CLEAN WATER FUND

EASE: EDUCATION AND ACTION FOR SECURE ENERGY

FINAL REPORT TO CIRCA ON 2016/2017 PROGRAM DEVELOPMENT
JUNE 30, 2017

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Partially funded by a grant from the Connecticut Institute for Resilience and Climate Adaptation
More information about CIRCA can be found at circa.uconn.edu.

CIRCA
Connecticut Institute for Resilience and Climate Adaptation

ABOUT CLEAN WATER FUND

Since 1974, Clean Water Fund has helped people campaign successfully for cleaner and safer water, cleaner air, and protection from toxic pollution in our homes, neighborhoods and workplaces. Organizations and coalitions formed and assisted by Clean Water Fund have worked together to improve environmental conditions, prevent or clean up health-threatening pollution in hundreds of communities and to strengthen policies locally and nationally.

Clean Water Fund's mission is to develop strong grassroots environmental leadership and to bring together diverse constituencies to work cooperatively for changes that improve their lives, focused on health, consumer, environmental and community problems.

Clean Water Fund's programs build on and complement those of Clean Water Action, a one million member national organization which has helped develop, pass, strengthen and defend the nation's major water and toxics laws such as the Clean Water Act, Safe Drinking Water Act, Superfund and others, including their state-level counterparts. Clean Water Fund is a nonprofit organization under section 501(c)3 of the U.S. Internal Revenue Code.

Based in Washington, DC, Clean Water Fund operates locally staffed environmental and health protection programs serving communities in more than 15 states including Connecticut. Here, the work focuses upstream to reduce toxic substances in commerce and speed up the shift to clean energy while working on water policy and education. The organization coordinates the Coalition for a Safe and Healthy Connecticut and supports over 60 Clean Energy Task Forces as well as conducting energy and climate change policy education.

PROJECT SUMMARY AND RATIONALE

In February, 2016, an estimated 50 Clean Energy Task force members met at the Energize CT Center in North Haven for a semiannual gathering to discuss common concerns, share best practices and identify ways to collaborate to accelerate each other's work in local energy conservation, planning and clean energy procurement. Three themes of strong common interest were identified:

- Integrating energy efficiency and renewable energy into local Plans of Conservation and Development to strengthen the status of local efforts to scale up these resource investments.
- Mapping out communities' pathways to 100% renewable energy as a long-range planning exercise that can guide near-term priorities and inspire participation.
- Finding ways to strengthen energy security and local self-reliance in conjunction with local energy planning and scaled up renewables.

This third priority gave rise to a working group of Task Force members (initially representing Middletown, Enfield, and Madison) along with state and nationally recognized experts (see Appendix 5 for project advisor bios) with the initial goal of getting our own heads around this complex topic. With 2016 and 2017 funding from the consortium that supports our overall work[1] with the Task Forces and a generous matching grant awarded by CIRCA[2], we developed an advisory group and a goal: to understand communities' energy planning needs in the context of climate action and how resilience could be an integrating concept. Sixteen months later we have developed a needs assessment questionnaire, planning framework, introductory briefing, community stakeholder workshop – and a poster for CIRCA summarizing the work.

CONTEXT OF ENERGY RESILIENCE IN CT

Connecticut has been hit hard by a number of extreme weather events including storms and the recent drought. CIRCA's planning and preparation for resilience, with many partners, has established a foundation for protecting critical infrastructure and natural resources, and keeping people safe, with a special focus on coastal areas. The resilience of non-generating energy infrastructure has been addressed significantly by the work of the UConn/ Eversource Energy Center. But planning for secure energy supply, and its integration with scaled-up renewable energy, has not historically been on communities' radar. As local interest in planning for renewable energy development mounts, energy security planning is a critical component.

[1] Emily Hall Tremaine Foundation, Hampshire Foundation, Common Sense Fund.

[2] Connecticut Institute for Resilience and Climate Adaptation: http://circa.uconn.edu/

Some communities have received help on this from the US Department of Agriculture and from the Connecticut Center for Advanced Technology – both time-limited grants for particular communities focusing on technology planning. Our effort sought to be ongoing and to empower communities to stay on top of a fast-changing subject area by educating and empowering a key constituency, the appointed Clean Energy Task Forces and Committees that exist in over 60 population centers including most of our major cities. Early on, we learned from staff at the Green Bank and at DEEP's Micro-Grids program that there is a gap between theoretical interest (which is high) and the capacity of local officials to delve into this topic with the depth of focus that is needed. And as DEEP's Micro-Grids funding officer told us, "Every time I try to hold a workshop for towns, I get a room full of consultants instead."

