

# Resiliency through Energy Efficiency



*Disaster Mitigation and Residential Rebuilding  
Strategies for and by State Energy Offices*



*National Association of  
State Energy Officials*

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### **Acknowledgment of work by the National Association of State Energy Officials contributing to this effort:**

This material is based upon work supported by the U.S. Department of Energy under award number DE-EE0004556.

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### **The following organization prepared this report:**

National Association of State Energy Officials ([www.naseo.org](http://www.naseo.org))  
2107 Wilson Boulevard, Suite 850, Arlington, VA 22201  
703.299.8800

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## Acknowledgements

The National Association of State Energy Officials (NASEO) greatly appreciates the support, input, and data provided by the U.S. Department of Energy Residential Buildings Integration Program, State Energy Offices, local jurisdictions, and other organizations involved in the development of this report. A number of individuals provided guidance, expertise, and thoughtful reviews that helped make this a useful resource for the 56 State and Territory Energy Offices and their partners.

NASEO would like to thank the following State Energy Office members and others for the time and input they contributed to the development of this report:

### State Energy Offices

- Colorado Energy Office: Peter Rusin
- Florida Department of Agriculture and Consumer Services: Alexander Mack
- Georgia Department of Community Affairs: Bill Towson
- Kansas Corporation Commission: Ryan Freed
- Massachusetts Department of Energy Resources: Elise Anderson, Ian Finlayson, and Amy McGuire
- Nebraska Energy Office: Ginger Willson, Danielle Jensen, and Joy Manning
- New Jersey Board of Public Utilities: Mike Winka
- Oklahoma Department of Commerce: Kylah McNabb

### U.S. Department of Energy

- David Lee, Program Manager, Residential Buildings Integration, Building Technologies Office
- Subid Wagley, Technology Development Manager, Residential Buildings Integration, Building Technologies Office

This report was co-authored by Christopher Wagner, Program Director, NASEO; Hillary Dobos, Principal and Owner, Merrill Group LLC; and Sandy Fazeli, Program Director, NASEO.

The cover image came from [Montira.photo/stock.adobe.com](https://www.gettyimages.com/detail/stock-photo/1177777777).

## List of Acronyms and Abbreviations

AIA	American Institute of Architects
BPU	New Jersey Board of Public Utilities
CARRI	Community and Regional Resilience Institute
CEO	Colorado Energy Office
DCA	Department of Community Affairs (New Jersey)
DHS	Department of Homeland Security
DOE	Department of Energy
DOER	Massachusetts Department of Energy Resources
EECBG	Energy Efficiency and Conservation Block Grant
EPA	U.S. Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FLASH	Federal Alliance for Safe Homes
GORR	New Jersey Governor's Office of Recovery and Rebuilding
HERS	Home Energy Rating System
HUD	U.S. Department of Housing and Urban Development
HVAC	Heating, Ventilation, and Air Conditioning
IBHS	Insurance Institute for Business and Home Safety
ICC	International Code Council
ICLEI	International Council for Local Environmental Initiatives
LEED	Leadership in Energy and Environmental Design
NAHB	National Association of Home Builders
NASEO	National Association of State Energy Officials
NIST	National Institute of Standards and Technology
NOAA	National Oceanic and Atmospheric Administration
NREL	National Renewable Energy Laboratory
PACE	Property Assessed Clean Energy
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USGBC	U.S. Green Building Council
VOAD	National Voluntary Organizations Active in Disaster

## Executive Summary

In its 2014 report, the U.S. Global Change Research Program indicated that extreme weather linked to global climate change is already affecting every region of the country and is projected to worsen in the near and long term.<sup>1</sup> The United States will see an increase in extreme weather and natural disasters ranging from heat waves to heavy downpours, droughts, hurricanes, wildfires, and floods. Following a natural disaster, state and local governments face numerous challenges in supporting residents in restoring and rebuilding their communities. In these situations, urgent demands for emergency medical care, ensuring public safety, and restoring utilities must be addressed as quickly as possible.

After the initial period of disaster relief, communities can begin the full process of recovery and rebuilding, which can also double as a critical opportunity to use rebuilding to enhance resiliency—the ability to withstand and rebound quickly from future disasters. Many resiliency measures in the built environment overlap with energy efficiency measures that can further benefit residents through lower operating costs and benefit the community through energy savings that can lower demand and stress on energy infrastructure.

Given the many priorities state and local governments and residents face following a disaster, integrating energy efficiency and resiliency into residential rebuilding can be a challenge. Fortunately, research into state experience with energy-efficient and resilient rebuilding in the residential sector<sup>1</sup> has revealed several key strategies that other state and local communities can employ to mitigate the impacts of a natural disaster and plan for coordinated and effective disaster recovery.

This report focuses on the experiences of State and Territory Energy Offices as leaders and key players in the rebuilding process. The National Association of State Energy Officials (NASEO) and the 56 State and Territory Energy Offices<sup>2</sup> have led innovation on energy assurance and emergency planning, mitigation, and response for over 25 years.<sup>3</sup> These efforts have focused on limiting the impact of energy supply disruptions from all hazards—natural and man-made—and returning energy systems and communities to normal activity as rapidly as possible.

This report integrates NASEO's long-standing energy assurance expertise with residential rebuilding activities and explores strategies that State Energy Offices, partner state and local agencies, and the private sector can implement to rebuild the residential sector following a natural disaster and to prepare for potential future disasters, with a focus on energy efficiency, renewable energy, and resiliency. Lessons and recommendations in this report may also provide insight to inform other state agencies, local governments, and private sector partners that are involved in rebuilding and in developing strategies to mitigate the impacts of potential future disasters.

Through a literature review and interviews with representatives from State Energy Offices and other organizations and agencies involved in past residential rebuilding efforts, NASEO identified numerous challenges to integrating energy efficiency and resiliency into residential rebuilding, such as: motivating

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<sup>1</sup> As explained below, this document and the rebuilding protocol focus on single-family, detached homes, which have unique rebuilding challenges compared to other types of residences, such as multifamily buildings. Throughout the document, NASEO uses the term “residential rebuilding,” “residential sector,” or “residential homes” to refer to single-family, detached homes.

<sup>2</sup> Throughout the report, State and Territory Energy Offices will be referred to as “State Energy Offices.”

<sup>3</sup> For more information about NASEO's Energy Assurance program, visit <http://naseo.org/energyassurance>.

property owners and developers to value energy efficiency and disaster resilience during the rebuilding process; identifying and understanding the various sources of federal, state, and private rebuilding funding and assistance; and working with property insurance providers to allow upgrades of rebuilt homes above the value of the pre-existing structure.

Despite the challenges, NASEO's research on state experiences found a number of helpful strategies that can set a State Energy Office up for effective disaster mitigation (before the disaster) and rebuilding (after the disaster) efforts:

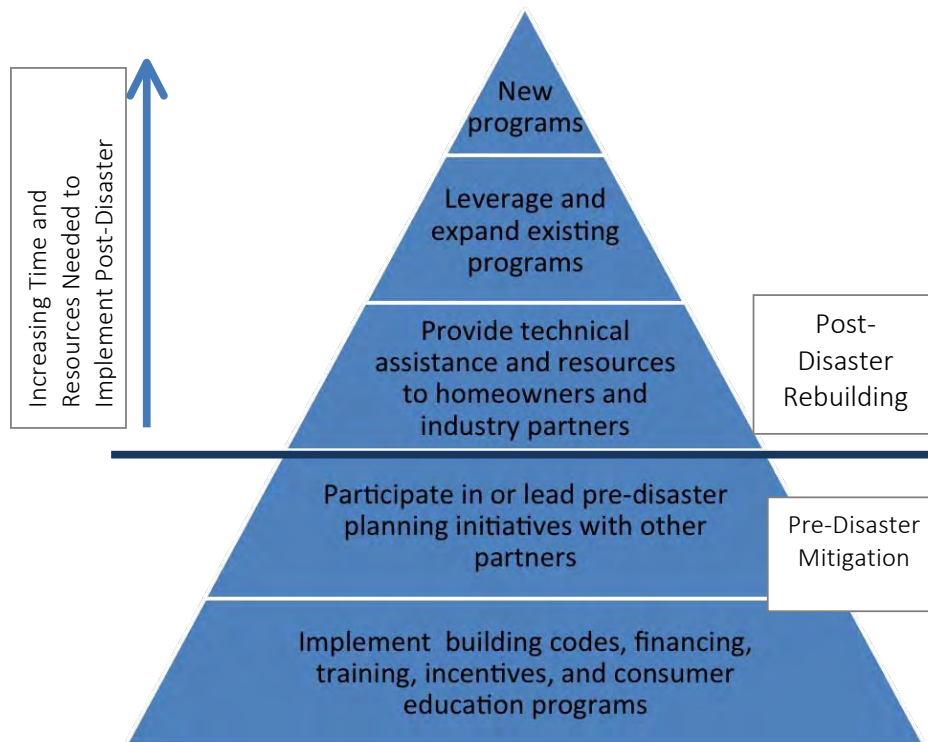
- 1. Many of a State Energy Office's existing efforts can help mitigate the impact of natural disaster *before* it strikes and can also be leveraged during the disaster recovery period.** State Energy Office programs such as training for and implementation of building energy codes; energy efficiency and renewable energy financing mechanisms; consumer education and awareness-building; rebate and discount programs; utility partnerships; industry partnerships with homebuilders, contractors, and big-box stores; and energy assurance planning all present significant mitigation and rebuilding opportunities. Across all these efforts, a State Energy Office can prime other stakeholders for effective mitigation and disaster recovery efforts by integrating education around the value of and opportunities for energy efficiency and resiliency.
- 2. The most effective disaster rebuilding coordination happens when there is a plan and relationships in place before a disaster.** Developing strong working relationships with utilities, private sector partners, and federal, state, and local agencies before a disaster strikes allows for smoother coordination and implementation of response, recovery, and rebuilding efforts. State Energy Offices naturally engage in partnership building across all of their program areas, and these efforts can be further strengthened and formalized in a disaster planning process that incorporates energy efficiency and resiliency. NASEO recommends that State Energy Offices consider highlighting disaster rebuilding efforts as part of their comprehensive state energy and/or energy assurance planning processes.
- 3. As part of rebuilding planning, State Energy Offices can assess available resources across different federal agencies such as the Federal Emergency Management Agency (FEMA), U.S. Department of Housing and Urban Development (HUD), and U.S. Department of Energy (DOE) to optimize coordination, reduce duplication of efforts, and limit confusion during the critical disaster recovery period.<sup>4</sup>**
- 4. After a disaster, designating a staff member to lead a State Energy Office's disaster recovery and rebuilding efforts and to coordinate with other partners** can vastly enhance the speed and effectiveness of implementation.
- 5. Following a disaster, assessing target markets and matching resources and programs to those distinct residential rebuilding segments can help optimize efforts.** Depending on the severity of the damage to the home, a homeowner will face different challenges, choices, and timelines in rebuilding, and a State Energy Office's programs would ideally mirror these crucial decision points.
- 6. Like other similar energy efficiency and resiliency efforts, mitigation and rebuilding initiatives benefit from formal evaluation and feedback mechanisms.** Evaluation of these initiatives helps provide feedback on the program and create a process of continuous improvement that improves operations and informs future disaster planning and mitigation efforts.

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<sup>4</sup> Appendix A contains information and links to websites where State Energy Offices and other state and local officials can access points of contact at each of these federal agencies.

A number of factors, including funding availability, staff expertise and capacity, and timeframe for the project, impact how a State Energy Office can make decisions regarding disaster mitigation and rebuilding strategies. Some of these efforts—such as implementing building energy codes or establishing energy efficiency or renewable energy financing mechanisms—are only suited for disaster mitigation strategies, as the resources and time needed to implement these programs go beyond what is available during a disaster rebuilding period.

The conceptual framework presented in Figure 1 illustrates one way that State Energy Offices can assess options for spending their time and resources most effectively. The framework also presents potential strategies in a way that different efforts build on a foundation of other efforts.



**Figure 1: Residential Building Disaster Mitigation and Recovery Conceptual Framework**

This report expands on this conceptual framework to discuss a State Energy Office’s options at each disaster mitigation and rebuilding stage in detail. The four disaster stages include:

1. **Pre-Disaster Planning and Preparation:** activities leading up to the time of the disaster, including mitigation strategies.
2. **Disaster Planning:** the window of planning time after disaster response and relief and before recovery or rebuilding.
3. **Rebuilding Implementation:** design and implement the rebuilding program, integrating energy efficiency and resiliency strategies.
4. **Program Evaluation and Feedback:** efforts to assess attainment of program goals and synthesize successes and lessons learned for future disaster planning and response.



As part of the section on Rebuilding Implementation, NASEO developed a Residential Disaster Rebuilding Assessment Tool (see Figure 5). The assessment tool summarizes lessons learned and experiences from the State Energy Offices that NASEO interviewed for this report and will assist states in determining what programs may make sense to implement given their set of available resources.

Future NASEO reports and resources will address other building types and broader community needs, adding to the research in this report and previous resources developed by NASEO's energy assurance planning program. As NASEO works with its State Energy Office members and private sector partners to utilize the report findings and assessment tool, we will continue to the process of documenting additional state experiences and developing resources and to aid State Energy Offices in learning from their peers.

