



National Institute of  
**BUILDING SCIENCES**

Multihazard Mitigation Council  
& Council on Finance,  
Insurance and Real Estate

# Developing Pre-Disaster Resilience Based on Public and Private Incentivization



*An Authoritative Source of Innovative Solutions for the Built Environment*





National Institute of  
**BUILDING SCIENCES**

# **Developing Pre-Disaster Resilience Based on Public and Private Incentivization**

*developed by the*

**Multihazard Mitigation Council (MMC)**

*in conjunction with the*

**Council on Finance, Insurance and Real Estate (CFIRE)**

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## Contents

<b>Acknowledgements</b> .....	<b>5</b>
<b>Foreword</b> .....	<b>7</b>
<b>Executive Summary</b> .....	<b>9</b>
<b>Introduction</b> .....	<b>15</b>
Incentivization Stakeholders .....	16
Approach to Developing Incentives .....	18
Incentivization Benefits.....	19
<b>Stakeholder Incentivization for Decision Makers</b> .....	<b>21</b>
Homeowners .....	21
Businesses .....	24
Small Businesses and Property Owners.....	28
Large Businesses.....	29
Developers and Builders .....	31
Utilities .....	31
Communities .....	32
<b>Stakeholder Incentivization for Offerers</b> .....	<b>35</b>
Private Sector .....	35
Communities .....	36
States .....	38
U.S. Congress.....	40
<b>Enhanced Incentivization Strategies</b> .....	<b>41</b>
<b>Technical Support for Incentivization</b> .....	<b>43</b>
Valuations .....	43
Data .....	44
Software Tools .....	45
Flow of Information .....	45
<b>Low-Potential and Ineffective Approaches</b> .....	<b>47</b>
Incentives with Less Potential.....	47
Disincentives and Ineffective Incentives.....	48
<b>Conclusion</b> .....	<b>51</b>
<b>References</b> .....	<b>53</b>



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## Foreword

Recent major disasters, such as Hurricanes Katrina and Sandy—and their considerable financial, social, and environmental impacts— have substantially raised the profile of resilience in communities, in policymaker deliberations, and within the buildings and infrastructure industry. In May 2014, more than 20 organizations representing the planning, design, construction, operations, and management disciplines came together, in conjunction with Building Safety Month, to issue a statement on the importance of resilience and the need for a multi-disciplinary, collaborative, and coordinated approach to assure the safety of U.S. citizens.<sup>1</sup>

While it was not initially called resilience, the National Institute of Building Sciences has been working towards realization of these same goals since we were established by the U.S. Congress in 1974. One of the Institute’s first councils was the Building Seismic Safety Council (BSSC), with its mission to translate seismic research into recommended updates to building standards and codes. Since then, a number of Institute programs have focused on improving the nation’s resilience. In 2005, the Institute’s Multihazard Mitigation Council (MMC) released a foundational study, *Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities*, on the benefits associated with federal government investment in mitigation. Ten years later, the study’s finding that one dollar invested in mitigation results in four dollars in future benefits is still cited regularly by the media and members of Congress.

And, today, the Institute’s effort to advance investments in mitigation and resilience continues. Through the MMC, industry experts have initiated two important efforts to support community resilience. This white paper, *Developing Pre-Disaster Resilience Based on Public and Private Incentivization*, developed in conjunction with the Council on Finance, Insurance and Real Estate, identifies the potential mechanisms from both the public and private sectors that can drive investment in mitigation—an approach called “incentivization.” This expanded assessment of opportunities to encourage mitigation investments identifies mechanisms outside those currently offered by government programs.

MMC also is in the process of raising funds for a follow-up study to *Natural Hazard Mitigation Saves*. The new study will examine the benefits associated with private-sector investment in mitigation. Please consider supporting this important work in making the case for both public and private sector investments in mitigation.

As the nation, communities and building industry practitioners examine the pathways to achieve resilience, the Institute will continue to help lead the necessary research and develop the required tools to provide the necessary guidance. We hope that this white paper on incentivization will serve as one of those tools.

Sincerely,



Henry L. Green, Hon, AIA  
President

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<sup>1</sup> See <http://www.nibs.org/resource/resmgr/Docs/StatementonResilience.pdf>.



## Executive Summary

Resilience has come to occupy a place in public policy and programs across the United States. Yet, even in the face of growing losses and the deleterious effects of natural disasters, the nation's capacity and appetite is waning for continued funding of federal and state pre- and post-disaster mitigation efforts to create resilience. A new approach is necessary—one focused on capturing all of the potential incentives provided by both the public and private sectors for pre- and post-hazard investment. The most cost-effective manner to achieve resilience is through a holistic and integrated set of public, private, and hybrid programs based on capturing opportunities available through mortgages and loans; insurance; finance; tax incentives and credits; grants; regulations; and enhanced building codes and their application. This focus on private/public-sector opportunities to induce corrective action is called “incentivization.”

This approach calls for input, consensus, leadership, and action from a broad spectrum of stakeholders that represent the entire U.S. incentivizing community and the regulatory and economic processes that need to be developed and coordinated to make incentivization part of the nation's economic fabric. Such discussions need to occur at high enough levels in the public and private sectors to ensure enactment. Participants should include those who offer incentives, such as insurance and finance-related companies, lenders, and foundations, as well as forward-thinking communities and federal and state government agencies. It also needs to include homeowners, businesses, utilities, and communities as decision makers. The private sector will not undertake investments to support achieving resilience just because it is sensible, but because it is economically prudent. Therefore, stakeholder offerers need a level of confidence that using incentives to implement mitigation strategies to achieve resilience will justify investments, underwriting, and loan and grant programs. Decision makers want the certainty that they can offset the cost of implementing mitigation strategies. In this win-win scenario, all stakeholders should experience the expanded benefits and co-benefits of resilience, including reduced losses and operational continuity. Once incentives start becoming the standard practice of leading private-sector stakeholders, the rest of the private sector should begin to follow.

This paper provides a catalogue of existing programs for different hazards that private and public-sector stakeholders can evaluate, and then modify or expand to develop incentives. The specifics of incentivization need to be tailored for new and existing construction using optimal resilience measures beyond current law or custom, and to account for hazard, risk, locality, business size, and the value of resilience strategies. One size cannot fit all. Incentives should be an integrated set of solutions, and evolve with the changing field of resilience. Incentives programs should be developed to have defined entry points and streamlined processes that can be easily understood and applied to ensure widespread usage and effectiveness. Incentivizing the means to achieve resilience before disasters occur focuses on monetizing the benefits realized by financial institutions and others for incorporating risk mitigation practices in the ordinary course of business.

The interests of the insurance sector align substantially with pre-disaster concerns. Resilient buildings reduce the loss risks associated with property insurance issuance, and grow even more important in an era of increasing natural disasters. Similarly, building resilience strategies would reduce the payouts for business interruption insurance, which frequently exceed amounts

expended by insurers in compensation for property damage. Some insurance companies already have instituted discount programs because they recognize the result of increased resiliency is decreased claim volatility. The whole industry needs to understand this relationship.

Decision makers can promote the adoption of enhanced, beyond-code mitigation standards for resilience (such as the Insurance Institute for Business and Home Safety's FORTIFIED programs for residential and commercial buildings). To incentivize the take-up of such standards, insurers can offer premium discounts to property owners who utilize the standards in construction or retrofit. This approach draws from insurance premium reduction programs for green-certified buildings, which have been successfully introduced and come in to broad use over the past decade. Such favorable insurance premium terms have helped to mainstream the use of green building standards.

Resilient properties also enhance the security of mortgage lenders. Therefore, banks and other loan agencies have perhaps the most potential to scale and transform the retrofit finance market by integrating performance-based retrofit finance within their normal mortgage and refinance lending programs to reflect increases in market-based collateral values and to limit risk. All other factors being equal, resilient properties constitute stronger mortgage loan collateral than less-resilient properties. This suggests that permanent mortgage loans on resilient properties, if pooled and sold as bonds, could enhance the credit quality of mortgage-backed securities.

Businesses, large and small, are recognizing the value of being more closely involved in community resilience to strengthen their long-term viability, and the ability of their employees to continue to live and work in their communities. Developers and builders need to engage in resilience discussions, and realize that there is an untapped market for more-durable construction. From the owner's perspective, a more-resilient property should increase the likelihood of securing debt financing. In addition, a more-resilient property—especially in areas prone to natural disaster—is likely to be more valuable than a less-resilient comparable property, thus resulting in enhanced sale prospects and (for commercial properties) better leasing performance.

Incentivizing property owners, lenders, and securitizers to increase the use of mitigation standards should involve:

- The development and adoption of appraisal and bond underwriting standards that recognize the valuation benefits of building resilience, all other factors being equal. [Enhanced appraised values allow a borrower to leverage more mortgage financing for a given loan-to-value ratio. Conversely, for a specific loan amount, a more-resilient building will be better collateralized (that is, have a lower loan-to-value ratio) than a less-resilient comparable property. Similarly, bonds backed by resilient properties would carry higher ratings, thus minimizing interest expense to the issuer.]
- Federal, state or local tax incentives for building owners participating in mitigation programs.
- Federal, state or local grant programs to support participation in approved mitigation initiatives.

- Expanded disclosure by realtors of resilience features, which could drive the marketplace to seek these resilience strategies.

Additional incentives strategies would be especially useful for residential properties:

- The expansion of federal home renovation programs to include mitigation improvements.
- Interest rate reductions for residential mortgages, provided through Fannie Mae and Freddie Mac, on properties built to approved mitigation standards. This approach was recently introduced by Fannie Mae for mortgages on green-certified residential properties.

Buildings owned by small businesses are likely to face special challenges implementing mitigation strategies for resilience. There is currently a significant market gap in supplying renovation financing for such properties. Closing the gap should include:

- Locally administered resiliency programs that would provide turnkey renovation services to participating property owners. Local property-assessed clean energy (PACE) programs are already providing such services for green building renovations.
- Federal Small Business Administration (SBA) loans, guaranteed by the federal government and made by private lenders or community development financial institutions, to finance building resiliency upgrades. SBA loans are already a key source of building acquisition and renovation financing for small businesses, although such loans lack specific resiliency requirements.
- Contractor-based financing, whereby a general contractor would develop turnkey resilience programs for small buildings.
- Public-private solutions, combining PACE and SBA approaches with private capital and delivery of resilience-based renovation programs at the local level.

Financial institutions are becoming involved in resilience discussions. Incentives for mitigation in resiliency programs could also be addressed through the capital markets, as follows:

- Corporate debt ratings, in appropriate cases, could recognize mitigation strategies. This approach would focus on companies whose assets are significantly concentrated in facilities or equipment in a single region or urban area prone to natural disasters, where such an event would have a profound effect on property loss and business discontinuity. Such companies would experience improved bond ratings, all other factors remaining equal, by adopting comprehensive mitigation strategies that achieve resilience. Similarly, municipal bonds linked to the construction of resilient facilities in areas prone to natural disasters could realize enhanced bond ratings, other factors being equal.
- Resilience-based real estate investment trusts (REITs), private equity funds, and bond issuances could represent potential market innovations. In such cases, resiliency approaches could be combined with other environmentally friendly approaches. Such investment strategies would address growing investor appetite for green investments, while resiliency strategies would reduce investment risk and improve portfolio operating performance.

Community investment decisions are not dissimilar to those in the private sector in that resilience to disasters positively affects a community's reputation as a place to establish and retain businesses. Incentives for communities as decision makers could consist of enhanced bond ratings for hazard-resistant facility projects; federal and/or state grants for communities to create either a local mitigation grant program or a revolving fund loan program; and, building code programs that encourage local governments to adopt and enforce increasing standards for resilience incentivized by federal and state investment with post-disaster recovery funding. In addition to exercising political will, communities, in a dual role as offerers, also are in a position to create incentives, including those that upgrade local building codes, accelerate local permitting and inspection procedures, and encourage resilience through zoning; developer agreements with a community for increased resilience; and, tax incentives and disincentives.

Utility incentives could include reduced insurance premiums to support the avoidance of interruption losses; a public utility commission policy that allows a small but immediate increase in rates to pay for system resilience enhancements for communities participating in a rating system; and enhanced bond ratings for projects that incorporate resilience strategies.

States have a key role in enhancing private-sector incentivization by both removing barriers to mortgage and insurance programs, and providing tax incentives and grants. For the U.S. Congress, a public-private sector approach to resilience could begin alleviating the federal government's role in supporting response and recovery.

In order to assure the effective implementation of resilience strategies through regulatory and business-based decision making, stakeholders—both offerers and decision makers— must determine the value of such strategies. They need better data and tools to identify localities with the highest risk, and where levels of increased building code requirements and incentives would be most effective, in addition to software to expedite underwriting of the financial impacts of mitigation and other business processes that support incentivization. Stakeholder offerers and decision makers also need an enhanced flow of information to promote incentivization.

At the same time, a comprehensive incentives-based resilience framework must avoid disincentives, such as state insurance rate regulation that ignores risk-based pricing, which might limit the penetration of mitigation programs into the private-sector arena. Meanwhile, some strategies, such as offering insurance rate discounts for an entire community or resilience-based construction loans, do not have the same level of potential for operating in an incentives framework.