In the networks of interest in this topic,"Resilience" is a common short-hand for four integrated concepts:

- Security in emergencies through backup power and managed demands
- Ongoing control of energy supply options
- Increased stability of the local energy supply through distributed system design
- Strategic planning for increases in the use of renewables.

The project name, EASE, was chosen to embody all these dimensions. Our initial focus was on electric power but we realized that fuel supply would be an equally important factor so we included both.

Our background research showed that we are working in a context of rapid change in technology, markets and financing options. This is somewhat at odds with the not-so-rapid planning and at times long decision horizons in local planning, and a need for broad consensus building within communities to consider trade-offs and set a direction. For example, "smart" approaches to energy demand management and widely distributed renewables have benefits in making the system less vulnerable to physical disruption – but can make it more vulnerable to cyber-attack. Resulting from this, one of the most critical decisions we made was to counsel communities to take the time needed to consider scenarios in depth and make plans based not just on economics but also on community values and perceptions of risk.

PROJECT STRUCTURE AND KEY ACTIVITIES

The project was structured around a series of interactive workshops with advisors and municipal representatives, along with online collaboration to develop a tool kit for resilient energy planning that could be piloted in a few communities, refined and eventually adopted with some consistency.

We began by designing and piloting a needs assessment survey which was completed by representatives of seven communities. The survey made it clear that communities are very different in their goals, attitudes, capabilities and priorities. And within a community there can be a deep gulf between aspiration and capacity. We received six responses online, and then one of our advisory team members had an "aha moment" and contacted his town engineer and first selectman for a face to face discussion, which opened the door for a more substantive working group at the local level that would never have come together based on administering the survey online.

In all, seven pilot responses showed that Connecticut has communities at all levels of capacity and preparedness from having high-functioning micro-grids and expertise to share, all the way to facing challenges even in funding basic emergency backup generators. But in light of the vulnerability of the entire grid to cyber-attack and general failure as well as climate related stresses, even the best prepared communities (by today's standards) have work to do to develop energy systems that make it possible for the entire community to truly withstand an extended crisis in the supply of power and/or fuel. We had discovered that, during Hurricane Sandy, the biggest financial losses incurred by businesses were not direct physical damage but lack of continuity of operations. When critical businesses such as hardware stores and grocers are compromised, the burden on the public sector is increased many-fold. Therefore, not only government operations but critical businesses and institutions must become involved before our communities can reach the goal of genuine energy security in emergencies.

With support from CIRCA matching funds, we held three free-standing workshops (one in January 2017 and two in June) and two other short briefings – at the September 2016 and February 2017 semiannual gatherings of Clean Energy Task Forces. A total of 49 people were part of at least one of the in-depth discussions.

Based on this participatory approach to designing and refining our program materials, we have proposed utilizing them in the field with a cluster of 3 or more communities functioning as an "accelerator," as part of our 2017-18 funding from the Tremaine-led foundation consortium. We have also presented the briefing at a meeting hosted by the Middletown Clean Energy Task Force (June 28, 2017) and have been invited to report on it at a July 20 focus group of the South Central CT Council of Governments as an early step in updating the Plans of Conservation and Development for their 15 member communities.

LESSONS LEARNED

Energy is hard to wrestle with as a subject of its own; it underlies the operation of our buildings, power systems, transportation, materials and water management and more. SustainableCT, the emerging collaborative framework for CT communities, recognizes this by including energy action opportunities in all its "working group" processes. In grappling with energy planning and especially resilience, our Clean Energy Task Forces have had to look outside their conventional scope of interest to consider not just technology but design and management systems. This allows supply and demand to meet without waste.

All the dimensions of resilience that we explored -- emergency backup power, local control of energy systems, the capacity to manage demand and derive value from system efficiencies, and the capacity to scale up renewable energy – are connected with the risks of a changing climate, complex technologies, uncertain grid conditions, and the "black swan" events that can occur without warning in our world. Yet it is rarely useful to open the conversation by focusing on danger. A better focus, we found, is the benefits of planning and taking control of local resources – and the creative processes that can be brought to life by doing so. The needed conversation must be layered to accommodate diverse levels of knowledge within a stakeholder community and the questions and dilemmas that inevitably arise.

