

MEETING SUMMARY:

GREEN RESILIENCE: CLIMATE ADAPTATION + MITIGATION SYNERGIES

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We are grateful for the support and contributions from each of our additional panelists (in alphabetical order):

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- Shalom Flank, Chief Technology Officer and Microgrid Architect, Pareto Energy
- Jessica Grannis, Adaptation Program Manager, Georgetown Climate Center (GCC) and Staff Attorney and Adjunct Professor, Harrison Institute, Georgetown University Law Center
- Clay Nesler, Vice President, Global Energy and Sustainability, Johnson Controls
- John Nordgren, Senior Program Officer, Environment, The Kresge Foundation
- Susan Ruffo, Deputy Associate Director, Climate Change Adaptation, White House Council on Environmental Quality
- Brendan Shane, Chief, Office of Policy and Sustainability, the District Department of the Environment
- Brian Swett, Chief of Environment and Energy, City of Boston, MA.
- Laurens van der Tak, Vice President and Technology Fellow for Water Resources and Ecosystems Management, CH2M HILL

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The Center for Clean Air Policy

Since 1985, the Center for Clean Air Policy (CCAP) has been a recognized world leader in climate and air quality policy and is the only independent, nonprofit think tank working exclusively on those issues at the local, national and international levels. Headquartered in Washington, D.C., CCAP helps policy-makers around the world develop, promote and implement innovative, market-based solutions to major climate, air quality and energy problems that balance both environmental and economic interests.

CCAP's [Weathering Climate Risks program](#) helps cities and companies enhance resilience to the economic impacts of severe weather and a changing climate. Our partners are embedding climate risk management into business continuity and strategic planning efforts.

CCAP is helping its partners [Connect-the-Dots](#) between climate mitigation and adaptation by identifying research priorities for the synergies between these strategies and implementing policies and measures that both reduce carbon pollution (mitigation) and enhance resilience to climate change impacts (adaptation).

NCAnet "AMNex" Affinity Group

The U.S. Global Change Research Program (USGCRP) is congressionally mandated to assess the effects of global change in the U.S. every four years through their National Climate Assessment (NCA). Much of the stakeholder engagement of the NCA has been accomplished through a network of partner organizations that can extend the NCA process and products to a broader audience. In the largest sense, this "network of networks" (NCAnet) includes all of the organizations that deliberately work to connect the NCA with a broad array of stakeholders. NCAnet has several "affinity groups," one of which is AMNex. The purpose of the AMNex affinity group is to conduct research on, provide guidance for, and encourage implementation of integrative adaptation and mitigation practices. This work will inform the NCA's focus on evaluating progress on adaptation and mitigation. For more information, please click [here](#).

This is not a U.S. Global Change Research Program product and does not reflect the perspective of the Federal government.

Acronyms

AMNex	Climate Change Adaptation + Mitigation Nexus
A+M	Climate Change Adaptation + Mitigation
CEQ	White House Council on Environmental Quality
CHP	Combined Heat and Power
CO ₂	Carbon Dioxide
CO _{2e}	Carbon Dioxide equivalent units
CSO	Combined Sewer Overflow
EPA	Environmental Protection Agency
FERC	Federal Energy Regulatory Commission
GCC	Georgetown Climate Center
GHG	Greenhouse Gas
IBHS	Insurance Institute for Business and Home Safety
MW	Megawatts
NCAnet	National Climate Assessment Network
NCSE	National Council for Science and the Environment
P3	Public Private Partnership
PACE	Property Assessed Clean Energy
PV	Photovoltaic
SRF	State Revolving Fund
T&D	Transmission and Distribution
USGCRP	U.S. Global Change Research Program

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Green Resilience: Climate Adaptation + Mitigation Synergies

Purpose of this Report

The purpose of this report is to capture best practices and lessons learned from experts in the field who are contributing to an integrated approach to climate adaptation + mitigation (A+M) to cut carbon pollution (mitigation) and prepare the nation for climate change impacts (adaptation). These best practice and lessons learned were distilled from the [“Climate Adaptation + Mitigation Synergies: Pursuing Implementation Pilots”](#) symposium and workshop sessions held at the 14th National Conference and Global Forum on Science, Policy and the Environment Conference held in Washington, DC from January 28-30, 2014. The Center for Clean Air Policy (CCAP) and the National Climate Assessment’s network (NCAnet) Adaptation + Mitigation Nexus (AMNex) affinity group co-hosted these sessions.

We have chosen “Green Resilience” as a simplified way to capture the co-benefits of an integrated approach to climate adaptation and mitigation. While we know non-beneficial conflicts may come from an integrated approach, our objective is to understand those conflicts and promote the beneficial A+M strategies and policies.

Overview of the A+M Sessions in January 2014

CCAP and the AMNex NCAnet affinity group designed the A+M sessions to identify innovative partnerships for the implementation of A+M pilot projects in 2014. The A+M sessions enabled local practitioners and decision makers at multiple scales to learn about best practices and discuss opportunities for achieving synergies among actions that cut carbon pollution and prepare for climate impacts. The sessions included experts that: (1) reviewed the current and planned state of practice on integrating mitigation and adaptation; (2) identified actionable research and information needs; and (3) explored policy and implementation opportunities.

This report provides:

- An overview of the A+M Nexus;
- Reflections on research, capacity building, and funding needs; and
- Examples of integrated A+M approaches (by sector and select cities).

Adaptation + Mitigation Nexus Overview

Together we are encouraging communities, businesses, and government agencies to **Ask the Climate Question** about policies and infrastructure investments: Does it cut carbon pollution while also preparing for and responding to climate impacts? How can we maximize the return on our infrastructure and climate

investments – mitigation and adaptation – while also maximizing the economic, social, and environmental benefits?

President Obama’s [Climate Action Plan](#), and the subsequent [Executive Order 13653](#) on climate preparedness and resilience, provide guidance for the Federal government to Ask the Climate Question: how can the Federal government modernize its programs, policies, and technical assistance in an effort to help communities successfully mitigate greenhouse gas emissions and adapt to a changing climate?

Government agencies place high priority on adaptation planning, while also working on strategies and policies

to reduce carbon pollution. Yet the nexus between adapting to a changing climate and reducing carbon pollution is rarely approached in an integrated fashion. CCAP and AMNex see great opportunities in focusing in on that sweet spot at the center of the A+M Venn diagram (Figure 1). The process of identifying adaptation and mitigation synergies can be thought of as a continuum that can either start from the adaptation side (e.g., include GHG reduction measures in flood risk reduction projects) or from the mitigation side (e.g., enhance electricity grid resilience to climate impacts when developing renewables).

