RESILIENT


POWER

A Project of Clean Energy Group

# Clean Energy Group Webinar: Financing Resilient Power

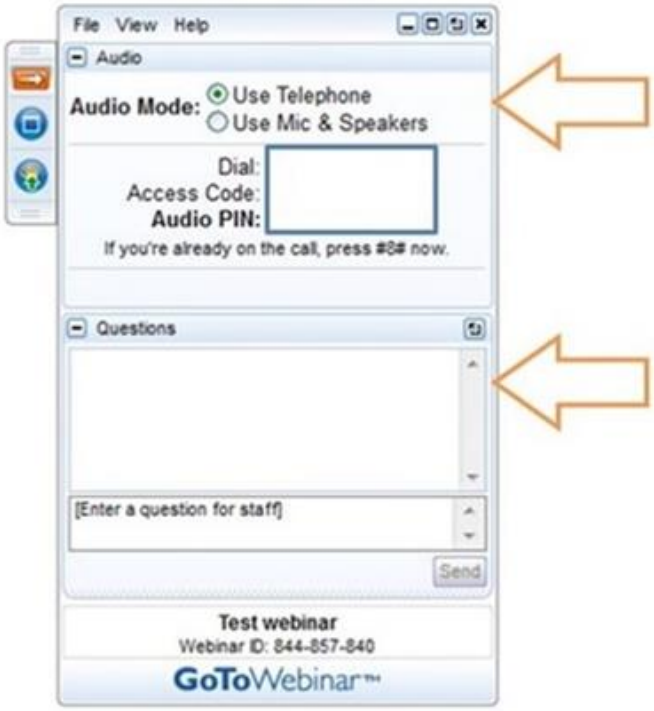
**November 20, 2014**

**Rob Sanders, Clean Energy Group**
**Henry Misas, Bright Power, Inc.**

CleanEnergyGroup

Innovation in Finance, Technology & Policy

# Housekeeping




All participants are in "Listen-Only" mode. Select "Use Mic & Speakers" to avoid toll charges and use your computer's VOIP capabilities. Or select "Use Telephone" and enter your PIN onto your phone key pad.

Submit your questions at any time by typing in the Question Box and hitting Send.

**This webinar is being recorded.**

You will find a recording of this webinar, as well as previous Resilient Power Project webinars, online at:

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and at

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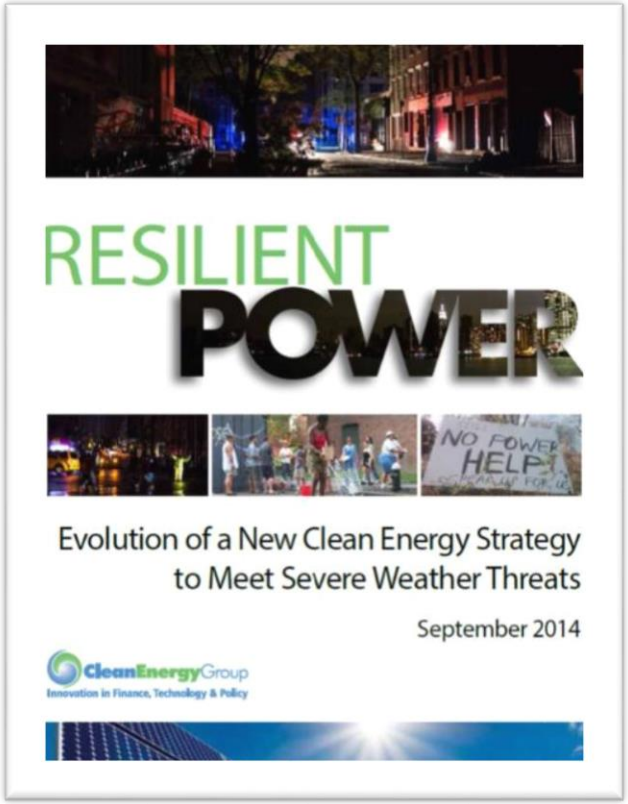
# Who We Are




CleanEnergyGroup
Innovation in Finance, Technology & Policy

Meridian Institute
Connecting People to Solve Problems

CleanEnergy States Alliance

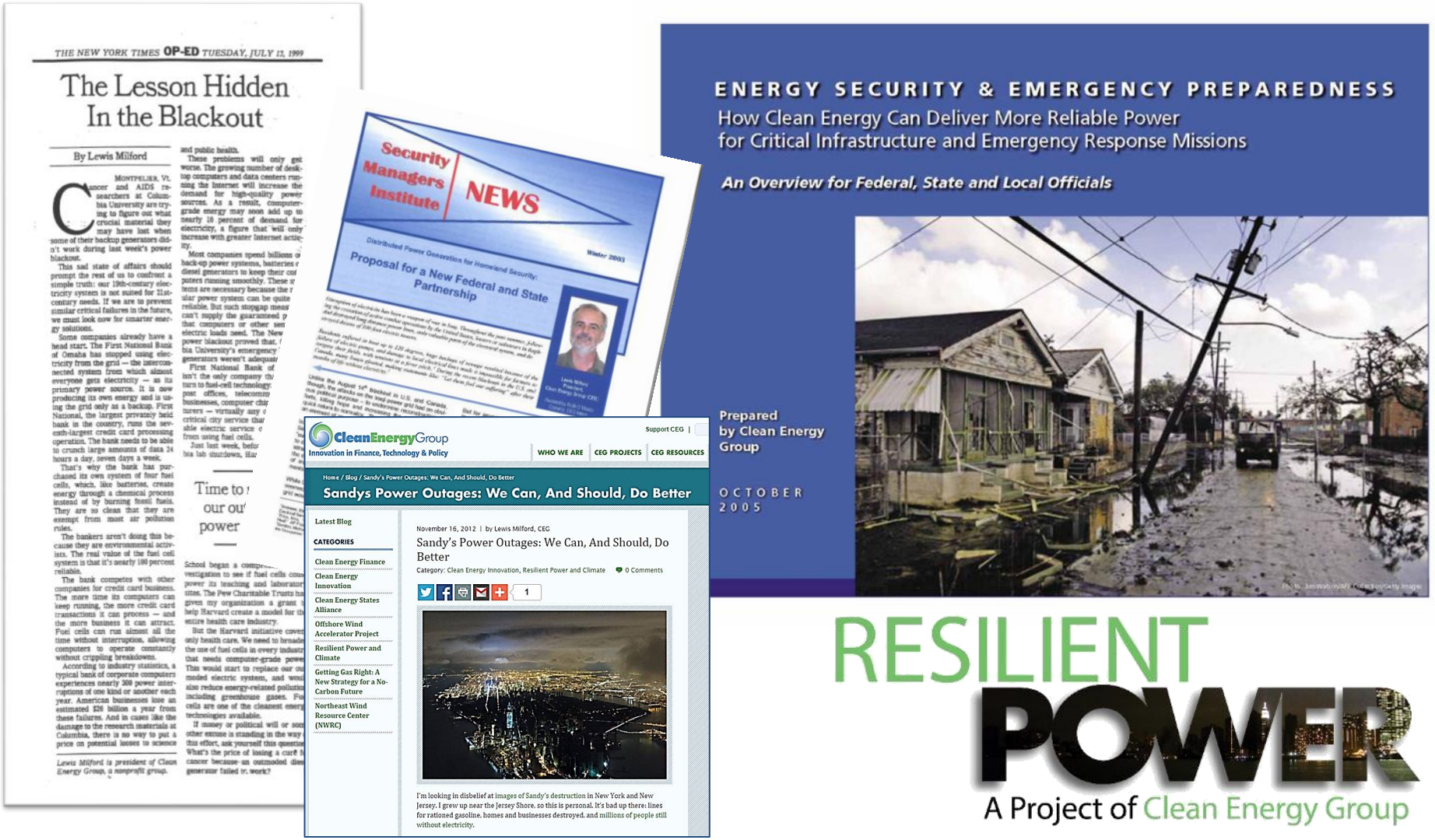
THE JPB FOUNDATION

SURDNA FOUNDATION
Fostering sustainable communities in the United States

THE KRESGE FOUNDATION

[www.resilient-power.org](http://www.resilient-power.org)
**www.cleanegroup.org**