The purpose of incentives is to augment achieving resilience—going beyond the benefits of enhancing response and recovery, to include the economic benefits of enhanced loan security, minimization of insurance losses, expanded jobs, increased construction, and attraction of business. In addition to these benefits, there is the added value of co-benefits, such as enhancing the reputations of businesses themselves, and addressing the disadvantaged of society at-large, which often take place irrespective of the occurrence of any disasters.

This white paper identifies many possible strategies. The next step is implementing the public-private incentives to support resilience. These include expanding existing programs or creating

new programs (including those modeled on related green building programs); and developing supporting business and investment processes, programs tailored to utilities, and community initiated incentives. With these approaches, promoting resilience should become part of common business practices, and integral to maintaining and enhancing the nation's economy.





## Introduction

Resilience<sup>2</sup> has come to occupy a place in public policy and programs across the United States (Kahan, p. 2). Yet, even in the face of growing losses and the deleterious effects of natural disasters, the nation’s capacity and appetite is waning for continued funding of federal and state pre- and post-disaster mitigation<sup>3</sup> efforts to promote resilience. A new approach is necessary—one focused on capturing all of the potential incentives provided by both the public and private sectors for pre- and post-hazard investment. The most cost-effective manner to achieve resilience is through a holistic and integrated set of public, private, and hybrid programs based on capturing opportunities available through mortgages and loans; insurance; finance; tax incentives and credits; grants; regulations; and enhanced building codes and their application. This focus on private/public sector opportunities to incentivize action is called “incentivization.”

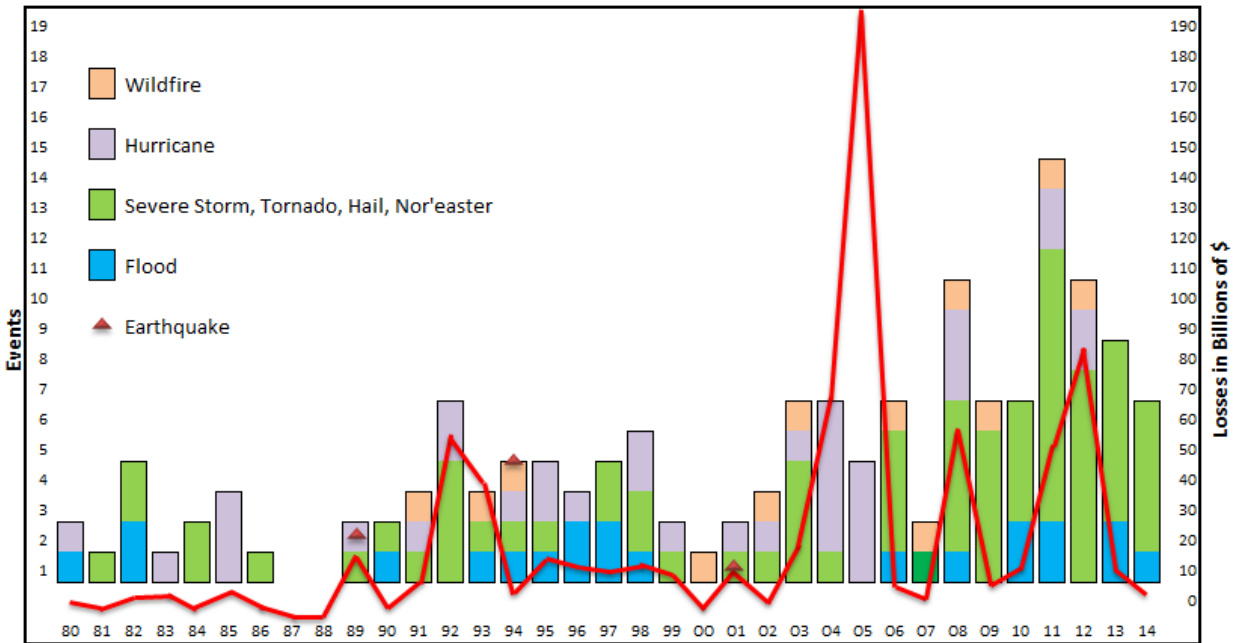
Beginning in 2014, the National Institute of Building Sciences, through its Multihazard Mitigation Council (MMC) and Council on Finance, Insurance, and Real Estate (CFIRE), assembled a multi-sector team of experts to examine the concept of incentivization, strategies for its implementation, and important actions to set this approach in motion. Through this discussion, the experts came to believe that achieving resilience requires a holistic, incentives-based approach to ensure mitigation strategies and programs are effectively implemented in both the public and private sectors.

The current methods to incentivize investment in resilience strategies rely on three primary mechanisms: federal grant programs (with some support from private foundations); insurance premium discounts for implementing measures to reduce vulnerability; and the political will of communities, either in the wake of a disaster or before an event occurs, through the foresight of community champions. While these approaches have provided a level of resilience, they have taken the nation only so far. Yet, as shown in Figure 1, the damage from extreme weather events has continued to increase in the past 35 years.

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<sup>2</sup> As defined by the National Academies 2012 publication, *Disaster Resilience: A National Imperative* (p. 16), “resilience is the ability to prepare and plan for, absorb, recover from, or more successfully adapt to actual or potential adverse events.” This definition is considered by the National Academies to be consistent with the international disaster policy community (United Nations Office for Disaster Risk Reduction - UNISDR, 2011), and U.S. governmental agency definitions (Subcommittee on Disaster Reduction - SDR, 2005; Department of Homeland Security - DHS Risk Steering Committee, 2008; Presidential Policy directive - PPD-8, 2011), and National Research Council – NRC, 2011). However, there is no one-size-fits-all definition of resilience; a variety of definitions has the benefit of providing users with flexibility in applying resilience in differing situations (Kahan, p. 6).

<sup>3</sup> In “*Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities, Volume 1 – Findings, Conclusions, and Recommendations*” (p. 1), The National Institute of Building Sciences Multihazard Mitigation Council defines disaster mitigation as physical measures to avoid or reduce damage from disasters, such as elevating, acquiring, or relocating structures threatened by floods, and strengthening structures to resist earthquake and wind forces. Mitigation in the context of resilience allows structures and infrastructure, and consequently the economic and social processes associated with them, to be useful after a disaster.



**Figure 1: Billion Dollar+ Extreme Weather Events in Frequency and Losses from 1980-2014 (Earthquake Losses Included)<sup>4</sup>**

The 2005 MMC study, *Natural Hazards Mitigation Saves*, demonstrated that investing in mitigation at the federal government level provided a nearly four-fold benefit in terms of avoided future costs.<sup>5</sup> Yet, despite increased losses and the myriad benefits of investing in community resilience, federal assistance for resilience in terms of “pre-disaster mitigation” has actually declined over the past decade, according to Congresswoman Lois Capps (D-CA) and 37 other members of the U.S. House of Representatives in a letter to President Barack Obama (Weiss, p. 5). More must be done before natural disasters hit to prevent the aftermath that plays over and over again after an event: the loss of life and injury to loved ones; families and children made homeless; irreplaceable possessions lost; curtailed ability of breadwinners to make income; businesses, built with hard work over the years, destroyed; and wrecked regional economies.

### Incentivization Stakeholders

The concept of incentivization is best understood through a discussion of its stakeholders. Stakeholders see the impetus for taking resilience measures as coming from two directions: benefit to the offerer and benefit to the decision maker. First, an incentive (as used here) is a

<sup>4</sup> Figure 1 is constructed from the reference: “NOAA National Climatic Data Center, Billion-Dollar Weather and Climate Disaster: Table of Events, National Oceanic and Atmospheric Administration,” <http://www.ncdc.noaa.gov/billions/time-series>. Costs are CPI adjusted. According to NOAA, cost estimates are rounded to the nearest billion dollars. Ongoing research is seeking to define uncertainty and confidence intervals around the cost of each event. Earthquake losses are based on an article by Gregory Wallace: “The Ten Most Expensive U.S. Earthquakes,” *CNN Money*, August 25, 2014, <http://money.cnn.com/2014/08/24/news/economy/earthquakes-10-most-expensive/>.

<sup>5</sup> When including the benefits from investment in mitigation across both the public and private sector, the benefit is thought by authors of the 2005 MMC report, *Natural Hazard Mitigation Saves*, to be significantly higher. The MMC is in the process of seeking funding to conduct a study to quantify these benefits.

mechanism offered by an entity, such as an insurance or mortgage company, that, with a high degree of certainty, offsets the offerer’s potential liability if a resilience measure is undertaken, or reduces the offerer’s uncertainty associated with the benefit of the resilience measure. (For example, an insurance company might offer a reduced insurance premium as an incentive to generate resilience in its portfolio because it anticipates reduced future pay-outs in the aftermath of disasters.) Offerers provide incentives not just because doing so benefits them specifically, but because the offerer expects the resilience measure to benefit society more generally. Second, when the offerer extends these mechanisms to the decision maker, such as a homeowner, business, utility, or community, the decision maker has a high degree of certainty that the incentive will offset the cost to undertake the resilience measure, enhance the benefit to the decision maker, or reduce the uncertainty associated with the benefit of the resilience measure. (For example, offering homeowners a guaranteed reduction in their earthquake insurance premiums would be an incentive if, with high certainty, it offsets the homeowners’ costs to purchase seismic retrofits for their homes.) The incentive increases the likelihood that people will undertake optional resilience measures by offsetting the cost or reducing uncertainty in the benefit. Generally, however, the higher the cost and the lower or more uncertain the benefit, the less likely the decision maker will undertake the resilience measure.

Developing an approach for the cost-effective implementation of incentives-based resilience strategies requires input and action from the spectrum of stakeholder organizations—both offerers and decision makers—that represent key intervention points and are positioned to either capture or provide value. It also requires the engagement of forward-thinking communities and government agencies that develop, analyze, and implement policies (including both “carrots and sticks,” i.e., rewards and punishments) that can encourage resilience measures. Such activities need to occur at high enough levels in the public and private sector to ensure enactment. These stakeholders and their interests in resiliency include:

### *Offerers*

- Insurance companies that want to set premiums concomitant with insurable risk, based on achieved resilience.
- Banks and other lenders that want to ensure that a threshold level of resilience is in place to support mortgage and business loans, and loan servicing.
- Bond rating companies that want to assign ratings to appropriately reflect asset resiliency, and the ability of bond issuers to support payment of interest following a disaster.
- Investment companies; mutual, hedge, and pension funds; and others that have a long-term fiduciary duty to their members, contributors, or beneficiaries to safeguard capital and investments in companies, states, and municipalities.
- Private foundations that support focused mitigation efforts.
- Communities, as providers of incentives, based on political will for developing resilience to alleviate regional social and economic losses.
- Federal and state agencies that need to stretch grant and emergency fund resources for mitigation before and after disasters.

## *Decision Makers*

- Homeowners who understand the need to protect their families and their homes (as their most significant asset) and possessions from disasters.
- Businesses and utilities that are interested in attenuating interruptions (sometimes in response to disasters elsewhere) that cut into operating resources, profits, and the trust of their customers and of the public.
- Communities, as recipients of incentives, that want to maximize preparation for disasters, minimize disaster recovery, and preserve their economies. Communities have a significant dual role as offerers and decision makers.

The crux of an incentives-based resilience approach is to promote and support the protection, maintenance, recovery, and sustainability of the built environment. This approach includes four major points:

- Make resilience in the built environment part of each stakeholder's approach to asset management and how they conduct their business and community operations.
- Provide a level of confidence to stakeholders that implementing the actions will justify their participation in resilience programs, investments, underwriting, and loan and grant programs.
- Incorporate the expanded benefits and co-benefits when promoting resilience, such as supporting emergency response, reducing negative supply-chain reactions, reducing uncertainty to promote economic growth and stability, enhancing a brand, and protecting the most-vulnerable elements of the population.
- Move beyond the current metrics and indices to create stakeholder tools and guidance to assist them in using incentives to support resilience.

Once incentives-based resilience starts becoming standard practice for leading private-sector stakeholders, the rest of the private sector should begin to follow. Private-sector managers are influenced by what their peers are doing at other companies, and are especially motivated if they believe that there is a risk to not getting involved (Latham). Developers, building owners, construction companies, and others whose primary interest is the least first-cost of building will see it in their best interest to take advantage of incentives. Resilience will be undertaken, not just because it is sensible, but because it is economically prudent.

## **Approach to Developing Incentives**

The MMC and CFIRE developed this white paper to encourage a dialogue, describe the possibilities of increased resilience, and broaden the range of strategies supporting its implementation. This paper provides a catalogue of existing programs for new and existing construction, and for different hazards that can be evaluated, and then modified or expanded to support development of incentives. Incentives should be developed with the following characteristics:

- *Use of Optimal Resilience Measures.* This white paper addresses optional resilience measures: that is, incentives for resilience measures that are not currently required by law

or custom. Optional resilience measures usually have costs and benefits. The MMC is aware of no thorough study of incentives for optional resilience measures. Such a study could propose a framework to quantify the benefits to the offerer and to the decision maker. Such a study also could benefit from an inventory or taxonomy of optional resilience measures, even if the inventory is not exhaustive. This white paper does not purport to be that thorough study, but it does offer a large inventory of realistic incentives as conceived by scholars and professionals familiar with the practices and interests of the offerers and decision makers. In a separate effort described in the section “Technical Support for Incentivization,” the authors hope to quantify how much each of the many incentives could offset the cost of a resilience measure, while still providing a reasonable benefit to the offerer, at least for some resilience measures.

