, benefits and performance. This could be maintained by national labs, with industry and NGO collaboration. (G)

- **Invest in New Software Platform**
  Investments should be made in a freely available, national software platform so that building owners could assess the potential to use solar+storage to reduce their electricity bills through measures like demand charge reduction, minimizing time of use (TOU) rates, and other measures. (Geli is beginning to develop this platform for commercial customers, but needs additional investment to expand the platform to include sub-domains for multifamily affordable housing and community facilities for the LMI market. Funding groups such as the National Renewable Energy Lab (NREL) for software development (with involvement of other groups, such as Arup), hosting, and maintenance of the publicly available tool is needed.) (G, P, M)

- **Provide Data to Property Owners**
  At the same time, it still will be important to provide individual data to property owners to supplement more standardized assistance, so greater support for state and regional Technical Assistance Funds (TAFs) is still an important and continuing investment opportunity for foundations. (G)

- **Fund an Independent Voice**
  Independent organizations like NGOs in this space should be supported to create an *independent voice* on project economics and potential for market development. (G)

- **Invest in Greater Analytics**
  Investments must be made in *greater analytical capacity to assess* project economics and technical optimization of systems involving energy efficiency, solar+storage and CHP, instead of one-off analysis that fails to create a baseline of optimal decision making. (G)

- **Funding for Customer Behavior Data**
  Better understanding of customer behavior is needed in this space to know what motivates or inhibits building owners from making decisions to install these new technologies. (G)

- **Fund New LMI Energy Office Positions**
  Foundations should support states and communities to improve their analytical understanding of these markets perhaps by funding new positions in state and local energy offices dedicated to development of LMI markets in this space. (Massachusetts has such a staff person dedicated to LMI issues.) (G)

- **Support Market Trend Analysis**
  Better policy making at the federal level depends on *greater investment in institutions assigned to keep track of market trends, project economics and policy implications* (like Lawrence Berkeley National Labs now does in solar). A national energy lab should develop the analytical capacity and the U.S. Department of Energy should fund a new data gathering initiative. (Foundations should support advocates to develop the strategic framework for this effort.) (G)

- **Fund New LMI Network**
  Local LMI advocates should be better funded to work together in a network to understand the technical and financial aspects of installing these systems in their communities. A new *Resilient Power Community Network* should be considered for new foundation support to bring together local advocates with other experts in the field. (G)

- **Fund New LMI Financing Group**
  Foundations should support greater collaborative efforts between NGOs, industry, LMI market participants and financing institutions to gain a better understanding of the data needed for conventional lenders to participate more actively in the LMI space. Creating a new *Financing Solar+Storage in LMI Markets Collaboration* should be considered. (G)

Barrier 4

Need for additional capacity of technical services providers, project developers and nonprofit intermediaries to reach low-income communities

Solar+storage project developers and technical service providers are on the front line of engaging property portfolio owners in new projects. But there are relatively few companies that are experienced in designing and developing solar+storage projects and very few that have targeted LMI markets.

In the instance of one company that works primarily with east coast portfolio owners, there are five solar engineers but only one engineer who can design energy storage systems with solar PV and other technologies. This represents a serious capacity constraint.

Property Owner Limits

Property portfolio owners—whether they own affordable housing, nonprofit or public buildings—admit to a lack of information and awareness about how energy storage can reduce utility costs and enhance the economic value of stand-alone solar projects. This makes it more difficult for solar+storage project developers and technical service providers to get portfolio owners seriously engaged in considering and proceeding with projects.

Widespread adoption of this new technology will not be achieved without greater success in educating portfolio owners and building awareness.

NGO Intermediaries

Independent nonprofit intermediaries have a vital role to play in sharing information that builds market awareness. There is also a need to identify and conduct preliminary screenings of prospective projects— essential work that is necessary for building financeable pipelines of projects.

New Online Tools Needed

This identification and screening of potential building projects would be greatly assisted by the development of new online tools that assess technical and economic feasibility at a high level, and that would be widely available for free to interested market participants. Such a tool would be an important aid to educating and enlisting solar developers in helping build pipelines of solar+storage projects.

BARRIER 4

Quotes from Interviewees

"There are only a handful of companies doing distributed storage and none is focused on low-income communities."

"We need to make solar and storage off the shelf, and accessible to all housing developers."

"There is a big capacity challenge to finding high quality contractors working in this market segment."

"We need to address the lack of confidence from LMI residents in new technologies like solar+storage—education is needed."

Microgrid Issues

Microgrids have been success-ully financed and built for universities, industrial parks, and other projects that have adjacent facilities that are owned by the same entity. But the considerable complexity of microgrid projects (technical, legal and regulatory) has resulted in many of them having difficulty being completed in LMI communities.

