RESILIENT POWER

A Project of Clean Energy Group

Resilient Cities: Clean Energy to Power Critical Public and Private Facilities

April 2, 2015

Hosted by
Lew Milford, President, Clean Energy Group
Rob Sanders, Senior Finance Director, Clean Energy Group

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.

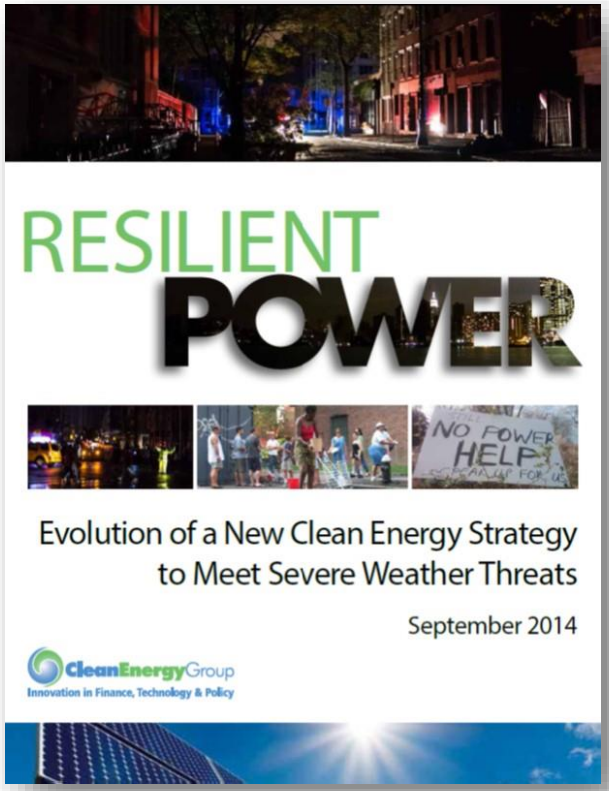
You will find a recording of this webinar, as well as previous Resilient Power Project webinars, online at:

www.cleanegroup.org/ceg-projects/resilient-power-project/webinars/

and at

vimeo.com/channels/resilientpower

Who We Are



CleanEnergyGroup
Innovation in Finance, Technology & Policy

Meridian Institute
Connecting People to Solve Problems

CleanEnergy States Alliance

THE JPB FOUNDATION

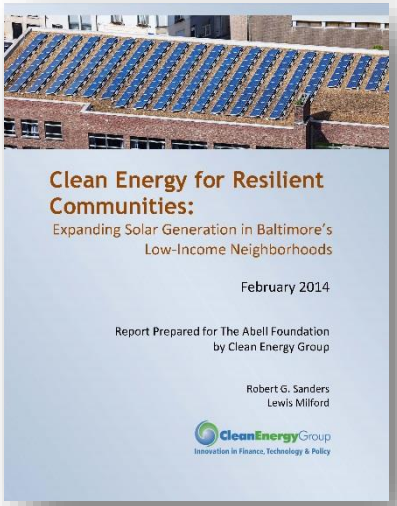
SURDNA FOUNDATION
Fostering sustainable communities in the United States

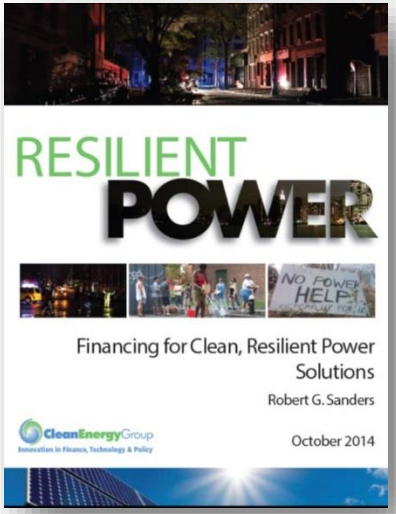
THE KRESGE FOUNDATION

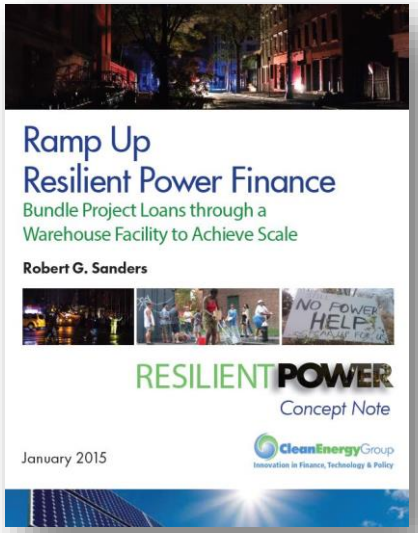
www.resilient-power.org
www.cleanegroup.org

CEG Resilient Power Project

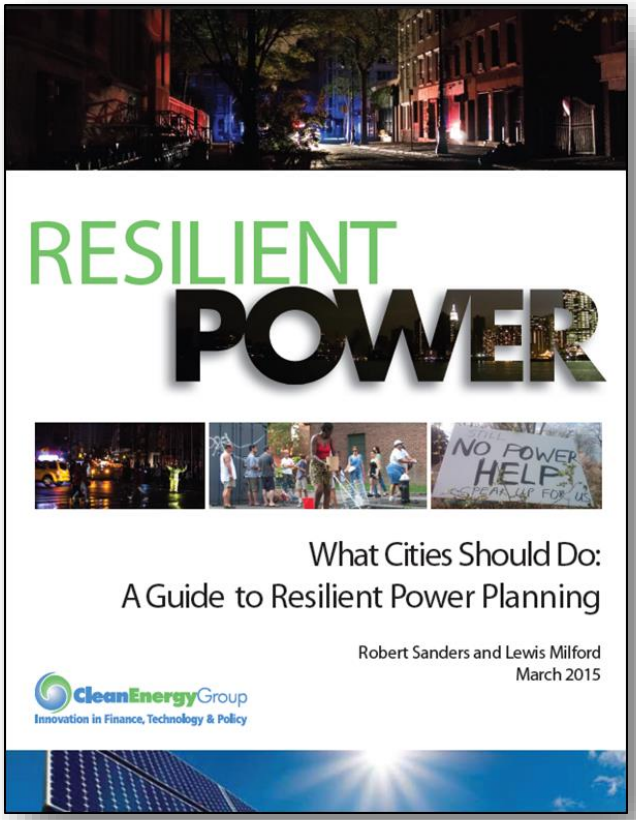
- Goal: significantly increase public/ private investment for clean, resilient power systems.
- Support state energy agencies in developing resilient power policy and programs.
- Engage city officials to develop resilient power policies/ programs, link to state energy policies.
- Protect low-income and vulnerable communities; focus on affordable housing
- Technical assistance & targeted support for pre-development costs for resilient power projects to help agencies/ project developers get deals done.
- See www.resilient-power.org for reports, newsletters, webinar recordings