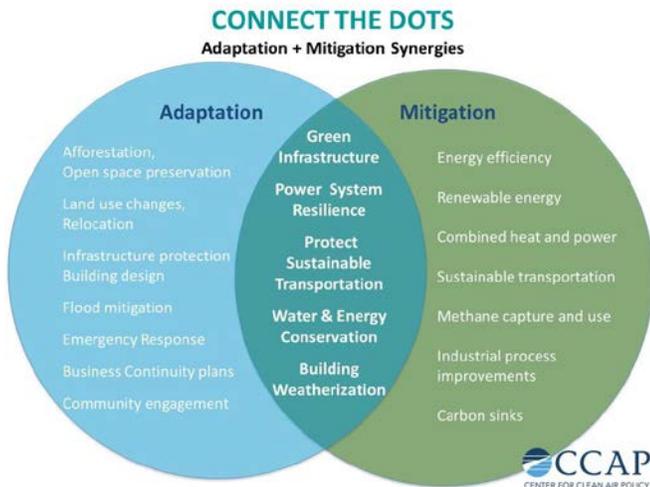


Figure 1. CCAP’s Connect-the-Dots Venn diagram illustrating the climate adaptation + mitigation synergies.

Connecting-the-Dots between A+M can:

- ✓ Increase return on investments in mitigation, adaptation;
- ✓ Enhance climate benefits of infrastructure investments; and
- ✓ Increase revenue sources for implementation.

Integrated A+M projects can attract mitigation and adaptation funds while leveraging investments in infrastructure, disaster relief, and economic development.

Integrating the A+M Climate Strategies: Ask, Follow, Connect...

CCAP has several methods to connect the climate adaptation + mitigation dots to increase beneficial synergies.

Ask both parts of the Climate Question (A + M)

The Connect-the-Dots process can start from either an adaptation or mitigation measure, or can result from Asking the Climate Question of current policies and investments. For example, when investing in renewable energy, make sure that the power grid is resilient to extreme weather. When setting new building codes for

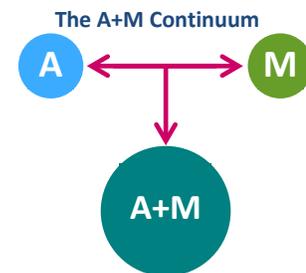


Figure 2. The A+M Continuum illustrating how decision-makers can leverage funding and momentum from either an adaptation strategy or a climate mitigation one.

storm and flood resilience consider energy and water efficiency as well. When implementing transit oriented development, include green infrastructure to address heat and stormwater management practices.

Follow the Money (and other stakeholder priorities)

How organizations spend their money reflects their organizational and policy priorities. Aligning climate investments and policies with stakeholder economic concerns can increase support for implementation. Examining how organizations have already decided to allocate their budgets and human resources can reveal opportunities to leverage those investments and build upon their momentum. Yet too often organizations don't see beyond departmental silos, and thus miss opportunities to coordinate investments and maximize returns.



Figure 3. A framework for decision makers to examine their climate adaptation and mitigation portfolios to find how best to maximize returns on investments and make efficient use of constrained human resources.

CCAP's 3x3 A+M Matrix is intended to help an organization to quickly identify opportunities to maximize the climate mitigation, and adaptation benefits of their top investments.

- ✓ Are there synergies that can be pursued?
- ✓ Are there conflicts that can be avoided?
- ✓ Are infrastructure investments increasing or decreasing GHG emissions and resilience?

Ask the 3x3 Climate Question		Adaptation	Mitigation	Infrastructure
				
Investments	#1	\$10,000,000 Dune restoration	\$10,000,000 Wind turbines & Photovoltaics	\$2,000,000,000 Roads
	#2	\$5,000,000 Green Infrastructure	\$5,000,000 Green Buildings	\$1,000,000,000 Water treatment facilities
	#3	\$1,000,000 Vulnerability Assessment	\$500,000 Education & Outreach	\$500,000,000 Transit system improvements

Figure 4. CCAP's 3x3 A+M matrix to demonstrate a hypothetical approach to examining one's portfolio of adaptation and mitigation projects.

Connect the Dots: A+M

After an organization has taken a look at their investments, it's important to next take a broader look at their budgets, staffing, investments, policies, programs, development, and design decisions. Consider specific

opportunities to enhance mitigation benefits of adaptation measures and vice versa. Assess how infrastructure investments can be (re)designed to maximize climate benefits.

Reflections on Policy, Research, Capacity Building and Funding Needs

With this background on how the process of connecting adaptation and mitigation, we can now delve into how climate A+M fits into the policy, research, and funding aspects at the community and national levels.

Susan Ruffo provided a brief overview of the Administration's climate actions. On June 25, 2013, President Obama announced his [Climate Action Plan](#) - a comprehensive plan for action to reduce carbon pollution in America, prepare the country for the impacts of climate change, and lead global efforts to fight it.

More recently, on November 1, 2013 President Obama signed [Executive Order 13653](#) "[Preparing the United States for the Impacts of Climate Change](#)" which directs Federal agencies to take a series of steps to make it easier for American communities to strengthen their resilience to extreme weather and prepare for other impacts of climate change. The order established a Council on Climate Preparedness and Resilience that will be co-chaired by the Chair of CEQ, the Director of OSTP, and the Assistant to the President for Homeland Security and Counterterrorism and will include senior officials from 30 federal agencies.

She underscored the importance of understanding where there might be trade-offs between adaptation and mitigation and ensuring the implementation of such projects are made in an informed way. Microgrids are a good example of A+M because they can help to build resilience and reinforce energy efficiency. There is a critical need to avoid redundancies that create inefficiencies and a continued focus on the relationship between energy and water. Finally, the Federal government is focused on the natural resources and transportation sectors as important areas for both adaptation and mitigation efforts.

Emily Seyller provided an overview of USGCRP's goal of conducting research to help inform adaptation and mitigation decisions. A recent area of interest is to research and assess how adaptation and mitigation strategies influence each other. Examples of research to support an integrated A+M approach include, but are not limited to:

- Foundational science to support and understand synergies;
- Cost-benefit and risk analysis on co-benefits and conflicts;
- Quantifying economic and social benefits of A+M measures;
- Integrated modeling (across disciplines), observations, and monitoring networks;
- Scenario development to understand the interactions;
- Responses of human systems and ecosystems;
- Performance measures and frameworks to assess A+M measures;
- Access to usable data that is understandable to decision-makers; and
- Assessment of existing practices and lessons learned.



Image 1. Workshop panelists from Left to Right: Emily Seyller (USGCRP), Steve Winkelman (CCAP), Jessica Grannis (GCC), John Nordgren (Kresge Foundation), Shalom Flank (Pareto Energy), Debra Ballen (IBHS), Laurens van der Tak (CH2M Hill), Brendan Shane (Washington, DC DDOE), Brian Swett (City of Boston), and a participant.

Jessica Grannis and Steve Winkelman provided perspectives on policy and where there might be trade-offs between adaptation and mitigation to support informed decision making. Some A+M measures will be more weighted toward adaptation, others more toward mitigation. There are rich A+M opportunities at the intersections of the energy and buildings sectors, such as developing microgrids to enhance resilience and reinforce energy efficiency. Similarly, the relationship between energy and water will be important, for example considering water efficiency measures in place of energy-intensive desalinization, and methane capture and combined heat and power at water utilities. Green infrastructure can address multiple climate risks (e.g. heat, flooding) while also reducing energy use.