NGO Project Aggregators

Nonprofit intermediaries acting as project aggregators are now beginning to address the significant barriers to making these projects financeable by targeting and aggregating

sizable portfolio project pipe-lines, as well as standardizing deal and finance structures and documents.

HUD Disincentives

Another challenge facing nonprofit intermediaries and portfolio owners is the disincentive that exists in U.S. Department of Housing and Urban Development (HUD) assisted housing against energy retrofits that result in reduced utility costs for tenants. Currently, the rent amount is based on tenant income and is capped at 30 percent of a low-income tenant's income. What the tenant pays the landlord, though, is reduced by the utility allowance established by local housing authorities under HUD regulations. In other words, what the landlord gets is the agreed rent minus the utility allowance.

If a sub-metered tenant has reduced utility bills because of energy upgrades—including solar+storage—the tenant's rent payment to the landlord could go up.

BARRIER 4
PROPOSED INTERVENTIONS

The following interventions have been designated as grants (G), program related investments (P) and mission related investments (M).

- **Fund Fellowship**
  Fund a one-year fellowship to develop the data analytics for housing, non-profit and public community facilities to create the sub-domains (above), build their internal capacity to address this market segment and create education modules for portfolio owners and nonprofit intermediaries. (G)

- **Expand Service Providers**
  Support the regional expansion of technical service providers experienced in working with multifamily affordable housing and community facilities portfolio owners. (G, P)

- **Provide Capital to Public ESCOs**
  Provide growth and working capital to "public purpose ESCO" technical service providers who could address the LMI housing and community facilities market (e.g., the $1 billion affordable housing solar and solar+storage market opportunity in California over the next 10 years), but who need to build internal capacity by cross-training engineers, hiring additional installers, and project support staff, etc. (G, P)

- **Expand Companies into LMI**
  In addition to providing such capital to public purpose ESCO companies, work with the major entities now active in the commercial and industrial space to explore ways that investments could help them focus on the LMI market, to expand their conventional market strategy. (P, M)

- **Support Growth Capital to Developers**
  Provide project developers with growth and working capital and credit enhancement to expand their reach into low-income community markets and leverage additional capital for project financing requirements. Grants may be needed as well to support project developers' marketing and pre-development costs associated with the expansion of their business model to include housing and community facilities resilient power projects. Some of these Interventions include:

  - *Provide funding for predevelopment costs* for identifying, recruiting, and assessing potential sites, structured as "revolving" grants or a working capital credit facility. (G, P)
  - *Provide credit enhancement* (loan loss reserves, guarantees, performance and investor rate of return guarantees) to facilitate utility contract payment agreements. (P)
  - *Provide a source of five-year project financing* or credit enhancement so third-party project developers can prove out utility and community resiliency benefits of solar+storage until utilities can gain approval to own the systems themselves. (P)

- **Support Marketing and Outreach**
  Provide support for marketing and outreach activities that promote project developers' "energy management company" model whereby project developers contract with portfolio owners to monitor and maximize the energy performance of their entire portfolio of properties, as well as design and develop energy upgrade projects. (P)

- **Fund Intermediary Project Aggregation**
  Fund state and regional nonprofit intermediaries to assist with project aggregation through education, targeted outreach efforts to motivated portfolio owners, and preliminary building screening using online tools that are to be expanded to include targeted market segments. (G)

- **Support NGO Bundling of Portfolios**
  Support national nonprofit intermediaries that are bundling pipelines of portfolio projects into 1 MW or larger financing transactions (multifamily affordable housing, nonprofit-owned community facilities) by using standardized prepaid PPA documents and PACE financing structures. (G, P)

- **Expand Technical Assistance (TA) by NGOs**
  Fund nonprofit organizations to conduct TA efforts, work with housing developers and entities to do project reviews, analyze project performance and market trends, and otherwise serve as a trusted third-party intermediary that is needed to objectively provide un-biased data on projects and markets to LMI developers and advocates. (G)

- **Support NGO Work with HUD**
  Fund state nonprofit intermediaries to work with local housing authorities and HUD to resolve the utility allowance disincentive against low-income tenants retaining utility costs savings from energy upgrades. (G)

- **Support Advisers to Community Groups**
  Support expert NGOs that can serve as trusted advisers and intermediaries to community advocates that might not have the capacity and expertise to address energy issues, including on energy literacy as it relates to energy justice training, and consumer protection issues such as sales vs. leasing of solar PV and related technologies. (G)

Barrier 5

Inadequate market rules, incentives and regulatory policies to advance new solar and storage technologies in low-income markets

More affluent communities and large commercial companies now deploy most of the solar+storage technologies in the country, benefitting in part from generous public subsidies collected from all utility customers. Low-income customers have not been able to access these same benefits. Indeed, studies show that public clean energy incentives disproportionately flow to upper income households.