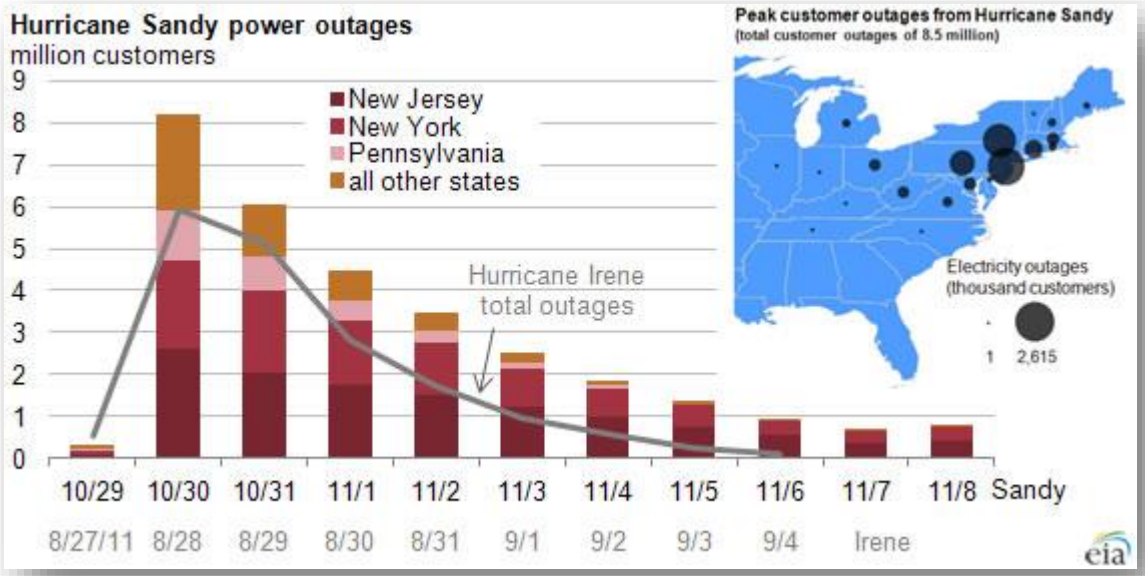
# History of CEG and Resilient Power



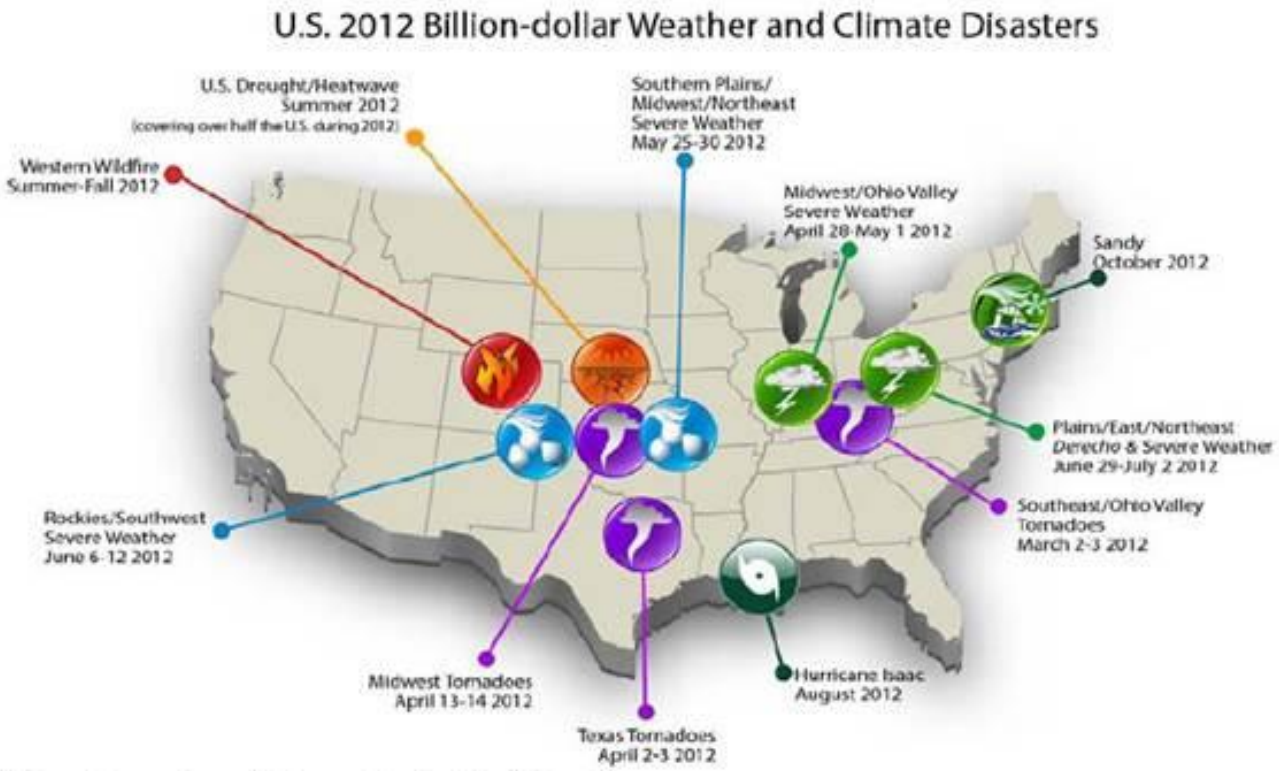
# Sandy and Power

"Extensive power outages during Sandy affected millions of residents and resulted in substantial economic loss to communities. Despite the size and power of Hurricane Sandy, this was not inevitable: resilient energy solutions could have helped limit power outages."

*Hurricane Sandy Rebuilding Strategy: Stronger Communities, A Resilient Region* (Aug. 2013)