Jessica Grannis spoke to the inevitability of the climate change impacts and the need to adapt. She underscored that what actions are taken now on mitigation will determine how difficult and expensive it will be to adapt, and whether it is even possible to adapt. She provided a couple of examples of policies that have both A+M benefits including: (1) Green and cool roofs; (2) wetlands restoration; and (3) the concept of lining the California Aqueduct with solar photovoltaics to reduce evaporation and power the water pumps.

She provided a couple of examples where decision makers will need to evaluate the tradeoffs between A+M:

- Urban redevelopment: how are planners ensuring that growth isn't driven to vulnerable areas?
- Water recycling/reuse/desalination – energy intensive where is the energy coming from?
- Stormwater pumps and back up diesel generators – increasing carbon pollution?

John Nordgren explained that The Kresge Foundation has been actively supporting both climate mitigation policies and measures (such as energy efficiency) and adaptation efforts (such as green infrastructure) for some time now. They have focused on “field building” supporting tools, enhancing technical expertise and fostering professional networks. Having supported a lot of state and local adaptation planning, it is especially important to assess and address barriers to implementation. Both adaptation and mitigation needs to be a means to an end, addressing community priorities.

CCAP hypothesizes that if cities pursue synergies between climate mitigation and adaptation measures, they can increase returns on investments in climate policy and infrastructure and attract new funding sources.

Participants agreed that this thesis is solid. They emphasized the importance of understanding how to scale pilot projects up to city-wide and regional resilience. They also noted the need for research on quantifying the co-benefits of adaptation + mitigation measures.

Examples of Integrated A+M Approaches

Sector Specific Examples:

In this section, we dive deeper into sector specific examples on how best to integrate climate adaptation + mitigation in the following four areas: buildings, energy, water and cities.

Buildings – Part I: Overview

Exploring opportunities to add resilience measures into existing green building projects, programs, and policies is important. Buildings provide major opportunities for Green Resilience actions as the “Buildings / Energy Adaptation + Mitigation Nexus” figure 5 demonstrates. Improved building design, operations, green roofs, cool roofs, and water conservation can reduce energy use in buildings and protect them from severe storms, flooding, and extreme heat. Incorporating combined heat and power (CHP), renewables, and microgrids can minimize business interruption losses.

Buildings / Energy Adaptation + Mitigation Nexus

(CCAP draft January 2014)

MEASURE	BENEFITS	
	Mitigation	Adaptation
Energy Efficiency	↓ GHGs	Enhance electricity grid resilience. Maintain business continuity.
Building Code updates	↑ energy efficiency	↑ resilience to wind, flooding earthquakes
On-site Renewables and CHP	↓ GHGs	Enhance electricity grid resilience. Maintain business continuity.
Micro-grids	Supports efficiency & renewables	"
Protect / elevate mechanical and electrical systems	(↓ GHGs from re-building)	Enhance electricity grid resilience. Maintain business continuity.
Elevate / protect structures	"	Protect people, building, infrastructure. Maintain business continuity.
Water efficiency, grey water reuse	↓ GHGs from water distribution & treatment	Prepare for declining water supplies. Maintain ecosystem services.
Green infrastructure (green roofs, green walls, landscaping)	Cooling -- ↓ air conditioning energy use ↓ water treatment needs	↓ urban heat island ↓ stormwater runoff ↑ flood resilience Maintain ecosystem services

Figure 5: An A+M matrix for the built environment demonstrating the co-solution by storing thermal and electrical energy in storage tanks, building mass and batteries, switching off non-critical loads during demand peaks, and charging electric vehicles during non-peak periods.

Buildings – Part II: Insights from Clay Nesler, Johnson Controls

Clay Nesler presented a vision of the future of “GREENER” buildings. GREENER buildings will be “Grid-Responsive”, Energy Efficient, Net positive Energy, and Resilient.

Grid-Responsive

The bi-directional transfer of information to and from the grid allows the building to provide valuable services to the electric grid. Grid responsiveness can be particularly valuable in a state like California, which has had a comprehensive renewable energy program in place since 1998 and is seeing late afternoon spikes in energy demand (once the sun goes down). Buildings can be part of the

Energy Efficient

The Empire State Building Company brought Johnson Controls together with other leading energy-efficiency organizations to develop an innovative approach to sustainable retrofits (read the [case study](#)). The program involves infrastructure improvements, design standards, tenant energy management, property management, leasing and marketing initiatives. The program has resulted in a 38% reduction in annual energy use. Johnson Controls retrofitted the building with efficient windows, which along with high efficiency lighting, reduced the cooling load by one-third. This is important on the mitigation side but also for adaptation because it provides additional capacity as cooling requirements increase along with increasing outdoor temperatures.

Net positive energy

The U.S. Army has a Net Zero Initiative which includes producing as much energy from distributed sources at its installations over the course of a year as it takes from the grid. The U.S. Army's Net Zero Initiative also includes net zero water and waste goals and contributes to improved energy security, resource efficiency and installation resilience.

Clay Nesler's [Building Resilience: 6 Lessons from Superstorm Sandy](#)

Clay Nesler presented his lessons learned on how best to rebuild after an extreme weather event to ensure more resilient communities, first published in a blog by the UGSBC in December of 2012. Excerpts from that blog are included here.

Superstorm Sandy forced many people to abandon the homes, offices, schools, churches and stores in their communities for extended periods of time to seek refuge. This extreme event placed a heavy burden on those affected and was a test of how well these buildings were designed and operated. The results were mixed.

As we reflect on how well our buildings and energy systems met the challenge and how we can do better moving forward, we should consider three overall objectives of building resilience: 1) minimizing damage to critical infrastructure during the event; 2) maintaining operational integrity and critical services immediately following the event; and 3) returning the building to normal, safe operating conditions as soon as possible. The following are six lessons that should help guide the redesign and reconstruction of our buildings, cities and energy infrastructure to be more resilient.

1. Reduce the initial damage to building systems and infrastructure.

Major electrical and mechanical equipment that provides critical services should be installed in locations unlikely to be flooded. This can be accomplished by installing equipment above ground level or providing underground storm water holding areas or diversion paths. Burying electrical lines underground is another practice to increase reliability and robustness. These practices need to make their way into building codes, as they are much more practical and cost-effective to implement during initial construction or reconstruction.

2. Improve the reliability of emergency backup systems.

Anecdotal estimates suggest that up to half of New York City buildings' emergency backup generators failed to start when they were needed. This was due to a lack of maintenance and regular full-load testing. Many generators ran out of fuel in a day or less, as they were unable to receive supplemental fuel deliveries. The

conventional practice of storing one day's worth of fuel supply on-site needs to be reconsidered, given the increasing likelihood of severe storm events in the future.

3. Have buildings support limited critical services for extended periods of time.

After Superstorm Sandy, most [grid-connected solar photovoltaic \(PV\) systems](#) were not operational because of safety systems installed to protect utility workers and grid integrity on restart. This was a surprise to many businesses and homeowners who had invested in solar PV systems, expecting their buildings to be powered at least during daylight hours. Availability of even a limited amount of renewable energy, such as solar or microwind, combined with energy storage and a secure grid disconnect mechanism, would allow buildings to provide critical services over extended periods of time.