NEXT STEPS

Over the next year, we will invite a cluster of community representatives to pilot our framework, document their results and help us to refine the approach. A focus area in Middlesex County appears possible as the city of Middletown

prepares to develop an energy plan with interest in resilience as a component. We hope this will allow for additional funding proposals. In due time, we would love to uncover ways to scale up EASE and provide in-depth support for energy security and resilience planning for the entire 91 corridor as the backbone of Connecticut, a scale we think would be sufficient to allow the models to be visible statewide and easily disseminated.

APPENDIX 1: NEEDS ASSESSMENT QUESTIONNAIRE

Resilient Energy Planning Questionnaire
for CT Municipalities
By Melissa Everett and Woodie Weiss, SustainableCT Energy Network

This short questionnaire supports Clean Energy Task Force volunteers in taking stock of local efforts to ensure resiliency of municipal energy systems and services to residents in emergencies. Please add details and comments as you see fit. Return to Melissa Everett meverett@cleanwater.org.

1. In an emergency that affects electric power supply, what are the critical municipal functions you want to be sure will not be interrupted? At what level of operation compared to ordinary loads? For what period of time?

1a. In such an emergency, are there services you want to be able to deliver to the community (e.g. shelter with light, water, charging)? At what scale? For what time period?

1b. In such an emergency, is your heating fuel supply at risk and do you have a plan for dealing with that? (e.g. oil deliveries)

2. Considering the most relevant/ widely used means of delivering those benefits — backup generators, on-site power supply; storage; energy efficiency and conservation - which ones are the best fit with your community with respect to:

_____ priorities in your local energy plan if you have one;

_____ systems you already have in place, or funded;

_____ in-house expertise;

_____ likely community support.

3. Have you taken steps to investigate the options for resilient energy supply and systems for your community? Check all that apply.

___ We have made a conceptual plan.

___ We have designated member(s) of our staff and/or boards and commissions to navigate this topic and begin to figure it out. [If so, who?]

___ We have done feasibility assessments and/or engineering studies.

___ We have a detailed technical plan.

___ We have applied for funding to implement that plan.

___ We have been awarded funding.

___ We have the following technologies / systems in place:

4. Which of these statement(s) describe your needs for technical and planning assistance, and your ability to help others in Connecticut municipalities?

___ We have knowledge and success models we'd be happy to share.

___ We could really use some overall hand-holding to establish a direction.

___ We have figured out aspects of this challenge but periodically could use some help.

___ This topic is not high enough in our municipal priorities right now to ask for help or offer to help others.

5. Please add any other comments on the state of your municipality's preparation for resilient energy supply in emergencies, and your interest in collaborating with other communities on this topic.

6. Name, title/ affiliation and contact info of person completing this survey:

Thank you!

APPENDIX 2: COMMUNITY PLANNING FRAMEWORK

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860.232.6232 • www.cleanwater.org/ct

Energy Security and Resilience – A Community Planning Framework

If the grid goes down – in spite of Connecticut's best planning efforts – how will your community keep the lights on and make sure everyone is safe? "Education and Action for Secure Energy" (EASE) is an exploratory project by and for the state's network of local clean energy task forces with the assistance of CT Clean Water's energy team, the DEEP Micro-Grids Program, the CT Green Bank, the CT Academy for Resilience and Climate Adaptation (CIRCA), Clean Energy Group and local community practitioners.

This project does not compete with, or try to duplicate, formal Hazard Mitigation Plans. Instead, it supports broadening and updating them to address a newly recognized issue: energy reliability and security.

Whether you are thinking about a micro-grid or just making sure your backup generators are working well, this is a fast-moving field with a lot of options to consider. Our framework is based on several assumptions:

- Technology and financing options are evolving rapidly.
- Local planning and project development often follow a complex path.
- Energy planning is a relatively new area of interest in communities, but an important one.
- Government alone can't carry the entire load to keep the community comfortable and functional in an extended emergency.
- The path forward contains many trade-offs.
- The planning we do, and the alliances we build, will uncover unexpected possibilities and strengthen our communities, emergency or no emergency.