Today's Topic :
Resilient Cities



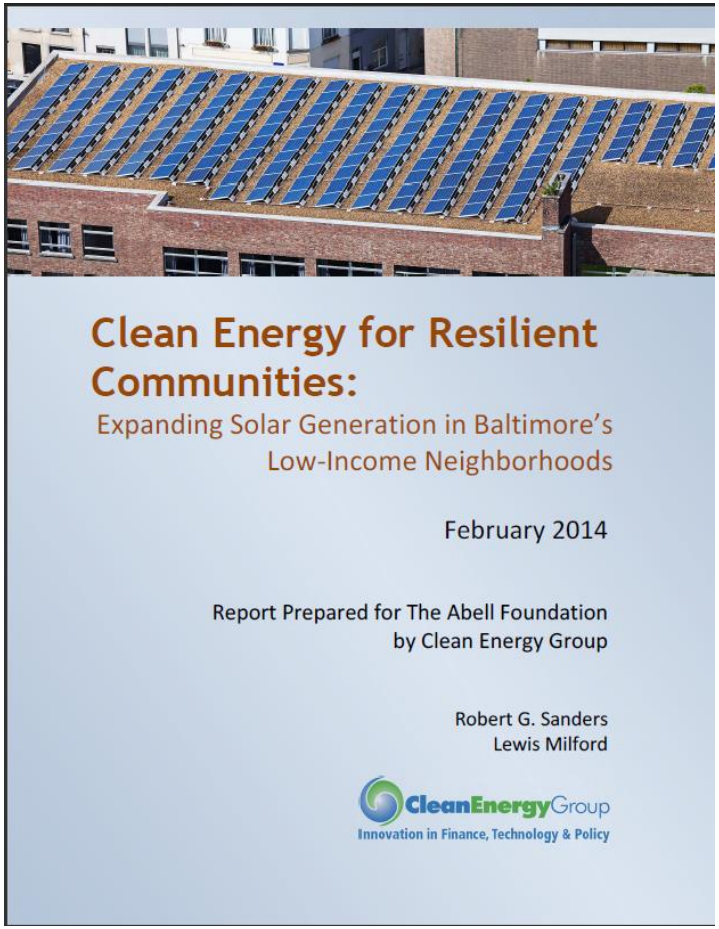
http://www.cleanegroup.org/assets/2015/Resilient-Cities.pdf

When it comes to reliable energy technologies to protect against power outages, there is a disparity between the haves and the have-nots.

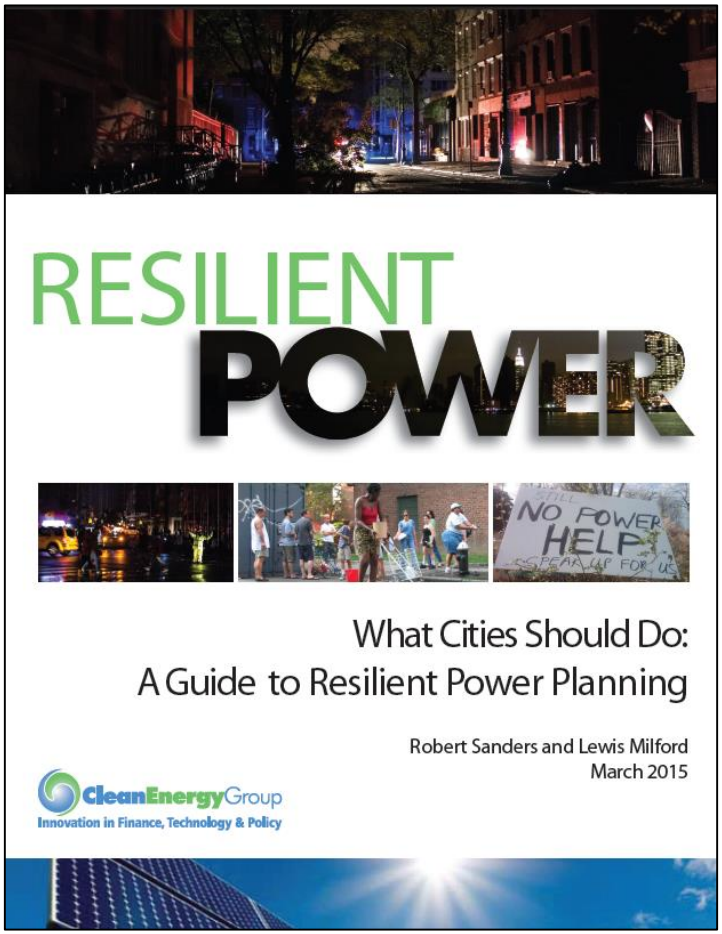
Call it "resilient power inequality."

Resilient Power and Baltimore

- *Clean Energy for Resilient Communities*
- How to expand solar PV to benefit low income & vulnerable (LIV) populations
- Disproportionate impact of power outages on LIV communities
- Critical facilities should be evaluated for resilient power
- City should use bond & lease financing, 3rd party ownership to implement projects
  - http://www.cleanegroup.org/assets/Uploads/2014-Files/Clean-Energy-for-Resilient-Communities-Report-Feb2014.pdf



Resilient Cities – What Should Cities Do?



- Disaster preparedness planning: evaluate vulnerabilities in multiple infrastructures
- Few cities assess risks & mitigation strategies re: grid outages for critical public & community facilities
- None has developed citywide resilient power strategy
- Many solar PV + battery storage systems are financed with little or no upfront costs
- FERC rules permit new revenues to be paid for grid services provided by battery storage

New Resilient Power Initiatives

- NYC - Smart DG Hub –Resilient Solar Project
  - 3-year project to address local barriers to implementing resilient power projects
- Multifamily affordable housing developers – DC, NYC, Chicago & Boston
  - Beginning to address community equity issues re: who has access to resilient power
- Leveraging state resilient power funding for local projects
  - MA DOER Community Clean Energy Resiliency Initiative: $40 million, 31 municipal projects
  - NJ Energy Resilience Bank: $200 million for infrastructure and building-related resilient power projects

Project-based Resilient Power Strategy for Cities

- Make it someone's job, and require close coordination between city departments
- Identify, prioritize critical facilities to be protected
- Identify critical power loads at select critical facilities
- Conduct engineering assessments for select critical facilities
- Develop viable financial plan (3rd party ownership, capital investment plan)
- Develop & supervise an implementation/ oversight plan for projects, including performance evaluation

Today's Guest Speakers

- **Kristin Baja,** Climate and Resilience Planner, City of Baltimore
- **Laurie Reilly,** Communication Director, Sustainable CUNY
- **Erica Helson,** New York State Solar Ombudsman, Sustainable CUNY