## Introduction

The U.S. Global Change Research Program released the third National Climate Assessment report in 2014, which states that extreme weather linked to global climate change is already affecting every region of the country and is projected to worsen in the near and long term.<sup>ii</sup> The United States will see an increase in extreme weather and natural disasters ranging from heat waves to heavy downpours, droughts, hurricanes, wildfires, and floods. In fact, as of 2012, four out of five Americans were living in counties that were hit by at least one federally declared weather-related disaster since 2005.<sup>iii</sup>

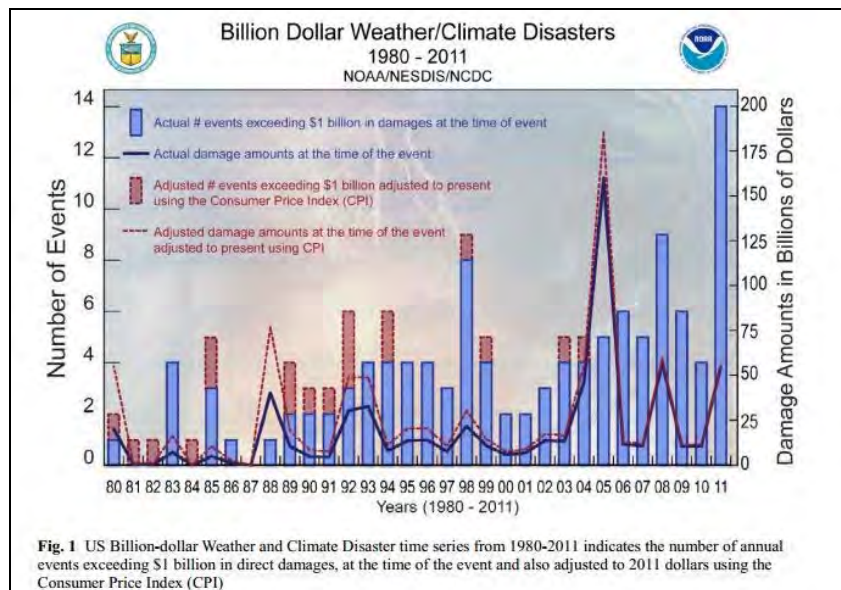


Figure 2: Billion Dollar Weather/Climate Disasters (NOAA National Climatic Data Center)<sup>iv</sup>

Correspondingly, extreme weather and natural disasters create increased risks and harm for U.S. infrastructure, communities, and the economy. As shown in Figure 2, the cost of weather/climate disasters is significant. In 2011, the country experienced roughly \$200 billion in damage from weather events. It is increasingly important for communities to have a strong understanding of how to mitigate and quickly recover from natural disasters, including implementing disaster-rebuilding strategies that simultaneously restore communities and also strengthen resiliency. Such resiliency will enable individuals and communities to rebound more quickly after a disaster, minimize costs, and also bolster protective factors against negative impacts of future events. A number of states and communities, including those profiled in this report, have invested in energy-efficient rebuilding programs to achieve both resiliency outcomes and benefits of energy efficiency, including lower operating costs, greater occupant comfort and safety, reduced demand on energy infrastructure, reduced emissions, and job creation.

Several technologies help homes become more resilient to natural disasters while also improving the energy performance of the building. While this report focuses on broader state strategies for disaster mitigation and rebuilding, an understanding of relevant technologies can help state and local leaders design appropriate disaster mitigation and rebuilding programs. Technology advancements can be required through codes, encouraged through financial incentives such as grants or rebates, and

highlighted in educational campaigns. The Georgia Department of Community Affairs recently developed Disaster Resilient Building Code Appendices for the International Building Code and the International Residential Code, their goal to increase safety and reduce the number of dollars to recover from a natural disaster. Depending on the region, different technologies and design strategies may apply. Figure 3 provides an overview of recommended technologies for homes in New York City, which are vulnerable to floods, high winds, blackouts, heat waves, and extreme weather.

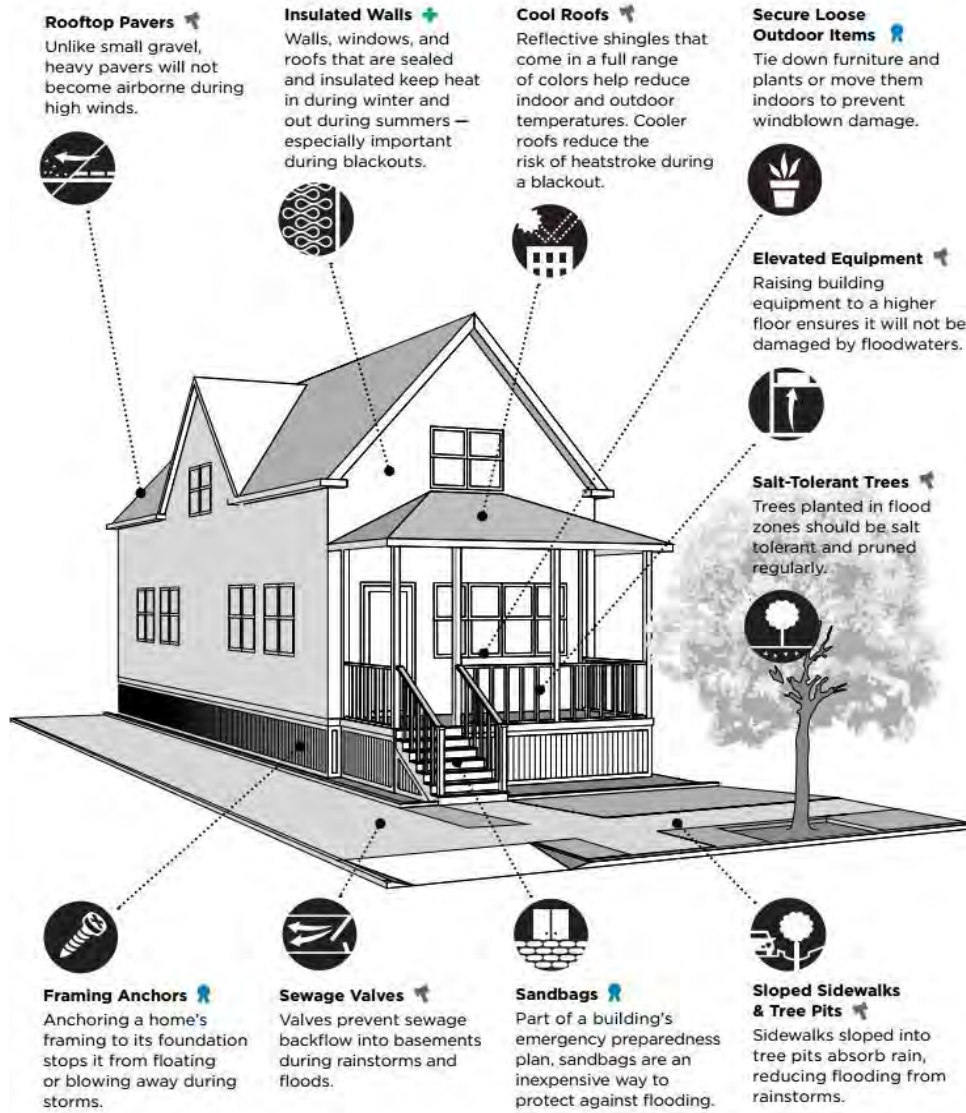


Figure 3: Potential Upgrades for Homes that may Experience High Winds, Blackouts, and Flooding (Urban Green Council)<sup>Y</sup>

One of the most important but a sometimes-overlooked resiliency benefit of energy efficiency in the residential sector is the reduced heating or cooling load of the building, resulting, for instance, from effective air sealing and high insulation levels. Overall, these smaller load demands decrease the strain

on the electricity system during periods of emergency. Furthermore, homes with an energy efficient building envelope have a higher likelihood of being able to keep occupants safe and minimize the negative impacts of extreme heat or cold.<sup>5</sup>

In addition to energy efficiency and disaster resiliency technologies, homeowners might also consider renewable energy systems to provide electricity during blackouts. Potential technologies include “islandable” photovoltaic systems, which contain their own battery bank and inverter, enabling the system to operate independently from the main grid in emergencies rather than automatically shutting down with the rest of the grid. Off-grid solar, micro-wind, and micro-hydro systems are also possibilities. States may also consider incentives and education around building site designs strategies such as tree placement, vegetation, and cool pavements to further reduce energy use and mitigate effects from a natural disaster such as flooding or heat waves.

Lastly, some non-building elements such as trees and vegetation can also help reduce energy use and mitigate effects from a natural disaster such as flooding or heat waves. For instance, the ReBuild Program in Massachusetts funded a substantial tree replanting effort after a tornado when a study found that the storm had reduced street tree cover from 44% to less than 1%, which caused increased average morning and afternoon temperatures. This in turn led to reported increase in the use of air-conditioning units and thereby increased energy use and cost during a time when the grid was already strained. Massachusetts planted more than 1,100 trees with a projected net benefit of over \$1.8 million<sup>vi</sup> in reduced costs and also mitigated impacts of future disasters such as flooding from torrential rainfall.

## FEMA Disaster Assistance and HUD Disaster Resilience Activities

State Energy Offices and other state and local agencies focused on disaster mitigation and rebuilding will benefit from accessing federal assistance and funding. The Department of Housing and Urban Development (HUD) and the Federal Emergency Management Agency (FEMA) are two agencies that State Energy Offices can develop stronger relationships with to support disaster and mitigation efforts.

Over the past several years, HUD has announced several programs that seek to promote resilience in the built environment. Following Hurricane Sandy, HUD and the Rockefeller Foundation launched “Rebuild by Design,” a competition that awarded \$930 million to projects that help communities impacted by Sandy redevelop their communities in environmentally- and economically-healthier ways and to be better prepared for future natural disasters. The winning projects<sup>6</sup> were announced in June 2014 and as of the end of 2014 are in the beginning stages of implementation.

In 2014, HUD also announced a \$1 billion National Disaster Resilience Competition. The competition will “fund the implementation of innovative resilience projects to better prepare communities for future storms and other extreme events.” All states with counties that experienced a Presidentially Declared Major Disaster in 2011, 2012 or 2013 are eligible for the competition—all but two states.<sup>7</sup> Several local jurisdictions and state agencies are currently developing Phase 1 applications, which focus on broad consideration of their “disaster recovery needs, vulnerabilities, stakeholder interests, resilience and other community development investment alternatives.”<sup>8</sup> While HUD’s activities focus on whole communities

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<sup>5</sup> NASEO’s disaster mitigation and rebuilding database contains additional resources related to residential building technologies, code requirements, and design resources, and is available at <http://naseo.org/disaster-matrix>.

<sup>6</sup> For more information, see: <http://www.rebuildbydesign.org/winners-and-finalists/>

<sup>7</sup> The only states that are not eligible are South Carolina and Nevada.

<sup>8</sup> Phase 1 applications were due on March 16, 2015. For more information, see:

[http://portal.hud.gov/hudportal/HUD?src=/press/press\\_releases\\_media\\_advisories/2014/HUDNo\\_14-109](http://portal.hud.gov/hudportal/HUD?src=/press/press_releases_media_advisories/2014/HUDNo_14-109)

and are broader than the residential sector, State Energy Offices have the opportunity to develop proposals that include residential disaster mitigation and resilience alongside other strategies.

Given its role in helping homeowners fund the rebuilding or repair of their homes, FEMA has a large influence on the rebuilding process following natural disasters. In order to receive FEMA assistance, households generally fall in two groups after a disaster: substantially damaged or damaged. According to FEMA, substantially damaged means “damage of any origin sustained by a structure whereby the cost of restoring the structure to its before-damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred.”<sup>vii</sup> A damaged home is defined as any home where the costs of restoring the structure to its previous condition would be less than 50 percent of the market value prior to the disaster. This distinction between substantially damaged and damaged is critical for receiving FEMA funding, as well as determining whether the process of rebuilding will trigger any additional federal requirements. For example, if a house is considered substantially damaged and is in a floodplain then it must be brought up to current floodplain management standards, which will lead to further costs in order to mitigate the impact of future floods.<sup>9</sup>

The community permit official determines whether a structure has been substantially damaged by affirming that the market value estimates of the household are reasonable and that the repair cost estimates accurately reflect the costs to fully repair the damage and make any other improvements to the structure. In some cases, the local permit official may require that the permit applicant or homeowner supply the information necessary to make the determination.

During the rebuilding process, FEMA has disaster assistance funds designed to help people find housing in a timely manner. Homeowners may access these funds if their insurance settlement is delayed longer than 30 days, their insurance settlement is insufficient, they have run out of funds, or if they cannot find stopgap housing. After major disasters, FEMA also establishes Disaster Recovery Centers where applicants can collect additional information about FEMA and other disaster assistance programs. More information on FEMA’s Disaster Assistance programs can be found in Appendix E: “Overview of FEMA”.

## State Roles in Rebuilding

A variety of state and local government agencies are involved in planning for and responding to natural disasters. State and Territory Energy Offices<sup>10</sup>, which typically lead state energy policy and program efforts, are often asked to play a role in the recovery and rebuilding phases. State Energy Offices accelerate energy-related economic development and enhance resilience and environmental quality through energy solutions by:

- Advising governors and legislators on energy issues;
- Setting and helping achieve energy-related goals;
- Aiding residents—through education and incentives—in adopting energy efficiency and renewable energy practices and technologies;
- Partnering with businesses to advance technologies and transform markets;
- Coordinating with federal agencies, national organizations, and the private sector; and

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<sup>9</sup> See <https://www.floodsmart.gov> for more information on these regulations.

<sup>10</sup> The 56 State and Territory Energy Offices are governor-designated agencies that develop and implement energy policies and programs at the state or territory level. Throughout the report, NASEO refers to these agencies as State Energy Offices. State Energy Offices were formed following the oil crisis during the 1970s to increase the energy independence, energy productivity, and energy efficiency of the United States and individual states. In 1986, the states formed NASEO to facilitate peer learning among state energy officials. NASEO continues to serve as a resource for State Energy Offices and advocates their interests to Congress and federal agencies.

- Outlining strategies on how to meet future energy needs in an environmental and economic way.

Given their experience working on energy efficiency programs in the residential sector, many State Energy Offices have helped design and implement residential rebuilding strategies following disasters. This report explores the types of action State Energy Offices can take in promoting energy efficiency and resiliency during the recovery and mitigation phases for the single-family residential sector after a natural disaster.<sup>11</sup> While the paper focuses specifically on State Energy Offices, many local governments and other state agencies play similar roles and therefore can benefit and utilize lessons learned from this report.