4. Designate and upgrade select buildings to provide critical community services.

With so many people displaced from their homes and workplaces, designated locations should be established in each community to provide critical services such as shelter, food, water, electricity and communications. Renewable energy with energy storage, or microgeneration with on-site fuel supplies, could help meet critical needs at schools, community centers, churches and other designated locations.

5. Use passive design principles to increase building resilience.

Passive approaches to providing electrical power, such as renewable energy, and passive building designs can increase building resiliency. Passive design principles — including building envelope, natural ventilation, shading, and water capture and storage — allow buildings to provide adequate comfort and water without requiring a significant energy supply. When severe storms or other events are accompanied by excessively hot or cold weather, providing comfortable and safe environments using minimal energy resources is highly desirable. An additional benefit is that buildings designed using passive principles will be significantly more energy efficient and have a lower environmental impact during normal day-to-day operation.

6. Use distributed generation and microgrids to increase community resilience.

Dependence on a centralized electrical grid is a definite liability given the extended time that is sometimes required for utilities to bring entire communities back online after a severe storm event. During Superstorm Sandy, large numbers of overhead power lines went down over an extended distance, making repair-crew logistics challenging. Microgrids, supported by distributed energy generation, are a potential solution, as they allow decentralized energy distribution at a community scale. At a community scale, the application of district heating, cooling and energy plants and renewable energy generation is more scalable, cost-effective and resilient than their use in individual building applications. Water treatment and other critical services can also be provided more cost-effectively within a community-scale microgrid. The U.S. Department of Defense is at the [leading edge of designing and installing microgrids](#) to maintain operational integrity and improve resilience, and it can set an example for cities, communities and campuses to follow.

Many involved in designing and operating the built environment have been promoting the environmental, economic and social benefits of more efficient and sustainable buildings for decades. There have also been strong voices in the sustainable energy industry calling for the greater use of renewable energy, distributed generation and district energy systems as a more cost effective and environmentally sound approach to meeting future energy needs. As we learned in Superstorm Sandy, many of the same design and operational

principles that lead to greater sustainability can also lead to greater resilience. As if improving efficiency, reducing costs, creating jobs and protecting the environment weren't enough, we can now add increasing resilience to the list of benefits resulting from more sustainable buildings and energy systems.

Buildings – Part III: Insights from Debra Ballen, Insurance Institute for Business and Home Safety (IBHS)

IBHS is a 501(c) 3 research and communications association supported by property insurers and reinsurers. The Institute and its members are committed to conducting objective, scientific research to identify and promote effective actions that strengthen homes, businesses, and communities against natural disasters and other causes of loss.

In addition to working on building codes, IBHS provides design and construction professionals, as well as building owners and contractors, a set of voluntary building standards, both general and hazard-specific.

Through the FORTIFIED programs, IBHS identifies best practices, taking a holistic approach to a structure, which is important, because building are systems, and either stay together or fail as systems.

Over the past several years, IBHS has emphasized the retrofit program (FORTIFIED Home™) – which focuses on strengthening existing homes – because of the downturn in the housing market – and that has turned out to be a great decision.

The residential programs are meeting with increasing enthusiasm, particularly in hurricane-prone areas. Several states now have mandatory insurance credits associated with FORTIFIED homes, and many individual insurers also offer market incentives.

Also, FEMA has adopted the FORTIFIED for Home engineering guidance as its own wind retrofit guidance related to post-Katrina FEMA mitigation grants.

Generally, in order to upgrade a typical new home to achieve a FORTIFIED designation, there will be an increase of 3 to 10 percent in costs, although this varies depending on the building code in place and local labor and materials costs. This range includes material, labor to install and verification of compliance. In the IBHS Research Center test house seen in the picture above, the cost to build to FORTIFIED for Safer Living standards was only \$3,000 for material and labor.



Image 2. Source: IBHS Research Center demonstrating (on the left) a home built without safe standards and (on the right) a home built to FORTIFIED standards under severe weather conditions.

After one of the four Research Center wind tests in October 2010 (during which the conventionally constructed house was damaged but not destroyed), IBHS brought in professional property claims adjusters from two insurance companies to estimate the amount of damage each house sustained. These individuals were experienced, well-trained catastrophe claims adjusters, one from a national insurer and one from a single state insurer with a focus in the Southeast.

Of particular note is the *magnitude* of the difference between the cost to repair the FORTIFIED for Safer Living® home and the conventionally constructed house. One company's loss estimate for the conventional house is nearly eight times the loss estimate for the FORTIFIED house, and the other was more than two times the loss estimate for the FORTIFIED house. This puts the average of the two loss estimates at roughly five to one. Had these houses been fully finished on the interior and furnished, the damage ratio would be even higher for the conventionally constructed house.

FORTIFIED standards are also at the heart of the U.S. Department of Homeland Security's (DHS) new Resilience STAR™ pilot program.

This fall, DHS launched their new [Resilience STAR](#) program, modeled on the very successful, ubiquitous ENERGY STAR® program. When fully operational, Resilience STAR will be a national public-private initiative to stimulate and recognize effective resilient building design and practices.

- After two years of thorough vetting, IBHS and the FORTIFIED Home™ (hazard-specific retrofits) and FORTIFIED for Safer Living® (all-hazard, new construction) standards were selected as the sole partner organization and building standards for the Resilience STAR pilot.
- Among the significant benefits of this program: DHS is actively working with IBHS to identify and implement the number and types of significant financial incentives for disaster-resistant buildings. Such incentives (e.g., tied to mortgages, taxes, building permits, etc.) are critical to widespread adoption of resilient building standards for both new and existing structures.
- Pilot communities featuring new construction and retrofitted homes are on the Atlantic and Gulf Coasts.
- Eventually, DHS envisions Resilience STAR designations being applicable to buildings of all types; however, during the pilot phase, only single-family homes will be eligible for designation.

This is what DHS said about why IBHS and FORTIFIED were selected for the pilot: “The unparalleled value of the IBHS FORTIFIED program is that it includes easy-to-use design guides for homebuilders and third-party evaluators, which are based on the same peer-reviewed, accredited, scientifically sound standards used in FEMA guidance documents. DHS has gathered a wealth of evidence through two years of discussions with subject matter experts and thought leaders in the field of structural resilience, including IBHS, the International Code Council, FEMA, National Institute for Building Sciences, National Institute for Standards and Technology, and Habitat for Humanity, along with actively participating in conferences, symposia, and workshops on structural resilience. The evidence points unambiguously to the conclusion that the FORTIFIED program offers resources that cannot be found in any other resilience programs.”

Energy: Microgrids and Adaptation – Shalom Flank, Pareto Energy

Microgrids can be appropriate adaptation strategies to severe storms and heat waves and may make sense when other infrastructure decisions are being made, for example undergrounding power lines.

Storm outages: Disruptions to the electricity transmission and distribution (T&D) system from a greater frequency of more severe storms will lead to more power outages. Because locally-generated power doesn't depend on the T&D network, and because microgrids add resiliency within the local distribution systems, microgrids reduce the number of outages, the number of users affected by each outage, and the duration of outages. Locations with microgrids will also have key services up and running for the benefit of the overall community, including places of refuge.