- *Flexibility.* The specifics of incentivization need to be tailored according to such factors as hazard, risk, locality, business size, and the value of resilience strategies. One size cannot fit all, and incentives need to evolve with the changing field of resilience.
- *Coordination.* Individual strategies will not work by themselves. Following one of Judith Rodin’s five main characteristics of resilience described in *The Resilience Dividend*, incentives and mandates should be an integrated set of solutions. This should involve creative private- and public-sector partnerships using a set of economic incentives (Kunreuther et al, p. 22). Further, solutions will not come singlehandedly by one company, one industry, or one state. Effective and sustainable solutions can only come from the coordinated efforts of all the stakeholders (The Travelers Institute, p. 3). Strategies to promote increasing resilience would be applied by offerers at four levels of decision making: residences, businesses, utilities, and communities.
- *Facilitation.* Any incentives program to be developed should be well-coordinated, with defined entry points and streamlined processes that can be easily understood and applied to ensure widespread usage and effectiveness.

## Incentivization Benefits

All stakeholders should experience the expanded benefits of resilience—reduced losses, retention of businesses and employees, and related revenues for services after disasters; accelerated recovery and reduced recovery costs for owners, occupants, and communities; reduction of resources required for relief and recovery; and, lessened demand on, and risk to, emergency response personnel and reduced expenditures for emergency response.

Such resilience adds value to the whole community. For example, the IKEA store in the Red Hook section of Brooklyn, New York, which was built to be resilient, with a generator and showroom floors above flood level, became a Federal Emergency Management Agency (FEMA) emergency response headquarters following Hurricane Sandy (Rodin, p. 292). Similarly, strengthened homes that experienced less damage than the surrounding residential building stock were able to supplement sheltering requirements. Using the Airbnb model, a process spontaneously inaugurated following Hurricane Sandy linked displaced people to available rooms in undamaged residences (Rodin, p. 187).

Beyond having more-resilient buildings and communities, stakeholders also may accrue additional economic benefits from establishing a system of private-sector incentives, including:

- Increased loan security for lending institutions and enhanced financing opportunities for borrowers and investors.
- More stability in the insurance and reinsurance industries.
- Increased construction activity and jobs associated with achieving resilience.
- Communities that are more likely to attract and retain quality developers and businesses.
- A reduction in the amount of damaged and contaminated materials and contents after a disaster event, which initially may pose health hazards and then must be disposed of in landfills or by incineration.

Even beyond the benefits listed above, the businesses themselves and society at-large can benefit from the added value of co-benefits. Businesses investing in resilience can produce co-benefits that go beyond helping disadvantaged segments of the population or contributing to sustainable development. Primarily, the businesses themselves can capture such co-benefits: for instance, image improvement, which can lead to an increase in long-run profits (Rose, p. 3). Other examples include limiting liability; for instance, strengthening the foundation of a tall building so that it does not fall on its neighbors, and instituting water drainage practices that reduce flooding potential for the community (Rose, p. 1). Co-benefits often take place irrespective of the occurrence of any disasters—a “no-regrets” strategy—that reaps benefits irrespective of future outcomes (Rose, p. 17). Businesses typically neglect such co-benefits, and hence underinvest in resilience (Rose, p. 1). Promoting the capture of co-benefits requires better information on how businesses can reap some of the rewards of broader co-benefits; developing more versatile financial instruments; and providing subsidies that correspond to some portion of the co-benefits that contribute to societal goals (Rose, p. 3). Co-benefits need to be expressed in monetary terms, so they can be viewed in the light that most businesses understand (Rose, p. 24).

## Stakeholder Incentivization for Decision Makers

Stakeholders as decision makers can use a variety of incentives-based approaches to resilience. The following sections, separated into stakeholder category—homeowner, business, utility, and community—highlight these targeted approaches.

### Homeowners

The four incentivizing approaches described below apply specifically to incentives that could be offered to owners of single-family homes, at all income levels. The MMC based these approaches on examples already working in the field.

1. Reduced insurance premiums for residences that incorporate resilience strategies.

Homeowners who build or retrofit their houses beyond the requirements of the building code should benefit from meaningful premium credits for their mitigation efforts. Currently, there are three primary models, 1) insurance discounts or credit programs by state, 2) insurance discounts by designation programs, and 3) insurance discounts by carrier.

States where insurance discounts or credit programs exist include Florida, Louisiana, Maryland, Mississippi, New York, South Carolina, and Texas (Rollins, p. 2). In these states, legislation requires rate filings to include discounts, credits, or other rate differentials, or appropriate reduction in deductibles, for properties that contain windstorm features. For example, in Florida, insurance companies are required to provide residents who install wind-resistant features on their homes with discounts on the hurricane windstorm portion of their insurance premiums (Fla. Stat. Ann. § 627.0629). Available discounts range up to 87% of the hurricane windstorm portion of insurance premiums (Florida Office, p. 32). The California Earthquake Authority (CEA), which provides earthquake insurance in California, offers a 5 percent premium discount on retrofitted homes (Adams, *Insuring a Way Out*, p. 10).

A number of states offer incentives through designation programs that are independent of state legislation. For example, Alabama requires insurers to file discounts for homeowners who build or retrofit to the Insurance Institute for Business & Home Safety (IBHS) FORTIFIED standard (IBHS, *What is FORTIFIED*). Alabama uses a two-part incentive: providing insurance discounts for mitigation and a law to require fortified buildings (Alabama Department of Insurance). The reason this program works is that the insurers have confidence in both the technical standards and the inspection process that underlie FORTIFIED, and trust that the insurance departments will administer the discounts on their merits and not for political purposes. (Per the MMC/CFIRE members, this confidence is based on the history of doing business in Alabama and does not apply in all states). FORTIFIED has been found to be applicable to homes even in the \$60,000 to \$100,000 range (Disaster-Smart).

In addition, programs exist that are independent, or became independent, of any state legislation or regulation. In 1998, after the Texas Department of Insurance made it mandatory for insurance companies to provide premium discounts for hail impact-resistant roofs (IRR), State Farm Insurance developed a program that major roof manufacturers at first balked at, but small manufacturers took up. At the time, IRRs cost \$30 more per sq. ft. than a normal roof, or on average about \$1,200 more per roof. State Farm offered a premium discount of \$500 per year to homeowners who installed an IRR. The discount covered the life of the roof, and if damage due to just one storm was avoided, the homeowner got to save the future deductible (1% to 2% of the value of the home), a feature that, even today, is still transferable on the sale of the house. In 2003, the Insurance Institute for Business and Home Safety (IBHS), which was hired to evaluate the roofs after a severe hailstorm in North Dallas, demonstrated that the IRRs worked. Since then, many more roof manufacturers have begun making IRR products—10 products existed in 1998; more than 1,000 products were available after 2003. Manufacturers receive the co-benefit of enhanced reputation for installing roofs that reduce losses from hail. For insurers and loss reduction, IRRs have the co-benefit of being wind-resistant up to 130 mph and carry a Class A fire rating. State Farm has found that when homeowners are proactively given information on hailstorm mitigation, they tend to take the appropriate action. In 2008, Texas lifted the mandate, with no effect on the momentum of IRR installations. The culture created in Texas consists of knowledgeable homeowners who, as decision makers, “no longer deal with non-IRR<sup>6</sup>.” State Farm now offers discounts on home insurance premiums in 27 states based on the use of qualifying hail IRR products (<https://www.statefarm.com/insurance/home-and-property/homeowners/discounts/roofing-materials/>).

2. Federal, state and/or local grants given directly to homeowners for incorporating approved resilience strategies.

Some federal, state, and local agencies have granted funds directly to residents based on pre-approved and proven cost-effective resilience strategies. The state of Florida was the first state to implement this strategy on a statewide scale. After the 2004 and 2005 hurricane seasons, the state created the Task Force on Long-Term Solutions for Florida’s Hurricane Insurance Market to identify solutions for continued availability of property insurance. The Task Force’s final report to the Florida Legislature included widespread recommendations, particularly one from the Federal Alliance for Safe Homes (FLASH), a mitigation-focused nonprofit, to create a Mitigation Consumer Assistance Program to provide: (1) free consumer mitigation retrofit inspections, (2) retrofit grants for low-income families, and (3) provision of low- or no-interest loan programs for proven mitigation methods. In 2006, the Florida Legislature created the Florida Comprehensive Hurricane Damage Mitigation Program, later known as the My Safe Florida Home (MSFH) Program and appropriated \$250 million (Florida State University, pp. 12, 13). The state of Florida requested FLASH to develop the MSFH Program and perform a pilot inspection program. By February 2007, FLASH had completed 14,116 inspections; 400 quality assurance inspections in 17 pilot counties; developed and implemented a

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<sup>6</sup> The description of State Farm’s involvement with IRRs is based on a telephone interview with John Hadden of State Farm, April 2, 2015.



homeowner inspection report that included return on investments (ROIs) for mitigation options specific to a home; developed curriculum to qualify inspectors and contractors; and created the first rating scale based on Applied Research Associates catastrophe modeling. In 2007, FLASH transitioned the MSFH Program pilot to the state for full implementation. On April 23, 2007, the MSFH Program re-opened (Florida State University, pp. 15, 16). The program concluded on June 30, 2009, with the end of legislative funding after completing 401,372 home inspections and \$82,650,215 in mitigation grant reimbursements (Florida State University, p. 18). By then, 40 percent of all residential policies in the state were receiving windstorm mitigation discounts, with an average premium reduction of 26 percent. (Florida Commission, p. 21.)

The state of South Carolina modeled its South Carolina Safe Home Program on the MSFH Program and asked FLASH to develop eligible mitigation activities, provide training programs for both inspectors and contractors, and assist with development of inspection protocols and accompanying forms. The program provides matching or non-matching grants (based upon income, as per U.S. Department of Housing and Urban Development guidelines, and the value of the home) not to exceed \$5,000 to retrofit properties to increase resistance to hurricane and high-wind damage. Since the program began in 2007, it has awarded in excess of 3,900 grants totaling more than \$17.7 million (South Carolina Department of Insurance, p. 26). The program is funded through one percent of annual premium taxes.

The California Earthquake Authority also is empowered to set aside up to 5 percent of its annual investment income, up to \$5 million, to fund mitigation programs in California. The programs may take the form of educational efforts, research, and even monetary incentives (Adams, *Insuring a Way Out*, p.10).

### 3. Tax incentives.

State and local governments also should consider offering property tax incentives to homeowners to retrofit their houses (The Travelers Institute, p. 5). Tax incentives can provide homeowners with the encouragement to pursue resilience (Kunreuther et al, p. 20). Such incentives can come in the form of tax deductions or tax credits. For example, Louisiana offers residents a tax deduction of up to 50% of the cost paid to bring existing homes into compliance with the building code, and also provides sales tax exemptions on the installation of storm shutters (Adams, *Before the Flood*, p 6). Alabama passed a law in 2011 that allows homeowners to qualify for a \$3,000 state income tax deduction if they retrofit or upgrade their homes to FORTIFIED standards. The state also is considering another bill that would enable homeowners to establish a catastrophe savings account to cover insurance deductibles, and other portions of uninsured losses for homes damaged by a catastrophic windstorm. Taxpayers would be able to claim a credit against their state income tax for deposits made into the account (Disaster-Smart). In another example, the city of Berkeley, California, provides a seismic retrofit refund on its 1.5% real property transfer tax for residential property. The program allows for up to one third of the transfer tax (0.5% of the purchase price of the dwelling) to be refunded for voluntary seismic upgrades to residential property (City of Berkeley). Between 2003 and

2014, the city provided 1,400 refunds, an average of 130 retrofits per year in that city of 113,000 people (Daniel). The program costs the city very little since the buyer is actually paying for it. The Association of Bay Area Governments (ABAG) attributes the success of the program to the fact that the time of sale is the opportune time to convince people to retrofit. “Prospective owners are paying close attention to all kinds of structural and safety issues at that time and the cost can be figured into the new mortgage.” (ABAG, p. 3). In California, for earthquake hazards in general, a flat property tax credit would likely make more sense than a property tax deduction. A tax credit also has the benefit of being more progressive; that way all Californians would be able to take advantage of it (Adams, *Insuring a Way Out*, p. 11).

#### 4. Mortgage programs that include upgrades for mitigation.

A Federal Housing Administration (FHA) 203k rehab loan, with lower interest than can be found commercially, is available to potential homeowners for large modifications, including structural rehabilitation. Though not originally designed for disaster resistance, this program could be simplified, made more flexible, and be made available for projects involving resilience. Currently, a 203k loan comes with the challenges of a longer closing; being bound to a single contractor, even if there is a lack of performance; and listing agents who do not understand the process (Mortgage 101). Also, FHA 203k loans must be for improvements that cost at least \$5,000, must be completed within 6 months, meet all building codes, and possibly include other items that may be added to a project list (Pritchard). Homeowners may need to hire an independent consultant to prepare the exhibits required, in addition to a detailed proposal of the work and cost estimates for each item (Zillow).