Just in the last decade, State Energy Offices have helped rebuild several communities following disasters. For instance, after an EF5<sup>12</sup> tornado destroyed 90% of Greensburg's infrastructure, the Kansas Energy Office worked with federal agencies and local non-profits to help rebuild the city into what is now considered one of the greenest cities in America. In Massachusetts, the Department of Energy Resources worked directly with homeowners and utilities to provide nearly \$1 million in grants to 235 business and households to rebuild in a more energy-efficient manner after a tornado left a 39-mile path of damage in Western Massachusetts. Following floods in 2013, the Colorado Energy Office conducted outreach to homeowners regarding pre-existing and expanded energy efficiency programs that homeowners could take advantage of in the rebuilding process. The office's rebuilding program included door-to-door marketing, doubling utility energy efficiency rebates in the affected areas, receiving a waiver from the U.S. Department of Energy to allow homes to be weatherized a second time through the Weatherization Assistance Program, and leveraging geographic information system (GIS) software to identify flood plains and prioritize outreach to the most damaged communities. The experiences of State Energy Offices in Kansas, Massachusetts, and Colorado, along with those in other states, provide lessons learned and recommendations that can be leveraged by a State Energy Office or local government when faced with rebuilding after a natural disaster.

While this report focuses on the residential sector, it should be noted that State Energy Offices and local governments have also been involved in broad disaster recovery and resiliency for the entire community. For example, State Energy Offices and the National Association of State Energy Officials (NASEO) have worked with the Office of Electricity Deliverability and Energy Reliability within the U.S. Department of Energy (DOE) for over a decade on broader energy assurance and emergency planning and response efforts which help restore vital energy infrastructure, such as the electric grid and oil and gas supply chains, after a disaster or disruption. State Energy Offices' involvement in disaster rebuilding and mitigation in the residential sector builds on the successes and lessons learned of these long-standing efforts.

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<sup>11</sup> This document focuses on single-family, detached homes, which have unique rebuilding challenges compared to other types of residences, such as multifamily buildings. Throughout the document, NASEO uses the term "residential rebuilding," "residential sector," or "homes" to refer to detached homes.

<sup>12</sup> EF5 refers to the Enhanced Fujita scale, which comprises of 6 levels, EF0-EF5, with EF5 referring to the largest and most intense tornados.

## Report Methodology

To identify lessons learned and develop disaster recovery and mitigation recommendations for State Energy Offices, NASEO employed a two-pronged research approach. First, NASEO conducted a comprehensive literature review of resources targeted to state and local government agencies. These resources included:

- **Case studies:** Best practices and lessons learned from cities, municipalities, and states dealing with disaster recovery, resilience, and mitigation.
- **Frameworks:** Frameworks to help communities with preparedness, recovery, and rebuilding after a disaster.
- **Reports:** Technical and non-technical reports covering a range of topics and natural disasters (e.g. tornadoes, hurricanes, flooding, etc.).
- **Websites:** A list of websites and resources that can help State Energy Offices and local governments prepare for, respond to, and recover from natural disasters.

NASEO has highlighted key resources, lessons learned, and state experiences in this report. Additional information on related topics (e.g., national efforts related to disaster mitigation and rebuilding, resources to create a rebuilding or mitigation plan) are available on the NASEO Buildings Committee's<sup>13</sup> Disaster Mitigation and Rebuilding Resource webpage<sup>14</sup>, which includes a database describing key resources, websites, and federal and state agencies that may help guide State Energy Offices in their efforts to use energy efficiency as a tool in disaster mitigation planning and emergency preparedness and response.

Second, NASEO conducted in-depth, qualitative interviews with staff in seven State Energy Offices that played direct roles in designing, implementing, or evaluating disaster rebuilding programs in the residential sector. Appendix C: "Profiles of State Experience with Disaster Recovery and Mitigation" provides additional detail on many of these State Energy Office experiences. Based on the literature review and state interviews, NASEO identified a set of key findings (beginning in the next section and summarized in the Executive Summary) related to disaster mitigation and rebuilding. The key findings are organized based upon the disaster phases, with mitigation and pre-disaster lessons learned and recommendations coming first, followed by sections on disaster rebuilding. In order to provide a quick decision tool for states that need to develop rebuilding strategies following a disaster, NASEO developed the Residential Disaster Rebuilding Assessment Tool for State Energy Offices (see Section V). Because each state represents a unique set of circumstances, the assessment tool provides a broad framework for taking into account agency expertise, financial resources, and staff capacity to guide State Energy Offices in determining what programs and opportunities best suits their needs and resources. It also identifies state examples that could be leveraged, through reading the state profile example included in this report or contacting their peers directly.

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<sup>13</sup> For more information on NASEO's Buildings Committee, visit <http://naseo.org/committee-buildings>.

<sup>14</sup> For more information on Disaster Mitigation and Rebuilding resources, visit <http://naseo.org/disaster-matrix>.

## Key Findings for State Energy Offices

Disaster recovery and rebuilding touch on many areas of a State Energy Office's existing work. From interviews with State Energy Offices and other state and local leaders, NASEO identified different roles State Energy Offices can play in disaster mitigation and rebuilding, including planning and coordination prior to a disaster; convening stakeholders; advising governors or other leaders in rebuilding efforts; and implementing disaster-rebuilding programs, such as incentives, rebates, or homeowner education related to energy efficiency. These roles are highly dependent on a State Energy Office's in-house expertise, ability to dedicate staff time to rebuilding, and financial resources, as well as potential partners that could support or lead the work.

State Energy Offices have various options and resources that they can leverage and implement throughout the planning and response cycle. Based on past state experiences, efforts can fall into four main phases: (1) pre-disaster planning and mitigation, (2) post-disaster planning, (3) recovery and rebuilding implementation, and (4) evaluation and feedback. Various programs, strategies, and activities that states can implement in each phase to either mitigate against the impact of future disasters or to rebuild to incorporate energy efficiency and resiliency are discussed below.

### Pre-Disaster Planning and Mitigation

Throughout NASEO's interviews with State Energy Offices and research on natural disaster response and mitigation, the importance of pre-disaster planning and mitigation was consistently highlighted. *The most effective disaster rebuilding coordination happens when there is a plan and relationships in place before a disaster.* Disaster pre-planning can include developing specific "Disaster Rebuilding and Recovery" plans for the residential sector, conducting scenario exercises, creating awareness of energy efficiency and resiliency, and building relationships and partnerships that can or would be leveraged during disaster rebuilding.

In addition to pre-disaster planning, there are numerous *disaster mitigation* efforts that can reduce the vulnerability of residences and residents to natural disasters. Mitigation strategies can reduce the loss of life and injury, lower insurance premiums, limit property losses, and reduce overall rebuilding cost. Overall, disaster mitigation can be vastly more cost-effective than extensive rebuilding. Recent events, such as Hurricane Sandy, have created renewed focus on mitigation and several states are designing innovative mitigation and resiliency programs. These mitigation efforts overlap with many of a State Energy Office's existing priorities and programs and can integrate into ongoing efforts. Specific areas ripe for such integration include updating building codes, encouraging building performance standards that focus on mitigation, and promoting renewable energy, establishing flexible and accessible financing programs.

Figure 4 provides an overview of each of the pre-disaster planning and mitigation strategies, followed by sections that describe each of them in more detail and provide examples of how State Energy Offices can integrate the strategies into their existing energy programs.



Pre-Disaster Planning and Mitigation Strategies	
<b>Pre-Planning Programs</b>	<ol style="list-style-type: none"> <li>(1) Conduct internal assessment of resources and capability.</li> <li>(2) Establish disaster rebuilding and recovery plan.</li> <li>(3) Identify goals and priorities for disaster response.</li> <li>(4) Practice disaster response scenarios to refine plans and identify potential gaps.</li> </ol>
<b>Awareness Building</b>	<ol style="list-style-type: none"> <li>(1) Build public awareness around value of energy efficiency and resilience in homes.</li> <li>(2) Build public awareness of available state, utility, and federal programs.</li> <li>(3) Building public and industry awareness of energy efficient and resilient design and building technologies.</li> </ol>
<b>Partnership Building</b>	<ol style="list-style-type: none"> <li>(1) State and federal emergency management agencies</li> <li>(2) Utilities</li> <li>(3) Contractors and homebuilders</li> <li>(4) Financial institutions</li> <li>(5) Housing authorities and home associations</li> <li>(6) Big box and hardware stores</li> </ol>
<b>Financial Incentives</b>	<ol style="list-style-type: none"> <li>(1) Create energy efficiency and renewable energy loan funds or credit enhancements that can be easily accessed in an emergency situation</li> <li>(2) Establish consumer technical assistance and marketing initiatives that could be ramped up during times of emergency.</li> </ol>
<b>Building Codes</b>	<ol style="list-style-type: none"> <li>(1) Work with state agencies and local jurisdictions to adopt and implement energy-efficient code provisions</li> <li>(2) Provide technical assistance and training on improving and complying with code</li> <li>(3) Consider building performance programs (e.g. FORTIFIED Home™) that can encourage similar outcomes.</li> </ol>

**Figure 4: Pre-Disaster Planning and Mitigation Strategies**

### ***Pre-Disaster Planning***

In the pre-disaster planning stage, State Energy Offices have two main activities that will assist with creating a more-robust disaster rebuilding program in the residential sector: (1) reviewing internal resources and staff capacity that could be relevant to disaster rebuilding, and (2) developing a state-specific “Disaster Rebuilding and Recovery” plan.

**Internal Assessment of Resources and Staff Capacity:** First, a State Energy Office can determine what the office’s available funding are and identify what opportunities to expand or add on to disaster rebuilding programs when the time comes. An important consideration is to clearly delineate the limitations of each funding source and how they might or might not be adapted for rebuilding. For instance, some funding can only be used for rebates for low-income housing while other funding can only be used for building code training. In addition, if a State Energy Office has minimal funds, it might instead seek to partner with others.

Second, a State Energy Office can identify its existing and potential partners and what resources they bring. A program might greatly benefit from partnering with community organizations, government entities, private-sector organizations, non-profits, and/or utilities to leverage their resources and community influence, especially if they have resources that can be applied to a rebuilding program. This relates back to the key area of partnership building that predisposes communities to successful disaster recovery. A systematic assessment by the State Energy Office could inform and guide efforts to cultivate strong working relationships.

Third, a State Energy Office can optimize disaster response and recovery by routinely assessing its own in-house staff capacity and expertise. Naturally, a State Energy Office will most likely want to focus on their areas of expertise and rely on partners to provide knowledge on topics that they are not that familiar with in disaster recovery. Furthermore, if a State Energy Office has very little time to commit to the recovery, it will most likely need to look at programs that require short implementation timelines and need minimal ongoing programmatic management.

**Developing a “Disaster Rebuilding and Recovery” Plan:** State Energy Offices have a long track record of energy assurance and security planning, including creating plans for a state’s response to grid failures or fuel shortages resulting from natural disasters. State experiences with these activities illustrate the value in developing the networks and plans that can be leveraged following a disaster; having these networks and plans in place prior to a disaster can help overcome the chaos of the post-disaster period and help states implement efficient and effective responses.

A similar approach is valuable in terms of residential rebuilding. Numerous states interviewed by NASEO indicated that they would have benefited from having an “off-the-shelf” plan for coordinating with various stakeholders ready to implement immediately after a disaster. Other states have learned this valuable lesson and have prioritized—and in some cases mandated—disaster planning as a continuous priority. For example, each coastal county and municipality in Florida is required to create a Post-Disaster Redevelopment Plan that identifies policies, roles, and responsibilities for community redevelopment that will help reduce the community’s vulnerability to future disasters and help recovery be more successful.<sup>15</sup>

Based on these state experiences, NASEO recommends State Energy Offices consider developing a state-specific “Disaster Rebuilding and Recovery” plan, which could be a complement to the pre-existing energy assurance plans that many states have in place. The plan could have specific components based on building sectors and specifically address the residential sector, given the critical need to secure shelter following disasters. Thoughtful and effective planning and preparation efforts aim to comprehensively document and harmonize existing activities, maximize current and future program impacts, and minimize the duplication of efforts and costs. The plan would need to be developed with key stakeholders (e.g., home builders, contractors, homeowner associations, utilities) and could be developed on a statewide basis or with specific local jurisdictions. Rather than just focused on the programs or strategies State Energy Offices can implement (which is the focus of this report), the “Disaster Rebuilding and Recovery” plan would need to factor in the roles and resources of numerous organizations and create pre-determined coordination activities.

Related to the specific disaster rebuilding and recovery plan itself, a number of factors contribute to the strength of an effective plan. First, prior knowledge of federal disaster recovery and rebuilding processes, timelines, and programs, such as those managed by FEMA, will help facilitate more efficient and effective rebuilding efforts.<sup>16</sup> Second, developing overarching objectives that include potential goals for energy efficiency and resiliency, minimizing environmental impacts, infrastructure upgrades, energy affordability, and supporting a green

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<sup>15</sup> More information is available at <http://www.floridadisaster.org/Recovery/IndividualAssistance/pdredevelopmentplan/Index.htm>.

<sup>16</sup> The FEMA resources described in this report address the must-know information that State Energy Offices should understand regarding disaster response and rebuilding. More details and up-to-date information on FEMA’s role in disaster rebuilding are available at [www.fema.gov](http://www.fema.gov).

collar workforce through an inclusive stakeholder process before disaster strikes will provide vision and focus to guide response, recovery, and rebuilding efforts. The vision and goals should identify all of the climate vulnerabilities of a particular locale to ensure that the plan is all encompassing.<sup>17</sup>

### **Awareness Building**

Awareness building around the value of energy efficiency is already a major focus of programming at many State Energy Offices. State Energy Offices play a crucial role in advising policymakers, training industry professionals such as homebuilders and contractors, and in educating homeowners on energy-efficient building technologies and strategies as well as the many co-benefits of saving energy, including achieving cost-savings, improving environmental quality, improving occupant comfort, and creating jobs.