There are many financial instruments that can be developed to address these barriers. These finance tools are outlined in this paper. But finance alone will not suffice.

Public policy at this early market stage is important to do two things. First, policy can help accelerate these solar and storage tech-nologies in mainstream markets, to establish scale, achieve cost reductions and support market participants who can expand their offerings to LMI markets. Second, dedicated LMI policy tools can work alongside conventional market tools, to increase penetration of RP projects into LMI markets now, not decades from now.

(We make these recommendations knowing that some foundations do not support policy advocacy while others do. Depending on how that is defined, this work is open to support by many foundations working on state and local policy and incentives strategies.)

At present there are few policy tools in either the general or LMI markets to promote solar and storage technologies. That is problematic because the current cost of battery storage is still too high in many cases to result in financeable projects with sufficiently short payback periods, while other barriers stall significant project penetration. In contrast, the suite of policy tools and incentives now available for solar (15 years after it too was dubbed a "new technology") makes it generally economic today to install these technologies. And while battery storage improves the economics of stand-alone solar, policies and incentives will be needed to ensure widespread adoption, especially in underserved markets like affordable housing and community facilities.

In the mainstream markets, there are significant policy gaps:

Immature Markets

At present, immature markets for energy storage are not yet moving fast enough to capture the many benefits of energy storage and fully accelerate technology adoption and deployment. While there are hundreds of projects in high-end markets, these markets are fragmented and not well under-stood by key stakeholders like state policy makers, utilities, and grid operators.

BARRIER 5

Quotes from Interviewees

"There is no real solar and storage market in states like New York due to the lack of effective incentives and policies."

"We should support the development of mandates coupled with grants to put solar and storage in fire departments, public schools and other critical community facilities."

"We need to analyze the impact of new time of use tariffs on LMI communities and how to optimize regulatory policy for energy resilience for these communities."

"It's key to develop the right incentives and policy framework for solar+storage to achieve an economic case that supports five-year paybacks."

"A clear regulatory path is needed to pursue solar and storage in low-income communities."

Few Active Markets

The only active markets for storage are now in California, Hawaii and in the PJM Interconnection in the East. However other states have high demand charges (like Connecticut, Delaware) and should be targeted for projects.

Few Incentives

Few states have well-designed incentives to encourage project development. The key policy incentives that are needed to make projects in these early markets pencil out financially are: the application of the federal ITC to both solar and storage; state level incentives to reduce the upfront cost of storage (e.g., California's Self-Generation Incentive Program (SGIP); tariff structures that support storage's ability to reduce utility demand and TOU charges; and Public Utility Commission (PUC) mandates and targets that require utility investment in storage.

Uneven FERC Markets

A major barrier to the rapid expansion of energy storage is the lack of consistent application of FERC mandates and regional ISO/RTO implementation of market rules that would allow broad participation by energy storage in wholesale electricity markets. There is also no advocacy devoted to develop policy tools that consider regional differences in markets, policies and opportunities at the state and ISO levels.

Insufficient Advocacy at All Levels

At present, there is little advocacy work done around how to shape utility rate design to encourage energy storage, such as efforts to encourage PUCs to require evaluation of storage economics as an alternative to requests for additional distribution investment.

In the LMI market, the policy gap is even more pronounced.

Few Dedicated LMI Incentives

With the exception of only a few states with limited programs, there are virtually no dedicated incentive programs to reduce the upfront costs for solar and storage in either affordable housing or community facilities anywhere in the country. The exceptions are Massachusetts Department of Energy Resources' incentives for solar+storage in municipal-led projects, and New Jersey's rolling

rebate program for energy storage resiliency projects, as well as California's $1 billion AB 693 program for solar and storage in multifamily affordable housing that still must be developed. More states must implement these policies for this market to take off.

Virtually No Project Policies

There are no policies in place that would mandate the uptake of solar and storage in community facilities anywhere in the country for purposes of resiliency or for electric bill reduction—the only mandates in place generally require diesel generators in critical facilities.

Almost No Public TA Funds

Except for Massachusetts, there are no state, community or local public funds that are available to NGOs, communities or developers to assess the tech-nical and financial aspects of installing solar+storage facilities—no public TAF funds like the kind now offered on a limited basis through foundations.

No Policies to Value Resiliency

There are no policies that establish a value for energy resiliency in any jurisdiction in the US, which means that resiliency does not have any financial value to be factored into decisions to finance and install RP projects.