Similar to the FHA 203k loans, the Fannie Mae Home Style Renovation Loan (HSR) allows borrowing up to the value of the home after improvements, has no minimum for improvements, and does not require a proposal for projects under \$15,000 (HomeBridge). Eligible borrowers can include individual home buyers, investors, nonprofit organizations, and local government agencies. However, the HSR is only applicable to residences with Fannie Mae mortgages (PMI).

Because the homeowner carries all the costs in the loan, FHA and Fannie Mae programs modified for resilience would need to be bundled with other incentives to extend their use. Nevertheless, these programs provide a starting point. The Berkeley program suggests that such incentives work, even when 100% of the cost of rehabilitation is not covered (ABAG, p. 3).

## Businesses

According to the SBA, 25% of businesses do not reopen at all after a major disaster (Rodin, p. 294). The business community, including large and small firms, needs to be more closely involved in community resilience discussions, beyond the question of whether they get an insurance discount. This is about their long-term viability and the ability of their employees to

continue to live and work in their communities. They have to perceive that a resilience initiative will directly benefit their organization (Latham).

The article, *Economics of Resilience*, by Dane Egli and Jared McKinney, which appeared in the December 2014 *CIP Report*, demonstrates the need for businesses that issue stock to be involved in resilience discussions: “A groundbreaking 2005 study by Kevin Hendricks and Vinod Singhal analyzed the effects of 827 disruption events. The study found that over the course of three years, the average disruption reduced stock returns by up to 40 percent. The result was a negative regardless of a disaster’s cause. A follow-up study showed that disruptions increase share price volatility by 13.5 percent, reduce operating income by 107 percent, decrease sales growth by 7 percent, and increase costs by 11 percent. Infrequent and unlikely disruptions thus can destroy value created over a long period in a moment.” (Egli/McKinney, pp. 6-7).

Recent evidence indicates that business is showing greater interest in resilience. The Economist Intelligence Unit “found that 63% of companies it polled saw opportunities to generate value from disaster risk reduction” (Rodin, p. 290). An Allianz Global Corporate & Specialty Societas Europaea (AGCS SE) company survey of more than 500 risk managers across 47 countries found that the causes of business interruption that companies feared most were fire/explosion (43 percent) and natural catastrophes (41 percent). Loss of reputation (61 percent) and business interruption (49 percent) were cited as the main causes of economic loss following an incident (Wright, Alex). FM Global Insurance works with many of the world’s largest organizations, including one of every three FORTUNE 1000 companies, who share the belief that the majority of property loss is preventable. FM Global reports that these companies want to understand the key property hazards that can impact their business continuity, information that would help them make cost-effective risk management decisions. These firms also are working to combine property loss prevention with insurance protection (FM Global).

Incentives for businesses will vary depending on building size and owner characteristics. Almost 94 percent of U.S. commercial properties are small buildings, defined as structures of 50,000 square feet and below, and account for roughly half (49.5%) of U.S. commercial square footage (CFIRE, p. 27). Small commercial buildings frequently encounter difficulties in securing retrofit financing due to underwriting concerns related to atypical configurations, uses and market characteristics; challenges related to credit quality; and other barriers (CFIRE, pp. 16-18). By contrast, larger commercial buildings are likely to be the beneficiaries of a more robust array of financing options.

What follows is a basket of potential approaches to incentivizing resilience in businesses, according to size, to ensure implementation of mitigation in buildings and continuity in business processes. As stated earlier in this report, none of these approaches by themselves will be as effective as multiple approaches working together. If the proposed future *Mitigation Saves* study, which would specifically address the private sector, produces evidence of benefits exceeding costs by several-fold (MMC, Impact, p. 2), a set of combined strategies could be financially attractive in a business sense.

## 1. Innovations that increase property values and reduce financing risk.

Permanent lenders and equity investors, in their transaction underwriting, could consider the financial value of resilience based on property risk reduction. Property appraisers who consider resilience in developing valuations could verify this value that is determined and made explicit in the marketplace. The variables examined in property appraisals that resilience would be expected to affect include holding period risk (discount rate), eventual sale price (capitalization rate), potential insurance and replacement costs, and, potentially, market rents.

Another approach that could be applied to resilience is Fannie Mae's recently announced program to provide a 10 basis points interest rate reduction on loans for both newly constructed and existing certified green multifamily dwellings (Pearson). A market interest rate of 4 percent would be reduced to 3.9 percent, which for a \$10 million dollar loan amortizing over 30 years would save \$95,000 in interest payments over a 10-year term (Long). This approach also could be expanded to other commercial building types and to single-family residences.

In addition, lenders could require evaluation of properties for resilience in disaster prone areas, when properties change hands. In conjunction with opportunities to finance seismic, hurricane, or other retrofitting, a resilience assessment would grade each structure to allow potential buyers to take these variables into account when determining the property's value. The goal would be to use market mechanisms to encourage mitigation. If a mandatory resilience valuation proved too great a policy hurdle to tackle, sellers could be required to disclose whether they have undertaken such an evaluation (Adams, *Insuring a Way Out*, p. 10). In this case, real estate brokers would need education to facilitate this transfer of information.

For approaches like those described above, a positive value derived from resilience might:

- Allow a financial institution to increase the amount of permanent mortgage financing extended to a project, if the loan-to-value ratio is held constant by increasing the appraised value. (This would be advantageous to equity investors who wish to borrow to finance a property purchase).
- Add more security to a permanent mortgage loan, if the loan amount is held constant by increasing the appraised value. (This would be advantageous to the permanent mortgage lender).
- Reduce building loan rates for purchasers of commercial or residential property.
- Support higher rents and property prices, especially, if implemented mitigation strategies are reported to future owners as a seller requirement.
- As done for green projects, provide a basis for an added bonus of reduced insurance premiums for resilient projects as discussed below.

2. Insurance rate reductions for businesses that actively participate in resilience mitigation.

Where warranted by risk, insurance, through rate-reduction incentives, represents one of the most successful ways of promoting mitigation (Rose, p. 19) and, coupled with other incentives, helps to overcome individual biases against investing in mitigation (Kunreuther et al, p. 2). Resilience reduces risk for the property insurer, which facilitates the acquisition of insurance by businesses. Underwriters are expected to grant insurance premium reductions for structural and non-structural mitigation activities based on primary financial value established in property appraisals. An insurance program for green buildings could serve as a model for resilient construction. For example, in 2006, Fireman's Fund introduced a program for Leadership in Energy & Environmental Design (LEED) certified buildings, which offers a discount due to lower risk factors. Conventional insurance policies only cover the cost to restore a building to its original condition, but under Fireman's Fund Green Building Replacement, commercial property owners and managers are able to rebuild and replace with green alternatives (Fireman's Fund). With the growth of the green-certified building movement, other insurance carriers also have introduced insurance premium incentives for green construction.

Insurance companies can also reduce premiums based on a reduction of business interruption (BI) losses; which can easily exceed the losses associated with physical damages (MMC, Impact, p.5). An Allianz Risk Barometer 2015 survey revealed that for business interruption and supply chain risk caused by greater frequency and severity of natural disasters and extreme weather globally, as well as growing geo-political instability and unrest, the average business interruption claim at \$1.36 million is 32 percent higher than the average property damage claim at \$1.03 million (Wright, Alex).

There are two types of BI insurance: 1) insurance that covers lost profits when a business cannot operate due to damage to its facility; and 2) contingent business interruption insurance that covers a business unable to operate because one or more of its suppliers (including utility services) or employee access are disrupted. This form of insurance also provides working capital needed to purchase inventory for re-sale or inputs for production, over and above the standard property and casualty insurance policies, which cover repair and reconstruction (Rose, p. 19). Mitigation, both before and after disasters, would attenuate the business interruption losses, and therefore should have a net reduction on the business interruption insurance premium.

“More-resilient businesses pay less for insurance” is the business model of companies that invest a substantial amount in loss control, and as a result, less in claims. Businesses should prefer a more-resilient property—a roof not maintained, upgraded, or replaced to resist hazards represents a potentially large loss for the owner's bottom line.

3. Tax incentives and fee waivers.

Similar to the incentives for homes previously described, tax deductions, tax credits, or fee waivers should be used for businesses participating in resilience programs to implement mitigation strategies, including those that are mortgage and insurance-based.

4. Federal, state, and/or local grants directly to business owners for approved resilience strategies.

Agencies would grant funds directly to businesses to reinforce participation in mortgage and insurance resilience programs. Activities would need to be pre-approved and proven cost-effective.

### Small Businesses and Property Owners

Buildings owned by small businesses are likely to face special challenges implementing mitigation strategies for resilience. There is currently a significant market gap in supplying renovation financing for such properties. The following strategies are based on programs that apply specifically to small businesses.

1. Mitigation-based PACE program.

The Property Assessed Clean Energy (PACE) model could work for mitigation retrofits. PACE is a financing mechanism where local governments or designated financial institutions provide loan capital, which is paid back by assessing property taxes on the improvements. PACE is an emerging success story for small retrofit and renewable projects. The PACE mechanism, which improves loan security by collecting loan payments through the property tax bill and imposing a tax lien if the loan is not repaid, is highly accessible to small borrowers, including smaller commercial property owners (CFIRE, p. 21).

CFIRE has identified issues that would need to be overcome to conduct small mitigation projects through a model based on PACE, such as: transaction costs, including the time it takes to close loan transactions; program fees (in some cases); underwriting complexity; and borrowers that do not fully understand the “value” of a retrofit and are concerned about financial risk (CFIRE, p. 21). However, the PACE model, when financed exclusively or primarily with public or philanthropic capital, frequently overcomes the high upfront costs to property owners by amortizing the loan over a period of up to 20 years, roughly double the maximum loan term granted by private lenders. Investors also are protected under PACE, because of the attachment of a superior tax lien, and because the repayment obligation becomes attached to the property itself. Beyond the start-up costs, PACE programs cost nothing to taxpayers (Adams, *Insuring a Way Out*, p. 10).

2. SBA loans.

Federal credit supports could be used to finance small building retrofits for pre-disaster mitigation, as is the case with Small Business Administration (SBA) programs, such as Section 7(a) and Certified Development Company (CDC)/504, which provide credit enhancements to improve loan security and generate private financing for business assets, and sometimes for energy-efficiency upgrades (CFIRE, p. 22).

3. Public-private partnering to support mitigation-based PACE and SBA programs.

Private banks and financing sources have been actively involved in PACE financing and SBA loans, providing capital, structuring, and administrative services (CFIRE, p. 24). These activities also could be marshaled to support mitigation projects.

## Large Businesses

The following strategies apply to large businesses that issue corporate bonds or are the subject of investment vehicles.

1. Higher corporate bond ratings for companies that actively participate in resilience programs.

Rating companies could account for a business's catastrophe risk in the bond ratings for that business. The catastrophe risk factors would include both the property-related risk that catastrophe risk modelers, such as Risk Management Solutions (RMS), AIR Worldwide, and EQECAT, model and the business continuity risk associated with the lack of thorough business continuity and disaster response plans. A company with resilient assets and plans is likely to have more stable profits and a higher likelihood of taking advantage of, rather than suffering from, catastrophes that affect their industry. Some standards exist to measure both sources of risk. Rating agencies could develop standard procedures to report natural-hazard risk on a business's corporate balance sheet and to integrate resilience information with other credit rating factors. This strategy is most applicable to companies whose assets are significantly concentrated in facilities, plants, or equipment in a single region or urban area prone to a natural disaster, where such an event would have a profound effect on property loss and business discontinuity. It would likely not apply to companies with nationally distributed facilities, where loss in one region only incrementally affects profit and loss.

2. Resilience-based REITs and private equity real estate funds.

Real Estate Investment Trusts (REITs) have become a worldwide market valued at over \$1 trillion. Providing a liquid "stock-like" investment that both institutions and individuals can access, the REIT structure could be used to attract capital for investing in properties constructed or renovated to promote resilience. Given the complexity and cost of maintaining REIT status, in addition to the economics of generating sufficiently attractive returns for REIT investors, using a REIT structure would likely make the most sense for large aggregations of investment properties (CFIRE p. 26). REITs face catastrophe risk to their investment portfolio and commonly measure catastrophe risk for individual properties during the due-diligence stage of purchasing. However, they do not reflect that risk in their financial analyses or annual reports because they are not required to do so, and doing so on a voluntary basis would be a disadvantage for them relative to their competition (Porter et al 2004, p. 1215). To a large extent, this disincentive would vanish if rating agencies, or the U.S. Securities and Exchange Commission (SEC), were to establish standards for reporting catastrophe risk as a liability that reduces investment

yield. The more resilient the property portfolio, the lower the liability is, and the better the balance sheet.

Private equity real estate funds, which provide equity or mortgage financing for investment property, are also a substantial worldwide market, with 2014 global capitalization of \$742 billion (Preqin, p. 7). Private equity funds are already adopting sustainability strategies, and investing in resilience might be a logical extension of such strategies. As is the case with REITs, private equity real estate funds are probably best utilized for sizable portfolios of investment property.

### 3. Resilience bonds.

Just as REITs and other credit-worthy companies have the ability to issue corporate “green bonds” for sustainability investment in large projects (CFIRE, p. 26), “resilience bonds” could be used to finance organizations that finance or perform mitigation upgrades.