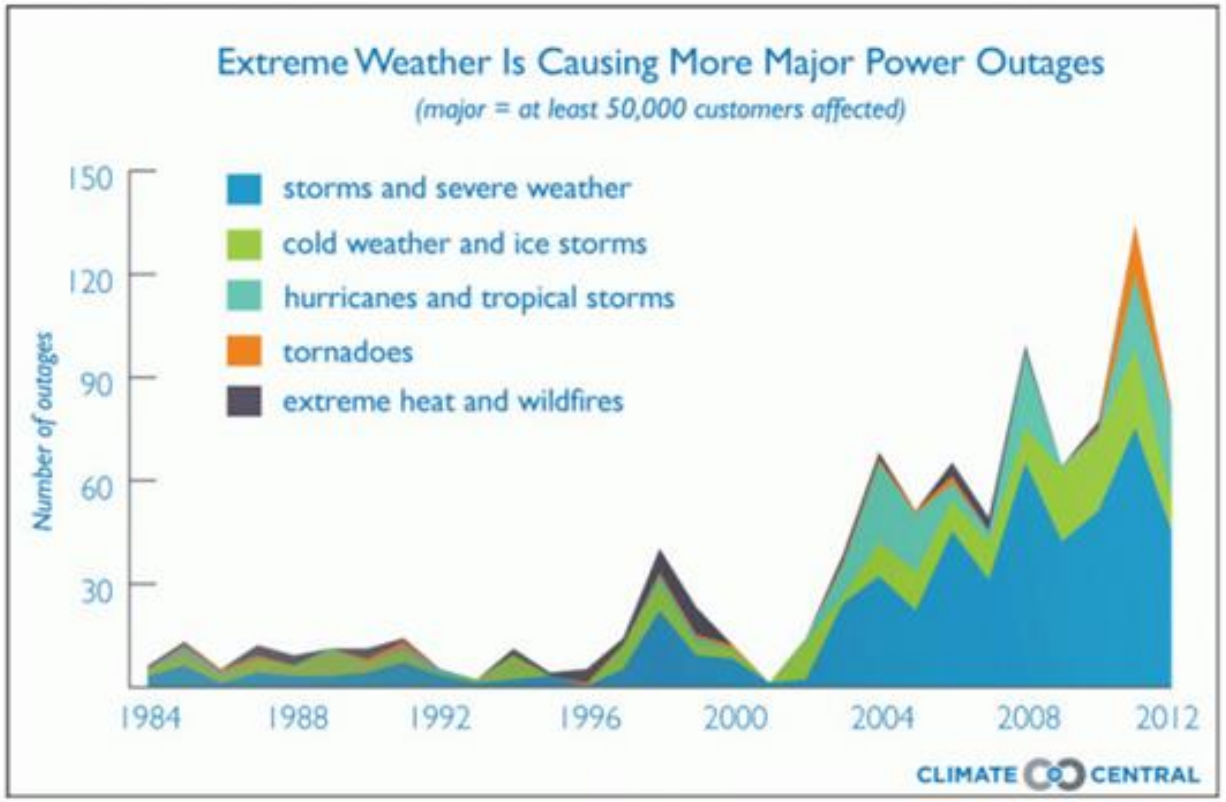



# Extreme Weather Events & Power Outages

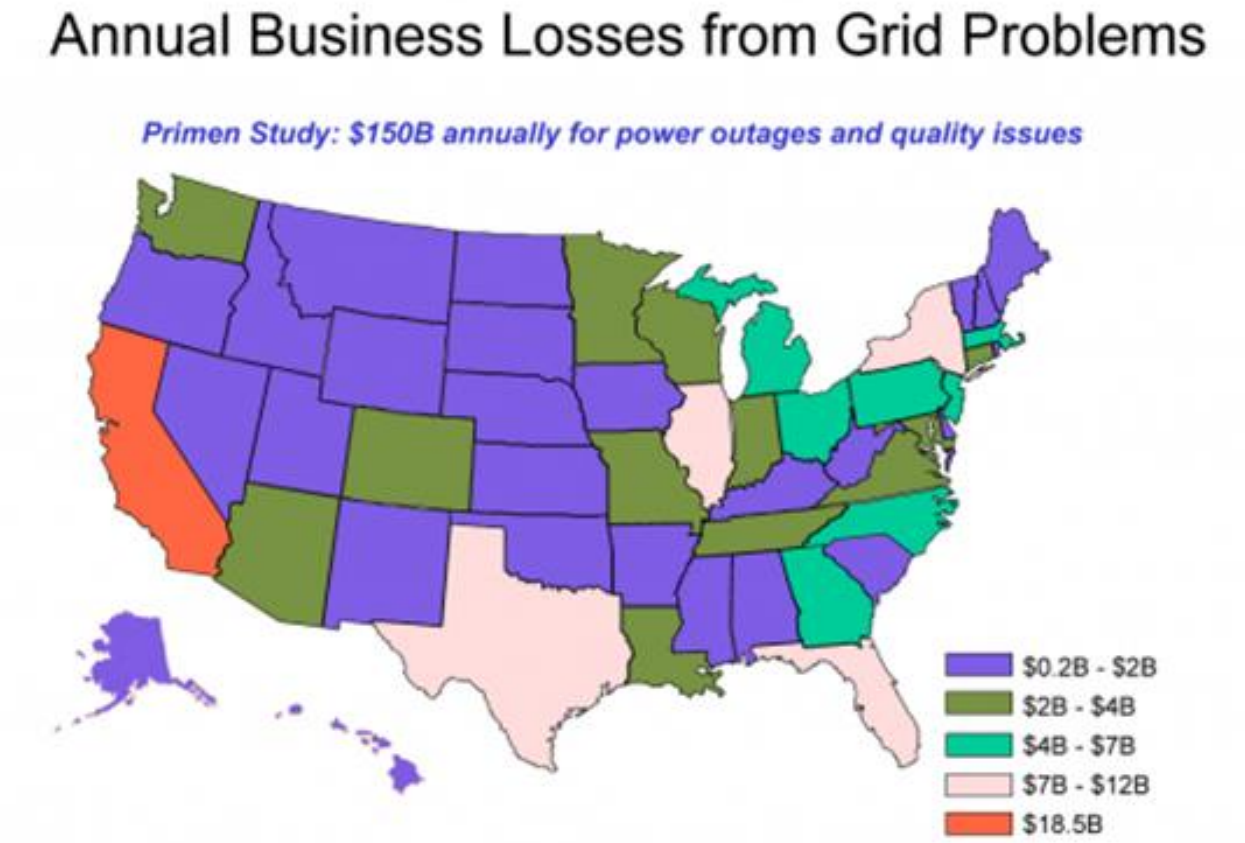



*Source: National Oceanic and Atmospheric Administration*

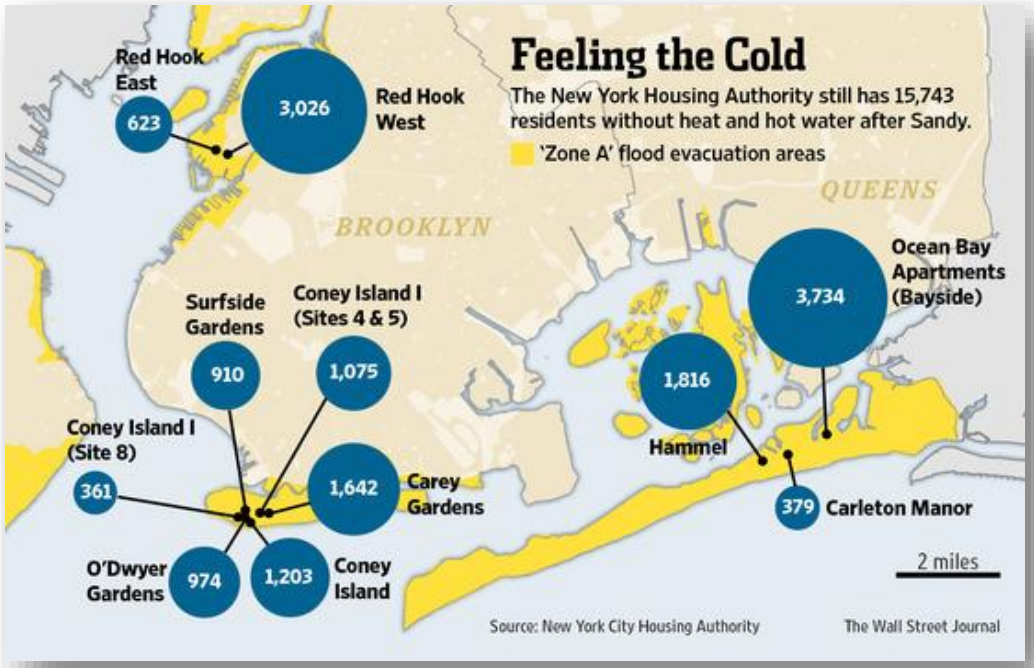
# Extreme Weather Events & Power Outages



# Extreme Weather Events & Power Outages



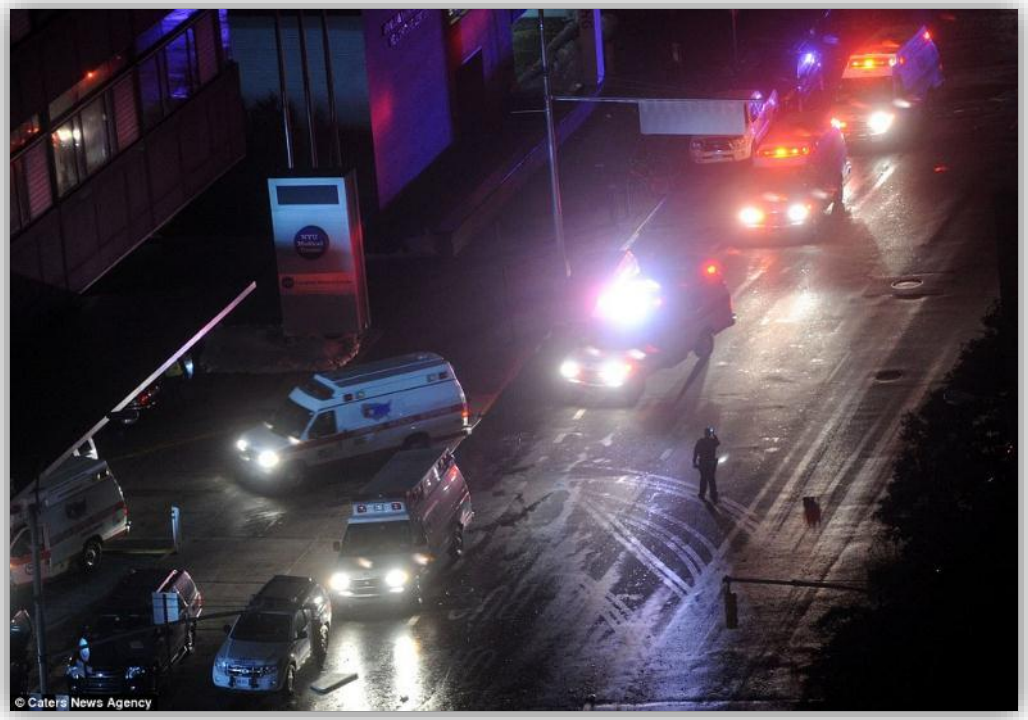
# Extreme Weather and Low-Income Communities




- Extreme weather causes power outages and higher electricity prices—disproportionately affecting the poor and vulnerable.
- Severe climate-related, weather events cause disproportionate harm to low-income Americans.
- Low-income & elderly populations are the most vulnerable to high or low temperatures during power outages.

- Low-income areas have more difficulty responding & recovering from destruction.
- They lack income, savings, employment, insurance, communication channels & information – less resilient after severe weather.

# Need for More Power Resilient Solutions




Hospital workers evacuate a patient from NYU Langone Medical Center during Hurricane Sandy on October 29, 2012 in New York City. More than 200 patients were evacuated from the hospital after backup generators failed due to flooding. (Michael Heiman/Getty Images)

- Critical need for reliable distributed generation (DG) & resiliency in hospitals, affordable housing, police, fire stations, schools, hospitals, community centers, gas stations
- Protect vulnerable populations
- Distributed solar with batteries, CHP, fuel cells can provide life-saving power
- DG a democratizing force through community projects
- Resilient DG is both climate mitigation and adaptation

# Resilient Power for Affordable Housing & Assisted Living Facilities

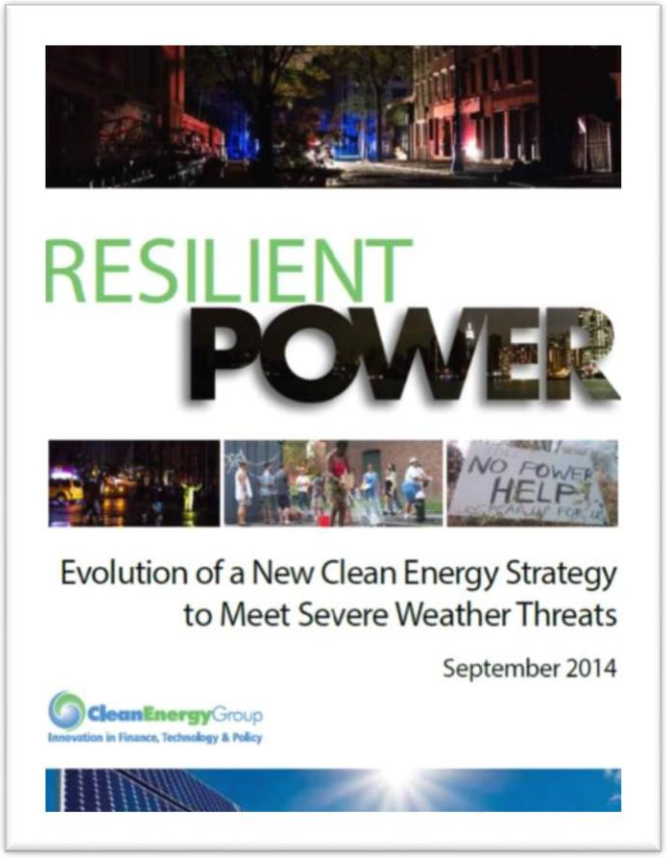
- **SuperStorm Sandy**: 375,000 New Yorkers—including 45,000 public housing residents—lived in mandatory evacuation zone.
  - Many low-income, elderly & disabled in NYC public housing were stranded.
  - No heat, backup generators, emergency boilers, or working elevators.
  - Many had no other affordable place to stay, no means of leaving their neighborhoods because mass transit did not operate.
- Small battery storage systems combined with on-site generation are needed for residents to shelter in place.
- Where possible, incorporate battery storage in HUD Better Building Partners' solar projects.