##

The questions below are designed to foster discussion of options and possibilities, among staff departments, boards and commissions, elected officials and with the public. There may not even be broad agreement on the answers. This is why it is important to grapple with them as a community, before the next storm, cyber-attack, heat wave, ice storm other unanticipated stresses cause a loss of power, fuel supply, or both.

1. SUMMARIZING COMMUNITY NEEDS AND OPTIONS

1a) How long an emergency are you prepared to plan for at this time?

1b) What are your target functioning levels for municipal operations?

Electricity requirements (kW-hours per day)

Fuel requirements (BTUs or gallons per day)

1c) What services to the community (routine and special) are needed? You can identify your power and fuel needs in the table below. The table invites you to consider the level of energy access that is desirable and possible, and correlate it with measures of energy delivery such as BTUs of heating fuel and kW-hours of electricity. "Crisis management level" refers to what's needed to prevent fatalities, injuries and hardship. "Reasonable comfort" means what's needed to keep the community comfortable and able to carry out many of their standard activities including working (for example, enough showers, mobility, refrigeration, access to light after dark) – even if they are in shelters with camp chairs and chocolate bars! "What emergency?" refers to a higher level of preparation to truly insulate the community from the effects of the emergency – an ambitious goal, but like all goals, one that can only be achieved if it is first imagined.

Function	**Crisis management**	**Reasonable comfort**	**"What emergency?"**
Lighting			
Drinking water			
Water for showers, dishwashing, etc.			
Communications			
Heating/ cooling			
Mobility			

Critical facilities e.g. health clinics, gas stations, hardware stores (specify)			
Live/ work space			
Other			
TOTAL			

In the next two sections, we will consider which of these services – and to what extent – can be provided by the municipality, and what kind of resources might be developed by working in advance of an emergency with residents, businesses and institutions so that reliance on government is minimized.

2. MUNICIPAL FOCUS

In this next section you can review your plans for backup power, fuel and energy storage.

1. Resources you already have – check all that apply:

_____ Generator
___ Number ___ Approx. year(s) purchased
_____ High-efficiency generator
_____ Fuel cell - capacity: _____
_____ Combined heat and power system - capacity _____
_____ Centralized battery storage
_____ Micro-grid
_____ Renewable energy installation that can be islanded in an emergency

What portion of your emergency power and fuel needs do these resources provide?

Comments:

2. a. Possible new investments: In considering possible investments in technology and systems to improve local energy security, consider the

following perspectives on technology types.

Primary goal	Possible ingredients	Comments
Least up front cost	High efficiency natural gas or propane generator	Behind single meter only
Low/ predictable cost	Storage for, and procurement of, liquid fuels[3]	Includes capital and operating costs
Lowest operating costs; zero carbon emissions	PV + storage	Behind single meter only. Suitable for short outages only.
Low operating cost or longer run times on available fuel	PV + storage + high efficiency standby generator	Behind single meter only. Generator only runs when needed to charge batteries.
Nearly continuous run times or multiple meters and buildings	Microgrid (with or without some of the above)	Can (and should) install as many of the above as possible while deciding whether & how to go forward with microgrid

b. Rank the following options for best fit with your community's various planning documents, capabilities, etc. Plans include energy strategy, climate action plan, natural hazard mitigation, POCD, infrastructure etc.

Technology	Fit w/ local plans [R = recommended; C = consistent with plans; I = inconsistent w/ plans]	Fit w/ your staff or consultant's technical capabilities 5 = high, 1 = poor
Generators		
Battery storage		
Fuel cells		
Combined heat & power		

Micro-grid		
Renewable energy systems		

3. Prioritizing new municipal energy security investments

a. What % of your emergency needs can you meet with each of these, at the three levels of your goals?

b.

Technology	Emergency mgmt	General comfort	What emergency?
Generators			
Fuel cell			
Centralized battery storage			
Combined heat & power			
Micro-grid			
Renewable energy system that can be islanded			

If what you can imagine planning for is less than what you want, how will you adjust?

c. How can you best distribute these resources at locations that enhance resilience?
   - Should some be redundant?
   - Should they be widely distributed and if so, how?
   - Are there particular populations or assets that should be a special focus?
   - Other considerations?

d. What is your best way of sequencing these investments over the next 2 – 3 years? Consider quick-to-implement solutions, those you have funding or easy sources of funding for, and those that will definitely require a longer planning horizon such as a micro-grid.