Heat waves: The greater frequency, intensity, and duration of heat waves will lead to higher air condition loads, higher peak demand, higher losses on the transmission network, and greater use of the dirtiest power sources (such as oil-fired peaker plants, or diesel generators for demand response). More microgrids means less reliance on the stressed utility grid, more control over peak demand, and meeting more cooling load with recycled waste heat (trigeneration).

Undergrounding: In areas with overhead wires as part of the electricity distribution systems, microgrids provide an opportunity to replace those wires with underground conduits that are less vulnerable to disruption from storms and other events. While many jurisdictions are currently pursuing aggressive undergrounding programs in the wake of natural disasters, these programs often focus on just primary feeders, and also result in an adaptation-only approach, instead of measures that combine adaptation and mitigation.

Microgrids and Mitigation: Microgrids offer an excellent climate mitigation opportunity and can often utilize other green elements such as infrastructure for stormwater retention.

Local power: Microgrids generate power locally from lower-carbon energy sources such as PV, biomass, among others. Locally-generated combined heat and power (CHP) also makes it possible to capture and re-use waste heat that would otherwise be rejected up the stack, further reducing emissions.

Grid integration: Microgrids relieve an increasingly important constraint on larger amounts of lower-carbon energy sources, by improving their integration into the existing utility distribution system. Better grid integration enables a higher percentage of cleaner local power in a given area (“penetration depth”), and lowers costs for grid interconnection thus making such resources more affordable.

Stormwater: In particular locations, the infrastructure investment needed to install underground conduits for electric distribution wires, hot water pipes and chilled water pipes for a microgrid can be combined with cisterns, drainage improvements, bioswale installation, and wetlands restoration.



Figure 6. Case Study of the Oxon Run Microgrid, Washington, DC. Source: Zach Dobelbower: DC Dept. of General Services (January 29, 2014).

An example of a potential future micro-grid project is the proposed Oxon Run microgrid project in Washington, DC (see Figure 6). This project would provide both mitigation and adaptation benefits. The microgrid would rely on local sources of energy to give the microgrid more operational and investment control. The costs of the microgrid would be offset by cheaper energy. Microgrids can also provide more stable energy supply due to the ability to finely control power allocation during shortages so a community can provide power to buildings that need it during disasters. One barrier is that utilities see microgrids as disruptive and regulations exist that actually prevent projects moving forward, such as not allowing distribution lines to run through their areas. An area where more work is needed is understanding the organizational models that would help facilitate microgrid projects and how communities can benefit from such projects. For example, one form is to establish an energy co-op, where the community shares the cost through community energy savings.

Water: Laurens van der Tak, CH2M HILL

Climate change impacts (e.g., temperature, precipitation, sea level rise, storm surge) influences many aspects of infrastructure planning, design and operations. The threats to the water sector vary by region and infrastructure system. For example, changes in the frequency and intensity of precipitation increase flooding and water quality problems including urban drainage (road drainage and stormwater management systems) from 1- to 10-year storms, the frequency and volume (typical annual precipitation) of combined sewer overflows CSO) and riverine flood plain management (FEMA Floodplains on non-tidal waterways) for 100-year storms.

Adaptation options vary by climate threat, and should consider triple bottom line benefits (the economic, social, and environmental). Adaptation strategies for stormwater management and flood protection include building resiliency into systems and phasing adaptation to account for uncertainty in projections and risk tolerance. There are many ways to build resiliency into stormwater management systems including:

- Raising electrical and mechanical equipment
- Barriers or local surge walls
- Sealing wall penetrations
- Water tight doors
- Adding tide gates to outfalls
- Backup generators
- Adding capacity to the drainage network
- Moving flows from one part of the system to another
- Applying green infrastructure and low impact development techniques
- Emergency response planning



Image 3. Workshop panelist from Left to Right: Laurens van der Tak (CH2M Hill), Emily Seyller (USGCRP), Steve Winkelman (CCAP), Jessica Grannis (GCC), and John Nordgren (Kresge Foundation).

Many adaptation efforts must be considered as well for how best to improve a community’s resilience to drought. Examples include:

- Water banking and increased conjunctive use of surface water and groundwater
- New or increased water storage
- Municipal and industrial water conservation
- Temporary water transfers from agriculture to urban areas
- Development of local “drought-proof” supplies (including wastewater reuse and desalination of ocean or brackish supply)

In summary, triple bottom line analysis can provide tremendous value as it can change how decision makers consider adaptation options, including identifying climate mitigation impacts and benefits. Finally, while green infrastructure is rarely driven by climate adaptation/mitigation drivers, it could benefit from valuing climate co-benefits, such as: (1) reduced heat island effects; (2) reduced energy needs for cooling; (3) reduced energy demands for CSO pumping/treatment; and (4) better air quality.

City Efforts

Brian Swett, Chief of Environment and Energy, City of Boston, and Brendan Shane, Chief, Office of Policy and Sustainability, District Department of the Environment provided some highlights of their cities' A+M efforts.

Boston, MA was recently ranked #1 in energy efficiency across all US cities. The city is currently updating their [Climate Action Plan](#), which will focus on climate preparedness and community engagement. Boston has developed climate resilience requirements for new major private development. The Boston Redevelopment Authority is working to expand district energy systems. The Boston Water and Sewer Commission is launching new green infrastructure implementation and monitoring efforts and will soon issue an RFP to analyze stormwater fees.

Washington, D.C. has been a leader in green infrastructure and in stormwater credit trading. The [Sustainable D.C.](#) plan takes a comprehensive approach addressing energy, climate change, water, buildings, transportation, health and social equity. In 2014 the District will develop a climate adaptation plan in which they want to maximize A+ M synergies. DC Water is installing combined heat and power generating capacity to reduce GHGs and enhance resilience. Numerous regional and Federal stakeholders are involved in local climate initiatives including the Council of Governments, the regional transit authority, the National Capital Planning Commission, US EPA and the General Services Administration.

Conclusion

There seems to be a tremendous amount of interest and energy around helping to facilitate adaptation + mitigation projects. We found that indeed there are opportunities in Washington, DC and in Boston, MA to implement pilot projects. In addition, we learned that there are federal and local policies that can help and/or

Case Study One: [Onondaga County, NY's Combined Sewer Overflow Program, Gray-Green infrastructure implementation.](#)

The County invested a total of \$87 million in the program that was driven by consent decree with EPA. The program includes more than 150 projects that have been constructed, 30 that are under construction, and 75 that are in design. The program includes green streets projects with permeable pavement and green bioswales, connective corridors, significant public outreach components, and innovative financing. EPA recognized Onondaga County as one of [EPA's top 10 green infrastructure partners](#).

The innovative Green Improvement Fund financing mechanism includes utilizing funds from the State Revolving Fund (SRF) to create Public Private Partnerships "P3". They have many lessons learned including: (1) demand exists; (2) transparency throughout the process is paramount; and (3) it is okay to modify the program along the way; adaptation is key as program evolves.