# CEG Resilient Power Project – Objectives

- Expand clean resilient power at state and municipal level
- Protect low-income and vulnerable communities
- Focus on affordable housing
- Promote new technologies/business models

- New policy and financing options
- Support local projects
- Public education, technical assistance, information sharing
- Create national network
- Support new federal initiatives

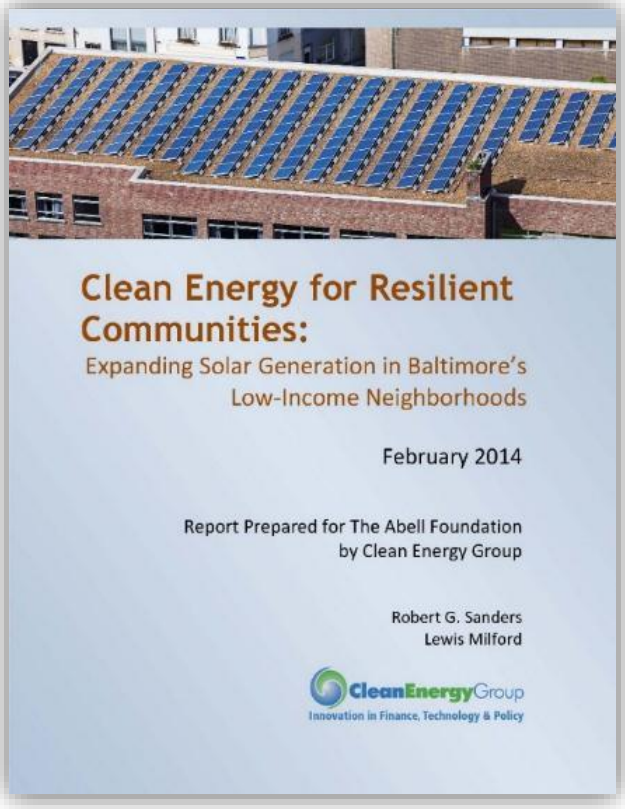
# CEG Resilient Power Project




- Goal: significantly increase public/ private investment for clean, resilient power systems.
- Engage city officials to develop resilient power policies/ programs, link to state energy policies.
- Technical assistance for resilient power projects to help agencies/ project developers get deals done.
- http://www.cleanegroup.org/assets/Uploads/Resilient-Power-Project-Evolution-Report.pdf

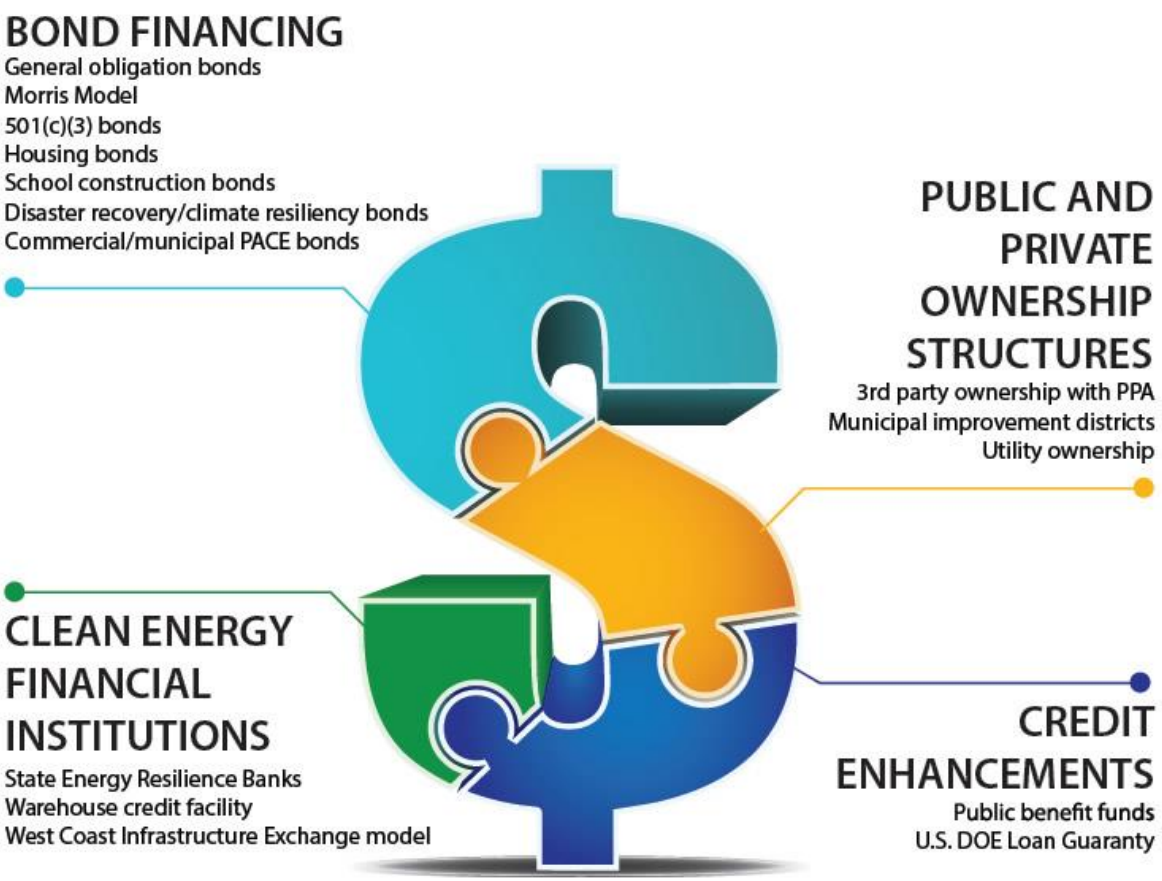
# Community Resilient Power: Baltimore

- How can cities deploy more solar in low income communities and be more power resilient?
- CEG report built on Baltimore's DP3 Report that evaluated critical facilities/ infrastructure.
  - Focus on community buildings
  - Bonds and credit enhancement mechanisms
  - Public buildings and nonprofit-owned facilities.
  - Third-party ownership, lease-financed
  - Foundation PRIs
  - Public schools, libraries, police/fire stations.
  - Explore legal exposure under ADA.
  - The full report can be downloaded at http://bit.ly/RPP-ResilientCommunities.



# Innovative Financing Models

- Once decision is made to pursue resilient power project – how do you finance it?
- Municipalities, housing/ community developers have broad range of options.

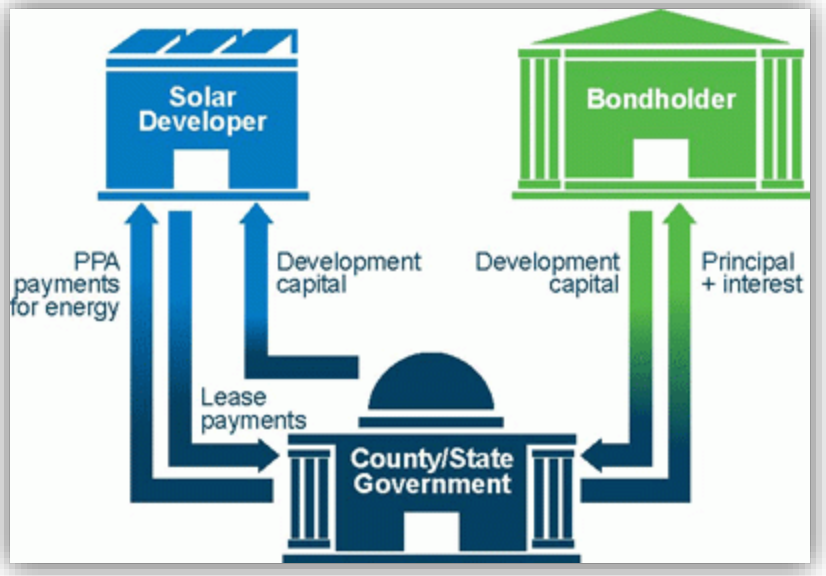



Source: Clean Energy Group

# Bond Financing

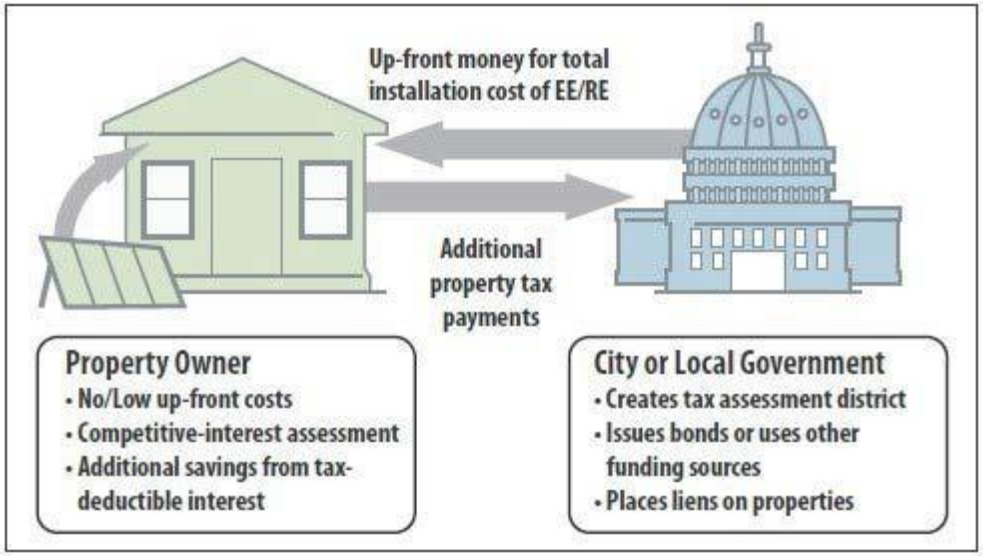
- Existing bond tools can be used to finance pooled resilient power projects
  - GO bonds:  NYC City Controller – multi-billion dollar "Green Bond Program"
  - 501(c)(3) bonds: hospitals, universities, affordable housing, community facilities
  - School construction bonds
  - Disaster recovery/ resiliency bonds: NYC Green Bond Program, Louisiana PSC ($315M of bonds by a LA bond authority for disaster recovery & reserves for future storms