No Energy Emergency Plans

There are few emergency plans that even evaluate or contemplate specific reliance on resilient power projects in critical community facilities in the United States.

BARRIER 5

PROPOSED INTERVENTIONS

The following interventions have been designated as grants (G), program related investments (P) and mission related investments (M).

There are important policy interventions that could both help develop the mainstream market as well as the LMI market for solar and storage technologies. Several are proposed here for consideration. For the most part, these would involve grants to NGOs and other entities to support policy development, outreach and advocacy.

The absence of effective and expert advocacy across the country on these solar and storage issues in LMI communities—working before relevant regulatory forums or other agencies—is troubling. Without it, it should not be surprising that the progress being made is slow and imperfect.

- **Mainstream Market Support**

  To build mainstream markets for energy storage and solar, it will be necessary to follow the policy strategies of a decade ago that led to the wide-spread support for stand-alone solar today. These policy interventions include the following:

  - ***Develop Consensus for Policy Toolkit.*** It will be important to develop a standard template for state and community-based solar+storage policy support including incentives, mandates, and other regulatory measures. (G)
  - ***Create State Advocacy Strategy.*** Set out and implement a state-level advocacy policy strategy in key states. It will be important that the environmental, low-income and community advocate groups work in states to push for state and community level policies in support of solar+storage in housing and community facilities. (G)
  - ***Support a New National Network.*** Explore creation of a national network of state and community policy makers interested in storage policy, along the lines of the state based RPS Collaborative. At present, there is no coordinated effort among policy makers to understand the challenges and policy approaches that could accelerate market activity. (G)
  - ***Develop Federal Strategy.*** Develop a parallel federal strategy working with the national labs to build support for a smarter and more integrated energy storage policy and funding platform at the federal level. At the same time that state and community policies in support of storage are promoted, there is room to develop a much strong federal policy in support of energy storage technology. (G)

- **LMI Markets**

  Targeted efforts to advocate for policies at the state and community level in support of LMI market development for solar+ storage are badly needed. Among the policy recommendations that could become part of this strategy for foundation support are the following:

  - ***Develop Public TA Funds.*** Develop policy support for Public Technical Assistance Funds. At present, Clean Energy Group's Technical Assistance Fund (TAF) is the only cost-free resource available to help local groups understand and get expert consulting on the financial and technical aspects of resilient power projects in low-income communities. Given our experience with the TAF and this emerging market, it is clear that communities, states, and other public entities should develop "public TAFs" to help low-income community advocates understand the benefits and limits to what resilient power projects can do, and to get objecttive, fair information about whether projects will work for their communities. (G) (In addition, development of the "go/no go" software assessment tool noted above would go a long way to serve this assistance goal as well).
  - ***Provide New LMI Housing Incentives.*** Work on new state and community incentive policy that would provide public incentives for solar and storage on affordable housing like in California's new Multifamily Affordable Housing Solar Roofs Program (AB 693), assuming it gets implemented well. This kind of program will dramatically reduce the upfront cost of solar+storage technologies in multifamily affordable housing, a model that should be replicated across the county. (G)
  - ***Provide New LMI Community Incentives.*** Develop a similar "AB 693" incentive program for critical community facilities in states, which would provide a subsidy to reduce the upfront cost of solar+storage technologies in critical community facilities like schools, shelters, and fire and police stations. Such a public incentive would internalize the market's failure to incorporate a "resiliency value" in community facilities, and help finance those systems. (G)

- **Mandates**

  In addition to incentives, simple policy mandates should be considered, those that would require technologies like solar+storage for emergency power protection for low-income communities, to reduce their economic burden and protect critical facilities during extended power outages. Cities like San Francisco are now mandating solar in new buildings, which is a similar mandate that could be supplemented with storage. (G)

  - ***Develop Technology-Based Performance Standards.*** Develop creative "performance standard" policies to encourage new technologies like solar+storage in place of oversized diesel generators that might not have fuel when disaster strikes. (G)
  - ***Develop Better Emergency Management Plans.*** Support the incorporation of resilient power technologies in emergency management plans and policies that require communities to protect the disabled and to comply with the *Americans with Disabilities Act* so people can shelter in place. (G)

SECTION FIVE

Conclusion

IT MUST BE UNDERSTOOD THAT THE RISKS and barriers in each category do not operate independently. That is, the informational, policy, finance, and other barriers all make it more difficult to make capital investments in solar+storage/resilient power projects.

It is important that the larger de-risking of projects take place within a more supportive policy and informational environment that will require a broad array of grant and soft-money investments in parallel with direct investments in market-building projects and companies.