Things we have or could procure quickly	12 – 18 months	18 months to 3 years or longer-range

3. COMMUNITY FOCUS

Review and prioritize community emergency needs and aspirations. What, how much, for what period, from what possible sources?

Lighting
Drinking water
Water for showers, dishwashing, etc.
Communications capabilities (how much and what kind)
Critical facilities e.g. health clinics, gas stations, hardware stores (specify)
Live/ work space
Other

Who are potential partners in meeting these needs? (For example, schools and school districts, neighborhood associations, business district, housing authorities, major community institutions)? Within these institutions, whose goals and programs may especially be aligned with these community needs in such a way that they would be active sources of help (business service providers, school project teams, etc.?)

4. ORGANIZING FOR SUCCESS

A. Municipal investments

To ensure everyone is protected in an extended emergency with power and fuel supplies enough to maintain public safety, we will:

To ensure everyone can withstand an extended emergency comfortably with minimal disruption of routine, we will:

B. Community partnerships

To leverage the impacts of municipal investments, we will work with residents, businesses and local institutions to:

Your answers to these questions should provide the basic elements in a plan to improve energy security and emergency resilience over the next three years. Now it is time to sort out and share responsibility among stakeholders to turn these concepts into pathways for action.

APPENDIX 3: SAMPLE WORKSHOP HANDOUT

Methods to Provide Electric Power Resiliency
(From Least Costly)

1. Standby Generator & Automatic Transfer Switch (ATS)

Operation: Generator is never connected to grid. During grid failure, ATS switches building loads from grid to standby generator for duration of grid failure. Upon restoration of grid, ATS switches building loads to grid after short delay.

Pros:

- Least expensive

Cons:

- Dependent on fuel source availability
- Must operate behind a single meter
- Inefficient (must run continuously to provide power)

2. PV System, Battery & Battery Inverter, No Standby Generator

Operation: PV power production is first consumed within the building with any excess sent to the grid. Battery remains fully charged by either the PV or grid. Grid failure initiates battery inverter and it powers the building using the battery. PV is restarted and will power the building, with any excess used to charge the battery, when sunlight is present. If sunlight is insufficient, and the battery becomes depleted, the system becomes inoperable.

Pros:

- Totally renewable energy system
- Operates in absence of fossil fuel

Cons:

- Dependent on sufficient sunlight
- Must operate behind a single meter
- Best suited for short grid outages

3. PV System, Battery & Battery Inverter, Standby Generator

Operation: PV power production is first consumed within the building with any excess sent to the grid. Battery remains fully charged by either the PV or grid. Grid failure initiates battery inverter and it powers the building using the battery. PV is restarted and will power the building, with any excess used to charge the battery, when sunlight is present. Generator will begin to recharge the battery when battery state of charge reaches 40% (generally) and shutoff when SOC reaches 80% (generally) if PV is insufficient.

Pros:

Capable of providing power to the building for extended periods of time, but without the generator running all the time.

Much more efficient than standby generator alone and extends life of generator because of significantly reduced run times.

Cons:

Dependent on fuel source availability

Must operate behind a single meter

4. Microgrid

Definition: A microgrid is a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid. A microgrid may connect and disconnect from the grid to enable it to operate in both grid-connected or island-mode.

Operation: May utilize a CHP, microturbine, or fuel cell to provide both electricity and heat to the loads on a continuous, or nearly continuous, basis. Can operate with PV and battery storage as well as other generators. One or more generation sources directly serve the electrical load at the project host site(s) and feed excess generation to other facilities within the microgrid utilizing existing or new distribution infrastructure.

May be designed to operate only in island mode.

Pros:

Capable of providing power to multiple buildings, with multiple meters, in either grid-tied (not all microgrids) or island mode for extended periods of time.

Depending on generator type, may be less costly than purchasing power from the grid if heat is considered.

Much more efficient than standby generator alone.

Cons:

Most expensive and complex solution

Must be able to utilize heat produced to be the most cost effective
Dependent on fuel source availability

Option for Systems 2 & 3: Adding a demand controller would allow the systems to trim demand using the PV first, battery second, and generator third. This can help smooth demand to reduce charges that are based on annual peak demand (& overall demand).