- Morris Model:
  - Innovative public-private financing for solar on public buildings
  - Hybrid model: public entity issues a government bond, transfers low cost capital to developer for lower PPA price.
  - Bonds are issued for a pool of projects



# Bond Financing

- C-PACE bonds:
  - Provides states & municipalities with financing for CE building projects
  - Bonds are repaid by property assessments added to building owners' property taxes.



# Clean Energy Finance Institutions

**NJ Energy Resilience Bank:**

- First-in-the-nation Energy Resilience Bank (ERB).
- Designed to address a repeat of the devastating impacts of SuperStorm Sandy:
- $200 million of CDBG-DR funds for municipalities to finance clean resilient power solutions.
- For critical public facilities, initially clean water/ wastewater treatment facilities
- Other critical facilities: public housing, schools used as emergency shelters, hospitals, emergency response facilities, etc.

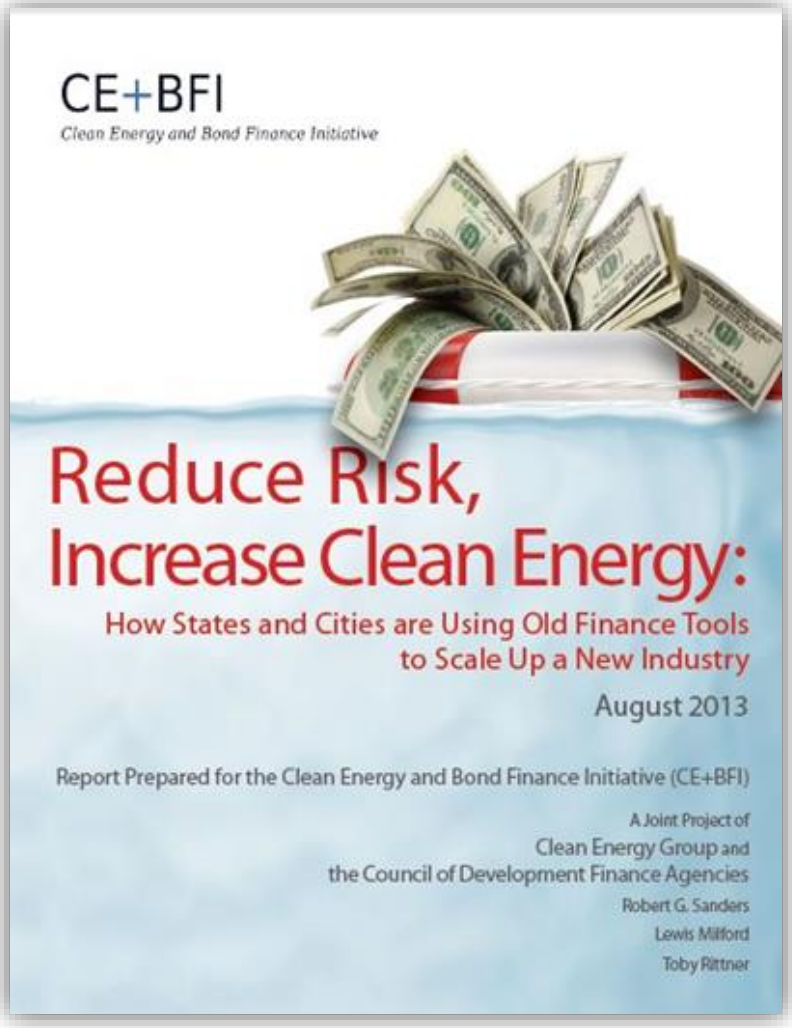
- Jointly managed by NJ BPU and NJ EDA
- Direct loans and grants, but can also provide credit enhancement for bond issuances, etc. A model other states should evaluate for possible replication.

# Credit Enhancement

- Risk reduction methods that improve credit worthiness of a projects/ companies, reduce cost of borrowing.
  - Guarantees, pledge of additional collateral, cash reserve accounts, subordinated debt
- SBC funds used as credit enhancement
  - Hawaii Green Infrastructure Loan Program
- U.S. DOE Loan Guaranty Program
  - $4 billion in loan guarantees to support innovative CE/EE projects
  - 5 eligible technology areas, the first of these grid integration & storage (microgrid, resilient power)
  - Opportunity to aggregate projects statewide and regionally.

# Credit Enhancement

- New framework for CE investment being built by states providing credit enhancement
- "Reduce Risk, Increase Clean Energy"
  - States are playing an important transitional role to a time when CE securities are a readily traded asset class
  - By reducing risk for investors, states are also reducing the cost of financing and securing long term fixed rate capital for CE
  - http://www.cleanegroup.org/assets/Uploads/2013-Files/Reports/CEBFI-Reduce-Risk-Increase-Clean-Energy-Report-August2013.pdf



# Public & Private Ownership Structures

- Over the past decade, companies such as SolarCity transformed residential solar PV by providing lease financing.
- Third-party ownership is largely responsible for tremendous growth in residential solar in recent years.
  - **Can lease financing (3rd party ownership) accomplish for energy storage what it did for residential solar PV?**

# Third-Party Ownership

- Solar Grid Storage & other storage developers are proving the model out for commercial, government & nonprofit entities.
  - Eliminates upfront costs to host
  - Transfers development & performance risk to the private developer.
- These companies' business models have benefited greatly from new FERC rules:
  - Owners of solar + storage systems can receive additional revenue streams from providing ancillary grid services:
    - E.g., demand response, frequency regulation services
    - ISOs need to pay sellers for frequency regulation-related performance payments for faster, more accurate response to dispatch signals
  - These new business models can make it much easier for customers to include storage using third party leasing and PPA financing.

# Utility-owned & financed microgrids with resilient power


- **Vermont Solar + Storage Resilient Power Microgrid**
- One of the first US exclusively solar-powered microgrids
- First to provide full back-up power to an emergency shelter on the distribution network, first solar+storage microgrid developed on a landfill/brownfield site.
- Project supported with funding from federal-state-NGO partnership – remaining financing was rate-based.


- Incorporates 7,722 solar panels, capable of generating 2.5 MW of electricity
- Incorporates 4 MW of battery storage, both lithium ion and lead acid, to integrate the solar generation into the local grid
- Will provide resilient power to a Rutland school that serves as an emergency shelter (additional critical facilities may be similarly supported by this microgrid in the future)

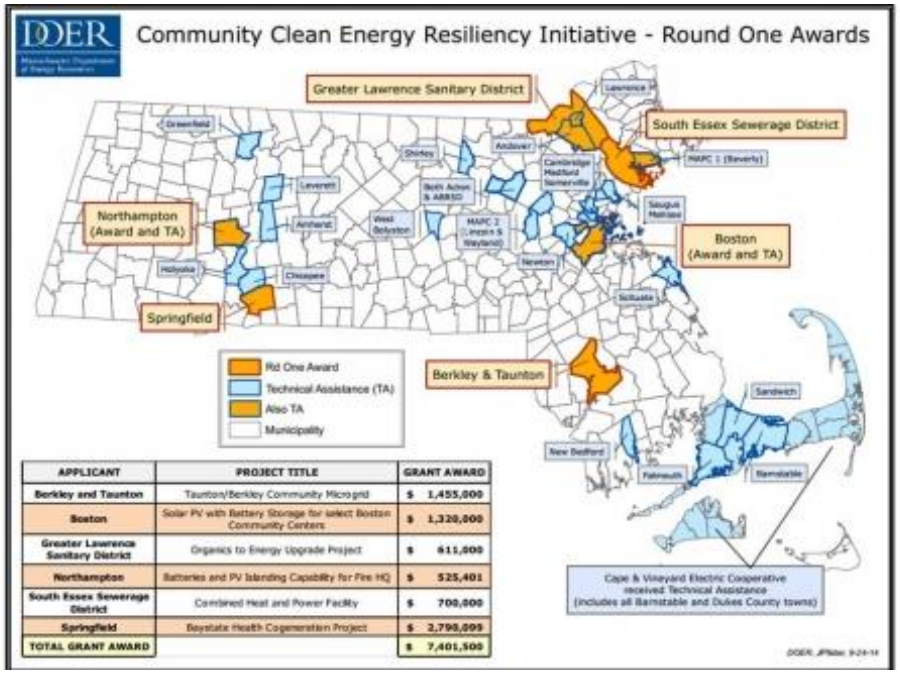
# Results

- **Connecticut** Department of Energy and Environmental Protection (DEEP): $48 Million Microgrid Grant and Loan Pilot Program
- **New Jersey** Board of Public Utilities (BPU): $200 Million Energy Resilience Bank and $10 Million Energy Storage Program
- **Massachusetts** Department of Energy Resources (DOER): $40 Million Community Clean Energy Resiliency Initiative
- **New York** State Energy Research and Development Authority (NYSERDA): $40 Million NY Prize microgrids competition and $66 million CHP program
- **Maryland** Energy Administration Microgrids RFP: Coming This Fall