CEG –Resilient Cities

New York's Smart DG Hub Resilient Solar Project

April 2, 2015

Sustainable CUNY

Sustainable CUNY Conserves

NYSolar Smart

Smart DG Hub

Modeling a CUNY transformation

Removing the barriers to wide-scale solar adoption in NY

Developing a strategic pathway for resilient Distributed Generation

Focus Areas

Solar Infrastructure

- Permitting
- Zoning
- Grid Analysis
- Policy Support
- Installer Roundtable

Mapping the Way

- One stop Portal
- Solar Maps
- Data Analytics
- Roadmaps

Accessing Solar

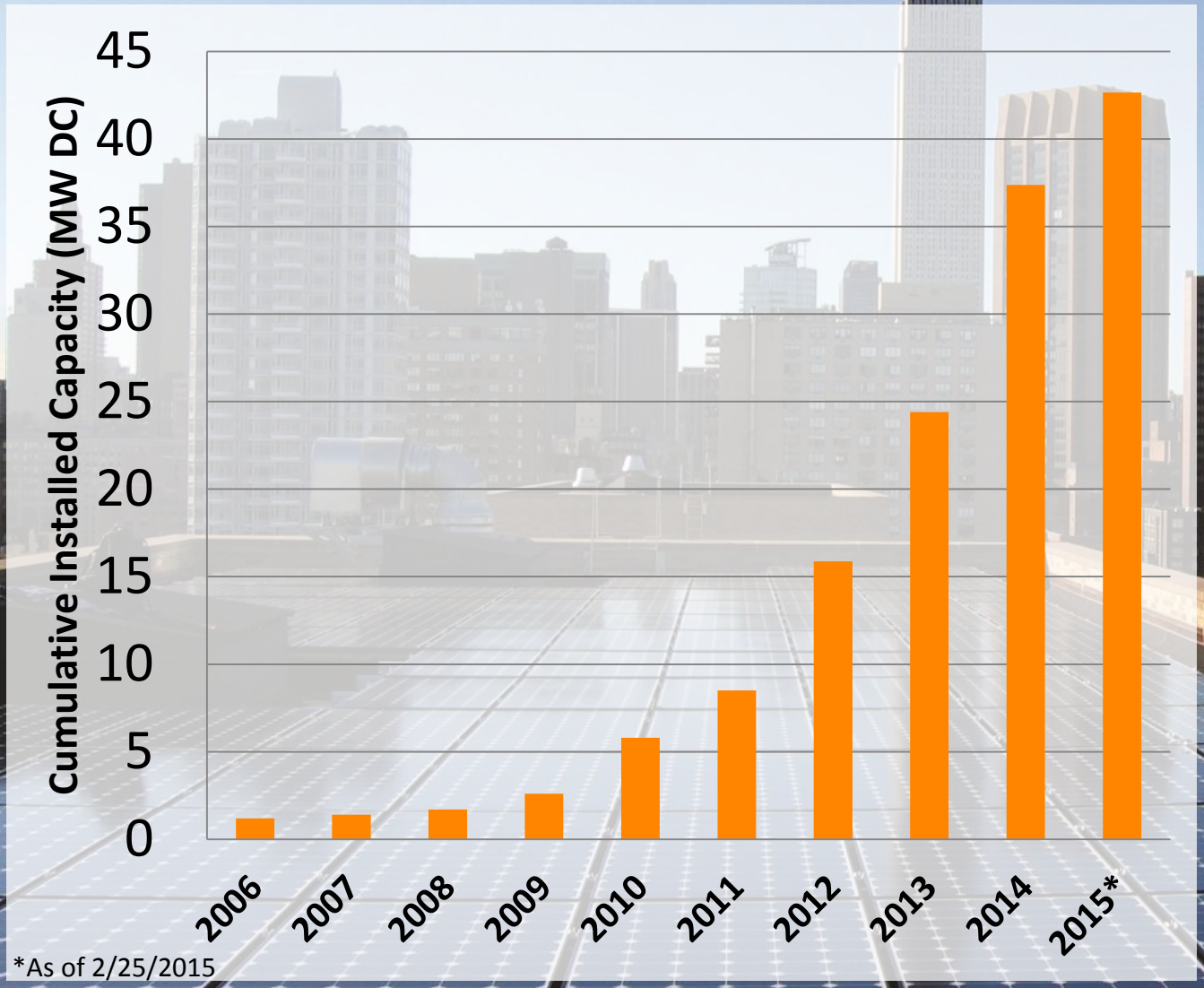
- Group Purchasing
- Community Shared Solar
- Education
- NY Solar Summit

Resiliency

- Smart DG Hub
- Solar-plus-storage
- Critical Facility Support

U.S. Department of Energy | State of New York | New York City | CUNY | Private Foundations

NYC Solar Growth



*As of 2/25/2015

2005

Capacity: 1.1 MW

Installs: 45

Value: $13 million

2015

Capacity: 42.6 MW +

Installs: 2,682 +

Value: $269 Million +

Hurricane Sandy's Extensive and Prolonged Power Outages

The New York Times

N.Y. / Region

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UPDATED October 30, 2012

FACEBOOK TWITTER GOOGLE+ E-MAIL SHARE

A Close Look at Power Failures in New York City

5:45 P.M. ET Nov. 8

Hurricane Sandy knocked out power to hundreds of thousands of people in the area. Data updated every 15 minutes.

Sandy Fast Facts

Outages

5 million NY & NJ residences

Total cost

$50 billion

Cost to NYC

$19 billion

Photo: Iwan Baan/New York Magazine

State of NYC Solar PV During Recovery

Solar in affected area in 2012:

- 5,500 kW
- 281 installations
- Nearly 50% of NYC installations

Estimated untapped solar energy per day after the storm:

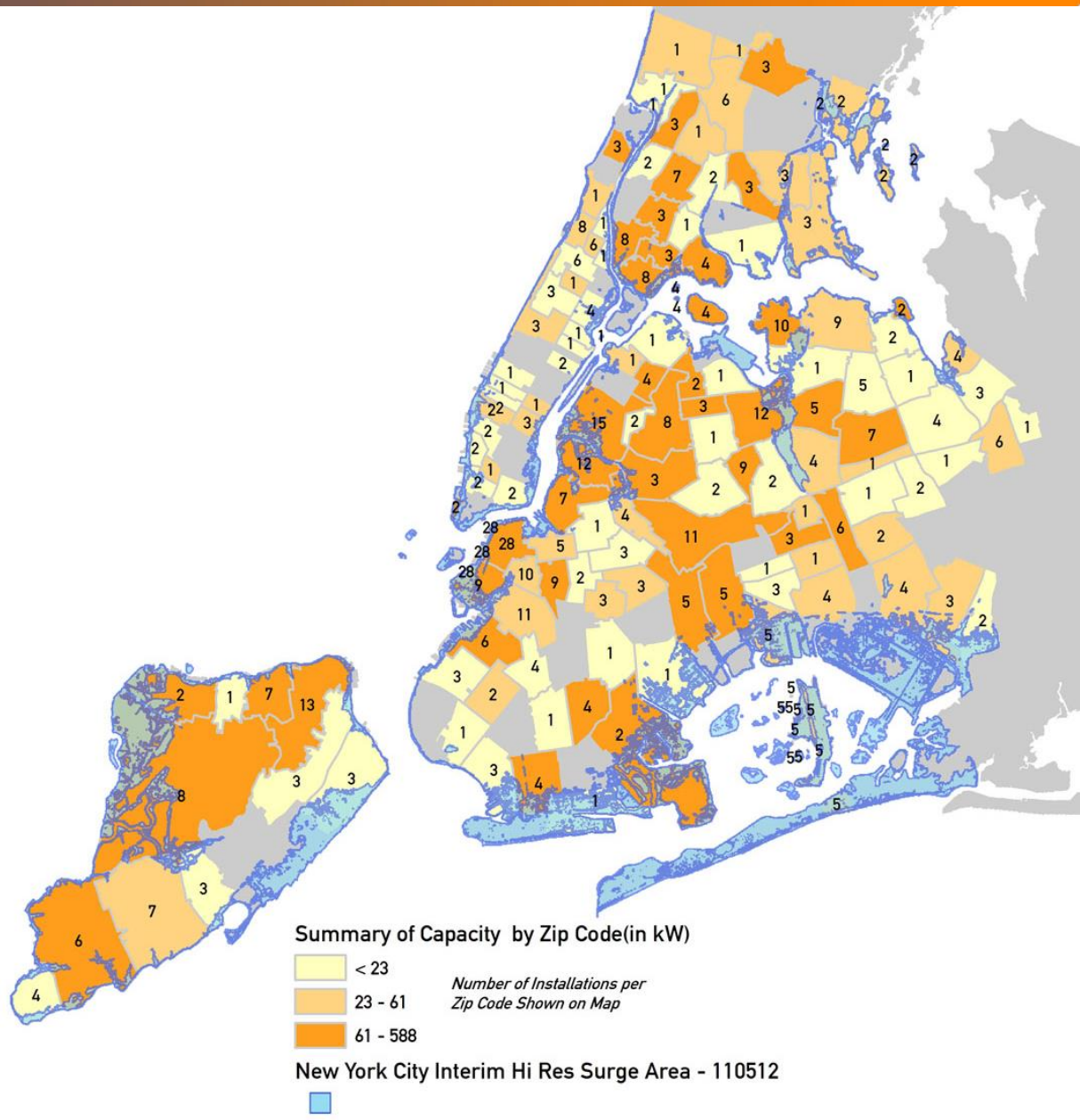
6,500 kWh

Solar in affected area in 2015:

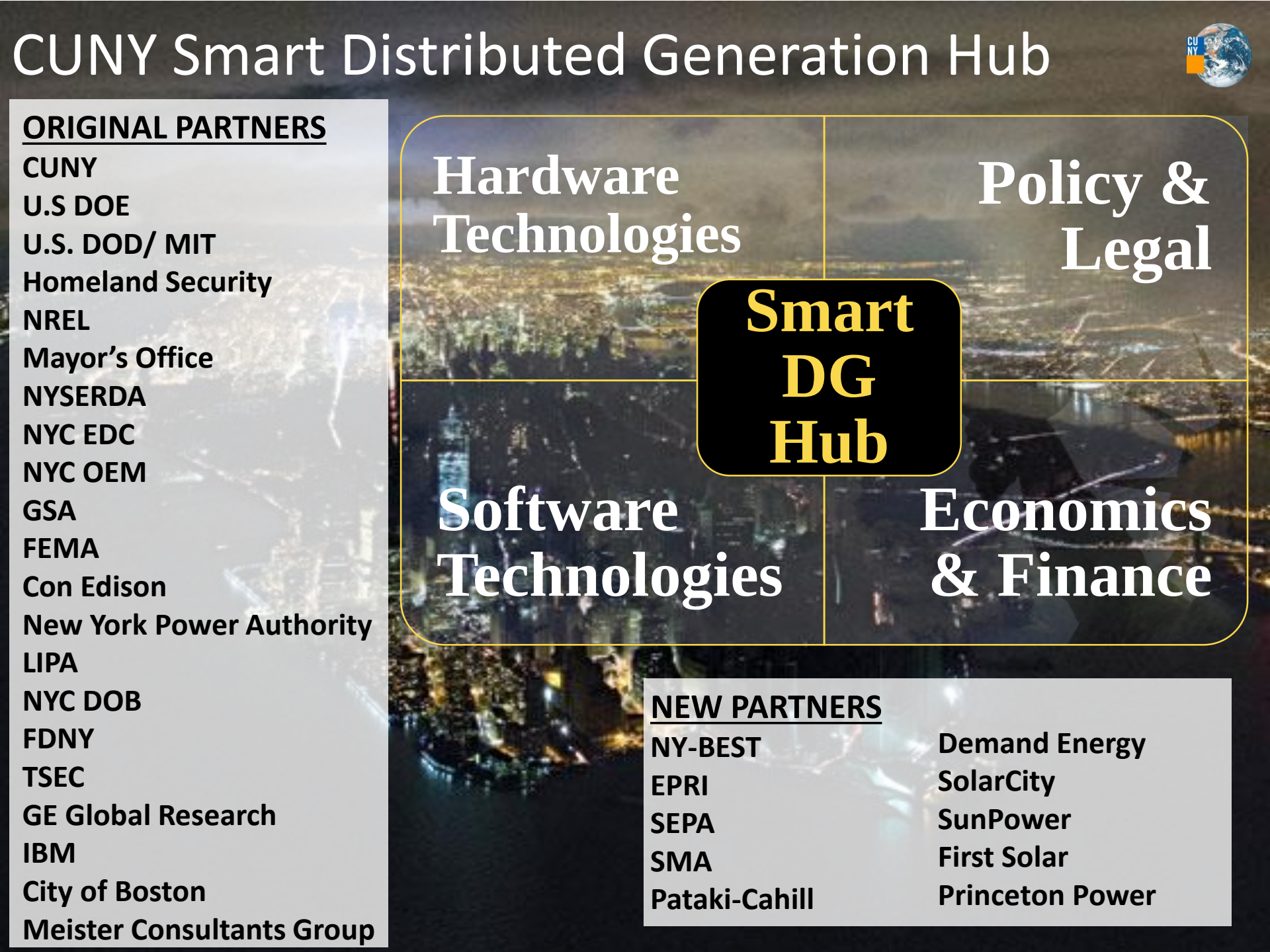
- 15,500 kW
- 1,571 installations

Solar arrays in NYC with daylight emergency power plug via SMA inverter in 2015:

177



CUNY Smart Distributed Generation Hub



ORIGINAL PARTNERS

- CUNY
- U.S DOE
- U.S. DOD/ MIT
- Homeland Security
- NREL
- Mayor's Office
- NYSERDA
- NYC EDC
- NYC OEM
- GSA
- FEMA
- Con Edison
- New York Power Authority
- LIPA
- NYC DOB
- FDNY
- TSEC
- GE Global Research
- IBM
- City of Boston
- Meister Consultants Group