Case study data demonstrates that risk mitigation can yield impressive financial results. For example, the IKEA in the Red Hook section of Brooklyn, New York, which came through Hurricane Sandy with an operational store, used resilience techniques, such as putting the parking on the first level and the merchandise on the upper levels. Meanwhile, nearby Fairway, which was located in a 19th century warehouse at ground level, had to gut the building and restock its entire inventory (Rodin, p. 293).

In the early 1980s, Anheuser Busch assessed the risk to brewery buildings and equipment in its large brewery in Van Nuys, California, just a few miles from the epicenter of where the 1994 Northridge earthquake would later occur. The company seismically upgraded those with unacceptable levels, without affecting daily operations. Low-risk buildings, less important to operations and judged not to be life-safety hazards, were screened out of the process, thereby ensuring the most efficient use of limited resources. The total cost of the strengthening program was about \$11 million, less than 1% of the total facility replacement cost. After the Northridge earthquake, post-earthquake surveys conducted by Anheuser-Busch’s engineering consultants showed that none of the retrofitted structures sustained significant damage, nor did equipment essential to the brewery’s operations. Additionally, there were no major employee injuries associated with the earthquake. Other on-site buildings and equipment that had not been strengthened in the 1980s did sustain damage, requiring about \$17 million in repairs. The brewery was quickly returned to nearly full operation in seven days, following minor cleanup and repairs, and the restoration of the off-site water supply. Anheuser-Busch lost none of its pre-earthquake market share, which had been the overriding goal of the seismic risk reduction program. Anheuser-Busch estimated that the Van Nuys facility would have suffered a direct property loss of about \$350 million from the Northridge earthquake had there been no seismic strengthening. This averted damage is more than 30 times the actual cost of the brewery’s loss control program. Conservative estimates of direct and business interruption losses at the brewery—had there been no strengthening—could



have exceeded \$750 million, over 60 times the cost of the mitigation program. In turn, the market share losses would have exceeded the direct and business interruption losses.<sup>7</sup>

## Developers and Builders

Two other decision makers in the business arena have a potential role. Developers and builders need to engage in resilience discussions, and realize that there is a huge untapped market for more durable buildings. However, the culture of the industry needs to change to achieve results on a broad scale. Incentives can include:

1. Agreements with developers for increased resilience.

Developers and communities can work through a process to create development agreements that define what standards the communities want developers to adhere for the commercial facilities they intend to build. Communities can offer incentives to the developer for higher standards of construction by either providing tax incentives, investment in infrastructure to support the project, or alterations to design standards and densities that are beneficial to the developer. Most communities have Economic Development Corporations that can assist with these incentive programs. Developers can use the increased cost offset by the community's investment to build their development to meet the necessary resilience standards. For buildings built to sell or for lease, developers need to consider the role of renters in hazard risk, a process called loss control.

2. Contractor-based financing and execution.

CFIRE describes another growing market segment that could be used as a strategy for mitigation. Financing approaches that rely upon a master "contractor" that is also the source for financing make a lot of sense for smaller building retrofits, though there are inherent issues of conflict and performance. Service providers that design and execute retrofits are currently involved in all types of financing schemes. The benefit to contractors is that such project financing enables these small- to mid-sized contractors to offer in-house financing, significantly shortening sales cycles and extending their project pipelines (CFIRE p. 25).

## Utilities

Utilities, such as water, electric, gas, and telecommunications networks, are the lifelines of a community. When a utility ceases to function after a disaster, the community as a whole is impacted, whether or not homes and businesses are resilient.

There are three approaches to incentivizing resilience in utilities.

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<sup>7</sup> The Anheuser Busch case study is found in the California Seismic Safety Commission report, *Earthquake Risk Management: Mitigation Success Stories*, pp. 21-24.

1. Reduced insurance premiums (using the approach described above for businesses) to support avoidance of property damage and interruption losses.
2. A public utility commission policy that allows a small but immediate increase in rates to pay for system resilience enhancements for communities participating in a rating system.

Utilities should be allowed to add a small sun-setting rate increase for residences and businesses within a community or service area to be used to strengthen the utility within the community, increase its reliability, and to allow the community to increase its resilience rating. Utilities should focus their efforts on reducing cascading failures and ensuring that their systems within the community can be restored more quickly, or reduce the likelihood of failure. The utility will need to notify users of the rate increase and the anticipated sunset, with no extensions allowed. The notification at the time of the rate increase should inform ratepayers of the estimated benefits that accrue to them, such as reduced business-interruption risk and reduced risk of fire following an earthquake, to reassure them of the value of the effort. Informing the utilities of benefits to the community, as well as reduced risk to the utility's revenue stream might help to motivate utilities to participate.

3. Enhanced bond ratings for projects that incorporate resilience strategies.

Resilience should have relevance for public revenue-based bonds, which look to the project's cash flow for repayment. If resilient design makes the project less risky and therefore more valuable, that might influence bond terms (pricing/interest rate) and the amount that can be borrowed. Los Angeles is advocating working with local, regional, and state partners to develop a seismic resilience bond measure to help fortify water infrastructure (Mayoral Seismic Safety Task Force, p. 71).

## Communities

Community investment decisions are not dissimilar to those in the private sector in that resilience to disasters positively affects a community's reputation as a place to establish and retain businesses. Three approaches are available for incentivizing resilience in communities as decision makers.

1. Enhanced bond ratings for community facility projects that incorporate mitigation and resilience, or for any projects with a general-obligation bond in a community whose overall building stock is designed with greater resilience.

Communities that incorporate resilience in schools and other facilities have an increased capability to repay their bond obligations. Bond rating agencies could recognize those communities with a more favorable bond rating, which would thereby lower interest rates and increase bonding capacity. In a community whose building stock as a whole is designed with greater resilience, bond-rating agencies also could recognize lower default risk to general-obligation bonds. The city of Moore, Oklahoma, for example, now requires new buildings to resist 50% higher wind speeds (and 125% higher wind forces)

than the *International Building Code* requires, and as a consequence is less likely than surrounding communities to suffer loss to its tax-revenue base (City of Moore).

2. Federal and/or state grants allowing communities to create either a local mitigation grant program or a revolving fund loan program.

FEMA could create a component under the pre-disaster mitigation grant program that would allow local communities to receive grants and distribute funds to private businesses and/or residents to implement approved mitigation strategies. Alternatively, a community could use grants to support a low-interest loan program that allows longer-term investment in private-sector mitigation, both for businesses and residences. Such a program could fund local governments to provide revolving loans to property owners. Repayment and interest funds would then be re-invested in other properties, thereby creating an on-going program.

3. Building code programs that encourage local governments to adopt increasing standards for resilience, incentivized by federal and state investment through pre-disaster and post-disaster recovery funding.

Like LEED building standards, communities could put building codes in place with staged levels of resilience, e.g., bronze, silver, gold, and platinum, based on a community's tolerance level for risk, willingness to invest to buy down that risk, and overall vulnerability of the community. While facility buyers and owners would carry the increased cost of construction for the enhanced codes, agreement at the federal and state level to provide assistance through public assistance, individual assistance, and hazard mitigation programs (both pre- and post-disaster), could incentivize the entire community to accept and move towards higher standards for their local hazards. The public would have input through their local representatives in the code adoption process. One of the great challenges in convincing local governments to enact stricter building-code requirements is uncertainty, or a highly exaggerated perception of the costs associated with higher-performing buildings. (Preliminary estimates by MMC earthquake experts suggest that designing buildings to be 50% stronger against earthquake loads can increase costs on the order of 1%. A future *Mitigation Saves* study will better quantify those cost increases and the associated benefits of greater resilience.)



## Stakeholder Incentivization for Offerers

Like decision makers, stakeholders as offerers also have available a variety of incentives-based approaches to resilience. The following sections, separated into stakeholder category—private sector, communities, states and the U.S. Congress—highlight these targeted approaches.

### Private Sector

*Insurance companies:* The insurance industry already is active in incentivizing resilience. As shown in previous examples, State Farm’s IRR program for hail, and similar insurance programs created a win-win-win for homeowners, roof manufacturers and installers, and insurance companies. The FORTIFIED residential program for wind hazards also has demonstrated success in overcoming obstacles, and IBHS has since established a FORTIFIED program for commercial buildings (IBHS, FORTIFIED for Safer Business). In addition, FM Global considers resilience issues in-depth in its underwriting, and, for large projects, owners are engaging FM Global, AON, and others to recommend design criteria based on exposure and risk (Szoke, p. 3). Despite the fact that business insurance premiums for disaster risk mitigation are such a small percentage of business costs, and incentive rate reductions can easily be overlooked, these incentive programs have flourished (Rose, p. 25). The payback from reduced residential insurance premiums does not necessarily cover the cost of implementing resilience strategies within a reasonable amount of time, especially where premiums are less than \$2,000 per year (Szoke, p. 3). However, more companies will join in if they receive knowledge about the benefits of resilience and how it can maintain portfolio consistency. In California, for example, providing deeper premium discounts for claims-saving measures could be a way to increase take-up rates in the California Earthquake Authority program (Adams, *Insuring a Way Out*, p. 10). In addition, the incentives through mortgage-based rehab programs, as well as tax rebates and credits, can make insurance premium reductions attractive as part of an integrated strategy.

*Banks and other lenders:* With the exception of SBA lending, private banks have yet to emerge as a significant lender in the small building retrofit market because of small loan size, hybrid construction/permanent loan characteristics, poor security, underwriting complexity, and significant transaction costs (CFIRE, p. 24). Financial institutions also are constrained in commercial real estate acquisition, development, and construction (ADC) lending due to more-stringent, risk-based capital rules adopted as a result of the 2008 financial crisis. Many ADC commercial real estate loans now require additional capital set-asides by financial institutions, making them less attractive relative to less-risky investment vehicles (Rubin et al, p. 2). This development might constrain lending for major building resilience projects. Nevertheless, the financial sector is eager to participate in discussions about resilience to broaden the basis for loans. A recent FEMA-facilitated event with bankers, where they were asked for input, created enthusiasm within the industry. Private financial institutions have perhaps the most potential to scale and transform the retrofit finance market by integrating performance-based retrofit finance within their normal mortgage and refinance lending programs. Growing recognition of the market-based value created by hazard mitigation retrofits would increase collateral values and limit risk. However, such change will require financial institutions to address legal work for mortgage and related securities documentation, and to educate sellers and borrowers in the new

processes. If states require resilience standards, banks are more likely to step in, especially if standards are consistent or similar across jurisdictions so as to facilitate underwriting.

*Financial institutions:* Institutional real estate owners are beginning to recognize the importance of resilience. Grosvenor, a privately owned property group that has been developing and investing in real estate for more than 300 years (Barkham, p. 1), has assessed the effect of resilience on its portfolio with vulnerability, adaptive capacity, and resilience ratings for 50 of the most important cities worldwide that point clients to more stable investments (Barkham, p. 3). Its perspective on investing is summed up as follows, “Grosvenor’s ‘Living Cities’ approach recognizes that our future success as a business is tied to the sustainable growth of the cities in which we invest. The motivation for this research on city resilience is to enable Grosvenor, its clients, and partners to move beyond such classic but limited definitions of property risk, such as standard deviation of returns, projected vacancy rate, and forecast rental growth. These have relatively little meaning in the long term, and are particularly unhelpful in a world where the basic patterns of the last millennium are shifting. Successful real estate projects depend on the long-term stability and prosperity of cities.” (Barkham, p. 4)

Resilient properties also enhance the security of mortgage lenders. All other factors being equal, resilient properties constitute stronger mortgage loan collateral than less-resilient properties. This suggests that resilient properties, if pooled and sold as bonds, could enhance the credit quality of mortgage-backed securities. Appetite for securitized investments in environmentally-friendly and resilient properties is likely to grow with the growth of the green bond market, which reached \$36.6 billion in 2014 and is expected to exceed that amount in 2015.

*Foundations:* Private foundations can provide support for incentivization to fund resilience strategy valuation studies, as well as pilot studies involving targeted decision makers and incentives. For example, the 100 Resilient Cities program of the Rockefeller Foundation provides member cities with access to a suite of resilience-building tools and services supplied by selected partners from the private, public, academic, and nonprofit sectors. Among other purposes, these tools are able to aggregate, evaluate, and integrate data for decision making and assessing risk exposure to hazards (Yee).

## Communities

Communities themselves also are in a position to create incentives as offerers. Public-sector investment decisions are not dissimilar to the private sector at the core (Rose, p. 9). Communities need to be aware that resilience to disasters positively affects a community’s reputation (Ballen) as a place to establish and retain businesses for the long term, especially, if they ensure that the homes are intact so that persons who are employees of local businesses are able to report to work after a disaster, and do not become a reason for discontinuity. In addition to the previously discussed developer agreement, incentivizing strategies include:

1. Using community political will for promoting resilience.

National resilience is built from the bottom up, community by community, inclusive of businesses, neighborhoods, faith-based organizations, ethnic groups, and civic

associations (Wright, Roy). Tulsa, Oklahoma, is often mentioned as an example of resilience in action, based on the efforts of a vibrant community organization called Tulsa Partners (<http://tulsapartners.org/tpi/>), which has been able to achieve a comprehensive flood protection program.<sup>8</sup> The partnership is described as a grassroots movement that uses great technical skill, extraordinary political courage, and a cohesive, connected community asserting its will to insist that changes be made (Rodin, p. 100).