Immediately following a disaster, energy-efficient technologies and approaches will often compete with lower first-cost, less efficient options or conventional practice. Therefore, as much work can be done to raise awareness before a disaster will directly influence the adoption and implementation of energy efficiency and resiliency measures during disaster recovery. Additionally, the level of awareness and openness to energy efficiency and resiliency among policymakers, industry partners, and private sector actors such as insurance companies will enable smoother coordination, saving time during a critical period in disaster recovery. Furthermore, a strong foundation of industry training, consumer awareness building, and open channels of communication with key stakeholders such as policymakers and agency leaders prepare State Energy Offices to quickly ramp up information dissemination following disasters.

### **Partnership Building and Stakeholder Coordination**

*The most effective disaster rebuilding coordination happens when there is a plan and relationships in place before a disaster.* As part of their ongoing work, State Energy Offices initiate and cultivate partnerships with a wide variety of organizations, and this foundation can allow for easier facilitation of disaster planning and rebuilding implementation. Stakeholders in disaster pre-planning should include government (local, state, and federal) agencies, utilities, business and industry leaders, homebuilders and homebuilder associations, contractors, chambers of commerce, energy efficiency or resiliency non-profits, and residents. An active list of contacts that can be leveraged leading up to and following a natural disaster is critical. Given the amount of work to be done in the post-disaster period, it is extremely challenging and hampers responsiveness to coordinate when pre-existing relationships and communication channels are not already in place.

One proven planning strategy borrowed from energy assurance planning is to host “exercises” or workshops that bring together key stakeholders to run through a natural disaster scenario. These exercises provide a space for simulated training to identify how partner coordination, communication, and implementation are or are not harmonized. The goals of these exercises include solidifying response and recovery roles after a disaster, fine-tuning communication and conflict resolution processes, and identifying and addressing potential gaps. Pre-disaster partnership-building reinforces working relationships and capitalizes on a State Energy Office’s coordination, convening, and partnership-building capacities. When disaster strikes, strong working relationships can create measurable differences in quick and effective program launch and implementation.

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<sup>17</sup> For example, a community could be vulnerable to both floods and tornadoes and should be able to address both of those issues. See Disaster Safety (<https://www.disastersafety.org/>) for a list of potential disaster by region.

In some cases, State Energy Offices may fill a convening role by establishing networks of local and national experts, hosting workshops and stakeholder meetings, and/or organizing public meetings. For example, the Kansas Energy Office acted as a convener after the Greensburg tornado in 2007 by organizing a group of energy experts to discuss short term and long terms needs of the community. In addition, the office helped organize several federal agencies, nonprofits, and donors to help ensure a green recovery. Relationships with many of these stakeholders had been cultivated prior to the disaster through the agency's on-going energy programs. In other cases, State Energy Offices may serve as participants in a larger state-wide recovery effort, often organized by the governor.

### ***Energy Efficiency and Renewable Energy Financing and Incentive Programs***

Financing or energy efficiency incentives can be used to promote energy efficiency and resiliency as mitigation strategies. Additionally, if these programs are in place in a state or community, they can be leveraged after a disaster to promote energy efficiency during the rebuilding process. Given the amount of time and resources it takes to set these programs up, they should be viewed as a pre-disaster planning or mitigation strategy, and promoting the benefits of the programs to mitigating disasters and the role they could play in rebuilding can help make the case for states and utilities to establish them. This section provides a brief overview of energy efficiency and renewable energy financing and incentives programs and highlights how they have been leveraged by states for disaster mitigation or rebuilding.

An incentive program can be defined as an offering from an entity (i.e. federal entity, State Energy Office, utility, or local administrator) to encourage homeowners to reduce their energy use and/or increase their use of renewable energy. There are three main program structures—rebates, discounts, and financing—for directly incentivizing residential homeowners.

**Rebates:** Rebates are a very common mechanism to encourage energy efficiency, renewable energy, and resiliency. Rebates can applied to prescriptive measures, meaning fixed amounts for specific products, or custom, meaning formulas are used to calculate payments, usually for whole-building upgrades. A whole-building approach might entail tiered incentives linked to overall energy reduction based on improved scores in energy efficiency ratings or labels, such as the DOE Home Energy Score or Home Energy Rating System (HERS) Index ratings.

The Massachusetts Department of Energy Resources (DOER) identified funding to create an incentive program for businesses and households to rebuild in a more energy-efficient manner after a tornado left significant damage in Western Massachusetts. The program included a mix of new grants, rebates, and leveraging the pre-existing HEAT loan program that provided 0% interest loans. In another case, the Colorado Energy Office did not have funds or the ability to create a new rebate program, so the agency collaborated with Colorado's largest utility, Xcel Energy, to help increase marketing around existing rebates and incentives, which included energy saving mortgage products for new and existing homes that provide tiered incentives based on improvements in HERS ratings.

In addition to home improvements to main building systems such as building envelope and heating and cooling, programs can also target plug load reductions in homes through appliance rebates. Under the American Recovery and Reinvestment Act, the U.S. Department of Energy funded the State Energy Efficient Appliance Rebate Program (SEEARP). Several states and a territory that suffered natural disasters just prior to or during the program modified their approaches to assist residents who lost appliances during the destructive events. These State Energy Offices modified their programs to better assist their residents in rebuilding their

residential homes and their lives following floods, tornados, and a tsunami. SEEARP demonstrated that appliance rebates are a useful and valuable form of disaster recovery support but may entail added program coordination.<sup>viii</sup>

If existing rebate programs are repurposed or altered to serve as a resource during disaster rebuilding, the program administrators should consider the following questions and issues:<sup>18</sup>

- What is the target market?
  - Income level
  - Housing type
  - Disaster impact: Will eligible consumers include all homeowners in the community or only those impacted by the disaster and are approved for FEMA financial assistance?
  - Are insurance recipients included or only residents without insurance?
- What partners can co-fund or co-implement the program (e.g. utilities or big-box stores)?
- What marketing bandwidth and capabilities exist?
- Will rebates cover prescriptive measures or a whole-house approach?
- Will the rebate program require the same restrictions as before the disaster or have reduced requirements to increase implementation speed and ease? For example, some states that leveraged SEEARP rebate programs simplified the process by dropping replacement requirements for consumers in affected areas under the assumption that many appliances were destroyed.
- What evaluation, measurement, and verification (EM&V) requirements will the program have?
- How can the rebate program coordinate with other federal and state rebuilding efforts?

**Discounts:** Discount programs, sometimes referred to as coupon programs, are upfront rebates for energy-efficient and mitigation technologies, taken off the price at point of purchase. These programs are less common but can be an effective mechanism to encourage energy efficiency, renewable energy, and mitigation technologies. A State Energy Office can partner with one or multiple entities (e.g. hardware stores, window retailer, etc.) to encourage energy-efficient and mitigation choices among their customer base. The sales entity would provide discounts to consumers during checkout and work with the state to recoup the difference. This approach reduces paperwork and marketing costs for the program, while utilizing an existing marketing and delivery network. In addition, the customer benefits from the upfront savings and minimal paperwork hassle. These benefits are especially helpful during a disaster rebuilding period, when many homeowners might make equipment purchases on their own and processing a rebate could serve as a barrier to program participation.

**Financing Programs.** Financing programs State Energy Offices can design, implement, or support include revolving loan funds, credit enhancements, bond financing, on-bill financing, and secondary market sales. State Energy Offices can administer programs themselves, partner with other institutions, and provide consumer education about energy-efficiency benefits and

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<sup>18</sup> Many of these considerations are based upon the results of the SEEARP program. For more information, see [http://www1.eere.energy.gov/recovery/appliance\\_rebate\\_program.html](http://www1.eere.energy.gov/recovery/appliance_rebate_program.html).

financing options. Over the past decade, the scale of public-private financing programs for energy efficiency and renewable energy has grown to an estimated investment of approximately \$3 billion in 2013.<sup>ix</sup>

While financing programs are typically designed for broader energy efficiency objectives, they can often provide additive financing support for residential rebuilding efforts.

The following is a quick description of different financing mechanisms state and local jurisdictions currently use to finance energy efficiency, renewable energy, and mitigation technologies in the residential sector:

- **Revolving Loan Funds:** Revolving loan funds provide low-interest financing for energy improvements and can be leveraged for energy-efficient and resilient rebuilding following a disaster. For example, Massachusetts leveraged its 0% interest rate HEAT Loan Program during recovery of the 2011 tornado in the western area of the state.
- **Credit Enhancement Mechanisms:** Credit enhancement expands the pool of borrowers who are able to access funding and may include interest rate buy-downs, loan guarantees and loan loss reserves. For example, the Michigan's Home Energy Loan Program provides a 5% loan loss reserve, leveraging lender capital at a ratio of 20 to 1. Between the start of the program in 2009 and 2013, nearly 3,000 homeowners had taken out loans representing over \$22 million in investment.<sup>x</sup>
- **On-Bill Financing and Repayment Programs:** On-bill mechanisms are loans made by or in partnership with a utility, allowing customers to implement energy efficiency measures and repay the cost with an additional fee added to their monthly utility bills. The Help My House Loan Pilot Program in South Carolina provided on-bill financing to 125 residential homes to help pay for energy efficiency improvements. The average loan size was \$7,684 with an average electricity savings of 34% per home and average payback of 6.6 years.<sup>xi</sup>
- **Secondary Market Sales:** Financing for energy efficiency projects can originate from a variety of sources including lending institutions such as banks. Banks may sell energy loan portfolios on private capital markets to investors. In return, programs can use proceeds from sales as capital to make more loans and potentially offer a lower cost financing. An example is the Warehouse for Energy Efficiency Loans (WHEEL), which supports the secondary market for residential energy efficiency loans sponsored by states, local government, and utilities.<sup>19</sup>
- **Bond Financing:** Bonds are debt security that can be used to pay for energy efficiency, renewable energy and mitigation projects.
- **Property Assessed Clean Energy (PACE):** PACE enables property owners to implement energy improvements on their property and repay the costs through an annual assessment on their property tax bill. This method of financing has been largely frozen in the residential sector since 2010 due to the Federal Housing Financing Agency refusal to purchase mortgage loans of properties with outstanding first-lien PACE obligations. Boulder County in Colorado provides an example of the launch of a successful PACE program with their ClimateSmart Loan Program, which financed over \$9 million between 2009 and 2010.<sup>xii</sup>
- **Green Banks:** Green Banks are public financing institutions that support energy efficiency and renewable energy investments by offering a diverse set of financial products such as below-market interest rates. For example, in October 2014, New Jersey launched its \$200

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<sup>19</sup> For more information see <http://www.naseo.org/wheel>.

million Energy Resilience Bank, the first public infrastructure bank in the nation to focus primarily on energy resilience, in response to Hurricane Sandy's impact.<sup>xiii</sup> While the bank concentrates on microgrids and distributed generation at critical facilities such as water and wastewater treatment plants, this strategy can integrate into a state's larger multi-sector community disaster mitigation and recovery plan.

For additional information on financing program options, see the NASEO report, *Unlocking Demand: An Analysis of State Energy Efficiency and Renewable Energy Financing Programs in the Buildings and Industrial Sectors*, which summarizes best practices from 21 state energy financing programs.<sup>20</sup>

### **Building Codes**

Building codes act as minimum requirements that establish a building's quality, safety, and energy performance for years to come. Updating and enforcing residential codes to include energy efficiency and disaster mitigation requirements help ensure new homes and substantially renovated homes are built to current standards that will reduce energy consumption while protecting homeowners' health and safety. State agencies involved in building codes, including State Energy Offices and housing/building agencies, can look for opportunities to integrate disaster mitigation and resiliency strategies into future versions of building codes.

Several state experiences illustrate how building codes can be leveraged to increase resiliency in the residential sector. Georgia has experienced many natural disasters such as hurricanes, floods, and tornadoes. In 2012, the Georgia Department of Community Affairs was awarded a HUD grant to develop Disaster Resilient Building Code Appendices for the International Building Code and the International Residential Code. The codes were created by a diverse group of stakeholders and are structured so that they can be adopted all together or section by section by a local jurisdiction or state.<sup>21</sup> After finalizing the codes, Georgia created a comprehensive training program for code enforcement officials to highlight the importance of resilient building. The ultimate goal of these codes is to increase safety and reduce the number of dollars to recover from a natural disaster.<sup>xiv</sup>

The town of Moore, Oklahoma also utilized building code updates to increase the safety and energy efficiency of residential buildings. In 2014, the Moore City Council passed 14 changes to the residential building code to help strengthen homes against tornadoes, including requiring hurricane clips or framing anchors, continuous plywood bracing, and wind resistant garage doors.<sup>xv</sup> Lastly, the City of Portland Developmental Services website<sup>22</sup> promotes energy-efficient codes that also mitigate the impact of disasters by providing an extensive overview of how homeowners can strengthen their houses to help reduce earthquake damage.

Alongside building code updates, state and local jurisdictions often invest in training building inspectors, plan reviewers, contractors, home builders, architects, and engineers on new code requirements. Code updates can be undermined if these important stakeholders do not participate in compliance. NASEO's last member survey found that over 80 percent of State Energy Offices are involved in code training, education, and implementation. Despite these important efforts, State Energy Offices consistently

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<sup>20</sup> The report is available at <http://www.naseo.org/data/sites/1/documents/publications/Unlocking-Demand.pdf>. See page 28 for a review of the major benefits and challenges associated with each of the 21 financing programs.

<sup>21</sup> The code appendices can be accessed from the Georgia Department of Community Affairs website: <http://www.dca.ga.gov/development/constructioncodes/programs/DRBCWorkshop.asp>.

<sup>22</sup> See more at <http://www.portlandoregon.gov/bds/53562>.

identified persisting need for more training, strategies and resources that focus more on code compliance training and enforcement.