Case Study Two: [City of Lancaster, PA Green Infrastructure \(GI\) Planning and Program Implementation.](#)

The City projected a \$144 million investment needed for the GI program. The driver was not climate change, but instead regulatory – the city needed to meet their NPDES permits (CSO and MS4), an administrative order for the CSO, and the Chesapeake Bay nutrient TMDL.

The City secured \$11.5 million in implementation grant funding for 25 GI technologies and applications including an integrated program of rain gardens, green streets and alleys, green parks, green parking lots, vegetated rooftops, enhanced tree planting, green schools and public facilities, and private property projects. One example is Brandon Park where 4 million gallons a year of runoff are captured. Many of the projects came at little additional cost. For example, Alley 148 was greened for 10% additional cost to the conventional reconstruction and now provides the benefits from permeable pavers and an infiltration trench. The City is also utilizing innovative financing by taking advantage of SRF to create P3's.

hinder the implementation of green resilience projects. We have captured key lessons, research and capacity building needs, and how to best communicate with communities on these issues.

Pilot Project Opportunities

The following project opportunities rose to the top as areas ripe to pursue in Washington, DC and Boston, MA:

- Adding resilience measures to green building projects, codes and policies.
- Installing Combined Heat and Power (CHP) in “Meds & Eds” community (hospital & university campuses) as a first step toward microgrids.
- Targeting green infrastructure and cool roofs to maximize cooling and water capture.

Policy Opportunities

The group highlighted four main policy opportunities:

- Whitehouse Council on Environmental Quality (CEQ): assess and provide input on A+M in the Resilience Toolkit and the Climate Preparedness Task Force;
- Federal Energy Regulatory Commission (FERC) and International Organization for Standardization (ISO): modify policies to facilitate microgrids;
- Property Assessed Clean Energy (PACE): integrate resilience into PACE (Connecticut is starting this); and
- Stormwater fees and trading facility: follow DC’s model to raise funding for green infrastructure.

Key Lessons

The group discussion focused-in on four key lessons learned:

(1) Speak in terms people understand:

- “Green” and “Resilient” is less wonky than “Mitigation” and “Adaptation”.

(2) Follow the Money:

- Ask the Climate Question for your next major investment: does it help to cut carbon pollution while also preparing for and responding to climate impacts?
- Connect the Dots: that is, if you’re investing in mitigation consider how you can increase adaptation benefits; and vice versa in order to increase return on climate and infrastructure investments and maximize co-benefits.

(3) Understand Drivers and Barriers:

- Learn why decisions are being made (regulations, markets, competitiveness, quality of life).

(4) Look for Maximizing “Accidental” and “Intentional Resilience”:

Clay Nesler’s memorable phrase “Accidental Resilience” illustrates how many solutions aren’t driven by climate concerns, for example:

- DC Water is installing CHP for environmental compliance, but will enjoy major cost savings, increased energy resilience and enhanced reliability.
- CHP and building efficiency measures motivated by cost savings can lead to energy resilience.
- “Intentional Resilience”, on the other hand, is when we plan ahead and use common sense to avoid conflicts and maximize synergies.

Research Needs

The group underscored some key research needs:

- Broad economic analysis that includes business continuity benefits, energy savings and ecosystem services.
- Quantification of the co-benefits of implementing adaptation + mitigation projects.
- Measuring resilience at different scales: building, neighborhood scale, infrastructure, and city.
- How to scale up from pilots to city-wide and regional resilience.

Capacity Building Needs

During our session and workshop we heard two main needs:

- City governments need energy planning experts for future resilience ; and
- Foundations could support embedded staff in city agencies and community groups.

Communication and Stakeholder Engagement

The group discussed three stakeholder engagement recommendations:

- Make the business and economic competitiveness case for resilience supported by economic data and success stories.
- Local power generation and microgrids can “empower” communities.
- The incremental cost of good design for new construction is often minimal, whereas the opportunity costs of not preparing are high.

Appendix A: Symposium and Workshop Agendas



OVERVIEW

NCSE BUILDING CLIMATE SOLUTIONS CONFERENCE

Climate Adaptation + Mitigation Synergies: Pursuing Implementation Pilots

Organizers: Steve Winkelman & Shana Udvardy, Center for Clean Air Policy (CCAP) and Emily Seyller, U.S. Global Change Research Program (USGCRP)

Symposium: Tues, Jan 28, 3:45 - 5:15pm

Workshop: Wed, Jan 29, 2:00 - 5:15pm

Overarching Goals

- Identify actionable opportunities for A+M pilot projects in 2014 in multiple sectors; and
- Provide input to the National Climate Assessment “AMNex” affinity group (Adaptation + Mitigation Nexus), the State, Local, and Tribal Leaders Task Force on Climate Preparedness and Resilience and the Climate Resilient LEDS working group (co-chaired by Ecosynergy Brazil and CCAP).

Outcomes

- Identify at least two focused and innovative partnership opportunities for implementation of pilot projects in 2014;
- A symposium summary whitepaper with concrete examples of adaptation and mitigation integrated strategies;
- An initial list of recommendations on ways to integrate adaptation + mitigation for the Council and State, Local, and Tribal Leaders Task Force on Climate Preparedness and Resilience established in Executive Order 13653; and
- Prioritized next steps, including plan for follow-up discussions.

SYMPOSIUM

The Climate Adaptation + Mitigation Synergies sessions will identify innovative partnerships for implementation of Adaptation + Mitigation pilot projects.

Together we will Ask the Climate Question: How can we maximize the return on our infrastructure and climate investments – mitigation and adaptation – while also maximizing economic, social, and environmental benefits? The “A+M” sessions, focused on urban resilience, will enable practitioners and decision makers at all scales to learn about best practices and discuss opportunities for achieving synergies among actions that both cut carbon pollution (mitigation) and prepare for and respond to climate impacts (adaptation). Panelists will: (1) review the current and planned state of practice on integrating mitigation and adaptation; (2) identify actionable research and information needs; and (3) explore policy and implementation opportunities.

Symposium Panelists

- Overview of the A+M Concept: **Steve Winkelman**, Director, Transportation and Adaptation, CCAP
- Overview of the State of the Nation for A+M: **Susan Ruffo**, Deputy Associate Director for Climate Change Adaptation Council on Environmental Quality
- Efficient and Resilient Buildings: **Clay Nesler**, Vice President, Global Energy and Sustainability, Johnson Controls
- Research & Capacity Building: **Emily Seyller**, Program Manager Inform Decisions, USGCRP

Workshop At A Glance

A+M Strategic Framing

Investment, Policy and Capacity Building Opportunities.

- **John Nordgren**, Senior Program Officer for Environment, The Kresge Foundation
- **Jessica Grannis**, Adaptation Program Manager, Georgetown Climate Center
- **Emily Seyller**, Program Manager Inform Decisions, USGCRP

A+M Sector Case Studies:

- Buildings: **Debra Ballen**, General Counsel and Senior Vice President of Public Policy, IBHS
- Energy: **Shalom Flank**, Chief Technology Officer and Microgrid Architect, Pareto Energy
- Water: **Laurens van der Tak**, VP, Water Resources & Ecosystem Management, CH2M Hill
- Cities: **Brian Swett**, Chief of Environment and Energy, City of Boston
- **Brendan Shane**, Chief, Office of Policy and Sustainability, District of Columbia Department of the Environment.