2. Local upgrades to building codes or adoption of ordinances.

The previously mentioned code enhancement adopted by Moore, Oklahoma, is sufficient to make new buildings withstand F1 and many F2 tornadoes, which comprise 95 percent of all tornadoes. Moore is the first city in the country to adopt tornado-specific building code provisions (APA-The Engineered Wood Association). San Francisco's Community Action Plan for Seismic Safety (CAPSS) led that city to adopt mandatory strengthening of soft-story, high-occupancy wood-frame buildings (Porter, p. 4), which house 8% of the city's population. Local financial institutions have supported the CAPSS loans for mandatory retrofits because of their dedication to having operations in the city (Rodin, p. 145). The city of Los Angeles developed a highly publicized earthquake plan, *Resilience by Design*, that advocates mandated retrofit of soft first-story buildings and concrete buildings built before the 1976 *Uniform Building Code* was enforced (Mayoral Seismic Safety Task Force, pp. 39 and 44). Another program that could be adapted to incentivizing adoption and enforcement of modern building codes is the Building Code Effectiveness Grading Scale (BCEGS<sup>®</sup>) program, a program of the Insurance Services Office, Inc. (ISO). The BCEGS classification measures the effectiveness of a community's building codes and enforcement through questionnaires and on-site interviews. The BCEGS database contains building code adoption and enforcement information for more than 15,000 building-code enforcement departments serving more than 20,000 communities nationwide (ISO). A favorable BCEGS rating might allow the community to apply for a better class rating in the Community Rating System (CRS), which might result in lower flood insurance premiums, but a negative classification might result in increased insurance premiums.

3. Acceleration of local permitting and inspection procedures.

Chicago implemented streamlined local permitting to encourage "green construction" (Rainwater, p. 32), a concept that could be exercised for enhanced resiliency as well. The city of San Francisco offers permit fee waivers for voluntary seismic retrofits. In addition, some cities waive inspection fees for work associated with voluntary seismic retrofit.

4. Encouraging resilience through zoning.

Communities could grant waivers to planning and zoning requirements or use zoning incentives to encourage the use of enhanced resiliency design and construction criteria. The Alaska Division of Community and Regional Affairs and the Alaska Division of

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<sup>8</sup> There is a good historical description in Judith Rodin's *The Resilience Dividend* (p. 96-101).

Homeland Security and Emergency Management have advocated offering incentives that include tax abatements, density bonuses, and off-street parking requirement waivers to encourage developers to locate projects outside of hazardous areas, and to adopt hazard mitigation measures that exceed those required by law (Boothby et al, p. 39).

5. Tax incentives and disincentives.

Communities can use their local tax authority to tax or otherwise penalize risk-prone behavior, such as failure to implement mitigation. The proceeds could be used to improve risk communication, data collection on risk and vulnerability, or implementation of other resilience measures.

Many more examples of community-based incentives, including locations where they have been implemented, appear in *Community Resilience Techniques*, prepared by NY Rising Communities ([http://stormrecovery.ny.gov/sites/default/files/documents/Community\\_Resilience\\_Techniques\\_October\\_2013.pdf](http://stormrecovery.ny.gov/sites/default/files/documents/Community_Resilience_Techniques_October_2013.pdf)) (NASEO, p.7).

## States

States have a key role in enhancing private-sector incentivization by both removing barriers to mortgage and insurance programs, and providing tax incentives and grants. State legislation critical for the support of incentives for resilience strategies can be marshaled for:

1. Tax incentives and grants.

The foundation of all progress in the building retrofit [and new construction] market is a high level of borrower demand (CFIRE, p. 20). States play a key role in enhancing private-sector incentivization of resilience strategies in both mortgage and insurance programs by providing tax incentives and grants. States should make it easy for homeowners to learn how to apply for mitigation grants, and establish uniform rules and regulations for contractors that perform mitigation work (ABAG, p.11). Even for earthquake insurance, premiums could be lowered based on seismic-retrofitting efforts, especially if high premiums are offset with a state tax incentive. (Adams, *Insuring a Way Out*, p.11)

2. Support for insurance.

States should modify insurance rate regulation so that it does not limit risk-based underwriting and pricing (Ballen).

3. Support for financing.

Legislation to achieve mitigation-financing flexibility could free property owners to amortize the cost of mitigation (Adams, *Insuring a Way Out*, p. 10). Seller disclosure laws also can have a major role in changing the public market and its perception on building resilience and mitigation. In many states, sellers and their real estate agents or



brokers are required to disclose information about the structure and its history. Disclosure could be extended for resilience. For example, sellers and real estate agents in tornado-prone areas could be required to furnish information on whether a home or business building has a tornado safe room for the occupants, or if the structure is designed to withstand an F1 or F2 tornado. Likewise, in earthquake-prone areas, disclosure of structural and non-structural mitigation strategies that have been built into, or retrofitted into the structure could help drive the marketplace to seek these resilience strategies, thereby incentivizing builders and owners to implementation.

#### 4. Stronger state-wide building codes.

Individual states, and the local jurisdictions within those states, are responsible for the adoption and enforcement of building codes, which establish minimum requirements to address life safety. Even though the majority of the population is protected by this minimum level (and some jurisdictions do exceed those requirements), adopting current building codes does not necessarily provide a level of enhanced resiliency (Szoke, p. 1). For seismic design, codes aim for life safety rather than continuity of building operations post-earthquake (Porter, p. 2), and do not account for the broader context of continuity over large urban areas (Porter, p. 1). When addressing other disaster threats, codes primarily provide for evacuation capability (Szoke, p. 2). Because decision makers, including homebuilders and building owners, focus on adhering to the lowest first cost, they usually oppose any code changes that increase the cost of construction (Szoke, p. 2). Yet, for the most part, the public has not been asked whether they are willing to pay for greater seismic [or any other hazard] resistance (Porter, p. 2). The San Francisco CAPSS, however, has demonstrated that landlords and tenants are willing to pay for higher levels of seismic retrofit to reduce the number of red, yellow, and green-tagged buildings following a disaster (Porter, p. 4). This opens the door for states to mandate a higher acceptable code level in urban areas to achieve a higher level of resilience. States could achieve even greater resilience by supporting even higher levels of performance through mortgage, insurance, tax, and grant incentives.

#### 5. Public-private partnerships.

CFIRE confirms that, to date, public-private ventures have been the most successful model for delivering energy-retrofit financing to the small commercial building sector. States, along with local governments and regional authorities, should become proactive in developing public-private partnerships for resilience through community development, economic development, and transportation planning programs, and should support contractor-led programs and a mitigation version of PACE. States, localities, and regional organizations, working with private-sector organizations, should help identify local program initiatives and offer community support to provide a proof of concept for larger programs (CFIRE, p. 30). Firms will work in a cooperative spirit if it is in their best interest, and for enlightened firms, best interest means not just short-run maximization of profits, but also maintenance of the business's image (Rose, p. 8).

## U.S. Congress

The U.S. Congress has a considerable role to play in fostering and enhancing both the private and public sectors' ability to implement resilience strategies through legislation that enacts tax strategies and grants as an extension to an integrated approach to support incentivization. Modifications to the FHA 203k program, mentioned previously, could support the use of mortgages to incentivize implementation of resilience strategies in the nation's homes.

A public-private sector approach to resilience could begin alleviating the federal government's support for response and recovery. At a National Institute of Standards and Technology (NIST) program on resiliency in Moore, Oklahoma, it was reported that the federal expenditures as a percent of total government expenditures on recovery after disasters has grown from 7% for Hurricane Diane (1955), to 23% for Hurricane Hugo (1989), to 50% for Hurricane Katrina (2005), to 68% for Hurricane Ike (2008), and to 80% for Super Storm Sandy (2012) (Szoke, p. 5).

It is not inconceivable that the day will come when a heavily indebted federal government will not be able to absorb the needs created by a large-scale disaster. According to the Congressional Budget Office's 2011 Long-Term Budget Outlook, even if revenues increase through 2021, discretionary spending will fall from the current 12.3% gross domestic product (GDP) to 9.1% GDP, while incurring a 7.5% GDP deficit. By 2035, discretionary spending will further decline to 8.1% GDP while incurring a 15.5% GDP deficit. Over this period, the debt held by the public will be 101% of GDP in 2021, and 187% of GDP in 2035. (The debt as of 2011 was 69% GDP.) Clearly, it is in the interest of government to support an incentives-based approach that provides the possibility of offsetting the government's growing incapacity to deal with disasters.

## Enhanced Incentivization Strategies

For businesses and utilities, a more far-reaching incentivization framework could be made possible by combining private-sector incentivizing for hazard resilience with incentivization for energy savings to enhance community security. In November 2013, ClimateWise<sup>9</sup>, Munich Climate Insurance Initiative (MCII), and the United Nations Environment Programme–Finance Initiative (UNEP-FI)<sup>10</sup> “jointly released a global insurance industry statement issuing a ‘collective call to action’ on ‘building climate and disaster-resilient communities and economies.’ It called on the insurance industry to exercise leadership both in reducing the emissions of greenhouse gases and in adapting to climate change’s unavoidable impacts, including strengthening disaster resilience” (Urban Land Institute, p. 10). Insurance and re-insurance companies concerned with the potential effects of climate change on insured building stock might grant premium reductions for both loss-reduction and energy-saving activities. Businesses and utilities that reduce potential losses and save energy would further enhance their bottom lines, making their corporate and revenue bonds more attractive.

This approach could trigger concomitant strategies in the other business-related incentives. For example, mortgage lenders can use both energy saving and potential-loss reduction to add property value as a basis for upgrading their assessment of loan security or providing additional capital for a project. The tax breaks that exist for installing energy-saving techniques can be similarly used for mitigation to enhance a comprehensive approach to security.

The National Association of State Energy Officials (NASEO) and the 56 state and territory energy offices have led innovation on energy assurance and emergency planning, mitigation, and response for more than 25 years. 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 (NASEO, p. 6). Programs include 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. At the state level, NASEO has identified opportunities for state energy offices to explicitly integrate disaster resilience and mitigation into existing energy programs and to enable program expansion during disaster rebuilding (NASEO, p. 31). NASEO asserts that many of the state energy offices’ existing efforts can help mitigate the impact of a natural disaster before it strikes, and can also be leveraged during the disaster recovery period.

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<sup>9</sup> Launched in 2007, ClimateWise is a not-for-profit organization of more than 40 insurance agencies.

<sup>10</sup> The United Nations Environment Programme–Finance Initiative (UNEP-FI) launched the *Principles for Sustainable Insurance* in 2012.



## Technical Support for Incentivization

In order to assure the effective implementation of resilience strategies through regulatory and business-based decision making, stakeholders—both offerers and decision makers— must determine the value of such strategies. They need better data and tools to identify localities with the highest risk, and where levels of increased building code requirements and incentives would be most effective, in addition to software to expedite underwriting of the financial impacts of mitigation and other business processes that support incentivization. Stakeholder offerers and decision makers also need an enhanced flow of information to promote incentivization. These tools and approaches for implementing incentivization are described below.

### Valuations

To support regulatory and business decision making, stakeholders need a recognized and standardized methodology to assess the dollar value of loss reductions based on implementing resilience strategies that can be used for property assessments, insurance underwriting, loans, investments, and bond valuations. This could be comprehensively developed as part of preparing Version 2.0 of *Mitigation Saves*, (the initial report established the metric four dollars saved for every dollar spent) (Rose, et al, and MMC, Volume 1, p. 5). Currently, the disaster-related component of most insurance policies is small, so “discounts” as incentives are limited (Ballen). Valuations need to take into account future loss from the expanded effects of disasters, such as business interruption. The cost-effectiveness of resilience should be evaluated in terms of its ability to manage short-term crises, to contribute to long-term sustainability, and to ensure resilience that will be implemented as efficiently as possible (Rose, p. 7). Valuations also should highlight the cost increment of mitigation versus doing nothing, to better recognize the benefits of implementing resilience strategies.

The first *Mitigation Saves* study evaluated a random sample of 10 years of FEMA hazard mitigation grants to arrive at the 4:1 benefit-cost ratio. However, there are many indications that the private-sector benefit-cost ratio would be at least as large (Rose, p. 3). The Consortium of Universities for Research in Earthquake Engineering (CUREE)-Caltech Woodframe project showed a benefit-cost ratio as high as 8:1 for earthquake retrofits, where cost was compared with the expected present value of future reduction in repair costs. One of the buildings in the study maintained the ability to be occupied after very rare, strong shaking by adding only 3% to the cost of conventional construction (Porter, p. 3).<sup>11</sup> For hurricane hazards, the MSFH program reduced the 100-year probable maximum loss (PML) by at least \$1.46 per dollar invested in grants, and if roof upgrades were covered by the grants, savings could be as high as \$2.50 (Young, p. 21).

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<sup>11</sup> As another low incremental cost example, the state of Georgia, which adopted the *2012 International Residential Code* Appendix R wind-resistant codes to provide resistance to F1 and F2 tornados, determined that the provisions in this optional appendix only add \$600 to the construction of a typical house (APA).