In other words, impact investment will have difficulty getting traction in this emerging market without support from an adequate policy and regulatory framework, sustained technical assistance, data collection and analysis, and information sharing.

To begin the conversation around the report, we recommend the following process:

- The Kresge Foundation, The Surdna Foundation, and The JPB Foundation will forward the current report to other foundations that have expressed interest in this work, including Nathan Cummings Foundation, The Barr Foundation, The Education Foundation of America, The Energy Foundation, 11th Hour Project and TomKat Foundation, to have their staff review the report and submit comments on where it can be improved and where further work is needed.
- CEG staff prepare a revised report based on the suggestions.
- CEG staff have an in-person presentation with foundation staff to discuss the report and the implications for further work in the area.
- CEG, with input from the foundations, develops a work plan for implementation of the report.

With that in mind, we have included a capital scan matrix (Appendix A) that summarizes recommended interventions, grouped by market participants, which have been selected to address market and financial barriers.
We look forward to continuing this conversation about this important work.

APPENDIX A

Capital Scan Matrix of Barriers and Proposed Interventions

THE MATRIX BELOW DETAILS PROPOSED interventions, grouped by market participants, to address the five barriers. The following interventions have been designated as grants (G), program related investments (P) and mission related investments (M).

The Proposed Interventions are listed in different colored cells to designate the estimated difficulty of implementation (☐ green = low difficulty, ☐ blue = medium difficulty, ☐ yellow = high difficulty). The expected term of intervention is designated in parentheses and follows each intervention (short-term = less than 3 years, medium-term = 3–5 years, long-term = more than 5 years).

	BARRIERS ADDRESSED (IMPACT AREAS)				
	No integrated finance model	**Lack of capacity—portfolio owners**	**Insufficient data, policies, analysis**	**Lack of capacity—intermediaries**	**Inadequate market rules, incentives**
Portfolio Owners					
Create, support Developers' Working Group on solar+storage in Affordable Housing (short-term)		**G**			
Create national software platform to assess solar+storage potential for portfolio owners (short-term)			**G, P, M**		
Provide credit enhancement to reduce technology, performance risk (short- to long-term)	**P**				
Create legal entity to aggregate solar+storage tax credits (short-term)	**G**				
Create public Technical Assistance Funds (TAFs) (medium-term)					**G**
Provide "Leadership Rewards" for offsetting organizational costs of new S+S projects (housing and public building portfolios) (short-term)		**G**			
Support national strategy to incorporate solar+storage incentives in state housing finance agency QAPs (short-term)					**G**

PROPOSED INTERVENTIONS: **G** = Grants **P** = Program Related Investment **M** = Mission Related Investment

ESTIMATED DIFFICULTY OF IMPLEMENTATION: ☐ Low Difficulty ☐ Medium Difficulty ☐ High Difficulty

	BARRIERS ADDRESSED (IMPACT AREAS)				
	No integrated finance model	**Lack of capacity—portfolio owners**	**Insufficient data, policies, analysis**	**Lack of capacity—intermediaries**	**Inadequate market rules, incentives**
Create state-based national network of state & municipal officials for solar+storage policy (like CESA's RPS Collaborative) (short-term)			**G**		
Project Developers					
Fund portfolio building evaluations using sensors to develop 15-minute interval data for comprehensive efficiency & solar+storage upgrades (short-term)			**G, P**		
Provide credit enhancement to facilitate project utility contract payment agreements (short- to medium-term)	**P**				
Provide working capital credit lines, "revolving" grants for pre-develop-ment costs (short-term)	**G, P**				
Invest in solar+storage developers currently focused on C&I markets to expand market strategy to include LMI (short- to medium-term)				**P, M**	
Technical Service Providers					
Fund one-year fellowship to develop housing & community facilities analytics for solar+storage (short-term)				**G**	
Support regional expansion of technical service providers experienced with solar+storage in LMI communities (short- to medium-term)				**G, P**	
Provide growth/working capital to public purpose ESCO/technical service providers focused on LMI markets (short- to medium-term)				**G, P**	
Financing/Investment Entities					
Provide capital for predevelopment loan pool (0%, two years, 75% of predevelopment costs) (short-term)	**P**				

PROPOSED INTERVENTIONS: **G** = Grants **P** = Program Related Investment **M** = Mission Related Investment

ESTIMATED DIFFICULTY OF IMPLEMENTATION: Low Difficulty Medium Difficulty High Difficulty