In addition to codes, states can further mitigation efforts by promoting building performance programs such as the Insurance Institute for Business and Home Safety's FORTIFIED™ certification programs for residential housing. FORTIFIED Home™ is for new and existing residential homes and provides a uniform, voluntary set of standards to upgrade a home and help improve its resilience for specific disasters by prescribing tailored upgrades to existing code requirements. Additionally, FORTIFIED for Safer Living® is a multi-hazard program specifying construction, design, and landscaping standards to increase a home's resilience to all natural hazards germane to the area where the home is located. FORTIFIED for Safer Living® also protects against other potential hazards such as water damage, internal fire, electrical surges, and burglary. Similarly, the U.S. Department of Homeland Security (DHS) is undertaking a pilot program called Resilience STAR™, which provides a label to residential homes that are built to withstand various disasters utilizing the standards and third-party verification program from the Institute for Business & Home Safety's FORTIFIED™ programs.<sup>23</sup>

## Post-Disaster Planning

Following a natural disaster, State Energy Offices and their partners, have a window of time between disaster relief and disaster rebuilding in which they can plan for new or expanded technical assistance and/or program implementation that target residential rebuilding.

Key questions during this critical time include:

- **How does the State Energy Office role fit into the bigger picture of disaster recovery and rebuilding?** Relating back to the pre-disaster planning stage, State Energy Offices can refer to pre-established visions and plans. Additionally, a higher office, such as the Governor's office, may choose to organize a coordinated state response to a major disaster, and State Energy Offices may have an opportunity to advise the executive branch, legislature, and general public on energy efficiency and resilience and incorporate that perspective into the rest of the recovery efforts. For example, Governor Hickenlooper called on the Colorado Energy Office to help manage the flood response and keep the government abreast on energy disturbances and rebuilding initiatives. Over a year later, the Colorado Energy Office continues to update the Governor's office on a weekly basis. In response to Hurricane Sandy, New Jersey's Board of Public Utilities—which houses the State Energy Office—advised on energy efficiency and renewable energy issues as well as utility response and mitigation as part of Governor Chris Christie's Office of Recovery and Rebuilding.
- **What are our current programs and can they be adapted for rebuilding?** One of the major lessons illustrated from the state profiles (see Appendix C) was that states should first leverage existing programs rather than create new ones for disaster rebuilding. Developing new programs can be costly in both upfront and unanticipated costs and lead to a delay in providing resources to the community when it's need the most.
- **What is the program design and implementation timeline?** Some programs take time to ramp up and need durable, long-term funding, while others can be up and running in a short period of time with little or no funding.

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<sup>23</sup> More information on Resilience STAR™ can be found at <http://www.disastersafety.org/fortified/resilience-star/>.



During NASEO's interviews with State Energy Offices, a consistent message was that natural disasters affect homeowners in different ways and create different "market segments" that will be relevant while implementing a disaster rebuilding program. State Energy Offices should think about these different segments during the post-disaster planning period. The FEMA "substantially damaged" and "damaged" distinctions can inform what programs to implement and how to support homeowners in incorporating energy efficiency and resiliency in home rebuilding. Overall, post-disaster residential rebuilding sector can be split into three major groups: (1) households that have minor damage and make repairs quickly, (2) households that need more extensive funding and time to rebuild, and (3) new construction.

### ***Minimally Damaged Homes***

The goal of homeowners following a disaster is to return to normalcy as quickly as possible. Households that have minor damage (e.g., broken windows, minor damage to the roof or building envelope) will begin rebuilding or repair in the days and weeks after the disaster. Homeowners that need minor household repairs sometimes opt out of filing insurance claims due to paperwork hassle and wait times; if these homeowners do file insurance claims, they may not wait for them to be processed to begin repairs.

In order to impact this segment, states will have to move quickly and rely on pre-existing networks of contractors, homebuilders, and residents to integrate energy efficiency and resiliency into the rebuilding process. In these cases, the extent and quality of industry training and consumer education programs prior to the disaster can result in marked increases in homeowners adopting resilient and energy-efficient rebuilding options.

Programs that may impact this segment include discount and rebate programs, delivered through pre-existing networks of homebuilders, utilities, or big-box retailers. For example, a State Energy Office can provide funding for discount programs at point-of-purchase to encourage energy efficient technologies. State Energy Offices can also support training for hardware store staff and contractors on energy-efficient products, available programs, and resulting savings to discuss with customers. Again, such training, conducted prior to an event, can be critical, since many stores may bring in temporary workers to fill staff shortages, as big box stores in Moore, Oklahoma had to do following a destructive tornado in 2013. Temporary staff was brought from other states to cover for absent employees and to address the spike in demand, and some stores were even open 24 hours a day for 3-4 months following the tornado.<sup>xvi</sup>

State Energy Offices can also take advantage of existing programs that can be quickly altered or ramped up to help homeowners with minor damages. For example, after the devastating floods in 2013, the Colorado Energy Office worked with the local utility to immediately increase their rebates to the affected residents to encourage energy-efficient upgrades. The rebate program was already in place and well-known; therefore, the program rollout was rapid and able to reach residents that wanted or needed to make upgrades in the short-term.<sup>xvii</sup>

### ***Substantially Damaged Homes***

Households that experience substantial damage or are destroyed often prioritize finding alternative housing while the insurance process is underway. In general, it can take a minimum of 45 to 60 days—if not more—before insurance claims are settled and rebuilding starts. Therefore, states have additional time to design, promote, and implement programs for targeting homeowners that experienced significant damage.

For instance, the Massachusetts Department of Energy Resources established a new rebate program several months after tornadoes touched down in Western Massachusetts. The program was highly

successful with 235 households and businesses receiving grants. Approximately \$1 million in grants leveraged nearly \$17 million in private investment. The program also issued \$90,000 in 0% interest loans through partnerships with local qualified banks.<sup>xviii</sup> Programs like this can align with other rebuilding support such as FEMA's disaster assistance funds and fill unmet need for homeowners while also improving the resiliency and energy efficiency of the rebuilt home, locking-in future savings and benefits for the household and the larger community.

### ***New Construction***

Lastly, a market segment that can be easily overlooked is speculation homebuilders that buy lots from families that decide to leave the area rather than rebuild. For example, after an EF5 tornado caused approximately \$2 billion in damage in Moore, Oklahoma, numerous speculation buyers were active in the community, as approximately 50% of the displaced families did not plan to rebuild on their lot. To encourage green rebuilding, Oklahoma's Department of Commerce partnered with various homebuilder associations, the U.S. Green Building Council (USGBC), and insurance providers to hold a one-day seminar with Moore residents to showcase new energy-efficient technologies and ENERGY STAR homes.<sup>xix</sup>

In order to maximize resources and best meet homeowners' needs, State Energy Offices should take into account the varying impacts of the disaster and diverse responses homeowners may have. Understanding the unique dynamics of the different residential rebuilding market segments can inform what programs State Energy Offices choose to design and implement.

### **Rebuilding Implementation**

The third phase of disaster recovery and rebuilding is implementation. State Energy Offices should utilize the goals and decisions made in the post-disaster planning period (and plans and programs developed in the pre-disaster planning phase, if any) to implement or work with partners on residential rebuilding programs. Specific programs State Energy Offices can implement in residential disaster rebuilding include:

- Consumer education to provide clear information to homeowners;
- Industry technical assistance that provides training on energy codes and energy-efficient products;
- Rebates, either prescriptive measures or whole-house retrofits;
- Discounts for energy-efficient and resilient products; and
- Financing to supplement other programs and/or support rebuilding.

An assessment table outlining these programs and various program design and implementation considerations appears in Figure 5.

Key Considerations	Disaster Recovery and Rebuilding Program Approaches				
	Consumer Education	Industry Technical Assistance	Rebates	Discounts	Financing
State Examples	CO, KS, MA, NJ, OK	FL, KS, MA, NJ	CO, KS, MA, NJ		MA, OK
Preexisting Status Necessary? <sup>24</sup>	No	Yes	No <sup>25</sup>	No	Yes
<b>RESOURCES REQUIRED</b>					
<i>Staff expertise</i>	Medium	High	Medium	Medium	Medium
<i>Time</i>	Low	Medium	High	Medium	High
<i>Funds</i>	Low	Low	High	Medium	High
<b>HOUSING SEGMENTS</b>					
<i>Minor Repairs</i>	❖	❖	❖	❖	
<i>Damaged</i>	❖	❖	❖	❖	
<i>Substantially Damaged</i>	❖	❖	❖	❖	❖
<i>New Construction</i>	❖	❖	❖		❖
<b>PARTNERS</b>					
<i>FEMA</i>	○				○
<i>Utilities</i>	○	○	●	●	○
<i>Other State/Local Agencies</i>	●	○			○
<i>Homebuilders/ contractors</i>	○	○	●		
<i>Big-box stores</i>	○			●	
<i>Housing Authorities / Home Associations</i>	○				
<i>Non-Profits</i>	○	○	○		○
<i>Financial Institutions</i>					●
● Necessary partnership(s)    ○ Important partnership(s)					

**Figure 5: Residential Disaster Rebuilding Assessment Tool**

While many of the program types mentioned above are detailed in the Pre-Disaster Planning and Mitigation section, disaster rebuilding may necessitate adapted approaches. For example, State Energy Offices may consider launching a dedicated technical assistance program during the recovery and rebuilding period that coordinates with FEMA’s Disaster Recovery Centers. Even if a state is short on time and funding, the community can still benefit from the State Energy Offices’ expertise. As an extension of State Energy Offices’ ongoing training and education work, offices can work with individuals,

<sup>24</sup> Some programs can be designed and implemented without preexisting infrastructure during disaster recovery, though even these are more effective when there is some groundwork in place ahead of time. Other programs are too time-intensive to launch at all during recovery.

<sup>25</sup> Ideally, rebate programs are already running and can be expanded. Launching a new program is more time-consuming.

communities, contractors, building inspectors, architects, and utilities to help educate them on energy-efficient and resilient building technologies during rebuilding.

State Energy Offices may develop a website and other informational materials that highlight the essential resources and contact information that will help with the recovery, such as utility incentive programs or local contractors that are promoting energy efficiency in rebuilding projects. Additionally, a State Energy Office can create a hotline, provide energy audits, or designate an energy specialist to assist homeowners as they weigh decisions regarding rebuilding. For example, following the 2007 tornado in Greensburg, the Kansas Energy Office paid for an energy audit for every existing and new home that applied for one. An energy auditor/engineer was also hired to help homeowners understand the energy audit and the incremental cost of energy efficiency measures. The Kansas Energy Office reported that these educational measures—both the energy audit and one-on-one technical assistance—was crucial in getting homeowners to invest in energy efficiency.<sup>xx</sup> Similarly, the Colorado Energy Office provided a direct line for homeowners to obtain support on selecting upgrades, accessing financing, and connecting with additional resources.

A State Energy Office can also act as a facilitator for homeowners by identifying funding opportunities that rebuilding programs can leverage and/or requesting help from other experts in the field. After the 2013 floods the Colorado Energy Office had a designated person available to homeowners to answer questions about how to access available resources and how to rebuild in a sustainable way. Similarly, the Oklahoma Department of Commerce worked with both individuals and builders to spread best practices for working with insurance companies, building a new home (on the same or different lot), and/or buying an existing home during the rebuilding stage after the Moore tornado.

One of the lessons highlighted from NASEO’s interviews with State Energy Offices is that these programs work best if implemented through local organizations and people “on the ground” rather than remote call-centers. In addition, the program implementers should be well versed in energy and rebuilding, rather than only general disaster response management.

### Program Evaluation and Feedback

As with any program a State Energy Office runs, evaluation and feedback to inform future efforts and facilitate continuous improvement in future disaster recovery situations is highly recommended. Figure 6 visualizes the cyclical flow of all four phases of disaster planning and recovery.

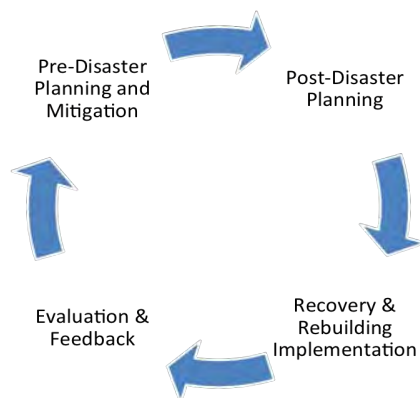


Figure 6: Disaster Planning, Recovery, and Rebuilding Cycle

Program evaluation and feedback can include assessment and recommended improvements on partner coordination, communication and conflict resolution, evaluation on whether approaches helped attain desired goals, and ways to further streamline preparation and implementation for future disasters. Lessons learned can then be shared more broadly among other state and local communities.

Specific to energy efficiency, State Energy Offices should consider what evaluation, measurement, and verification (EM&V) implications there might be in rapid increase and expansion of energy efficiency programs. Careful attention to these issues can inform future program planning and strengthen working relationships with utilities, who rely on energy savings returns to justify energy efficiency program funding. For instance, many whole-house upgrade rebate programs often measure baseline energy performance of the home through an energy audit and model a projected level of improvement based on adopted measures. However, in homes where the building envelope may have been damaged by a disaster (e.g., the windows were blown out or there may be holes in the roof or walls), an energy audit cannot accurately measure the pre-disaster energy performance of the building. To accommodate damaged homes, State Energy Offices and utility partners may need to adjust the program parameters. In Massachusetts, the Department of Energy Resources provided tiered incentives linked to a schedule of increasingly stringent HERS ratings. Homes had to demonstrate projected energy performance that would earn a particular HERS rating, as verified by certified HERS raters, but the program did not require pre-retrofit audits or baselines.<sup>xxi</sup>

Different states may take different approaches to address the difficulty in conducting energy audits on damaged homes. What's important is that State Energy Offices coordinate program procedures and expectations around energy savings data with key partners such as utilities in order to preserve good working relationships and establish precedents that satisfy different stakeholder needs for future disaster rebuilding initiatives.