## Data

Stakeholders need enhanced data to identify the localities with the highest risk and those where a targeted level of building codes and incentives would be most effective. There are three risk landscapes in the United States for implementing resilience strategies:

1. Low-risk regions where current codes reflect the risk tolerance of residential and commercial property. For example, buildings in areas outside of Tornado Alley or the U.S. coastlines are adequately protected when they are built to the wind requirements of the model building codes. At least eleven states could be considered at low risk for earthquake damage (FEMA, p. 16).
2. Higher-risk areas where strengthening the model building codes would likely provide optimum risk-based protection. For example, raising the wind-speed criteria in tornado-prone areas would protect homes from F1 and F2 tornados (which are the majority of events for this type of hazard), or introducing or raising earthquake requirements in lower risk/high exposure regions, such as New York and New England.
3. Highest-risk areas where high-performance strategies, supported by robust incentivization programs are needed, beyond the model building codes to protect lives, families, businesses, supply chains, and the regional economy. These areas, generally high in exposure, include the hurricane-prone Atlantic and Gulf coastal regions, and the earthquake-prone regions in the states of California, Washington, Utah, and South Carolina, and the New Madrid seismic zone region. Studies using high-resolution data are needed to identify the extent of highest risk areas at the local level.

The benefits of using a high-resolution database can be seen for hurricane hazards based on the Florida's MSFH program. Over two-thirds of the locations (70%) surveyed would see a decrease in insurance premiums with the use of the high-fidelity information. Nearly half of these locations would have premiums drop by more than half. In addition, only 13% of the locations would see significant increases in premiums, ranging from increases of 10% to as high as 150% for the locations with the highest absolute risk from wind damage. Focusing mitigation grants on the homes that could face increased insurance rates would make mitigation attractive to the homeowner, and could make a new rate filing more acceptable to the regulators and other stakeholders (Young, pp. 26-27).

For earthquake hazards, codes prevent collapse on a per-building basis, which might be suitable in rural and exurban areas, and isolated communities. However, based on localized data, building codes in urban areas might need to be more stringent to ensure post-earthquake operability to make the economy more resilient, not just the buildings (Porter, p. 12).

For targeting incentivization and code strategies, Hazus, FEMA's publicly available vulnerability model, can identify areas of high and moderate risk and exposure down to the level of the census block, and further by inputting local data. Hazus has the capability to perform this task, and assess damage and loss for earthquakes, hurricanes, floods, and coastal surge. However, adding data to the model requires a more streamlined application than currently exists.

If the representative organizations for design professionals engaged in the development of design provisions for life safety and property protection had established valuations and data and vulnerability models, they, especially, structural engineers, would be in a better position to convey the need for higher levels of requirements based on exposure, assigned risk, expected losses, and consequences.

## Software Tools

Stakeholders also need software tools for business processes to support incentivization. User-friendly and publicly-available software needs to be developed, and widely employed by property appraisers, underwriters, and financial institutions to readily assess and verify loss reductions to support valuation for losses avoided. Architects and engineers can support valuations by conducting a second level, more in-depth analysis. Currently, the FEMA-funded free software Rapid Observation of Vulnerability and Estimation of Risk (ROVER) tool allows a building professional to screen buildings for seismic risk in a matter of minutes per building. Also, the Integrated Rapid Visual Screening (IRVS) tool, developed by the U.S. Department of Homeland Security (DHS) and pilot-tested with building managers, performs this function for earthquake, wind, flood, and other hazards. Both tools could provide needed software capability to support incentivization, if coupled with a capability to assess the valuations of resilience strategies.

## Flow of Information

It is essential that stakeholder offerers and decision makers have a flow of information on resilience in order to support implementation of mitigation strategies and buyer demand for facilities that have implemented such strategies. Assuring that such information is available to the necessary party at an appropriate decision point in a meaningful format is crucial, especially to communities seeking preventable deaths, sustainability, and business continuity. There are several organizations actively working in this arena. In coastal Alabama, stakeholders have created a culture, through information flow, centered on the IBHS FORTIFIED program that values resilient construction. The nonprofit grassroots organization, Smart Home America (<http://www.smarthomeamerica.org/>), provides information and resources to homeowners, builders, building industry professionals, insurers, and other community stakeholders on FORTIFIED construction and stronger building techniques. Another nonprofit, FLASH, collaborates with more than 100 public, private, and nonprofit partners to ensure that resilience activities, ideas, programs, and policies are adopted and implemented nationwide.

While there has been discussion about the ability for insurance to provide discounts or other incentives to implement mitigation measures, insurance agencies and brokers also serve as respected “risk messengers.” While engaging with clients (or prospective clients), insurance brokers can provide information, or otherwise raise the profile of risk and potential mitigation opportunities. Having materials available that focus specifically on the needs of insurance clients would be valuable.

Energy-use benchmarking and disclosure requirements have been successful in raising owners' awareness of how their properties perform relative to their peers, and in empowering prospective buyers or tenants in selecting properties that support this mission or meet fiscal constraints. Owners, buyers and tenants who have expanded knowledge of these resilience requirements established at the state or local level can facilitate mitigation-based decisions to be triggered upon the sale or lease of a property. In 2008, the state of Florida adapted the MSFH program rating scale to create a Uniform Home Grading Scale – a rating system that scored a home on a scale of 1 to 100 to measure a home's abilities to withstand windstorm damage. While no longer in use, this scale could be studied as a model for future rating systems to support benchmarking and disclosure tied to incentives. Such an approach will require the identification of information to be conveyed, the most effective format, and the party responsible for such reporting. In some instances, much of the information will be included in a facility's building information model (BIM) and/or computerized maintenance management system (CMMS). In the future, as the use of these tools expands, the burden of retrieving such data will diminish, but the protocols must be in place to allow for easy retrieval now.

Educating and training realtors and commercial real estate leasing and sales brokers on the state's disclosure policies also is important. While many prospective homeowners, tenants, and building owners may not have the sophistication to understand the benefits of building codes and other mitigation strategies (or even know to ask about such issues), realtors and commercial real estate brokers have an obligation to protect the interests of their clients and support decision making that reflects the client's mission and financial position. Developing educational tools for realtors and brokers, along with resources they can provide to their clients, will be an important leverage point for institutionalizing resilience, and a basis for owners and tenants to place value on mitigation practices and build demand. Such requirements should be incorporated into the standards of practice for the profession.



## Low-Potential and Ineffective Approaches

### Incentives with Less Potential

The MMC and CFIRE considered a number of different strategies during their research that they deemed as not having the same level of potential for operating in an incentives framework as those described earlier in this paper. These include:

1. Insurance rate reductions for communities participating in a resilience rating system.

One can postulate, based on the National Flood Insurance Program's Flood Insurance Community Rating System and private fire insurance ratings, if communities actively work to improve their resilience, it could play a significant role in their receiving a favorable rating from the insurance industry that would reduce their citizens' residential and commercial insurance for damaging events such as fire, flood, earthquake, hail, snow, and wind. However, even as this concept has appeared in many public policy documents, it is not realistic to expect private insurers, who underwrite homes and businesses at the individual level, to offer discounts to home or business owners who live and operate in designated resilient communities. In respect to the insurance model, the value of resilience to the community is an externality. Insurance only captures resilience to the extent that probable loss is affected. So, other than pure property loss reduction, the value, such as jobs retained and avoided reconstruction, is not captured. An exception might be made for wildfire, where the concept of "Fire Adapted Communities" takes into account community-wide approaches to defensible space that do relate to the risk the individual structures face, although the characteristics of the structure still matter. But community resilience does not necessarily affect an individual structure's vulnerability to wind or earthquake. Elevating building code requirements does make a difference, but only if an individual structure is built to a more modern code, not whether the community has adopted it.

2. Construction loans as a basis for a resilience incentive.

In contrast to the motivation a master "contractor" has for providing construction financing, the resilience issue is likely to be less important to the construction lender because the construction loan is heavily influenced by non-resilience criteria: 1) the strength of the permanent mortgage lender or equity investor; 2) the strength of loan repayment guarantees from/on behalf of the borrower, and 3) the higher risks/high probability of construction problems, when compared to the low probability of a disaster during construction. However, post-construction loans or loans to builder/owners might be able to play a role in incentives, since they go to an appraisal when they are refinanced (typically every seven years).

## Disincentives and Ineffective Incentives

Stakeholders, as they work to build a comprehensive incentives-based resilience framework, also need to take into account that disincentives can potentially reduce the penetration of mitigation programs into the private property arena.

1. Post-disaster federal assistance increasingly is seen as a disincentive to resilience. While it is true that post-disaster aid is somewhat limited for individuals and small businesses, the level of aid that goes to communities and community institutions can be much larger. When communities believe that something else (e.g., a government bailout) is handling disaster rebuilding, it heavily influences the disaster planning end game. Some utilities (large and small) and state and local governments manage risk under the assumption that they will be bailed out by governments. In 2013, at an American Meteorological Society symposium on healthcare, a speaker from a hospital in Galveston, Texas, described the decision to rebuild in the same vulnerable area as being motivated in some significant part by the oblique sentiment that “we’ve always been there,” apparently fostered by a very large federal co-share for disaster recovery expenses.
2. State insurance rate regulation that ignores risk-based pricing so that people can build in risky areas or ignore superior construction techniques. This has adverse physical consequences (more vulnerable structures), and financial consequences (a weaker insurance system, as private insurers often are unwilling to put their capital at risk). A recent article in the *Wall Street Journal* entitled, “Florida’s Hurricane Dry Spell Lasts,” summarizes the result of this policy as it has evolved in the last nine years in the absence of a major hurricane. The Florida mandate to “suppress insurance rates by underpricing insurance products” (Lehmann) has rendered the state “woefully ill-equipped to handle even a nominally active hurricane season should its resources be depleted by one large event or a series of events” (Lehmann).
3. Closely related to rate suppression, most coastal states have insurance residual markets that guarantee availability regardless of location or risk. Post-event deficits generally are paid by assessing all private insurers in the state, even those that are not writing in risky areas. In some states this includes areas beyond even property insurance. For example, auto insurers can be assessed in Florida. Following Hurricane Katrina, one commercial insurer’s residual market assessment in Mississippi was larger than the company’s annual premiums. The point of both of these examples is to underscore that insurance often does not operate in a free market, so the concept of discounts for resilience is not always simple to implement.
4. Property owners who make mitigation improvements might find their properties assessed at higher values and have to pay higher taxes. In contrast, however, California has exempted seismic rehabilitation improvements from higher assessments (Kunreuther et al, p. 20).
5. Strictly voluntary programs that benefit only the affluent and knowledgeable (Szoke, p.7). However, though the city of Berkeley program previously described is voluntary, it

has been highly successful because of its structured incentives and because it makes sense to people who buy residential property in Berkeley.

6. “One size fits all” programs, for example, those that do not take into account business size, residential construction practices, or regional risk factors.
7. Post-disaster blanket enforcement of all other code requirements beside those for mitigation, such as increased plumbing installations, which drive up rehabilitation costs.

In principle, incentives can work when:

- Carrots and sticks are used for incentivizing. For example, the U.S. Department of Energy (DOE) uses federal funding as a carrot to achieve energy savings.
- Everyone is included in an incentives-based program. For example, the opposition to increasing the wind design speed in tornado zones can go away if the bar is raised for everyone, even if loss is minimized only in that part of a community on the edges of the tornado.
- Incentives or regulatory requirements are supported by underlying risk, vulnerability, loss reduction, and cost-benefit data, rather than by mandating.
- Programs are tailored to different states. For example, Alabama uses an insurance-based incentives program, while South Carolina uses a grant-based program.
- States exercise flexibility to create exceptions to code requirements that fit special situations.



## Conclusion

Stakeholders need an alternate approach to meet the growing losses and deleterious effects that natural disasters have on lives and property in a climate of scarcer federal and state resources. Such an approach should consist of an integrated set of resilience strategy incentives implemented through mortgages and loans, insurance, finance, tax incentives, and grants. Every public and private stakeholder in resilience needs to act. Based on the possible programs identified in this white paper, a summary blueprint for public-private incentives for supporting resilience falls into seven categories:

- Develop the technical support for incentivization, by:
  - Evaluating the financial impact that resilience strategies will have on regulatory and business processes.
  - Mapping community levels of risk as a basis for implementing levels of resilience.
  - Designing software tools to support incentivization processes.
  - Improving the flow of resilience information to stakeholders.

These approaches should be used in a cost-effective way to support “what kind of mitigation” and “how much mitigation.”

- Develop supporting insurance, loan, and investment processes (e.g., assessments and underwriting).
- Develop community-based incentives (e.g., permit acceleration).
- Develop programs tailored to utilities (e.g., small rate increases to help fund resilience efforts).
- Enhance building codes based on political will or the willingness of the public to pay for a higher level of security.
- Develop incentives programs by:
  - Enhancing and expanding existing programs (e.g., the South Carolina Safe Home Program and FORTIFIED).
  - Modifying existing related programs (e.g., the FHA 203k and Fannie Mae rehab programs).
  - Modifying green programs (e.g., PACE, SBA loans and Fannie Mae lower rate mortgages) for resilience.
  - Forming new programs (e.g., commercial loans).
  - Initiating public-private partnerships.
- Support incentivizing activities with tax incentives, tax credits, and grants.

Incentivizing strategies should avoid disincentives, such as increasing property taxes based on resilience upgrades, and not basing insurance on an appropriate level of risk.