	BARRIERS ADDRESSED (IMPACT AREAS)				
	No integrated finance model	**Lack of capacity—portfolio owners**	**Insufficient data, policies, analysis**	**Lack of capacity—intermediaries**	**Inadequate market rules, incentives**
Fund 50% of 3% underwriting fees paid to lenders (the balance to be paid by borrower) (short-term)	**G**				
Provide 10- to15-year capital to take out construction financing and as capital source for on-bill payment programs (long-term)	**P**				
Provide credit enhancement or capital for commercial/civic PACE & prepaid PPA financing for housing & community facilities pipelines (medium- to long-term)	**P**				
Provide subordinated debt, guarantees, first loss reserve to banks, CDFIs and green banks for solar+storage projects (medium- to long-term)	**P**				
Place MRIs through fund managers with a track record in clean energy investments (medium- to long-term)	**M**				
Nonprofit Intermediaries					
Fund organizations to work with local housing authorities & HUD to resolve utility allowance issues that keep tenants from retaining energy savings (short-term)				**G**	
Support intermediaries in bundling pipelines of projects into 1 MW financing transactions using standardized documents & financing structures (short- to medium-term)				**G, P**	
Create a public data platform of solar+storage systems in operation with real-time information about project costs, benefits & performance (short-term)			**G**		
Public Officials					
Fund state level or NGO "green public ombuds-person" to address energy resilience & equity issues (short-term)		**G**			

PROPOSED INTERVENTIONS: **G** = Grants **P** = Program Related Investment **M** = Mission Related Investment

ESTIMATED DIFFICULTY OF IMPLEMENTATION: Low Difficulty Medium Difficulty High Difficulty

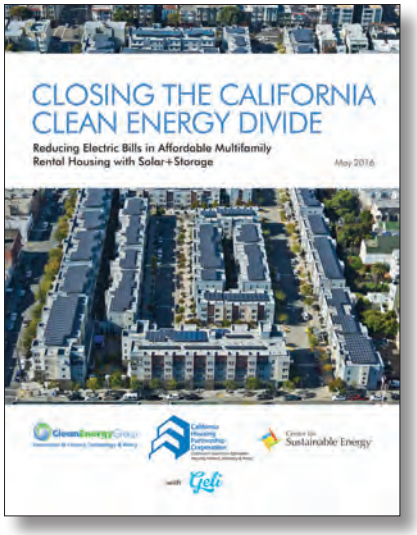
	BARRIERS ADDRESSED (IMPACT AREAS)				
	No integrated finance model	**Lack of capacity—portfolio owners**	**Insufficient data, policies, analysis**	**Lack of capacity—intermediaries**	**Inadequate market rules, incentives**
Create & support Municipalities' Working Group on solar+storage in community facilities (short-term)		**G**			
Create model template for state-based solar+storage policy including incentives, mandates & other regulatory measures (short-term)					**G**
Support creation of "AB 693" styled incentive program (upfront subsidies) for critical community facilities in states (short-term)					**G**
Advocates					
Fund organizations to train LMI residents in issues regarding resilient power to increase LMI participation in policy discussions (short-term)			**G**		
Fund state-level advocacy policy strategy in key states (designed with environmental justice, LMI & housing advocates) (short- to medium-term)			**G**		

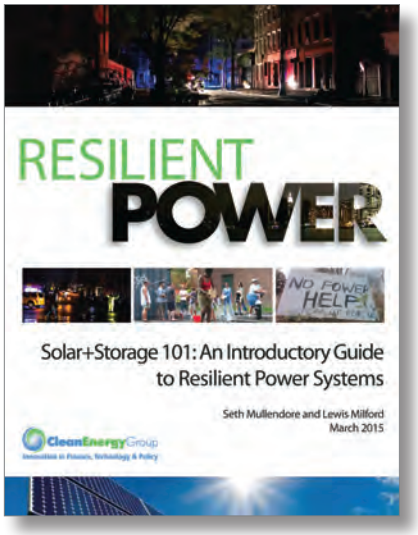
PROPOSED INTERVENTIONS: **G** = Grants **P** = Program Related Investment **M** = Mission Related Investment

ESTIMATED DIFFICULTY OF IMPLEMENTATION: Low Difficulty Medium Difficulty High Difficulty

OTHER RESILIENT POWER PROJECT RESOURCES

The Clean Energy Group and Meridian Institute Resilient Power Project has produced reports and analysis on a wide range of resilient power policy, finance, and technology application issues. Please see a sample of those reports below. For a complete list of the Resilient Power Project's other informational resources, please visit *www.resilient-power.org* to access its extensive knowledge base, including webinars, blogs, and presentations.