**TOTAL: >$400 Million in new state funds in the Northeast alone**

# Massachusetts DOER
# Community Clean Energy Resiliency Initiative

- $40 million state incentive
- $ coming from ACP payments
- Focus on critical infrastructure
- Municipal-led projects
- Technology agnostic
- Includes Technical Assistance Fund




| APPLICANT | PROJECT TITLE | GRANT AWARD |
|---|---|---|
| Berkley and Taunton | Taunton/Berkley Community Microgrid | $ 1,455,000 |
| Boston | Solar PV with Battery Storage for select Boston Community Centers | $ 1,320,000 |
| Greater Lawrence Sanitary District | Organics to Energy Upgrade Project | $ 611,000 |
| Northampton | Batteries and PV Islanding Capability for Fire HQ | $ 525,401 |
| South Essex Sewerage District | Combined Heat and Power Facility | $ 700,000 |
| Springfield | Baystate Health Cogeneration Project | $ 2,795,099 |
| TOTAL GRANT AWARD | | $ 7,401,500 |

See [http://www.mass.gov/eea/energy-utilities-clean-tech/renewable-energy/resiliency-initiative.html](http://www.mass.gov/eea/energy-utilities-clean-tech/renewable-energy/resiliency-initiative.html)

* MassCEC pursuing additional resilient power projects

# Massachusetts DOER
# Community Clean Energy Resiliency Initiative

## Round 1 Results

| Applicant | Project Title | Grant Amount | Brief Description | Factility(ies) |
|---|---|---|---|---|
| **Berkley and Taunton** | **Taunton/Berkley Community Microgrid** | $ 1,455,000 | Community microgrid | (1) Middle School - shelter<br>(2) Emergency Services Building - Police and Fire<br>(3) Community School - shelter<br>(4) Municipal fueling station/pump<br>(5) Police/fire radio repeater |
| **Boston** | **Solar PV with Battery Storage for select Boston Community Centers** | $ 1,320,000 | Solar and storage based islandable community shelters | (1) Shelburne Community Center - shelter<br>(2) Roslindale Community Center - shelter<br>(3) Tobin Community Center - shelter<br>(4) Curtis Hall Community Center - shelter |
| **Greater Lawrence Sanitary District** | **Organics to Energy Upgrade Project** | $ 611,000 | Islandable and black start capable self-sustaining wastewater treatment facility | (1) Wastewater treatment facility |
| **Northampton** | **Batteries and PV Islanding Capability for Fire HQ** | $ 525,401 | Solar and storage based islandable fire station, that incorporates existing backup generation for further resiliency | (1) Northampton Fire Department |
| **South Essex Sewerage District** | **Combined Heat and Power Facility** | $ 700,000 | Islandable and black start capable combined heat and power facility at wastewater treatment facility | (1) Wastewater treatment facility |
| **Springfield** | **Baystate Health Cogeneration Project** | $ 2,790,099 | Islandable and black start capable combined heat and power facility at regional hospital | (1) Baystate Health - hospital |
| **Total** | | **$ 7,401,500** | | |

# Conclusion

- Financing is just one key public resource that is needed to accelerate the deployment of resilient power for critical facilities and infrastructure.
  - Technical assistance
  - Targeted support for pre-development costs
  - Consistent, supportive policy

# RESILIENT POWER
# PROJECT DEVELOPMENT

Henry Misas
Sr. Project Engineer
Bright Power, Inc.

# RESILIENT POWER SOLUTIONS

- **Backup Power Sources**
  - Backup Generator
  - Co-Generation (CHP)
  - Solar PV
  - Energy Storage (Batteries)
  - Fuel Cell

Combined Heat and Power


Energy Storage

Solar PV


Backup Generator

# INTEGRATION AND CONTROLS

- Controls must manage various levels of operation and reliability
- Grid-tied vs Island Modes
- Project Developer must integrate distributed energy resources


**Benecia City Hall – Geli EOS Web Dashboard**

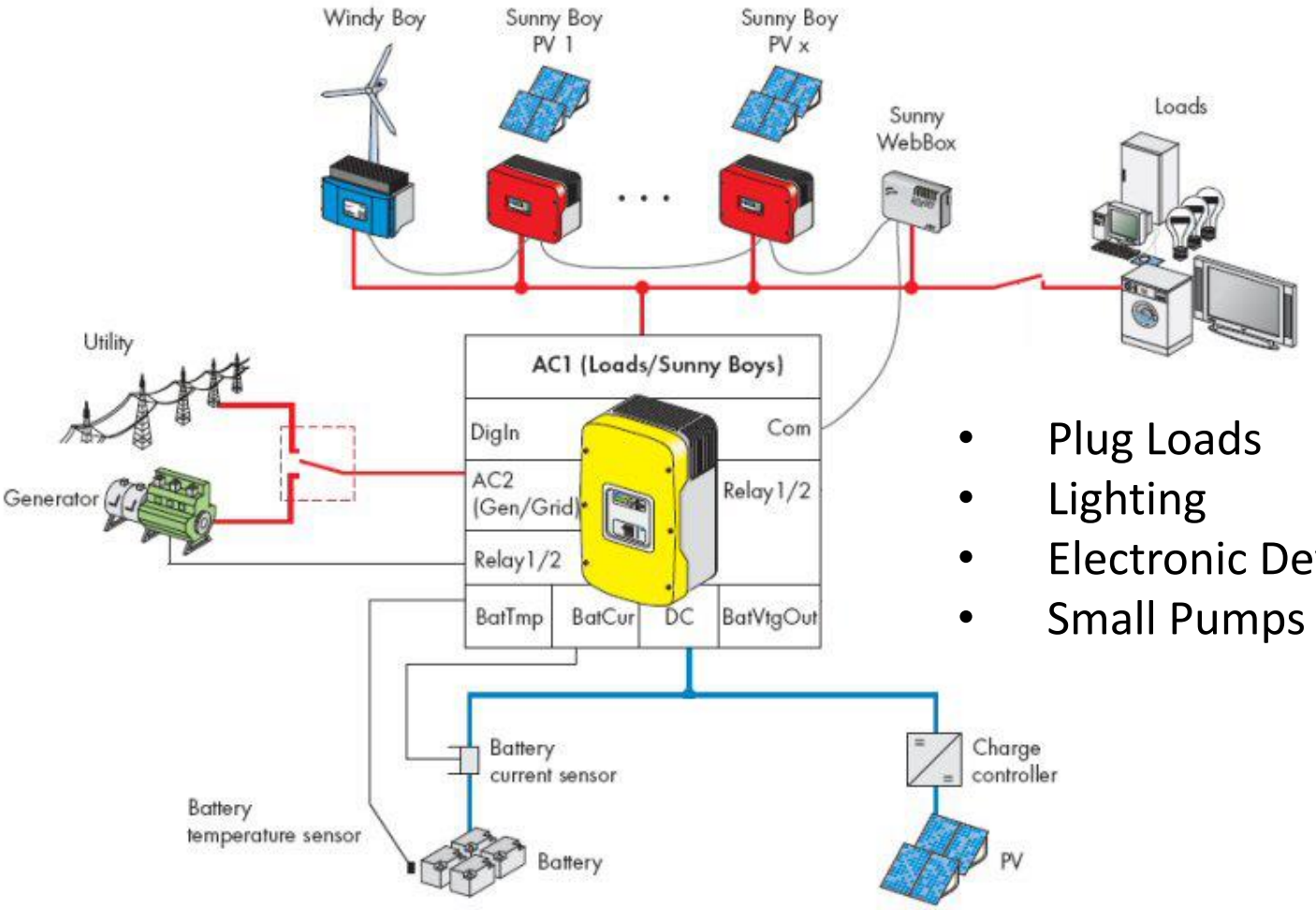
# NEED FOR POWER RESILIENCY

- **Facility types**
  - Public (schools, police and fire stations)
  - Community Center / Shelter
  - Healthcare
  - Multifamily

- **Critical Loads**
  - Elevators
  - Water Pumps
  - Lighting
  - Heating System
  - Telecom devices