APPENDIX 4: COMMUNITY WORKSHOP OUTLINE

Audience: local public works, operations, energy Task Force, planning and development teams and community leaders (e.g. neighborhood associations, tenant associations, business groups) pre-selected for interest via local conversations & mailing
Level: interested in energy innovation and some knowledge, not presuming depth
Goal: get on the same page re options and path forward for energy security and resilience in a given community, including tracks for governmental and non-governmental work

Opening

Goals of this workshop
Risk and opportunity summary
Not just power company – users and planners
Co-benefits
Fast evolving situation – we can't be about just finding an answer – we need to create community capacity to keep up with the circumstances

BRIEFING [15 – 20 minute PPT similar to our standard intro]/ discussion
- What surprised you?
- What is needed in terms of community action?
- What will it take to meet the challenge in your community?
- Where are opportunities for co-benefits

Best practice panel (flexible) w Q/A

Energy options in your community – history and potential of the various technologies
- Technology and economics oriented review/ discussion
- Goals/ benefits [Woodie handout]
- Linkage with your local plans, policies, capabilities (from questionnaire e.g. which option fits w your existing tech, skills, funding, local culture)
- State and federal requirements and funding opportunities [Don]
- Lessons from the micro-grid design and funding process (Veronica)

ASSETS and OPPORTUNITIES – who can step up with what kinds of preparation & resources?

NEXT STEPS

APPENDIX 5: PROJECT ADVISORS AND COORDINATOR

Megan Saunders: Executive Director of Stamford 2030 District
Megan directs the Stamford 2030 program, a joint venture between Connecticut Fund for the Environment and the Business Council of Fairfield County. She is responsible for the engagement of businesses and overall leadership of the district, ensuring that the organization is focused, respected, and effective in advancing its mission. Previously, Megan worked as a Sustainability Project Manager at Vidaris, Inc. where she led project design and construction teams to implement sustainable environmental practices and achieve LEED ratings. Megan earned a Master of City and Regional Planning from the Bloustein School at Rutgers University, and her undergraduate degree in Sociology from The College of New Jersey.

Donald Watson: FAIA CIP Architect / Planner
Donald Watson is an architect, urban designer and planner, and FEMA subject matter expert who is at the forefront of integrated emergency preparedness and resilient design work in the eastern U.S. He is principal of EarthRise design, providing planning and design services for civic, institutional and urban projects, serving governmental and corporate clients in the United States and abroad, with focus upon environmental design, sustainability and resilience. As an architect and planner, Mr. Watson has worked on leading projects and sustainable sites around the world. As a community workshop facilitator, Mr. Watson has worked with many diverse ethnic and cultural groups in the United States and abroad. He has pioneered many of the approaches used to promote consensus and develop community-based designs, including the Environmental Design Charrette Workshop process, now widely used by many in the architectural and development field. He was lead consultant for the Vita Nuova community outreach assignment for Went Field Park, Bridgeport CT, cited by EPA as one of the largest community based projects in the U.S., and recipient of a 2001 EPA Region 1 project award. He has published many books in the architecture and planning fields. Mr. Watson was formerly Rockefeller Foundation Research Fellow in Environmental Affairs (1969-70), professor at Yale University School of Architecture where he served as Chair of Yale's Environmental Design Program (1970-1990)

Rebecca French: Director of Community Engagement at CIRCA

Rebecca is the Director of Community Engagement for the Connecticut Institute for Resilience and Climate Adaptation (CIRCA). In this role, Rebecca works with a team of outreach and extension professionals from across the University of Connecticut to develop relationships with community leaders in at risk communities, state policy makers and relevant state, local

and regional organizations to solicit their input into the work of the Institute and to ensure the dissemination of information developed by the CIRCA faculty and staff. Rebecca also spent a year in Congress as a Congressional Science Fellow, sponsored by the American Geophysical Union, in the Office of US Senator Bernie Sanders (I-VT). Rebecca served as a policy advisor to the Senator in the areas of energy, environment, and agriculture. Through past policy fellowships, she has led initiatives on using innovative tools from crowdsourcing and citizen science which address the impacts of climate change and to improve air quality in communities. Rebecca holds a Ph.D. in geosciences from Virginia Tech and an M.S. in soil science from Cornell University. She received her B.A. from Oberlin College in chemistry and environmental studies.