Closing the California Clean Energy Divide: Reducing Electric Bills in Affordable Multifamily Rental Housing with Solar+Storage, by Clean Energy Group, California Housing Partnership, Center for Sustainable Energy, with Geli. Battery storage systems not only provide economic returns today, they can also preserve the value of solar in an evolving policy and regulatory environment. Because batteries empower owners of solar photovoltaics (PV) systems to take control of the energy they produce and when they consume it, storage can deliver deeper cost reductions that can be shared among affordable housing owners, developers, and tenants. This report examines the utility bill impacts of adding battery storage to stand-alone solar in affordable rental housing facilities in California's three investor-owned utility service territories, each with different rate structures. It is the first such report on these technologies in this sector in California. May 2016.

Resilience for Free: How Solar+Storage Could Protect Multi-family Affordable Housing from Power Outages at Little or No Net Cost, by Lew Milford, Robert Sanders, Seth Mullendore, Clean Energy Group. This report uses project data for buildings in New York, Chicago, and Washington, D.C. to examine the financial case for installing solar+storage systems to support critical common area loads in multifamily affordable housing. The report concludes that with the right market structures and incentives, solar+storage systems can provide a positive economic return on par with energy efficiency or stand-alone solar. In some cases, the addition of batteries improves affordable housing project economics by generating significant electric bill savings through reducing utility demand charges and creating revenue by providing grid services. October 2015.

Solar+Storage 101: An Introductory Guide to Resilient Solar Power Systems, by Seth Mullendore and Lewis Milford, Clean Energy Group. This guide provides a basic technical background and understanding of solar+storage systems. It is meant as a starting point for project developers, building owners, facility managers, and state and municipal planners to become familiar with solar+storage technologies, how they work, and what's involved in getting a new project off the ground. March 2015.

Financing for Clean, Resilient Power Solutions, by Robert G. Sanders, Clean Energy Group. This 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. 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. October 2014.

ABOUT THE AUTHORS

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PRESIDENT OF CLEAN ENERGY GROUP,
FOUNDER OF CLEAN ENERGY STATES ALLIANCE

Lewis Milford is president and founder of Clean Energy Group (CEG) and 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. He is also a nonresident senior fellow in the Metropolitan Policy Program of the Brookings Institution. He works with many public agencies and private investors in the United States and Europe that finance clean energy. He 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 print and online publications including *The New York Times*, *The Boston Globe*, *The National Journal*, *The Stanford Social Innovation Review*, *GreenTech Media*, *Huffington Post*, and *Renewable Energy World*. Before founding these two organizations, he was Vice President of Conservation Law Foundation, New England's leading environmental organization. He was an Assistant Attorney General for the State of New York where he helped prosecute the Love Canal hazardous waste case. He also directed the Public Interest Law Clinic at American University Law School where he represented veterans on a range of legal issues, including gaining compensation for their harmful exposure to Agent Orange and nuclear radiation. His first job out of law school was as a federal civil rights enforcement attorney. He is also co-author of *Wages of War*, a social history of America's returning war veterans, published by Simon & Schuster. He has a J.D. from Georgetown University Law Center. *LMilford@cleanegroup.org*

Robert Sanders

SENIOR FINANCE DIRECTOR

As Senior Finance Director for Clean Energy Group, Rob provides analysis and designs and promotes finance strategies to engage multifamily affordable housing developers, municipalities and other project developers in community resilient power. With over twenty-five years of experience in community development and energy-related commercial finance, Rob Sanders has deep expertise in designing, implementing and evaluating financing programs, financial products and related services in the areas of clean energy and sustainable community development. Rob was formerly the Managing Director of Energy Finance for The Reinvestment Fund, serving as Fund Manager for the Sustainable Development Fund, a $32 million fund created by the Pennsylvania PUC to promote renewable energy and energy efficiency, as well as TRF Fund Manager for the Pennsylvania Green Energy Loan Fund and the Philadelphia metropolitan area EnergyWorks Loan Fund. As lead for all energy investing, he made loans, leases, equity investments and performance-based grant incentives. Rob holds an MCP from the University of California at Berkeley and a B.A. from Stanford University. *RSanders@cleanegroup.org*

ENDNOTES

1 "Renewable electricity generation has surpassed levels from previous years in every month so far this year, based on data through June." See: *http://www.eia.gov/todayinenergy/detail.cfm?id=27672.*

2 "Most experts agree that prices for energy storage will fall in coming years…a significant drop in battery prices could have wide-ranging effects across industries and society itself." See *http://www.mckinsey.com/business-functions/sustainability-and-resource-productivity/our-insights/battery-technology-charges-ahead.*

3 See *https://cleantechnica.com/2015/08/04/battery-costs-set-to-fall-60-by-2020-from-energy-storage-megashift.*

4 See *http://www.mckinsey.com/Business-Functions/Sustainability-and-Resource-Productivity/Our-Insights/The-new-economics-of-energy-storage.*