Water Booster Pumps Grid Connection

# BACK-UP POWER FOR SMALL LOADS

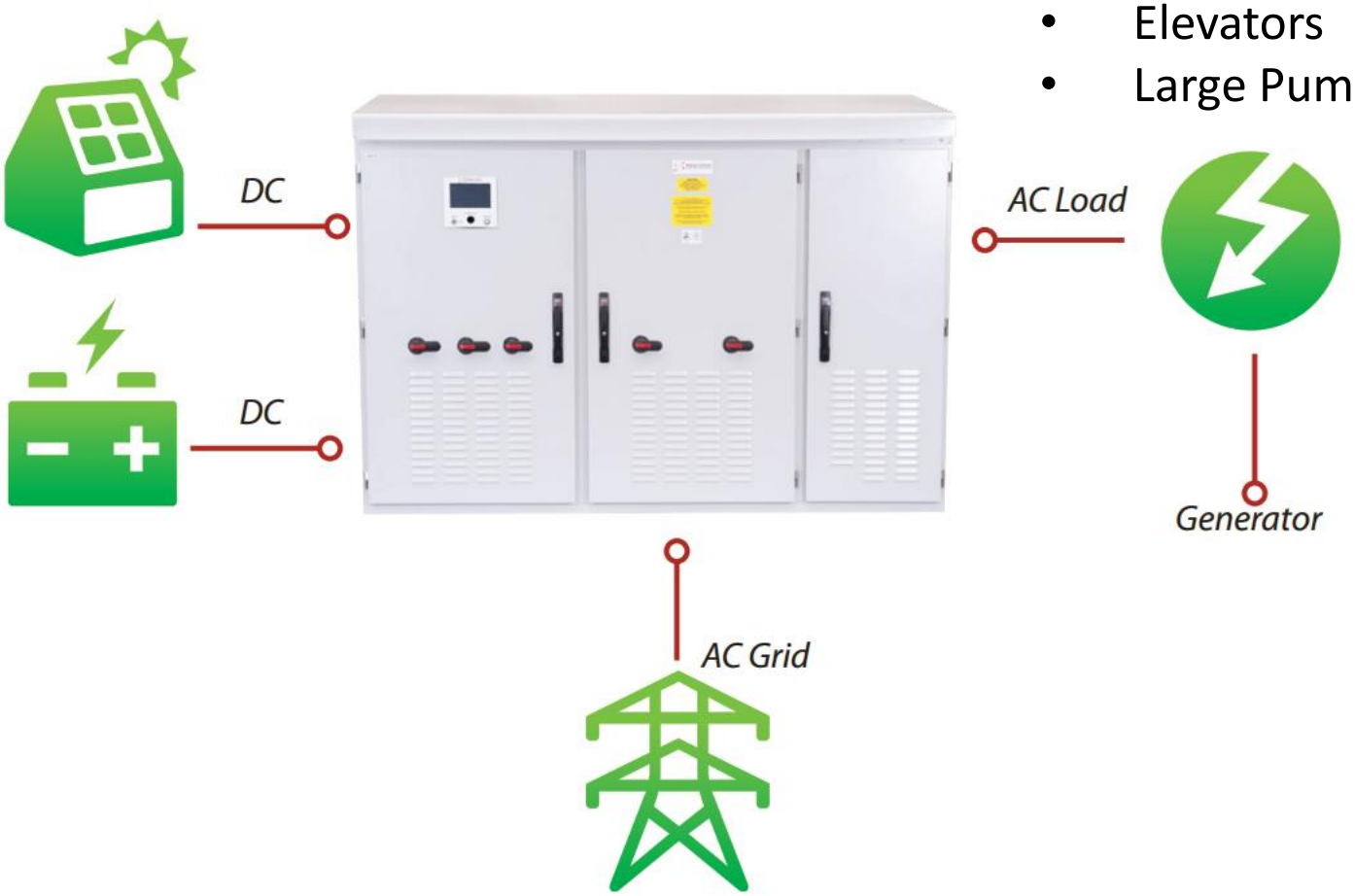



- Plug Loads
- Lighting
- Electronic Devices
- Small Pumps

*Schematic from SMA*

# BACK-UP POWER FOR LARGE LOADS

- Elevators
- Large Pumps




*Schematic from Princeton Power Systems*

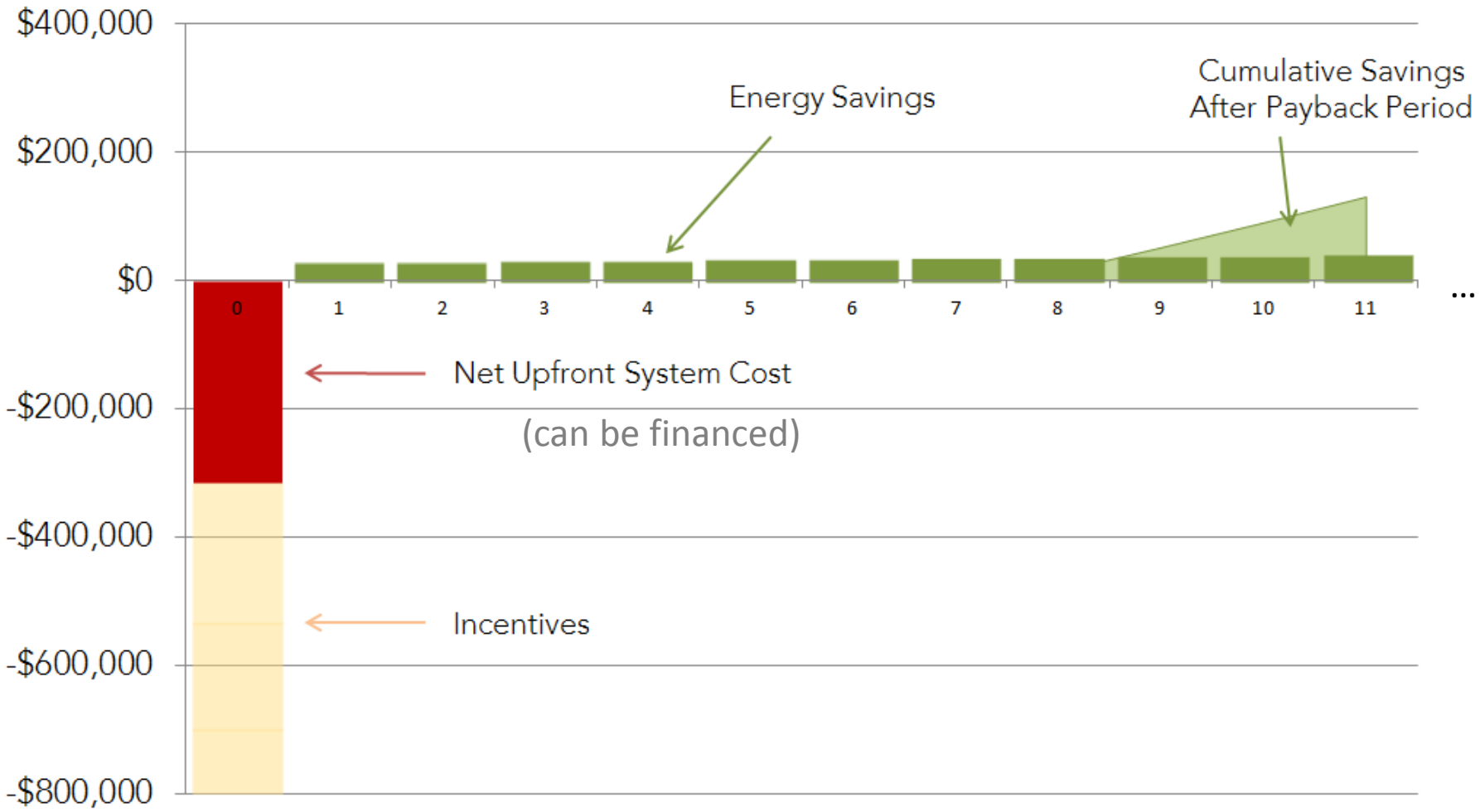
# PROJECT PROFILE

- **Resiliency Pays for Itself**
  - On-site electricity and heat generation
  - Demand management (reducing kW charges)
  - Grid support