Robert Sanders: Senior Finance Director at Clean Energy Group
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.

Tom Worthley: Forestry Professor & Extension Educator
Department of Extension & Center for Land Use Education and Research (CLEAR)
Tom Worthley is Assistant Extension Professor at the University of Connecticut Cooperative Extension Service and the University Of Connecticut Department Of Natural Resources and the Environment. He has written a number of scholarly articles and also teaches courses in Forest Ecology and Management and Dendrology. He has worked extensively on tracts in the UConn Forest and beyond in both outreach and educational activities.

Anthony Clark: Senior Manager Commercial & Industrial Programs at the Connecticut Green Bank

Anthony Clark's work integrates design thinking, environmental strategy, and life cycle analysis to find innovative solutions for improving energy and resource efficiency. In the summer of 2013, Anthony worked for the New York City Housing Authority (NYCHA) as an EDF Climate Corps Fellow identifying strategies for improving the energy resilience of NYCHA developments through deployment of distributed generation technologies. Anthony has consulted to the National Renewable Energy Lab (NREL), the Connecticut Department of Energy and Environmental Protection (DEEP), and the South Central Connecticut Regional Water Authority (SCCRWA) on a range of energy and environmental performance issues. He is co-author of a forthcoming case study in the Journal of Infrastructure Systems comparing the economic and environmental costs and benefits of replacing versus refurbishing municipal water storage systems. Anthony graduated with a B.A. from the interdisciplinary College of Social Studies at Wesleyan University. He is a graduate of Yale University's MBA/ MESc program.

Melissa Everett, P.H.D.: Energy Program Manager Clean Water Action Connecticut [PROJECT COORDINATOR].

Melissa Everett is a communications and organizational development profesional who helps small businesses, nonprofits and citizen groups to work effectively toward their goals. With background in counseling, teaching, training, and leadership development, she was Sustainable Hudson Valley's co-founder and has served for ten years as its Executive Director. In that role she orchestrated a successful energy challenge campaign helping Red Hook, New York to reduce its electricity use 3% in a year, as well as introducing the Energize-NY program into the Mid-Hudson region. The author of three books and a speaker on climate change communication, Melissa earned her Ph.D. from Erasmus University's International Off-Campus program in Sustainable Development. She chairs Enfield's Clean Energy Committee and coordinated the successful Solarize Enfield, which more than tripled the amount of residential solar in town.

Veronica Szeczerkowski is Coordinator of DEEP's microgrids program.

APPENDIX 6: RECOMMENDED RESOURCES

Climate Central: **States at Risk: America's Preparedness Report Card**
Download: www.statesatrisk.org

CT Energy Education: Our Town Microgrid Challenge lesson plan
Download: http://www.ctenergyeducation.com/lesson.htm?id=EAO7KBZU

Energy Efficiency Markets LLC (2015): **Community Micro-Grids: A Guide for Mayors and City Leaders Seeking Clean, Reliable and Locally Controlled Energy**

Gilbert, Stanley, David T. Butry, Jennifer Helgeson and Robert Chapman, **Community Resilience Economic Decision Guide for Buildings and Infrastructure Systems**. National Institute for Standards and Technology Special Publication 1197.

Mullendore, Seth and Lewis Milford (2015) **Solar+Storage 101: An Introductory Guide to Resilient Power Systems**.
Download: http://www.cleanegroup.org/wp-content/uploads/Energy-Storage-101.pdf

Public Technology Institute: Local Government Energy Assurance V. 2.0
Download:
https://dl.dropboxusercontent.com/u/14265518/leap/PTI_Energy_Guidelines.correx.v2.pdf

Resilient Design Institute (2016): The Resilient Design Principles
Download: http://www.resilientdesign.org/the-resilient-design-principles/

Resilient Power Project Solar-Storage Checklist
http://www.cleanegroup.org/wp-content/uploads/Solar-Storage-Checklist.pdf

Sustainable CUNY: Strategies for Integrating Solar and distributed Generation for Emergency Power and Resiliency Deployment. Downloaded: http://www.cuny.edu/about/resources/sustainability/SmartDGHubEmergencyPower.html

Watson, Don, OARS list: Organizations Active in Resilience and Sustainability. Updated periodically. Email subscription: earthrise001@sbcglobal.net.