5 Krieger E, Casey J, Shonkoff SBC. "A framework for siting and dispatch of emerging energy resources to realize environmental and health benefits: Case study on peaker power plant displacement." *Energy Policy*, September 2016. Available at *http://www.sciencedirect.com/science/article/pii/S0301421516302798.*

6 Based on CEG's research into the California subsidy program for battery storage projects.

7 See *http://www.seia.org/blog/1-million-solar-strong-growing.*

8 David Robison, *The Buffalo News*, "SolarCity, Tesla roll out batteries that store sun's energy for nighttime." Available at *http://www.buffalonews.com/business/solarcity-tesla-roll-out-batteries-that-store-suns-energy-for-nighttime-20150808.*

9 California legislation AB 693 (Eggman) established the California Multifamily Affordable Housing Solar Roofs Program, see *https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201520160AB693*.

10 See *www.resilient-power.org.*

11 See *http://www.eia.gov/todayinenergy/detail.cfm?id=27672.*

12 See "One Good Year Deserves Another: Energy Storage in 2016," January 27, 2016, by Peter Maloney at *http://www.renewableenergyworld.com/articles/2016/01/one-good-year-deserves-another-energy-storage-in-2016.html?cmpid=renewablestorage01282016&eid=319635404&bid=1293497.*

13 As if to underscore the timeliness of this work, the *New York Times* recently ran a piece on Tesla and Elon Musk as this report was finished. See "Tesla's Chief Sticks to Mission Despite Series of Setbacks," July 25, 2016, p. 1 ("Mr. Musk wants to create an alternative to fossil fuels by popularizing solar power and by using batteries to store energy from the sun and wind to power homes, cars and businesses at any time of day and in any season.")

14 Clean Energy Group has written extensively about the impact of future solar policies and how they will lessen the economic value of solar over time. These policy changes will increase the value of storage as a mitigation tool. See Waite and Milford, "Efficiency, Solar and Storage Offer a Unique Opportunity to Bring Clean Energy to Affordable Housing," available at *http://www.greentechmedia.com/articles/read/affordable-housings-progress-toward-integrated-energy-solutions.*

15 See "Barrier 1: Need for an integrated development finance model to overcome finance gaps in this underserved market" (page 20) for a full discussion of financial challenges faced by project developers and suggested interventions.

16 See *http://www.nber.org/papers/w21437.*

ABOUT THE RESILIENT POWER PROJECT

The Resilient Power Project, a joint initiative of Clean Energy Group and Meridian Institute, is working to accelerate market development of solar PV plus battery storage (solar+storage) technologies for resilient power applications serving low-income communities. The Resilient Power Project works to provide new technology solutions in affordable housing and critical community facilities to address key climate and resiliency challenges facing the country:

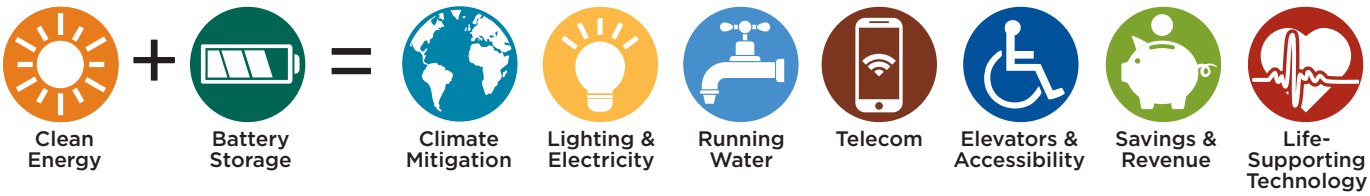
- **Community Resiliency** — Solar+storage can provide revenue streams and reduce electricity bills, enhancing community resiliency through economic benefits and powering potentially life-saving support systems during disasters and power outages.
- **Climate Adaptation** — Solar+storage systems can provide highly reliable power resiliency as a form of climate adaptation in severe weather, allowing residents to shelter in place during power disruptions.
- **Climate Mitigation** — Battery storage is an enabling technology and emerging market driver to increase adoption of solar PV for distributed, clean energy generation and to advance climate mitigation efforts.

The Resilient Power Project is supported by The JPB Foundation, Surdna Foundation, The Kresge Foundation, Nathan Cummings Foundation, and the Barr Foundation.

Learn more about the Resilient Power Project at
www.resilient-power.org.

RESILIENT POWER

A project of Clean Energy Group and Meridian Institute



RESILIENT POWER

PROTECTING COMMUNITIES IN NEED

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Innovation in Finance, Technology & Policy

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