NEW PARTNERS

- NY-BEST
- EPRI
- SEPA
- SMA
- Pataki-Cahill
- Demand Energy
- SolarCity
- SunPower
- First Solar
- Princeton Power

DG Hub Structure

PROJECT TEAM

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

MEISTER
CONSULTANTS GROUP

ADVISORY BOARD

- Hardware Technologies Working Group
- Software Technologies Working Group
- Economics & Finance Working Group
- Policy & Legal Working Group

Key Partners

Smart DG Hub Working Groups

HARDWARE TECHNOLOGIES

- NY-BEST
- Project developers
- Battery providers
- Solar installers

SOFTWARE & COMMUNICATION TECHNOLOGIES

- NYC Emergency Management
- Con Edison
- Software providers

ECONOMICS & FINANCE

- Clean Energy Group
- NYC Economic Development Corporation
- Finance companies

POLICY & LEGAL

- Dept. of Buildings
- FDNY
- DCAS
- Mayor's Office of
  - Sustainability
  - Recovery & Resiliency

Smart DG Hub Resilient Solar 3-Year Plan

Y1

Survey & Research

- Survey resilient PV costs
- Research barriers and solutions to more resilient PV in NYC

Y2

Resources & Roadmap

- Fact sheets and model guidelines
- Smart DG Hub Roadmap for Resilient Solar

Y3

Tools & Outreach

- Resilient PV calculator and new layers on Solar Map
- Workshops, trainings, webinars

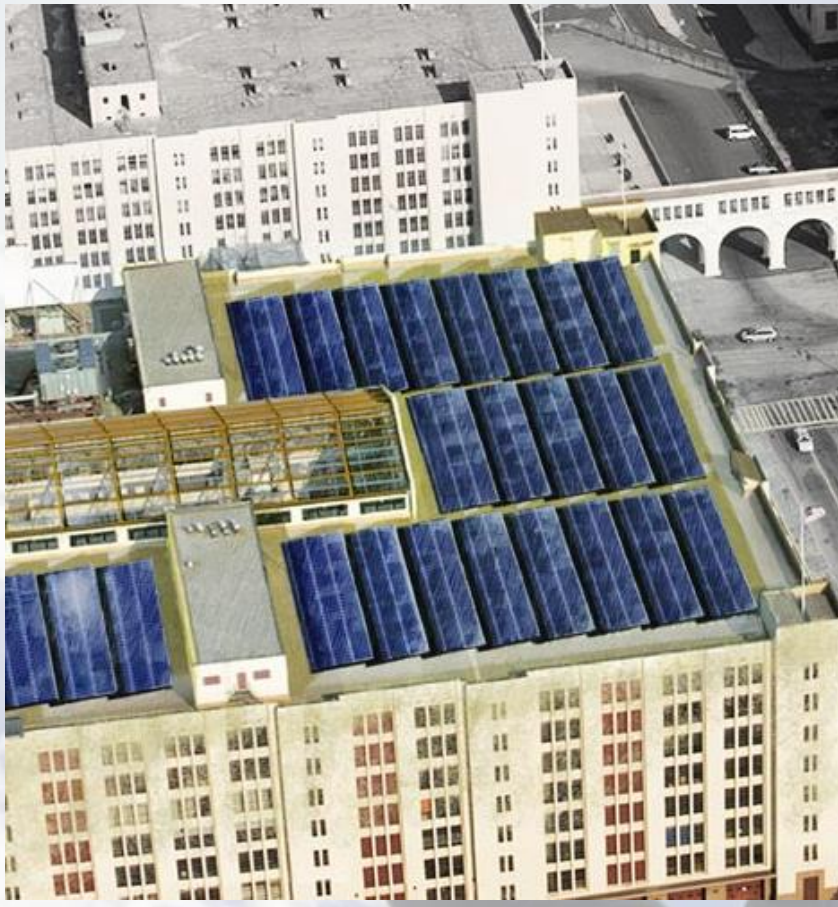
Considerations

1. **Ensuring key stakeholders are represented**

2. **Balancing economic incentives for storage with resiliency needs**

3. **Responding to Reforming the Energy Vision (REV)**

4. **Sharing project findings with targeted audiences**



Brooklyn Army Terminal solar+storage project developed by NYC EDC

DG Hub Goals

- Develop Platform
- Engage Stakeholders
- Create Strategic Pathways
- Increase Deployment of Resilient PV Systems

Objective

A more resilient distributed energy system in NYC, with a path for expansion across the state and country

Thank You

Please direct Smart DG Hub questions to:

Erica Helson
NYS Solar Ombudsman
Erica.Helson@cuny.edu
212.346.8577

Resilient Cities: Clean Energy

Climate Resilience Planning:

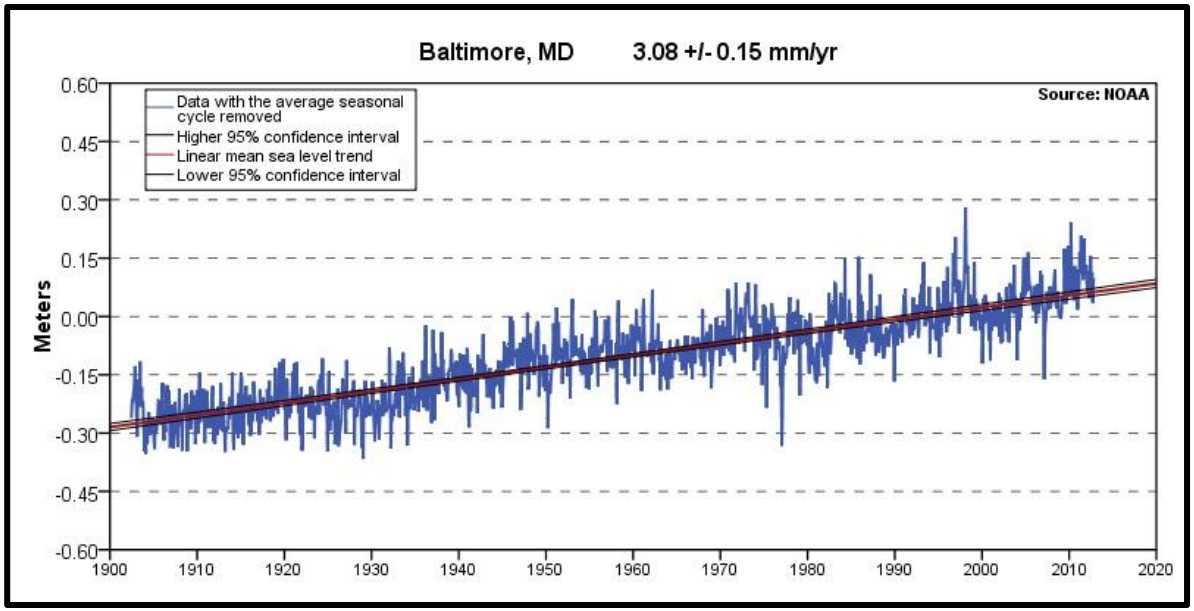
Baltimore's Combined All Hazards Mitigation and Climate Adaptation Process