## Residential Disaster Mitigation and Rebuilding Recommendations and Guidelines

While each state possesses a unique set of resources and constraints in disaster and rebuilding and mitigation in the residential sector, NASEO's research indicated several actions that State Energy Offices can pursue regardless of their situation. The recommendations are categorized based on whether they focus on disaster pre-planning and mitigation or rebuilding:

- **Disaster Pre-Planning and Mitigation**
  - The most effective disaster rebuilding coordination happens when there is a plan and relationships in place before a disaster.
  - State Energy Offices can learn from their experiences conducting energy assurance planning and conduct similar activities, such as developing a “Disaster Rebuilding and Recovery” plan to put coordination plans in place before a disaster.
  - Conducting workshops or exercises with key stakeholders (e.g, home builders, utilities, other state/local agencies) can help practice coordinating disaster rebuilding efforts.
  - Consider how existing efforts can be adapted to help mitigate the impact of natural disasters before a disaster. For example, align financing, training, and consumer education programs to focus on disaster mitigation and resilience technologies and strategies.
  - Research federal programs that focus on disaster recovery, such as FEMA and HUD, and their corresponding requirements.
  - Reach out to other state agencies and local governments to understand what their potential roles and skills are and what programs they have in place that could aid in rebuilding efforts for the residential sector.
  
- **Disaster Rebuilding**
  - Review current in-house expertise and programs to see what can be utilized for rebuilding in more energy-efficient and resilient ways. Always strive to adapt or expand existing programs rather than launching new programs.
  - Create a point person in the office to lead and coordinate all disaster rebuilding work.
  - Understand other natural disasters risks in the region to capitalize on opportunity to mitigate against future disasters in rebuilding.
  - Create separate strategies for the different residential market segments that will emerge following a disaster: (1) minimally damaged homes, (2) significantly damaged homes, and (3) new construction. Each segment will proceed along different timelines.
  - Providing access to energy audits and outreach to homeowners are potentially low-cost ways that State Energy Offices can promote energy efficiency during the rebuilding process.

As discussed in the previous section, there are many roles a State Energy Office can play in disaster rebuilding. A State Energy Office or local government may decide to take on an active role in disaster rebuilding through implementing a rebuilding program and/or take on a planning, convening, or advisory role based on the office's goals, funding levels, existing programs, in-house expertise, timeline, partners, and broader state initiatives.

## Conclusion

Over the last decade there have been numerous examples of how governments and communities have prioritized energy infrastructure and goals—including energy-efficient buildings, renewable energy assets, and grid resilience—after natural disasters. As extreme weather becomes more common, it is important that State Energy Offices, other state agencies, and local government entities help communities prepare for, protect against, respond to, and recover from a natural disaster.

State Energy Offices can play several roles in disaster mitigation and rebuilding, and a strong understanding of their potential partners' capabilities, in-house expertise, internal resource limitations, and other externally available resources, can greatly enhance disaster response and rebuilding. Most importantly, State Energy Offices' existing program activities already serve critical mitigation functions, and a State Energy Office's capability to maximize disaster recovery and rebuilding are contingent on the strength and efficacy of its existing programs.

This report synthesizes research and state experience to inform State Energy Offices about how to further enhancing disaster mitigation resilience in the residential sector. The report also highlights the opportunity for State Energy Offices to further explicitly integrate disaster resilience and mitigation into existing energy programs and to enable program expansion during disaster rebuilding.

While this report focuses on the residential sector, State Energy Offices and local governments play an important part in broad disaster recovery and resiliency for the entire community. For example, in 2014 the Massachusetts Department of Energy Resources launched a \$40 million program, the Community Clean Energy Resiliency Initiative, which is focused on municipal resilience that uses clean energy technology solutions to protect communities from interruptions in energy services due to severe climate events. The first round of project implementation grants awarded \$7.4 million for six projects to implement clean energy technologies to improve resiliency at critical facilities, such as fire stations, hospitals, and community centers. Similarly, following Hurricane Sandy, New Jersey has recognized the value of distributed energy resources, including combined heat and power, fuel cells, and off-grid solar inverters with battery storage, which allowed certain hospitals, universities, and wastewater treatment plans to continue operating while the rest of the grid was down.<sup>xxii</sup> New Jersey's new Energy Resilience Bank illustrates the importance of State Energy Offices in efforts to increase energy efficiency, disaster mitigation, and resilience at the community level.

In the future, NASEO anticipates expanding upon this report to address how State Energy Offices can also support mitigation and disaster rebuilding and mitigation in the commercial, industrial, and multifamily building sectors.

## Appendix A: Key Federal Websites, Contacts, and Disaster Resources

Federal Emergency Management Agency (FEMA)		
Relevant Webpages	Main:	<a href="http://www.fema.gov">www.fema.gov</a>
	Contacts:	<a href="https://www.fema.gov/contact-us">https://www.fema.gov/contact-us</a>
	Organization Chart:	<a href="https://www.fema.gov/media-library/assets/documents/28183">https://www.fema.gov/media-library/assets/documents/28183</a>
Mission	FEMA's mission is to support our citizens and first responders to ensure that as a nation we work together to build, sustain and improve our capability to prepare for, protect against, respond to, recover from and mitigate all hazards.	
Regional Offices and Contacts	<p><a href="#">Region I</a>: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont</p> <p><a href="#">Region II</a>: New Jersey, New York, Puerto Rico, Virgin Islands</p> <p><a href="#">Region III</a>: Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, W. Virginia</p> <p><a href="#">Region IV</a>: Alabama, Florida, Georgia, Kentucky, Mississippi, N. Carolina, S. Carolina, Tennessee</p> <p><a href="#">Region V</a>: Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin</p> <p><a href="#">Region VI</a>: Arkansas, Louisiana, New Mexico, Oklahoma, Texas</p> <p><a href="#">Region VII</a>: Iowa, Kansas, Missouri, Nebraska</p> <p><a href="#">Region VIII</a>: Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming</p> <p><a href="#">Region IX</a>: Arizona, California, Hawaii, Nevada, American Samoa, Guam, Northern Mariana Islands, Republic of the Marshall Islands, Federated States of Micronesia</p> <p><a href="#">Region X</a>: Alaska, Idaho, Oregon, Washington</p>	

U.S. Department of Housing and Urban Development (HUD)		
Relevant Webpages	Main:	<a href="http://portal.hud.gov/hudportal/HUD">http://portal.hud.gov/hudportal/HUD</a>
	Contacts:	<a href="http://www5.hud.gov:63001/po/i/netlocator/">http://www5.hud.gov:63001/po/i/netlocator/</a>
	Organization Chart:	<a href="http://portal.hud.gov/hudportal/HUD?src=/directory/director">http://portal.hud.gov/hudportal/HUD?src=/directory/director</a>
	Disaster Resources:	<a href="http://portal.hud.gov/hudportal/HUD?src=/info/disasterresources">http://portal.hud.gov/hudportal/HUD?src=/info/disasterresources</a>
	Disaster Tool Kit:	<a href="http://www.huduser.org/portal/sandy.html">http://www.huduser.org/portal/sandy.html</a>
Mission	HUD's mission is to create strong, sustainable, inclusive communities and quality affordable homes for all. HUD is working to strengthen the housing market to bolster the economy and protect consumers; meet the need for quality affordable rental homes; utilize housing as a platform for improving quality of life; build inclusive and sustainable communities free from discrimination, and transform the way HUD does business.	

U.S. Department of Energy (DOE)		
Relevant Webpages	Main:	<a href="http://www.energy.gov/">http://www.energy.gov/</a>
	Contacts:	<a href="http://energy.gov/contact-us">http://energy.gov/contact-us</a>
	Organization Chart:	<a href="http://energy.gov/leadership/organization-chart">http://energy.gov/leadership/organization-chart</a>
	Residential Buildings Integration:	<a href="http://energy.gov/eere/buildings/residential-buildings-integration">http://energy.gov/eere/buildings/residential-buildings-integration</a>
	Energy Assurance:	<a href="http://energy.gov/oe/services/energy-assurance">http://energy.gov/oe/services/energy-assurance</a>
	Disaster Recovery:	<a href="http://www.nrel.gov/tech_deployment/disaster_recovery.html">http://www.nrel.gov/tech_deployment/disaster_recovery.html</a>
Mission	The mission of the Energy Department is to ensure America's security and prosperity by addressing its energy, environmental and nuclear challenges through transformative science and technology solutions.	



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## Appendix C: Profiles of State Experience with Disaster Recovery and Mitigation for the Residential Buildings Sector

The following State Energy Offices provide examples of the roles a State Energy Office or local government can play in the recovery and mitigation phases of a community's recovery after a natural disaster. In addition, they provide valuable lessons learned and ideas for potential programmatic initiatives.

### Colorado's Response to the 2013 Floods

Over six days in September 2013, torrential rainfall fell along Colorado's Front Range, shattering flood records and causing the evacuation of over 10,000 people. The flooding damaged and destroyed more than 20,000 homes and numerous other structures, as well as vital infrastructure causing an estimated \$2 billion in property damage.



*A man rides a bike through flooding. By: Irina84/stock.adobe.com*

Colorado Governor John Hickenlooper immediately summoned all of his cabinet members to discuss the recovery and outline the potential roles each agency, including the Colorado Energy Office (CEO), can and would play in the response and rebuilding phases. In addition, Governor Hickenlooper mandated that all agencies had a point person that would prioritize flood relief work and be available at all times. The point person was responsible for reporting daily and eventually weekly on his/her agency's work on the recovery. In addition, the state set up a recovery website (<https://www.coloradounited.com>) that continues to update residents and affected communities on available resources.

The recovery was split into three stages:

1. **Initial Response Stage:** The initial response was led by first responders to secure the safety and welfare of residents. The CEO answered phones during this time and started to outline how their current programs could support the rebuilding stage. In addition, they were able to get petroleum transportation waivers for trucks to be on the road for longer hours to ensure the fuel got to the areas in need.
2. **Rebuilding Stage:** Colorado designated a three-year recovery window with most work being completed within the first year after the flood. The CEO immediately began to promote its current offerings to the affected communities once the initial response was completed and the recovery stage started. Throughout this stage, each agency is required to report weekly to the Governor's office on their progress.
3. **Long Term Planning Stage:** Colorado is currently creating a long term state-wide plan for recovery and mitigation of future disasters including fires, floods, and tornadoes. This stage overlaps with the rebuilding stage and the CEO is heavily involved with encouraging energy efficiency and more resilient grid infrastructure. In addition, the CEO is now helping the residential sector take advantage of a new disaster funding source from the U.S. Department of Housing and Urban Development that has become available.

### ***Disaster Rebuilding Activities***

For the first 180 days, each agency, including the CEO, set 30 day goals for the rebuilding of the communities and reported weekly on its progress. The CEO reached out actively to its networks to get feedback regarding what role the office might play and encouraged its contacts to consider energy efficiency and renewable energy in the rebuilding process. For example, the CEO collaborated with the largest utility in Colorado, Xcel, to double its energy efficiency rebates for damaged and new residential homes in the affected areas. More information on the rebates can be found at <http://xcelenergy.com/floodrebates>.

The CEO used geographic information system (GIS) software to overlay flood maps with community organizations to prioritize whom they contacted. For example, the CEO noted that one subdivision of housing that was heavily damaged surrounded an elementary school. The CEO worked with the elementary school to organize a presentation for the surrounding community on energy efficiency and the available resources for rebuilding. To efficiently reach as many people as possible, the CEO connected with homeowner associations', trailer parks, and housing authorities to take advantage of their contacts. In addition, the CEO used several formats to communicate with affected communities including door-to-door canvassing, social media, and mailing brochures (see Figure 8 and Figure 9). The CEO also had a dedicated staff person answer homeowners' questions regarding how to go through the process of repairing or rebuilding a new home more efficiently.

The CEO's weatherization team worked with the U.S. Department of Energy to get a waiver on a funding rule that states that residential homes can only be weatherized once. This was necessary because some of the residential homes that were damaged had been previously weatherized and, without the waiver, would not have been eligible for the program.

The CEO continues to conduct a lot of outreach to manufactured housing communities, which experienced a particularly high amount of residential homes destroyed by the floods. The CEO is encouraging the purchase of new, energy-efficient manufactured homes; however, when the purchase of a new manufactured home is not possible, the CEO encourages weatherization services.

Lastly, the CEO continues to heavily promote two energy-saving mortgage products for new and existing residential homes that were already in place. The tiered incentive program encourages buyers of an existing home to complete energy-efficient or renewable energy upgrades within 120 days of purchase. The tiered incentive is based on the estimated reduction in the Home Energy Rating System (HERS)<sup>26</sup> Index Rating (the lower the HERS Index, the more efficient the home). The program is structured so that deeper gains in efficiency will result in higher match amounts, ranging from \$2,000 to \$5,000. For new residential homes, the match range is \$1,000 to \$8,000, again based on the level of efficiency. For more information see the CEO website: [www.colorado.gov/energy](http://www.colorado.gov/energy).

### ***Disaster Mitigation Activities***

As of May 2014, the state is partnering with various organizations, including the National Renewable Energy Laboratory and the American Planning Association, to create a long-term, state-wide plan for recovery from and mitigation of future disasters, including fires, floods, and tornadoes. This plan will include lessons learned from the floods, as well as the many wildfires Colorado has experienced and will cover many topics such as energy, transportation, and public health. See the READYColorado website (<https://www.readycolorado.com/>) for more information.

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<sup>26</sup> More information on the Home Energy Rating System can be found at <http://www.resnet.us/energy-rating>.

### ***Lessons Learned/Future Programmatic Initiatives***

Several lessons learned and potential future programs were highlighted by the CEO:<sup>27</sup>

- Assign a point person from each agency that can and will prioritize the work of the recovery. It is vital that the person is given the support and time to complete the tasks and not forced to manage two jobs at once.
- The recovery must have continued top-down support. Without pressure from the top, the recovery effort might start to wane due to other pressing work.
- Set goals (preferably quantifiable) on a regular basis throughout the recovery process.
- Immediately reach out to all appropriate contacts to explain the role of the office and encourage them to promote services and forward questions.
- If an office is working on cleanup, it should make sure to track man-hours. These hours can be used as a match for FEMA funds.
- When marketing energy efficiency programs to individual homeowners, make sure to highlight that the community as a whole is trying to go green (if that is the case). Community pride went a long way to encourage participation in energy-efficient rebuilding programs in Colorado.
- Take advantage of the State Energy Office's current programs and do not try to create an entirely new program. It is much easier to tweak a program than to create, fund, and promote a new one.
- It is important to use several formats to communicate with affected communities. For example, the CEO used door-to-door canvassing techniques, social media, community meetings, and brochures.
- A State Energy Office can play a convening role by understanding all parties and their potential benefits to the residential consumer. The CEO was fully briefed on utilities, non-profits, and federal government programs and incentives to help residential consumers wade through the information and help repair their residential homes in a cost-effective, efficient manner.