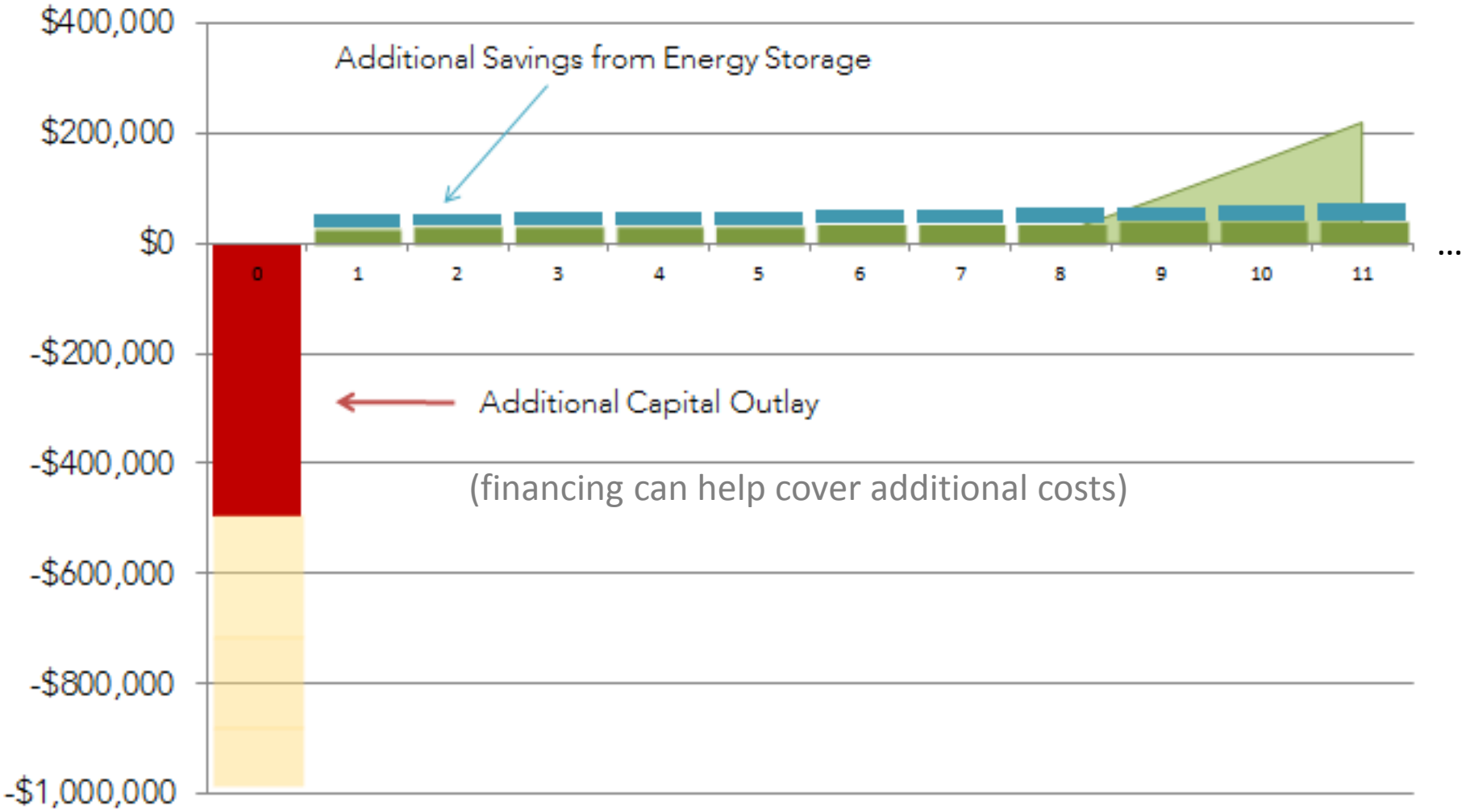
- **Incentive Programs**
  - Tax Credits
  - State (New York - NYSERDA)
    - Co-Gen Performance Based Incentive
    - Demand Management Program
    - Solar PV Rebate
  - Local (New York City)
    - Con Edison - Demand Response Program
    - NYC Property Tax Abatement

- **Financing Options**
  - Outright Purchase
    - Cash
    - Private or Public Loans
  - Capital and Operating Lease
  - Third Party Ownership

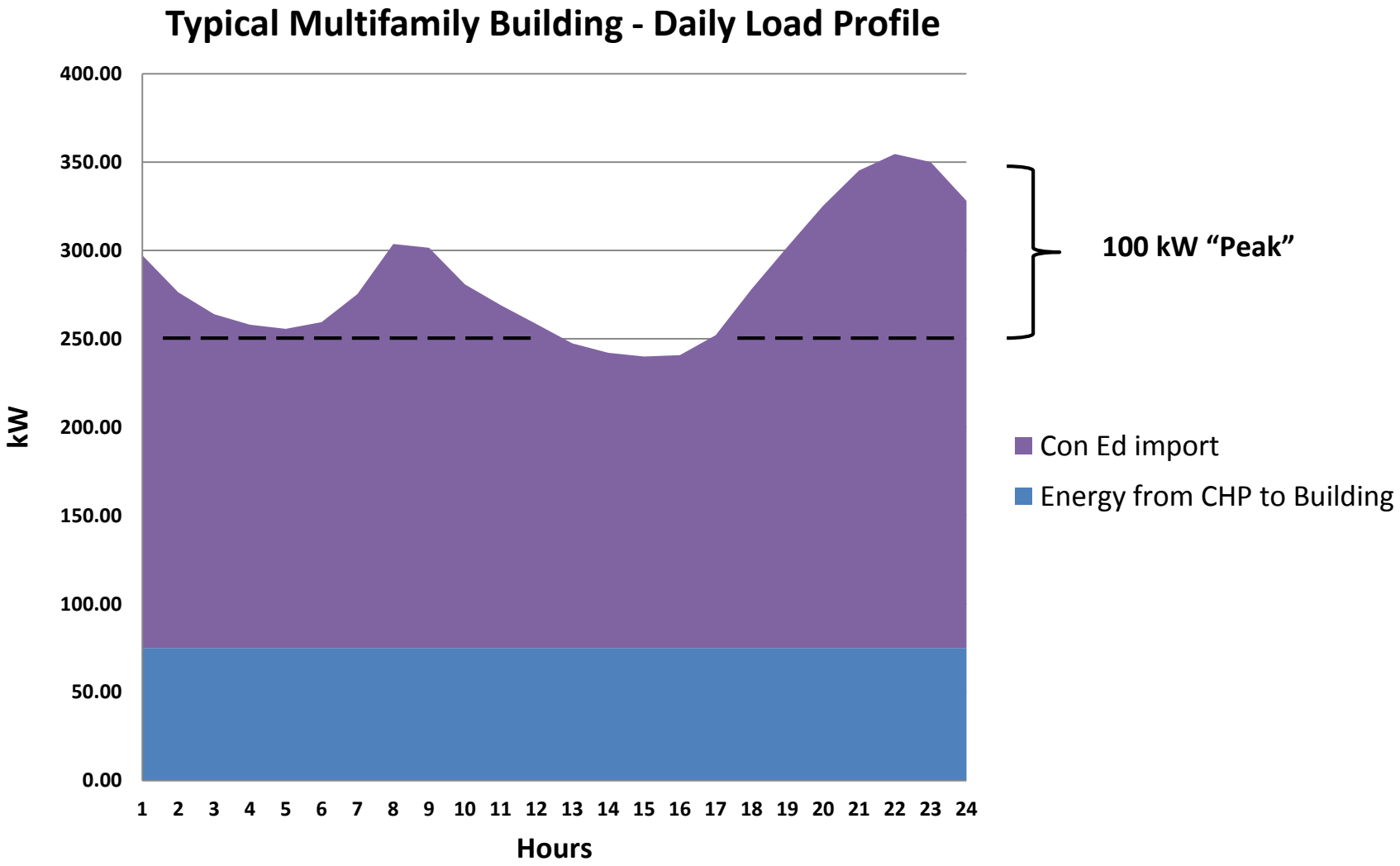
# SOLAR PV PROJECT – CASH FLOW



# SOLAR PV + STORAGE PROJECT – CASH FLOW



# DEMAND CHARGE REDUCTION

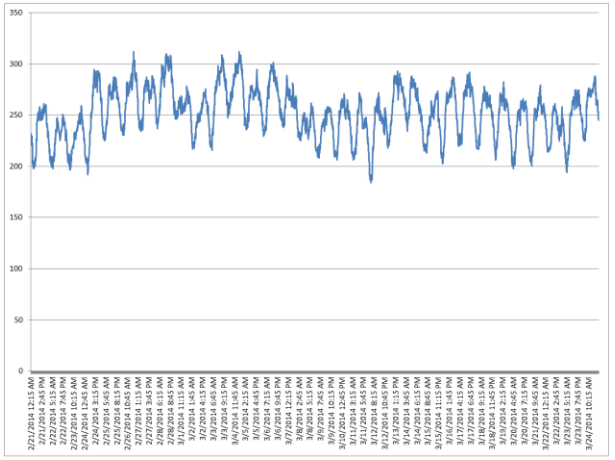


# PROJECT SCOPING PROCESS

- **Project budget**
  - Obtain turn-key installation and O&M costs
- **Savings**
  - Energy offset (electricity and/or heat)
  - Demand charge reduction
  - Enrollment in utility / system operator grid support programs
- **Incentives**
  - Need to obtain incentive award letter that guarantees availability and amount.
- **Value of resiliency & insurance**
  - Has the facility been impacted by grid / weather disruptions in the past?
  - Can the resiliency benefits enhance the project economics?

# FEASIBILITY STUDY

- **Analysis**
  - Utility Bills / Interval Data
  - Simulation / Modeling
  - System Sizing
  - Building Plan Review
  - Site Visit




- **Technology / Vendors**
  - Approved products by Authorities Having Jurisdiction

- **Project Specification for Pricing**
  - Drawing set
  - Book specifications

- **Contractor and Maintenance Provider**

# SAMPLE BATTERY RETROFIT PROJECT

Via Verde (Bronx, NY)
- 66 kW Solar PV Array, built in 2012
- No energy storage
- Emergency Generator on site


**CODA Core™ Tower (left),**

**Princeton Power 30 kW Inverter (middle),**

**Cummins Automatic Transfer Switch (right)**

# THANK YOU!

**Connect with Henry:**

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hmisas@brightpower.com

# Resilient Power Project Upcoming Events & Links

- CEG Webinar: MassDOER Resilient Power Solicitation Results, Wednesday, December 3, 1-2pm ET http://bit.ly/CEG-MassDOER-Webinar
- CESA Webinar: Accelerating Resilient Power in CT and NY, Tuesday, December 16, 1-2pm ET http://bit.ly/CT-NY-Webinar
- RPP e-Distribution List Sign-Up to get notices of future webinars and the *Resilient Power Project Newsletter*: http://bit.ly/RPPNews-Sign-Up
- More information about the project, its reports, and other information can be found at www.resilient-power.org.

# Contact Info

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