NCSE # 28 Workshop Agenda

Climate Adaptation + Mitigation Synergies: Pursuing Implementation Pilots

Workshop Wednesday, January 29, 2014

Time	Activity	Speaker
2:00 PM	Welcome	Steve Winkelman, Emily Seyller, Shana Udvardy
2:10 PM	Introductions: AMNex survey Q1 What are you currently doing on Adaptation + Mitigation?	<i>Group discussion</i>
	PURSUIING IMPLEMENTATION PILOTS	
	<u>Strategic Framing</u>	
2:25 PM	A. Investment Opportunities	John Nordgren, Kresge Foundation
2:30 PM	B. Policy Opportunities	Jessica Grannis, Georgetown Climate Center
2:35 PM	C. Capacity Building & Technical Resources	Emily Seyller, USGCRP
	<u>Implementation Opportunities</u>	
2:40 PM	3x3 A+M Matrix: Increasing climate returns on your top investments	Steve Winkelman, CCAP
	SECTOR EXAMPLES	
	<u>Buildings</u>	
3:45 PM	<ul style="list-style-type: none"> What: Description, A+M benefits Who implemented it and Why? How were investments, policies, and technical resources deployed to seize opportunities and overcome barriers? 	Debra Ballen, Insurance Institute for Business and Home Safety
3:50 PM	Local Respondents: Boston	Brian Swett, Chief of Environment and Energy, City of Boston
	<u>Energy (Microgrids)</u>	
2:45 PM	<ul style="list-style-type: none"> What: Description, A+M benefits Who implemented it and Why? How were investments, policies, and technical resources deployed to seize opportunities and overcome barriers? 	Shalom Flank, Pareto Energy
2:50 PM	Local Respondents: Washington DC	Brendan Shane, District Department of Environment
2:55 PM	Group Discussion: Opportunities, Barriers, Next Steps	
	<u>Water</u>	
3:15 PM	<ul style="list-style-type: none"> What: Description, A+M benefits Who implemented it and Why? How were investments, policies, and technical resources deployed to seize opportunities and overcome barriers? 	Laurens van der Tak, CH2M Hill
3:20 PM	Local Respondents: Washington DC and Boston	Brendan Shane and Brian Swett
3:25 PM	Group Discussion: Opportunities, Barriers, Next Steps	
3:55 PM	<u>A+M Synergies Group Discussion:</u>	<i>Group discussion</i>
	TOP IMPLEMENTATION OPPORTUNITIES	<i>Group discussion</i>
4:15 PM	<u>Identify actionable opportunities for A+M pilots that can be launched in 2014</u>	
	Top 3 Opportunities	
	Top Barriers (\$, technical, institutional capacity, political...)	
	Surmounting Barriers Investments, Policy, Capacity Building, Research...	
	Strategic Next Steps	
	- Follow up discussions (e.g., calls, web/meetings)	
	- Local pilot implementation	
	- Policy opportunities	
	- Capacity Building & Tools (e.g., 3X3 Matrix)	
	- Research (e.g., AMNex survey, technical...)	
	- Other?	
5:15 PM	<u>Adjourn</u>	

Appendix B: Speaker Biographical Sketches

DEBRA T. BALLEEN

GENERAL COUNSEL AND SENIOR VICE PRESIDENT, PUBLIC POLICY



Debra Ballen joined IBHS in 2008 as the general counsel and senior vice president of public policy. In this capacity, she is responsible for managing all of the organization’s legal matters and overseeing IBHS’ public policy efforts. In addition, she also serves as the organization’s corporate secretary. Prior to her work with IBHS, Ms. Ballen was the executive vice president of public policy management for the American Insurance Association (AIA) in Washington, D.C. She developed and implemented policy for AIA’s priority federal and state public policy issues. She also has served on the Organization for Economic Cooperation and Development (OECD) High Level Advisory Board on Financial Management of Large Scale Catastrophes, which includes a heavy emphasis on mitigation measures. Ms. Ballen graduated with a juris doctorate degree from Harvard Law School and an A.B. degree from Princeton University. She also has received the CPCU designation.

SHALOM FLANK

CHIEF TECHNOLOGY OFFICER & MICROGRID ARCHITECT



Dr. Flank manages all technical and engineering aspects of Pareto’s projects, from initial assessments and conceptual design, through full engineering and implementation. He also oversees the development of Pareto’s proprietary technologies. Dr. Flank was trained at MIT, where he studied energy engineering, economics, and policy. Dr. Flank has been a frequent advisor to commercial companies and public agencies on energy technologies, whether working as an Associate with the Distributed Energy Financial Group or helping the National Science Foundation assess the commercial viability of new photovoltaic and fuel cell technologies. As a business consultant, Dr. Flank has worked with cutting-edge companies commercializing clean energy and energy efficiency technologies, such as utility-scale concentrating solar power (CSP) and new LED lighting technologies. He served for a number of years as a program manager at the Defense Advanced Projects Agency (DARPA) and as a staff member at Lawrence Livermore National Laboratory and the U.S. House of Representatives, and has held appointments at Harvard and MIT.

JESSICA GRANNIS



ADAPTATION PROGRAM MANAGER, GEORGETOWN CLIMATE CENTER (GCC) AND STAFF ATTORNEY AND ADJUNCT PROFESSOR, HARRISON INSTITUTE, GEORGETOWN UNIVERSITY LAW CENTER

Jessica supervises GCC students and staff working with state and local governments on projects to help them adapt to climate change. Her recent publications include an Adaptation Tool Kit for Sea Level Rise (2012); and a book chapter on Coastal Retreat in the Law of Climate Change: U.S. and International Aspects (2012, with Peter Byrne). Prior to joining the Harrison Institute, she was staff counsel for the California State Coastal Conservancy and the Ocean Protection Council. She holds a B.A. in history from the University of Chicago; a J.D. , Cum Laude, from University of California Hastings College of the Law; and a L.L.M, with honors, from Georgetown Law.

CLAY NESLER

VICE PRESIDENT, GLOBAL ENERGY AND SUSTAINABILITY, JOHNSON CONTROLS



Clay Nesler is the Vice President, Global Energy and Sustainability for Johnson Controls. In this role, he is responsible for energy and sustainability strategy, policy, public affairs, innovation and the Johnson Controls Institute for Building Efficiency. He also serves on the company's global environmental sustainability council. Since joining Johnson Controls in 1983, Clay has held a variety of leadership positions in research, product development, marketing and strategy in both the United States and Europe. Clay is the vice-chair of the World Environment Center, serves on the board of American Council for an Energy Efficient Economy and is on the advisory boards of the NRDC Center for Market

Innovation and the University of Illinois Department of Mechanical Science and Engineering. He is also co-chair of the North American and Euro-Mediterranean Energy Efficiency Forum, a member of the Alliance to Save Energy International Steering Committee and a sustainable buildings track advisor for the Clinton Global Initiative. Clay received BS and MS degrees in Mechanical Engineering from the University of Illinois at Urbana-Champaign and is a co-inventor on eleven patents. He is a winner of the 2005 Corenet Global Innovator's Award and the 2012 VERGE 25 award.