Kristin Baja
Climate and Resilience Planner
City of Baltimore, Office of Sustainability

Overview

- Hazards
- Plan Development
- Implementation
- Resilient Power

Hazards


Baltimore, MD
3.08 +/- 0.15 mm/yr
Source: NOAA
Data with the average seasonal cycle removed
Higher 95% confidence interval
Linear mean sea level trend
Lower 95% confidence interval
Meters
0.60
0.45
0.30
0.15
0.00
-0.15
-0.30
-0.45
-0.60
1900
1910
1920
1930
1940
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1960
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1980
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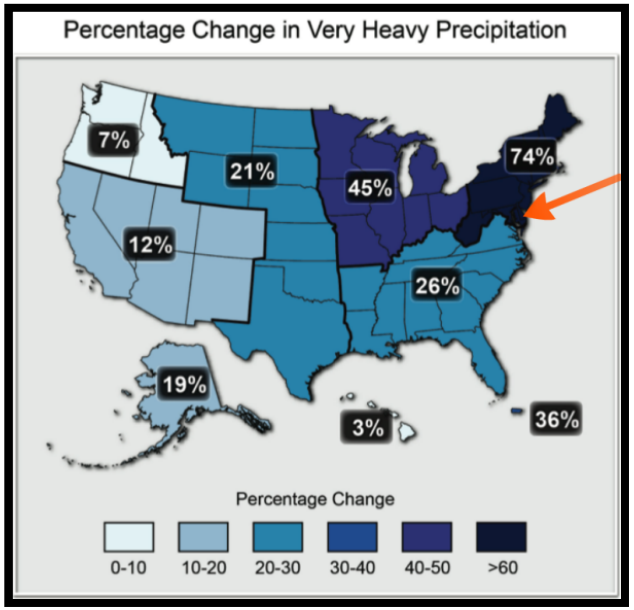
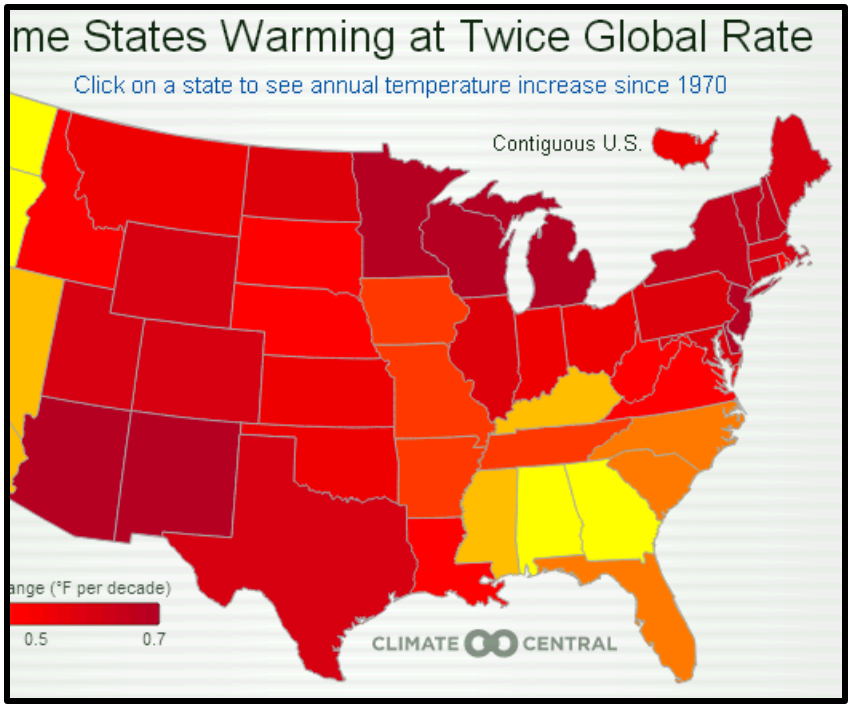
2020


Percentage Change in Very Heavy Precipitation
7%
21%
45%
74%
12%
26%
19%
3%
36%
Percentage Change
0-10
10-20
20-30
30-40
40-50
>60


me States Warming at Twice Global Rate
Click on a state to see annual temperature increase since 1970
Contiguous U.S.
ange (°F per decade)
0.5
0.7
CLIMATE CENTRAL

Quick Review of Hazards

Coastal Storms	**more severe**
Floods	**more extensive**
Severe Thunderstorms	**more severe**
Wind	**increase intensity**
Winter Storms	**less snow, more flooding**
Extreme Heat/Drought	**more severe and intense**
Sea Level Rise	**increased threat**
Air Quality	**lower quality and increase risk**


Planning

Baltimore's Unique Approach

All Hazard Mitigation Plan

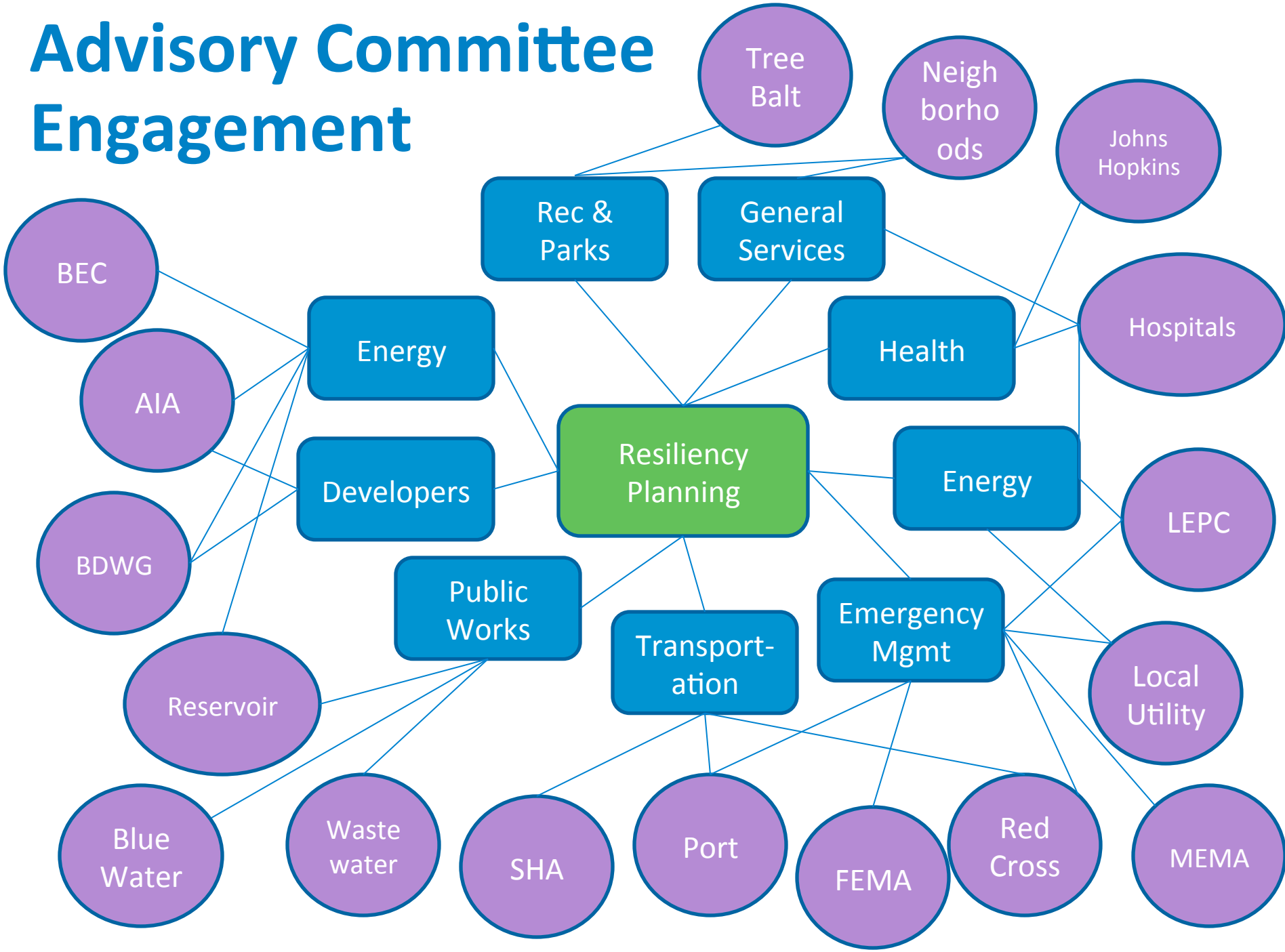
(Current and Historical Hazards)