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<sup>27</sup> Source: Rusin, P. (2014, May 14). Residential Program Manager, Colorado Energy Office. (H. Dobos, Interviewer)





# Disaster Recovery Assistance

**USEFUL WEBSITES**

Colorado Energy Office:  
[www.colorado.gov/energy/](http://www.colorado.gov/energy/)

Colorado:United:  
[coloradounited.com](http://coloradounited.com)

Department of Local Affairs  
[dola.colorado.gov/cdbg-dfr/](http://dola.colorado.gov/cdbg-dfr/)

**WEATHERIZATION ASSISTANCE PROGRAM**

Northwest Area Colorado Association of Local Governments: 888-790-8351 x 230 / Weld County 970-351-7772 [www.necalg.com](http://www.necalg.com)

Longs Peak Energy Conservations:  
 800-200-9006/720-864-6401  
[www.longspenergy.org](http://www.longspenergy.org)

Pueblo County Department of Housing and Human Services: 719-583-6110, [www.co.pueblo.co.us/hhs](http://www.co.pueblo.co.us/hhs)

**WHAT CAN I DO FOR MY HOME?**

- Contact your local County Emergency or Recovery Manager.
- Ask your local utility provider about rebates.
- Apply for weatherization assistance with your local weatherization agency.
- Apply for disaster recovery funds from the Department of Local Affairs: Contact Alison O'Kelly at 303.864.7821 or [alison.okelly@state.co.us](mailto:alison.okelly@state.co.us)
- New energy efficient home? Rebuilding or rehabbing your current home with a mortgage? Contact Pete Rusin for Mortgage Incentives at 303-866-2343 or [peter.rusin@state.co.us](mailto:peter.rusin@state.co.us)

**WHAT CAN I DO FOR MY BUSINESS OR FARM?**

- Contact the Small Business Administration
- Work with your County Farm Service Agency
- Contact your local Water Conservation District
- Apply for disaster recovery funds: Contact Office of Economic Development and International Trade at 303-892-3840 or [oodit\\_floodrecovery@state.co.us](mailto:oodit_floodrecovery@state.co.us).
- For Agriculture contact Lara Duran or Jeff Stalter 303-239-4100

Figure 8 Disaster Recovery Assistance Brochure (Front)

### INCOME QUALIFIED

### PROGRAM FOR HOMES

### COMMUNITY PROGRAM

#### WEATHERIZATION ASSISTANCE PROGRAM

In partnership with local agencies and the U.S. Department of Energy, CEO offers a free Weatherization Program to Colorado's eligible residents.

Weatherization is a blanket term for a variety of measures that increase the energy efficiency of your home. These improvements will reduce energy usage, saving you money while enhancing the comfort of your home year round.

Qualified homeowners or renters can apply for these services by contacting their local weatherization agency (see contact page on reverse).

The weatherization process will begin with an energy audit, including furnace safety testing. Home improvements may include:

- Insulation in Attics and Walls
- Furnace Replacement
- Refrigerator Replacement
- Sealing Air Leaks
- Compact Fluorescent Light Bulbs (CFL)
- Storm Windows and Doors

#### ENERGY PERFORMING CONTRACTING

Energy Performance Contracting (EPC) is a financing mechanism that allows public agencies to add energy efficient measures with no capital outlay. CEO helps navigate the process and ensures that the service providers maintain the highest levels of quality. CEO also provides education and outreach on the components of EPC, maintains contract documents, and sets industry standards for our Pre-Approved Energy Service Companies.

The Colorado EPC program has a very successful history and is currently ranked 4th in the Country for EPC completed by State. As of June 2013, the program has supported over 154 completed projects for a total of \$330 million construction. As of June 2013, the program was supporting 22 projects for a total of \$82 million in construction providing jobs throughout the state.

In the past, EPC projects have been used to show local match in grant programs. Your savings may be eligible.

If you are a public agency that is interested in participating in the program please contact the EPC Program Manager - Jeanna Paluzzi, 303-866-3464, jeanna.paluzzi@state.co.us

#### MORTGAGE INCENTIVES FOR HOMES

If you are repairing or rebuilding a damaged home, refinancing a current home, or buying an existing home, we want to help. You may qualify for mortgage incentives up to \$8,000, based on the level of energy efficiency upgrades. Incentives also apply to energy efficient manufactured housing (mobile homes).

CEO will help guide you through the process to receive the incentive. Contact Peter Rusin at 303-866-2343 or peter.rusin@state.co.us

Homeowners on TANF, AND, OAP, SSI and LEAP automatically qualify for Weatherization assistance. Households can also be eligible if the total gross (before taxes) income of all family members does not exceed these set limits:

Household Members	Gross Annual Household Income
1	\$23,340.00
2	\$31,460.00
3	\$39,580.00
4	\$47,700.00
<b>Each Additional Person</b>	<b>Add \$8,120.00</b>

Figure 9 Disaster Recovery Assistance Brochure (Back)

## Florida's Response to Multiple Hurricanes

Florida has a long history of hurricanes, among which Hurricane Andrew in 1993 was especially notable. Hurricane Andrew destroyed 63,000 homes, damaged over 100,000 more, and left approximately 175,000 people homeless. The storm damage was reported to be about \$25 billion making it one of the most expensive natural disasters in U.S. history. The sheer scale of damage led the state to consider updating building codes as a way to potentially minimize damage from future natural disasters.



*Damage from Hurricane Andrew.  
By: spiritofamerica/stock.adobe.com*

### **Disaster Recovery and Resilience Activities**

The Florida State Energy Office's main role in disaster response and recovery has been to make sure that fuel is provided to first responders, as well as creating an energy assurance plan to address critical energy systems issues arising after a natural disaster. In addition, several agencies in Florida are responsible in implementing energy efficiency during the recovery process:

- The Public Service Commission focuses on energy efficiency;
- The Department of Business and Professional Regulations is responsible for training builders on codes; and
- The Department of Financial Services helps fund energy efficiency.

Hurricane Andrew made building codes a salient topic in Florida and the state has used building codes to encourage energy efficiency and the hardening of homes. For example, after Hurricane Andrew, the building code included a "High Velocity Hurricane Zone" for Miami-Dade and Broward Counties in order to codify strong hurricane provisions for South Florida. The building code also includes standards for protection from wind-borne debris in specific regions where design wind speeds are greater than 120 miles per hour.<sup>28</sup> In these regions, there are specific requirements for hurricane risks, such as protecting window openings with shuttering or impact resistant glass and ensuring roof wind resistance through the use of hurricane straps or clips. All rebuilding must meet the Florida Building Code, which has the added benefit of reducing insurance costs.

Miami-Dade County also provides several examples of strategies related to code that ensure that more resilient provisions are implemented. The county offers an online database of building products that have been approved for use in the county.<sup>29</sup> This helps builders identify appropriate materials that are part of the building code. Additionally, the county requires structural engineers to check and certify building plans. This oversight helps lead to higher levels of code compliance, which is needed for the benefits of the code to be realized.

<sup>28</sup> The wind speeds are based on the American Society of Civil Engineers Standard ASCE 7-98 (Minimum Design Loads for Buildings and Other Structures).

<sup>29</sup> See [http://www.miamidade.gov/building/pc-search\\_app.asp](http://www.miamidade.gov/building/pc-search_app.asp).

Each coastal county and municipality is required to create a Post-Disaster Redevelopment Plan; the state also encourages inland communities to create these plans. The Post-Disaster Redevelopment Plan identifies policies, roles, and responsibilities for community redevelopment that will guide decisions that affect long-term recovery and redevelopment of the community after a disaster. The goal is to reduce community vulnerability to disasters and help a community more successfully recover from disaster impacts. Additional benefits to the community that have a plan include: 1) faster and more efficient recovery; 2) opportunity to rebuild better; and 3) more local control over recovery. More information can be found in the publication *Post-Disaster Redevelopment Planning: A Guide for Florida Communities* by the Florida Department of Community Affairs and Division of Emergency Management.<sup>30</sup>

### ***Lessons Learned/Future Programmatic Initiatives***

The following lessons were highlighted by the State Energy Office:<sup>31</sup>

- Building codes are a key strategy for promoting energy efficiency and resilience in residential buildings.
- The ability for agencies to work closely together is important to have a cohesive response.

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<sup>30</sup> Guide available at:

<http://www.floridadisaster.org/recovery/documents/Post%20Disaster%20Redevelopment%20Planning%20Guidebook%20Lo.pdf>

<sup>31</sup> Source: Morgan, T., Mack, A., Buchan, B., Stafford, G., and Boland, A. (2013 October 13). Florida Department of Agriculture and Consumer Services. (C. Wagner Interviewer).

## Kansas's Response to the 2007 Greensburg Tornado

On May 4, 2007, 90% of the infrastructure in Greensburg, Kansas was destroyed by an EF5 tornado, while the remaining 10% of the town was considered severely damaged. Immediately following the tornado, the City Council passed a resolution that the city would rebuild as a “green” community by decreasing energy use and increasing the use of renewable energy. Much of the work was supported by the help of a local non-profit (Greensburg GreenTown), the U.S. Department of Energy (DOE), the National Renewable Energy Laboratory, major donors, and the Kansas Energy Office.<sup>32</sup>



*A tornado in Kansas. By: Minerva Studio/stock.adobe.com*

Due to the prioritization to become a “green” community, new homes in Greensburg use 40% less energy on average than standard code, and in 2009 Greensburg was home to the largest number of LEED certified buildings per capita in the U.S.<sup>33</sup> In addition, 100% of the town is powered by a 12.5 MW wind farm.<sup>34</sup>

### ***Disaster Recovery Activities***

Right after the tornado, the Kansas Energy Office convened a group of energy experts to discuss short term and long term community needs. The office hired an architectural/engineering firm to provide on-the-ground support for Greensburg's City Council and residents. The engineer reviewed the street and building plans at no cost to Greensburg. In addition, the Kansas Energy Office was critical for organizing the many stakeholders and building buy-in for the community for green initiatives.

The Kansas Energy Office utilized \$100,000 from DOE funds and an additional \$100,000 from state funds to encourage energy efficiency in the residential sector. The office paid for an energy audit for every existing and new home that applied for one. The energy auditor/engineer was able to demonstrate that the incremental cost of energy efficiency was not high and that it would pay for itself over time, which was crucial in getting homeowners to invest in energy efficiency.

The Kansas Energy Office benefited greatly from partnering with various organizations such as:

- The Kansas Building Science Institute which provided building energy audits.
- The Small Business Administration leveraged their members to help advertise energy efficiency and renewable energy providers and sell energy-efficient products.

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<sup>32</sup> Source: Greensburg GreenTown. (2014, May 1). Greensburg GreenTown. Retrieved from Greensburg GreenTown: <http://www.greensburggreentown.org/>.

<sup>33</sup> Source: U.S. Department of Energy. (2009b). From Tragedy to Triumph- Rebuilding Green Homes after Disaster. Washington DC: U.S. Department of Energy. Retrieved from <http://energy.gov/sites/prod/files/2013/11/f5/45138.pdf>.

<sup>34</sup> Source: U.S. Department of Energy. (2012). A Tale of Two Cities: Greensburg Rebuilds as a National Model for Green Communities. Washington DC: U.S. Department of Energy. Retrieved from <http://www.nrel.gov/docs/fy12osti/54901.pdf>.

- A local college staff member held several contractor trainings to help educate the builders and contractors on new materials and technologies.

### ***Lessons Learned/Future Programmatic Initiatives***

Several lessons were learned and future potential programmatic initiatives were highlighted by the Kansas Energy Office:<sup>35</sup>

- The largest lesson learned was that there is a great opportunity after a disaster to rebuild and rethink the entire notion of communities. Greensburg was able to rethink everything from street grid layout and orientation to burying power lines to better access to renewables and smart meters. Due to strong community buy-in and the support of numerous organizations, Greensburg was able to benefit from and integrate the opinions of many stakeholders in order to create a new “green” community.
- Providing energy audits was extremely valuable in convincing homeowners that an investment in energy efficiency was worthwhile.
- The training the Kansas Energy Office and the local college professor provided to contractors was valuable. In the future, they would like to provide additional training opportunities.
- The Kansas Energy Office had contractors on the ground during the rebuilding phase, but in the future they want to have someone from the office visit at least once a week to check on progress and assess the situation.
- The Kansas Energy Office identified that, in the future, they could do more to reach out to national organizations, such as the National Association of State Energy Officials, to identify resources and private-sector partners whose experience could be leveraged.

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<sup>35</sup> Source: Freed, R. (2013, September 25). Director, Energy Division at Kansas Corporation Commission. (C. Wagner, Interviewer).

## Massachusetts' Response to the 2011 Tornado

On June 1, 2011, a tornado touched down in and around Springfield, Massachusetts. Three people were killed, hundreds were injured, and thousands of homes and businesses sustained extensive damage. Estimates of the storm's damage exceeded \$140 million.

Within a few days, the Massachusetts Department of Energy Resources (DOER) and other state agencies had a call with the Governor's office to help coordinate the response. In addition, DOER heard from many homeowners and stakeholders about the various immediate and long term needs.