JOHN NORDGREN

SENIOR PROGRAM OFFICER, ENVIRONMENT, THE KRESGE FOUNDATION



John developed the Environment Program's climate adaptation strategy. He manages The Kresge Foundation's adaptation portfolio, which uses strategic investments and other tools to build society's capacity to lessen the harmful impacts of climate change on people and nature. In addition to managing a grant portfolio, John contributes thought leadership to the nascent field of climate adaptation. In 2010, John organized and facilitated meetings of the White House Council on Environmental Quality, foundations, and nonprofit organizations that provided input for the National Task Force on Climate Adaptation's

recommendations to President Barack Obama. He serves as an adviser to the city of Chicago on the implementation of its climate adaptation plan, co-chair of the Conservation Science Working Group of the Consultative Group on Biological Diversity (CGBD), and a member of the CGBD's Horizons Committee. John holds a bachelor of arts in public policy from the American University in Washington, and a master of arts in public policy from Tufts University, where he focused on natural resource economics and management.

SUSAN RUFFO

DEPUTY ASSOCIATE DIRECTOR, CLIMATE CHANGE ADAPTATION, WHITE HOUSE COUNCIL ON ENVIRONMENTAL QUALITY



At CEQ, Susan Ruffo leads implementation of the climate preparedness pillar of the President's Climate Action Plan. She also manages the interagency Council on Climate Preparedness and Resilience, focusing on strengthening Federal programs to better prepare the United States for the impacts of climate change. Previously, Susan was the Director of Coastal and Marine Adaptation at The Nature Conservancy, where she led their strategy on coastal ecosystem-based adaptation, focusing on how ecosystems such as coral reefs and wetlands can help reduce human vulnerability to the impacts of climate change. Susan was also a Foreign Service Officer with the U.S. Department of State, where she served in the U.S. Embassies in China, Argentina and Nigeria and Washington D.C. Susan has degrees in Economics and Political Science from the Massachusetts Institute of Technology.

EMILY SEYLLER

PROGRAM MANAGER, INFORMING CLIMATE DECISIONS, U.S. GLOBAL CHANGE RESEARCH PROGRAM'S (USGCRP) NATIONAL COORDINATION OFFICE



In her role as the Program Manager at the National Coordination Office in Washington, DC, Emily is part of a comprehensive and integrated climate change research program under the purview of the White House Office of Science and Technology Policy. In her role at the USGCRP, she manages the coordination, integration, and translation of climate change science and impacts across the Federal government in an effort to enable and empower adaptation and mitigation decisions at a range of scales for a diversity of users. Emily is a certified Change Management Advanced Practitioner (CMAP) from Georgetown University and is also certified in Climate Change Decision-Making from the University of Washington. She received an M.A. in Environmental and Natural Resources Policy from The George Washington University and a B.A. in Public Policy and Environmental Studies from Hamilton College.

BRENDAN SHANE

CHIEF, OFFICE OF POLICY AND SUSTAINABILITY, THE DISTRICT DEPARTMENT OF THE ENVIRONMENT



As the Chief of the Office of Policy and Sustainability for the District Department of the Environment, Brendan oversees issues related to green building, climate change, and cross-cutting urban sustainability. He is a principal staffer for Mayor Vincent Gray's Sustainable DC initiative, which began in July 2011 and is now in the implementation phase following release of the Sustainable DC Plan in February 2013. In that capacity, he is working across the District Government and with stakeholders throughout the community to define and implement the Mayor's vision of making the District of Columbia the greenest, healthiest, most livable city in the nation.

Brendan is a watershed hydrologist and attorney by training, with a bachelors in government from Franklin & Marshall College, a masters in geology from the University of Maryland, and JD from the Georgetown University Law Center.

BRIAN SWETT

CHIEF, ENVIRONMENT AND ENERGY, CITY OF BOSTON



Over the last year, Chief Swett has led a variety of major policy and program initiatives in Boston including developing and passing a building energy disclosure ordinance, launching Greenovate Boston, a sustainability education and outreach initiative, and kicking off Climate Ready Boston, a set of climate preparedness initiatives. Chief Swett is now starting efforts to update the City's Climate Action Plan, which is due in 2014. Prior to his Boston appointment, Mr. Swett oversaw sustainability related initiatives at Boston Properties, worked for an environmental justice nonprofit, two socially responsible investment firms, U.S. Senator Barbara Boxer, and several offices in the U.S.

Environmental Protection Agency.

SHANA UDVARDY

CLIMATE ADAPTATION POLICY ANALYST, CENTER FOR CLEAN AIR POLICY (CCAP)



Under CCAP's Weathering Climate Risks program, Shana is advancing corporate and community preparedness for extreme weather and climate change impacts. Previously, she led flood risk and climate adaptation initiatives as president of Udvardy Consulting and as the director of flood management policy for American Rivers. Prior to joining American Rivers, Udvardy led the Georgia Conservancy's water program advocacy efforts that helped establish a comprehensive statewide water plan for Georgia. She also previously worked for the Smithsonian's Monitoring and Assessment of Biodiversity program where she led a comprehensive biodiversity assessment and monitoring program in Perú. Shana was a

Peace Corps volunteer in Nicaragua where she promoted soil and water conservation. She holds a M.S. in Conservation Ecology and Sustainable Development from the University of Georgia's Odum School of Ecology, and a B.A. from Syracuse University's Maxwell School.

LAURENS VAN DER TAK

VICE PRESIDENT AND DEPUTY DIRECTOR FOR WATER RESOURCES AND ECOSYSTEMS MANAGEMENT, CH2M HILL



Mr. van der Tak is a Vice President with CH2M HILL in Silver Spring, MD. He is CH2M HILL's Deputy Director for Water Resources and Ecosystems Management. He serves as CH2M HILL's Technology Lead for Climate Change Adaptation services. He is a member of AWWA, WEF, AWRA and IWA and is the Chair of AWWA's Climate Change Committee.

He has a BA in biology and a BS in agricultural engineering from Cornell University, an MS in agricultural engineering from the University of California at Davis, and a Civil Engineer Degree from MIT.

STEVE WINKELMAN

DIRECTOR OF TRANSPORTATION AND ADAPTATION PROGRAMS



Steve Winkelman, has 20 years of experience in the transportation, energy and environmental fields, assisting government officials around the world with policy design, implementation and evaluation. His research and writing focus on the intersections of infrastructure and land use planning, climate change policy and economics. Steve launched CCAP's Weathering Climate Risks program and blog to advance corporate and community preparedness for extreme weather and climate change impacts and assess the economic benefits of risk management and planning ahead. Steve directed the Urban Leaders Adaptation Initiative, helping leading governments "Ask the Climate Question"

when making infrastructure and land development investment decisions to improve their resilience to climate change impacts. Prior to joining CCAP, Steve managed ICF's Climate Wise industrial energy efficiency work for the US EPA. He holds a BS in Physics from the University of Michigan and an MA in Public Policy from the University of Minnesota. Steve lives in Montréal.

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