\+ = Resilience

Climate Adaptation Plan

(Adapt to new and predicted climate conditions)

Advisory Committee Engagement



Process

Risk Assessment

Hazard Identification

- Hazard Identification
- Review Historical Impacts
- Conduct an Asset Inventory

Vulnerability Assessment

- Determine likelihood
- Determine economic, social, legal & environmental consequence

Impacts Assessment

- HAZUS Modeling
- Integrate projected climate conditions
- Identify weaknesses

Plan Development

- Vision, Goals, Strategies, Actions
- Prioritization
- Integration
- Plan for implementation & monitoring

Structure

Infrastructure

- Energy
- Liquid Gas
- Communication
- Transportation
- Waterfront
- Wastewater
- Stormwater
- Solid Waste
- Policy

Buildings

- City Codes
- Structural
- Non-Structural

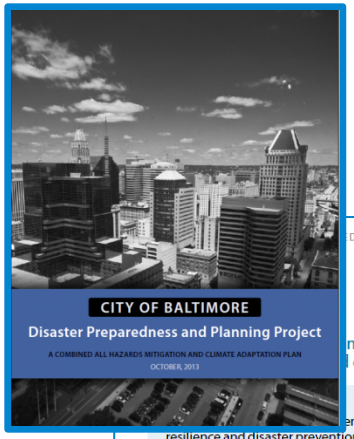
Natural Systems

- Urban Parks & Forests
- Water Supply and Management

Public Services

- Emergency Preparedness & Response
- Health
- Education & Outreach
- Food System

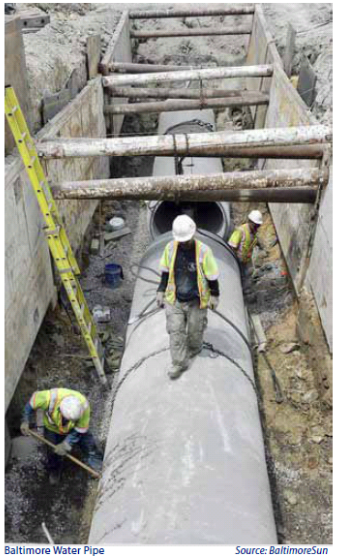
Disaster Preparedness Plan



Adopted unanimously in October, 2013

ment that evaluates and improves all pipes' ability to withstand
l cold

em is dated and in need of upgrades. It is important to build extreme weather resilience and disaster prevention into water and wastewater systems by using both adaptation and mitigation actions. Additionally, structural and infrastructural upgrades must be made to reduce loss of water supply from the distribution system.



Baltimore Water Pipe *Source: BaltimoreSun*

1. Replace old and malfunctioning pipes with new pipes or retrofit existing pipes with new lining

   Pipes that have already begun experiencing problems, or older pipes which are more vulnerable to the impacts of hazards, should be upgraded using the best available technology.

2. Evaluate and utilize new technology that allows for greater flexibility in pipes as they are replaced

   It is essential to prepare for future changes in hazard events and proactively upgrade pipe systems to prevent cracking and bursting.

IMPLEMENTATION GUIDELINES	
Lead Agency	DPW
Stakeholders	DOT, DPW, Water and Wastewater Utilities
Alignment with Goals	Goal 3
Connection with Existing Efforts	CAP; CRS; MD DNR; ESF-3; ESF-4
Timeframe	

STORMWATER

IN-16 Enhance and expand stormwater infrastructure and systems

Future changes in precipitation frequency and intensity may require reconsideration of the design of existing stormwater infrastructure systems.

Increase resiliency and disaster prevention measures related to stormwater systems by enhancing drainage systems in stream corridors and improving and repairing stormwater conveyance popes and outfalls.

1. Implement the requirements of Baltimore's MS4 (separate stormwater and sewer system) permit (S)

   The City of Baltimore operates under a Municipal Separate Stormwater and Sewer System (MS4) permit, which protects water-quality and requires that Baltimore prevents pollution as much as possible. It is critical that the requirements of these permits are fully met.

2. Prioritize storm drain upgrades and replacement in areas with reoccurring flooding (S)

   While proximity to a floodplain or floodway can increase vulnerability to flooding, certain measures can reduce this vulnerability. Inadequate or older pipes, which cannot accommodate the excessive amounts of stormwater, should be upgraded so as to handle extreme rainfall and storm surge events.

3. Install backflow-prevention devices or other appropriate technology along waterfront to reduce flood risk (M-L)

   Backflow-prevention devices are used to ensure that water does not flow back through drainage infrastructure. Through the installation of backflow-prevention devices, the City can improve the performance of the drainage network and prevent risk of flooding impact along the waterfront.

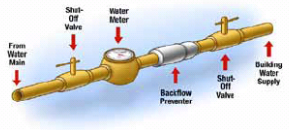
4. Preserve and protect natural drainage corridors (S)

   It is important to utilize natural drainage corridors and green infrastructure to capture more stormwater runoff and enhance the ability of the existing infrastructure to cope with environmental changes.

5. Review and revise storm drain design on a continuous basis, to accommodate projected changes in intense rainfall (O)

   The City's storm drains will require continual revision to incorporate new and projected changes in intense rainfall. This will ensure that the storm drains maintain adequate capacity.