*Springfield, Massachusetts skyline.  
By: SeanPavonePhoto/stock.adobe.com*

### **Disaster Recovery Activities**

Starting in November 2011, DOER launched an incentive program for energy-efficient rebuilding called the ReBuild Western Massachusetts Program. The program was funded through Alternative Compliance Payments, which are paid by electric utilities that have not met the Renewable Portfolio Standard requirements. The program provided grants and subsidized residential construction loans for energy improvements for homeowners and businesses. In addition, DOER held a series of trainings for contractors that highlighted the program and incentives to encourage more thoughtful repairs at no additional cost due to the availability of state funds.

It should be noted that this program aligned with utility energy efficiency programs that were already in place. In other words, residents were able to benefit from both programs. ICF, a contractor that was familiar with the regional utility programs, was selected to administer the ReBuild Western Massachusetts Program, which resulted in better coordination of the various incentive programs.

Ultimately 235 businesses and households received grants. The nearly \$1 million in grants were leveraged for nearly \$17 million in private investment. In addition, the program also issued \$90,000 in 0% interest loans. These loans were provided through an existing financing mechanism, the HEAT Loan Program. More information on the ReBuild Western Massachusetts Program can be found in the paper *Rebuild Western Massachusetts: Storm Recovery from the Ground Up* by ICF International.<sup>36</sup>

### **Disaster Resilience Activities**

Massachusetts has not made any changes to their building codes to address tornadoes. This is mostly due to the scarcity of tornadoes in the region. However, Massachusetts has considered additional code requirements on Cape Cod for wind bracing.

While not specific to the residential sector, Governor Deval Patrick announced in January 2014 a \$50 million investment for a statewide plan to address present and future impacts of climate change. In May

<sup>36</sup> Source: ICF International. (2013). *ReBuild western MA: Storm recovery from the ground up*. Cambridge: ICF International.

2014, Massachusetts launched the Community Clean Energy Resiliency Initiative. Through the initiative, DOER will provide grants to municipalities to harden energy services at critical sites that support life safety, lifelines, and community resources using clean energy technologies. Municipalities can apply for either technical assistance or direct project implementation funding.

### ***Lessons Learned/Future Programmatic Initiatives***

DOER identified several lessons learned and future potential programmatic initiatives from their experience with the 2011 tornado.<sup>37</sup>

- The ability to immediately market an incentive program was critical to gain attention and ensure it was part of the decision making process in rebuilding.
- Energy efficiency rebuilding programs should have flexibility to allow for unexpected delays such as insurance reimbursement.
- DOER recommends leveraging existing State Energy Office contact lists. DOER was able to utilize its contact list from code trainings to recruit and educate contractors on the incentive program.
- Having an approved list of Home Energy Raters (HERS) was very helpful to help encourage energy efficiency in homes.<sup>38</sup> The ReBuild Western Massachusetts Program included HERS rating requirements in order to receive incentives.
- Massachusetts already had the infrastructure in place to disburse rebates and implement financial mechanisms such as zero-interest loans, which enabled the program to be up and running quickly.
- DOER would have benefited from a better communication strategy with federal agencies, including having access to Federal Emergency Management Agency's (FEMA) list of impacted households. Many decisions that are made by FEMA and insurers immediately after a disaster are to meet minimum building codes but generally have little consideration for future operating costs. Therefore, it is essential to have an open line of communication with FEMA, insurers, and homeowner's to explain the advantages of incorporating energy efficiency and renewable energy into their projects.
- A rapid response protocol or program before an event would be very helpful.
- In general, Massachusetts found that there was a large absence of technical and program design documents in response to disasters. Moving forward Massachusetts thought it would be useful to have access to a list of documents that focus on both rebuilding a community and mitigating future damage from a natural disaster.

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<sup>37</sup> Source: Filayson, I. (2013, September 24). Deputy Director of Energy Efficiency Division of Massachusetts Department of Energy Resources. (C. Wagner, Interviewer).

<sup>38</sup> See the Residential Energy Services Network (RESNET) for more information (<http://www.resnet.us/energy-rating>).



## New Jersey's Response to Hurricane Sandy in 2012

Hurricane Sandy made landfall in New Jersey on October 29, 2012. Hurricane Sandy affected 24 states, with the majority of damage occurring in New Jersey and New York. Overall damage was estimated to be about \$65 billion, and 159 people lost their lives. In New Jersey, more than 350,000 homes were damaged and 50,000 were destroyed. Governor Chris Christie declared a state of emergency and set up the Governor's Office of Recovery and Rebuilding (GORR).<sup>39</sup>



*Homes on a beach in New Jersey after Hurricane Sandy.  
By: Bob/stock.adobe.com*

In the initial aftermath of the storm, the New Jersey Board of Public Utilities (BPU) supported the GORR and met daily. BPU focused on energy efficiency and renewable energy issues as well as helping manage the utilities response and mitigation. BPU also worked closely with the Department of Community Affairs (DCA) which traditionally manages code issues, low-income programs (weatherization and Low Income Home Energy Assistance Program), the U.S. Department of Housing and Urban Development (HUD) process, and insurance claims. After the storm, all of the rebuilding effort was led by the DCA.

### ***Disaster Recovery Activities***

Immediately following the storm, the BPU team started working with utilities and communities to answer questions regarding when the power would be back up. In addition, BPU immediately set up meetings with municipalities and utilities to understand what was available in terms of energy efficiency and renewable energy incentives. Utilities and the affected municipalities had a good line of communication, which was critical in order to provide information to the public. The South Jersey Gas Company had an especially strong program to promote clean energy and therefore was used as an outreach tool for the recovery. The South Jersey Gas Company organized forums with contractors and code officials that were open to the public enabling them to quickly reach many customers.

New Jersey temporarily suspended code requirements. However, to encourage green building standards, rebates were provided for green new construction and green retrofits done through the Home Performance with ENERGY STAR program. A list of rebates can be found at: <http://www.njcleanenergy.com/sandy>.

In addition, BPU increased the incentives for energy efficiency for nine communities that were deemed Federal Emergency Management Agency disaster areas. One of the largest struggles was encouraging energy efficient HVAC systems. Any HVAC system that was touched by salt water was thrown out and many people wanted it replaced immediately. The availability of additional funds made households more willing to replace their HVAC with more efficient equipment, despite a potentially longer installation time. BPU helped promote the rebates by reaching out to every mayor's office and code official before they

<sup>39</sup> More information at the GORR website: <http://nj.gov/gorr/>.

finalized plans and permits to rebuild. The funding for the rebates came from the existing Clean Energy New Jersey Fund.

Any household that received money from the National Flood Insurance Program (<http://www.fema.gov/national-flood-insurance-program>) had to meet the 2009 New Jersey Uniform Construction Code (based on the 2009 IECC), which had increased energy efficiency standards. In addition, many green standards and requirements were triggered as a result of receiving HUD funds.

### ***Disaster Resilience Activities***

In New Jersey, there is a general consensus that future storms are inevitable and that there needs to be a larger conversation of how to prepare on both a state and local level. After Hurricane Irene in 2011, an Emergency Preparedness Partnership Order was passed to complete an analysis on utilities that experienced outages during the storm to better understand how to prevent outages in the future. BPU hired a consultant to go through utility response issues and improve the statewide utility response.<sup>40</sup> One of the main issues was that there was little communication between utilities, state government, and local entities. As such, BPU has prioritized working with utilities to be more resilient in future storms and improve communication.

BPU has also been working with the U.S. Department of Energy to help design more resilient communities and structures. In addition, BPU has a Memorandum of Understanding with the DOE and New Jersey transit to develop a micro-grid for the transit system which was disabled for two weeks following Hurricane Sandy.

### ***Lessons Learned/Future Programmatic Initiatives***

Several lessons were learned and future potential initiatives were highlighted by the BPU:<sup>41</sup>

- As of early 2014, the BPU continued meeting every other week to check in on the recovery process. This is critical to ensure that goals are met.
- Communication before and after an event could be greatly improved by using various tools including social media.
- While New Jersey does have a state energy plan, the plan does not cover local planning issues. It became especially clear after Hurricane Sandy that there is little, if no, resilience planning on the local level for when the grid goes down. In the future, the conversation will most likely shift to supporting some of the local level work.
- Vegetation management is now a large focus of resilience as many of the power outages that affected the region were caused by the over 120,000 trees that came down during the storm.

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<sup>40</sup> The report had over 109 recommendations and can be found at: <http://www.nj.gov/bpu/pdf/boardorders/2013/20130123/1-23-13-6B.pdf>.

<sup>41</sup> Winka, M. (2013, October 9). Director of Clean Energy at New Jersey Board of Public Utilities. (C. Wagner, Interviewer).

## Oklahoma's Response to the 2013 Moore Tornado

On May 20, 2013, an EF5 tornado struck Moore, Oklahoma and several adjacent areas leading to multiple deaths, hundreds of injuries, and significant damages estimated at approximately \$2 billion. An estimated 1,150 homes were destroyed. The tornado was not Moore's first EF5. They experienced a devastating tornado in 1999 as well.



*Aftermath of Moore Tornado in Oklahoma.  
By: jsnewtonian/stock.adobe.com*

Before the storm, the Oklahoma Department of Commerce, which houses the State Energy Office, had experience working with multiple state agencies due to their work on creating energy assurance plans and managing American Recovery and Reinvestment Act grants. The Department of Commerce played a role in the rebuilding process and partnered with the Office of Sustainability throughout the rebuilding process.

### ***Disaster Recovery Activities***

Immediately following the tornado, the Department of Commerce held a meeting with builders and other stakeholders to highlight priorities in the recovery process. Approximately 50% of the displaced households moved in with family and friends, while the remaining 50% were dependent on rental and hotel housing. Approximately 50% of residents displaced by the tornado did not plan on rebuilding on their lot.

Rebuilding in the residential sector began about 3 or 4 months after the tornado. Some of the delay was due to the fact that it takes insurance about 45-60 days to approve a claim. The first 6 months after the tornado proved to be a key time for the Office of Sustainability's reach out to the community. For example, the Office of Sustainability partnered with various homebuilders associations, the U.S. Green Building Council, and insurance providers to hold a one-day seminar with Moore residents to inform them on best practices for working with insurance companies, building a new home (on the same or different lot), or buying an existing home. Builders implementing ENERGY STAR were able to showcase their approach during these workshops.

Moore found that there were three key segments of the population to which outreach was critical:

1. Individuals directly affected by the tornado and were still planning to stay in Moore by either rebuilding on their current lot or purchasing a new home in Moore.
2. Speculation homebuilders interested in purchasing some of the lots as a future investment.
3. Local builders active in the recovery. The Oklahoma Department of Commerce believed that outreach to this constituency was the best way to make an impact.

In addition, the Department of Commerce benefited from reaching out to state homebuilders associations which helped screen whether or not homebuilders were licensed.

### ***Disaster Resilience Activities***

After the tornado, storm shelters became the top priority for rebuilding. Federal Emergency Management Agency covered 100% of the costs for destroyed homes to put in storm shelters. Moore homes that were not affected were able to receive tax credits and grants to offsets some of the costs, while many banks offered 1-2% interest loans to cover the remaining costs for installing a storm shelter.

In 2014, Moore City Council members unanimously approved new residential building standards to help strengthen homes against tornados such as requiring hurricane clips for framing anchors and wind resistant garage doors. With the 14 proposed changes, Moore became the first U.S. city to adopt a building code to address the effects of a tornado.<sup>42</sup>

### ***Lessons Learned/Future Programmatic Initiatives***

Several lessons were learned and future potential programmatic initiatives were highlighted by the Oklahoma Department of Commerce:<sup>43</sup>

- If possible, the ability to provide cash to affected residents is important when immediate essentials need to be procured.
- There was a general consensus that the ability for State Energy Offices to buy down interest rates with various financial mechanisms such as Revolving Loan Funds would make it easier for people to invest in resiliency technologies such as wind resistant garage doors.
- The City of Moore benefited greatly from having a pre-determined debris-removal contract, which enabled the city to move forward quickly with the cleanup. In the end, FEMA reimbursed 80-85% of the debris removal costs. Having several pre-determined contracts for disaster recovery and rebuilding might be useful for states to consider when planning strategies for response and rebuilding.
- The Department of Commerce identified several supply chain issues. For example, after the tornado there was a shortage in windows. In the future, there is a potential opportunity for the Department of Commerce to work with manufacturers and suppliers to avoid shortages.
- The Department of Commerce and their constituents benefited from the ability to access applicable resources in a timely fashion.

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<sup>42</sup> Sources: (1) Cannon, J. G. (2014, March 17). *Moore City Council takes historic step in bolstering homes*. Retrieved from The Oklahoman: <http://newsok.com/moore-city-council-takes-historic-step-in-bolstering-homes/article/3944338>; (2) City of Moore. (2013). *May 2013 Tornado Fact Sheets*. Retrieved from <http://www.cityofmoore.com/may-2013-tornado-fact-sheets>.

<sup>43</sup> Source: McNabb, K. (2013, September 24). Renewable Energy Specialist at Oklahoma Department of Commerce. (C. Wagner, Interviewer).

## Appendix D: End Notes

- <sup>i</sup> U.S. Global Change Research Program, (2014). *Climate change impacts in the United States*. Washington, DC: U.S. Global Change Research Program. Retrieved from <http://nca2014.globalchange.gov/downloads>
- <sup>ii</sup> (U.S. Global Change Research Program, 2014).
- <sup>iii</sup> Resilient Communities for America. (2014). *Extreme weather and climate change: are we prepared?*. Retrieved from <http://www.resilientamerica.org/our-communities-at-risk/extreme-weather-and-climate-change-are-we-prepared/>
- <sup>iv</sup> Smith, A. B., & Katz, R. W. (2013). *U.S. billion-dollar weather and climate disasters: Data sources, trends, accuracy and biases*. Asheville: NOAA National Climatic Data Center. Retrieved from <http://www1.ncdc.noaa.gov/pub/data/papers/smith-and-katz-2013.pdf>
- <sup>v</sup> Urban Green Council. (2013). *Building resilience task force*. New York: New York Chapter of the U.S. Green Building Council. Retrieved from <http://www.urbangreencouncil.org/servlet/servlet.FileDownload?file=015U0000001Eybd>
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