Implementation requires input and field experience from incentivizing stakeholders; interaction with code organizations and local, state, and federal agency officials; and expertise from business continuity planners, emergency managers, academia, and the national laboratories to ensure that resilience practices (especially any to be mandated) reflect a wide consensus of what stakeholders constitute is an appropriate level of mitigation.

Promoting resilience with these approaches should become part of good business sense, and integral to maintaining and enhancing the nation's economy. To reduce property loss, business interruption, and human tragedy; to support and (reduce the need for) disaster response and recovery; and to provide co-benefits that improve businesses and communities, incentivization is ready to be positioned as the nation's way to implementing resilience.

## References

- ABAG, *Shaken Awake!* June 13, 2011, Conference Summary. <http://goo.gl/VE0WtG>.
- Adams, Ian, *Before the Flood: Reducing Louisiana's Vulnerability to Severe Weather through Market-Based Insurance Reforms*, Pelican Institute for Public Policy, February 2015.
- Adams, Ian, *Insuring a Way Out: Modernizing the California Earthquake Authority*, R Street Policy Studio, 2015.
- Alabama Department of Insurance, *Strengthen Alabama Homes*, 2015, <http://www.aldoi.gov/SAH/Home.aspx>.
- APA-The Engineered Wood Association, *Moore, Oklahoma, Amends Building Code to Require More Wind-Resistant Construction Systems*, News from APA, June 2014. <http://www.apawood.org/moore-oklahoma-amends-building-code-to-require-more-wind-resistant-construction-systems>.
- Ballen, Debra, "Managing Risk through Mitigation." Special Session—Ten Years after "Mitigation Saves": An Examination of the Value of Private-Sector Investment in Mitigation, Building Innovation 2015: The National Institute of Building Sciences Third Annual Conference & Expo, Washington, D.C., January 6-9, 2015.
- Barkham, Richard; Brown, Kate; Parpa, Cynthia; Breen, Charlotte; Carve, Siena; and Hooton, Christopher, *Resilient Cities, A Research Report*, Grosvenor Group Limited, 2014.
- Boothby, Taunnie, Cox, Sally Russell, Gravier, Ann, *Increasing Community Resilience by Integrating Hazard Mitigation into Local Comprehensive Planning Efforts*, 2012 Alaska Planning Conference, Anchorage, Alaska, November 13, 2012.
- California Seismic Safety Commission, *Earthquake Risk Management: Mitigation Success Stories, SSC Report 99-05*, 1999.
- City of Berkeley, California, *Real Property Transfer Tax – Seismic Retrofit Refund*, <http://goo.gl/nA5IT3>.
- City of Moore, Oklahoma, *City Adopts New Building Codes, First in the Nation*, 2014. <http://www.cityofmoore.com/node/2111> [viewed November 25, 2014].
- Congress of the United States, Congressional Budget Office, June 2011, *CBO's 2011 Long-Term Budget Outlook*. [http://www.cbo.gov/sites/default/files/06-21-Long-Term\\_Budget\\_Outlook.pdf](http://www.cbo.gov/sites/default/files/06-21-Long-Term_Budget_Outlook.pdf).
- Council for Finance, Insurance, and Real Estate (CFIRE), *Financing Small Commercial Building Energy Performance Upgrades: Challenges and Opportunities*, National Institute of Building, Washington, D.C., January, 2015.

Daniel, Christine, *Replace the Residential and Commercial Energy Conservation Ordinances (RECO and CECO) with the Building Energy Saving Ordinance*, City of Berkeley Office of the City Manager, February 2015. <http://goo.gl/ErZ190>.

Disaster-Smart, *Fortified a Program of the Insurance Institute for Business & Home Safety*, 2015. <http://www.disaster-smart.com/fortified.php>.

Egli, Dane and McKinney, Jared, "Economics of Resilience," (December 2014) *CIP Report*, Center for Infrastructure Protection and Homeland Security, Vol., 14, No. 5, pp. 6-7.

Fannie MAE, *HomeStyle® Renovation Mortgage*, 2014.  
[https://www.fanniemae.com/content/fact\\_sheet/homestyle-renovation-factsheet.pdf](https://www.fanniemae.com/content/fact_sheet/homestyle-renovation-factsheet.pdf).

Federal Emergency Management Agency (FEMA), HAZUS®MH Estimated Annualized Earthquake Losses for the United States, FEMA 366, Washington, DC.

Fireman's Fund, "Fireman's Fund Introduces Green Building Coverage," *Insurance Journal*, October 2006. <http://www.insurancejournal.com/news/national/2006/10/16/73335.htm>.

Florida Commission on Hurricane Loss Projection Methodology, 2010. *Windstorm Mitigation Discounts Report to the Governor, the Cabinet, the President of the Senate, and the Speaker of the House of Representatives*.

Florida Office of Insurance Regulation, *Mitigation Discounts, Summary for the Florida Commission on Hurricane Loss Projection Methodology*, Tallahassee, FL, August 12, 2009

Florida State University, *Hurricane Mitigation Inspection System Study Final Report*, September 10, 2010.

FM Global, "FM Global's Resilience Index Recognized by Business Insurance Magazine with an Innovation Award," *News and Events*, March 11, 2015.  
<http://www.fmglobal.com/page.aspx?id=903112015>.

HomeBridge, *Fannie Mae HomeStyle: LifeStyle Home Improvement Loan*, HomeBridge Financial Services, 2014.

Insurance Institute for Business and Home Safety (IBHS), *FORTIFIED for Safer Business Fact Sheet*, [https://www.disastersafety.org/wp-content/uploads/FFSB-factsheet\\_IBHS.pdf](https://www.disastersafety.org/wp-content/uploads/FFSB-factsheet_IBHS.pdf).

Insurance Institute for Business and Home Safety (IBHS), *What is FORTIFIED Fact Sheet*, [http://www.aiia.org/documents/Resources/IBHS/FH-Existing-Fact-Sheet\\_IBHS.pdf](http://www.aiia.org/documents/Resources/IBHS/FH-Existing-Fact-Sheet_IBHS.pdf).

Insurance Services Office, Inc. (ISO), *ISO's Building Code Effectiveness Grading Schedule (BCEGS®) Update Project*, ISO Mitigation Online, <http://www.isomitigation.com/building-code-regulation.html>.



Kahan, Jerome, February 2015, “Resilience Redux: Buzzword or Basis for Homeland Security,” *Homeland Security Affairs: The Journal of the NPS Center for Homeland Defense and Security*, <https://www.hsaj.org/articles/1308>.

Kajab, Spencer, “Florida’s Hurricane Dry Spell Lasts,” *Wall Street Journal*, November 28, 2014.

Kunrether, Howard, Meyer, Robert, and Michel-Kerjan, Erwann, *Overcoming Decisions Biases to Reduce Losses from Natural Disasters*, Risk Management and Decision Processes Center, The Wharton School of the University of Pennsylvania, August 2009.

Latham, Molly, “Getting Private Sector Buy-In for Mitigation Efforts.” Special Session — Ten Years after “Mitigation Saves”: An Examination of the Value of Private-Sector Investment in Mitigation, Building Innovation 2015: The National Institute of Building Sciences Third Annual Conference & Expo, Washington, D.C., January 6-9, 2015.

Lehmann, R.J., “Lasting Reforms for Florida’s Property Insurance Market,” *Backgrounder*, The James Madison Institute, No. 75, January 2015, pp. 3 & 7.

Long, Marisa, *Fannie Mae Rewards LEED-Certified Multifamily Properties with a Lower Interest Rate*, Green Building Council, February 6, 2015. <http://www.usgbc.org/articles/fannie-mae-rewards-leed-certified-multifamily-properties-lower-interest-rate?sf7316854=1>.

Mayoral Seismic Safety Task Force, *Resilience by Design*, Los Angeles, 2014.

Mortgage 101, *FHA 203k Rehab Loan: Advantages and Disadvantages*, <http://www.mortgage101.com/article/fha-203k-rehab-loan-adv-disadv>.

Multihazard Mitigation Council (MMC), *Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities, Volumes 1 and 2, Report to U.S. Congress on behalf of the National Institute of Building Sciences*, Washington, D.C., 2005.

Multihazard Mitigation Council (MMC), *Natural Hazard Mitigation Saves – The Impact of Private-Sector Investments*, National Institute of Building Sciences, Washington, D.C., 2014.

National Association of Energy Officials (NASEO), *Resilience through Energy Efficiency: Disaster Mitigation and Residential Rebuilding Strategies for and by State Energy Offices*, Arlington, VA.

The National Academies, *Disaster Resilience: A National Imperative*, National Academies Press, Washington, D.C., 2012.

Pearson, Candace, “Fannie Mae Offers Lower Interest Rates to Green Multifamily,” *Environmental Building News*, February 20, 2015. <https://www2.buildinggreen.com/article/fannie-mae-offers-lower-interest-rates-green-multifamily>.

PMI Mortgage Insurance Company, *Fannie MAE, HomeStyle® Renovation Mortgage*, [http://www.pmi-us.com/media/pdf/resourcecenter/uwguides/pmi\\_fannieHomeStyleRenovation.pdf](http://www.pmi-us.com/media/pdf/resourcecenter/uwguides/pmi_fannieHomeStyleRenovation.pdf), 2011.

Porter, K.A., J.L. Beck, R.V. Shaikhutdinov, S.K. Au, K. Mizukoshi, M. Miyamura, H. Ishida, T. Moroi, Y. Tsukada, and M. Masuda, 2004. "Effect of seismic risk on lifetime property value," *Earthquake Spectra*, 20 (4), 1211-1237, <http://www.sparisk.com/pubs/Porter-2004-LPV.pdf>

Porter, Keith A. (2015) "Safe Enough? A Building Code to Protect Our Cities as Well as Our Lives," *Earthquake Spectra* In-Press. doi: <http://dx.doi.org/10.1193/112213EQS286M>.

Preqin, *2015 Preqin Global Real Estate Report*.

Pritchard, Justin, *FHA 203k Loan Costs and Pitfalls*, About Money, <http://banking.about.com/od/fha203k/a/fha203kloanCostsRules.htm>.

Rainwater, Brooks, *Local Leaders in Sustainability, A Study of Green Building Programs in Our Nation's Communities*, American Institute of Architects, 2007.

Rodin, Judith, *The Resilience Dividend*, The Rockefeller Foundation, New York, NY, 2014.

Rollins, John, "Improving Wind Mitigation Incentives," *Air Currents*, AIR Worldwide, August, 2013.

Rose, Adam; Porter, Keith; Dash, Nicole; Bouabid, Jawhar; Huyck, Charles; Whitehead, John; Shaw, Douglass; Eguchi, Ronald; Taylor, Craig; McLane, Thomas; Tobin, L. Thomas; Ganderton, Philip T.; Godschalk, David; Kiremidjian, Anne S.; Tierney, Kathleen; and West, Carol Taylor, "Benefit-Cost Analysis of FEMA Hazard Mitigation Grants," *Natural Hazards Review*, 8(4), 97-111 (2007), [http://dx.doi.org/10.1061/\(ASCE\)1527-6988\(2007\)8:4\(97\)](http://dx.doi.org/10.1061/(ASCE)1527-6988(2007)8:4(97)), Online Publication Date: November 1, 2007.

Rose, Adam, Chapter 3. *Capturing Co-Benefits on the Private Sector Side*, Prepared for the World Bank, Washington, D.C., 2015.

Rubin, Joseph; Giczsewski, Stephan; and Olson, Matt, *Basel III's implications of commercial real estate*, Ernst & Young Financial Services, August 2013

South Carolina Department of Insurance, *Status of the South Carolina Coastal Property Insurance Market*, Status Report for 2014, January 30, 2015.

Szoke, Stephen, *Further Considerations for Enhanced Resilience, Prepared for the Multihazard Mitigation Council*, 2014.

The Travelers Institute, *Coastal Wind Zone Plan*, Washington, D.C., 2009.

Urban Land Institute, *What the Real Estate Industry Needs to Know about the Insurance Industry and Climate Change*, 2014.

Weis, Daniel and Weidman Jackie, *Disastrous Spending: Federal Disaster-Relief Expenditures Rise amid More Extreme Weather*, Center for American Progress, April 29, 2013.

Wright, Alex, "Supply Chain Risks: Breaking the Chain," *Risk & Insurance*, February 4, 2015. <http://www.riskandinsurance.com/category/lines/business-interruption/>.

Wright, Roy, "Means and Methods for Creating Resilient Communities." Special Session — Ten Years after "Mitigation Saves": An Examination of the Value of Private-Sector Investment in Mitigation, Building Innovation 2015: The National Institute of Building Sciences Third Annual Conference & Expo, Washington, D.C., January 6-9, 2015.

Yee, Liz, *What Is The 100 Resilient Cities Platform of Partners?*, Rockefeller Foundation, October 14, 2014. [http://www.100resilientcities.org/blog/entry/what-is-the-100-resilient-cities-platform-of-partners#/\\_/](http://www.100resilientcities.org/blog/entry/what-is-the-100-resilient-cities-platform-of-partners#/_/).

Young, Michael, *Analyzing the Effects of The My Safe Florida Home Program on Florida Insurance Risk*, RMS Special Report, Prepared for the Florida Department of Financial Resources, May 14, 2009.

Zillow, *FHA 203k Loans: What Are They? What Are the Benefits?* <http://www.zillow.com/mortgage-rates/finding-the-right-loan/fha-203k/>.





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