IMPLEMENTATION GUIDELINES	
Lead Agency	DPW
Stakeholders	Community Groups, DOT, DPW, MOEM, MDNR, NGOs, Private Developers, Stormwater Utility
Alignment with Goals	Goals 1, 3, and 6
Connection with Existing Efforts	CRS; MD DNR
Timeframe	



Backflow Preventer *Source: DemarPlumbingNYC*

Crosswalk

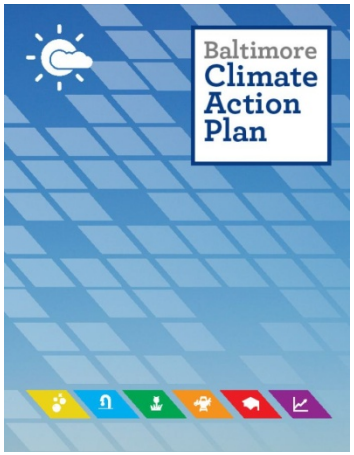
- Identify overlaps with existing planning efforts
- Prioritize Strategies and Actions with lead stakeholders

STRATEGY NUMBER	STRATEGY	ACTION	Water a	C1	C2	C3	PP1	PP2	PP3	PP4	PP5	RC1	RC2	RC3	RC4	G1	G2	G3	G4	T1	T2	T3	T4	T5	EA1	EA2	EA3	EA4	GE1	GE2
		Review and revise storm drain design on a continuous basis, to accommodate projected changes in intense rainfall							x				x																	
IN-17	Modify urban landscaping requirements and increase permeable surfaces to reduce stormwater runoff	Support existing stormwater requirements and continue to evaluate and improve Best Management Practices							x				x			x			x										
		Encourage urban landscaping requirements and permeable surfaces into community managed open spaces							x				x			x		x	x										
		Utilize water conservation elements such as green roofs, rain gardens, cisterns, and bioswales on residential, commercial, industrial, and City-owned properties to capture stormwater							x				x			x		x	x										
		Encourage permeable paving on low-use pathways							x				x					x	x										
IN-18	Evaluate and support DPW's stream maintenance program.	Review and improve status of standing maintenance requirements			x				x										x										
		Ensure adequate funding is in place to support stream maintenance			x				x										x										
		Identify opportunities where stream restoration efforts will off-set maintenance costs			x				x										x										
		Identify interdependencies and benefits of stream maintenance with other transportation programs			x				x										x	x	x	x	x	x						
		Clear streams on a regular basis, prioritize dredging the stream beds, and increase inspection and cleaning of culverts and storm drains to prevent flooding		x	x				x										x										
IN-19	Support and increase coordination and information sharing across jurisdictions to better enable mitigation of cross-border impacts on the regions watersheds (e.g., understanding flood conditions upstream in the County)	Partner with local counties to evaluate major tributaries in all watersheds to determine best management practices for capturing run-off and slowly releasing it (stormwater quantity management)							x				x						x										
		Encourage information sharing within the Chesapeake Bay community to assist in developing best management practices							x				x						x										
IN-20	Reevaluate and support a comprehensive debris management plan for hazard events	Investigate best practices for managing and disposing of downed trees, yard waste, building debris, as well as additional household garbage		x	x									x															
		Expand and integrate existing programs to reduce or intercept debris before it gets into the streams and harbor		x	x									x															
		Develop and promote solid waste management actions for citizens to implement before a hazard event		x	x									x															
		Incorporate consideration of hazards and climate adaptation efforts into all plans, systems,		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Implementation

Prioritization

MITIGATION



Energy Savings and Supply

Land Use and Transportation

Growing a Green City

RESILIENT + SUSTAINABLE

Drinking water

Renewable Energy

Trees

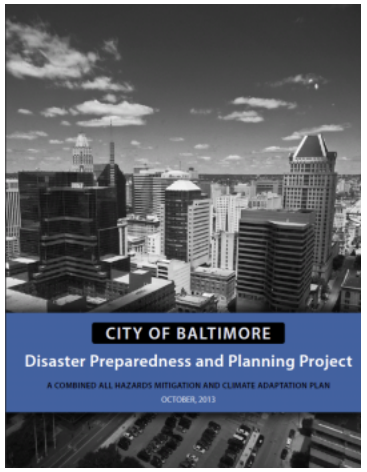
Building Codes

Energy Grid

Energy Efficiency

Transportation Inf.

ADAPTATION + HAZARD MITIGATION



Infrastructure

Buildings

Natural Systems

Public Services

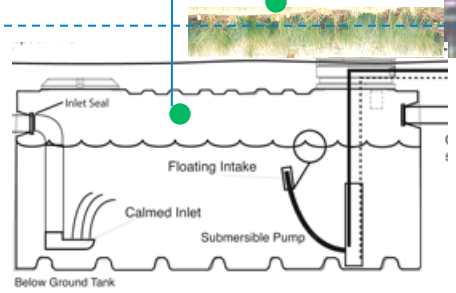
Whole Block Approach

Energy

- Cool Roofs
- Weatherization
- Energy Education

Additional

- Trees and Greening
- Renewable Energy
- Stormwater
- Heat sensors



Residential Pilot

- Identify neighborhoods most vulnerable to impacts from climate change
- Pilot project- solar on ten row houses in low income area
- Include weatherization and cool roof installation

Resiliency Hubs

- Effort focused on neighborhoods most vulnerable to high heat and flooding
- Identify community centers and trusted gathering spaces
- Solar with battery backup systems

Private Partners

Domino Sugar

76 blue solar panels producing 41,000 kilowatt- hours of electricity per year

Inner Harbor Waterwheel

On a sunny day, the water wheel can produce 2500 watts of electricity a day which keeps the wheel lifting trash and debris from the water

Critical Facilities

Back River Wastewater Treatment Plan

4200 panels on five acres

Lessons

Leverage other projects and programs

Baltimore Energy Initiative (BEI), a multi-agency, city-wide program to expand and streamline the City's energy conservation programs and education and outreach efforts.

The **Baltimore Energy Challenge (BEC)** teaches low to no cost ways to save energy to residents, businesses, and nonprofits through a grassroots effort in neighborhoods and schools. We ask everyone to sign a pledge committing to reduce their energy use through behavior change and for that, we thank them with a kit of energy saving products.

What worked well

- Still in process of taking actions in the DP3 and implementing them
- Starting small and with pilot projects
- Prioritizing areas at most risk
- Focus on projects that take into account anticipated impacts from climate change
- Looking at funding mechanisms
- Identifying co-benefits with adaptation and mitigation

Baltimore Office of Sustainability
People · Planet · Prosperity

Questions?

Kristin Baja
Climate and Resilience Planner
Kristin.baja@baltimorecity.gov

Resilient Power Project Upcoming Events & Links

Upgrading Distribution Resilience: A DOE-OE Solicitation,
Tuesday, April 7, 1:30-3pm ET http://bit.ly/ESTAP-Webinar-4-7-15

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