National Institute of BUILDING SCIENCES

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

An Addendum to the White Paper for

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

An Addendum to the White Paper for
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)

September 19, 2016

An Authoritative Source of Innovative Solutions for the Built Environment

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Foreword

A year ago, the National Institute of Building Sciences published a white paper, *Developing Pre-Disaster Resilience Based on Public and Private Incentivization,* to address ways the nation's communities could improve their mitigation and resilience efforts. The Multihazard Mitigation Council (MMC) and the Council on Finance, Insurance, and Real Estate (CFIRE), the two councils that developed the paper, offered a new approach that puts the focus on incentivizing stakeholders to invest in mitigation efforts to improve resilience before disaster strikes.

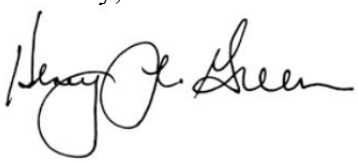
In the year since its release, the white paper has kicked off a major conversation among the nation's mitigation community. Institute representatives have provided testimony before a House of Representatives subcommittee and participated in a disaster-related event at the White House. Clearly, incentivization is an important topic. Louisiana experienced a major 1,000-year flooding event; wildfires devastated a number of California communities; and historic Ellicott City, Maryland was ravaged by a flash flood. In addition, many states have experienced extreme weather, including severe snow, rain, and wind storms and record-breaking temperatures.

In the wake of these events and other related activities, the Institute has initiated two important efforts to support community resilience. MMC and CFIRE developed this document, *An Addendum to the White Paper for Developing Pre-Disaster Resilience Based on Public and Private Incentivization*, to advance the incentivization concepts of the original white paper, summarize the programs available for incentivization, propose layered approaches using multiple incentivization strategies, and define a resilience economy to enhance the construction industry.

The MMC is in the process of finalizing funding to begin the follow-on study, under the leadership of the Federal Emergency Management Agency, to update *Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities*. The 2005 study found that every dollar spent by FEMA on mitigation saved society an average of four dollars in future losses. The new study will examine the benefits associated with federal mitigation grant programs and the effects of code enhancements to support mitigation in the private sector. The study will provide a basis for valuing mitigation to support incentivization, and offer motivation to the private sector to invest in resilience. Please consider supporting this important work in making the case for both public- and private-sector investments in mitigation.

For more than 40 years, the Institute has served to improve the built environment and make United States communities safer and more resilient. This addendum and the white paper it builds upon offer tools that the nation's communities can use to better achieve that goal.

Sincerely,



Henry L. Green, Hon, AIA

President

Executive Summary

In October 2015, two programs of the National Institute of Building Sciences—the Multihazard Mitigation Council (MMC) and the Council on Finance, Insurance and Real Estate (CFIRE)—published the white paper, ***Developing Pre-Disaster Resilience Based on Public and Private Incentivization***. That ground-breaking work described how the nation can achieve resilience to hazards in a cost-effective manner through a holistic and integrated set of public, private, and hybrid programs that incentivize action. This document, *An Addendum to the White Paper for Developing Pre-Disaster Resilience Based on Public and Private Incentivization*, builds on the white paper, providing an updated concept of incentivization, additional examples of incentives for the stakeholder community, and proposed layered approaches using multiple incentivization strategies; and, defining a resilience economy to enhance the construction industry.

Several activities contributed to this addendum, including preparing for two symposia on incentives held in January during *Building Innovation 2016: The National Institute of Building Sciences Fourth Annual Conference and Expo;* providing testimony before the U.S. House of Representatives Committee on Transportation and Infrastructure Subcommittee on Economic Development, Public Buildings, and Emergency Management in May 2016, which offered incentivization as a strategy to reduce government exposure in disaster response and recovery; developing an article for the October 2016 *Journal of the National Institute of Building Sciences* that highlighted the growing interest in incentivization in the private and public sectors; and being involved in the *White House Forum on Smart Finance for Disaster Resilience*, which addressed new investment approaches and incentives programs currently being deployed in communities. (That event reflected many of the concepts in the white paper, and feedback from attendees confirmed that the paper's proposed recommendations and programs are on target.) In addition, a new study for Florida wind hazards, in which benefits exceed the 1:4 cost-benefit ratio determined in MMC's 2005 study, *Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities,* also has reinforced the case for incentivization. Based on these activities, the MMC and CFIRE further refined and expanded the concepts of incentivization first identified in the 2015 white paper.

Incentivization is a process meant to work with, and be tailored to, a broad range of localized resilience approaches that vary from state to state and community to community. The goal of using incentives to achieve resilience is to create a product that consumers demand. As identified in the white paper, the effective utilization of incentives relies on using optimal resilience measures, flexibility, coordination, and facilitation. Mitigation strategies should be applied for individual buildings on a broad scale to support continuity, as well as property protection, and ultimately should be construed to be in both the public and private interests. Investing in mitigation for buildings and infrastructure and efforts to raise risk awareness are two separate, but essential, components of achieving community resilience. However, incentives programs should emphasize mitigation investment, correctly implemented and verified, as the surest way to save lives, reduce disaster losses and ensure continuity after a disaster.

The incentivization white paper proposed that the MMC potentially develop a methodology for valuation when the Committee updates its 2005 *Mitigation Saves* study. As this addendum is in process, several federal agencies and private-sector organizations are considering funding *Mitigation Saves* Version 2.0.
The flow of resilience information also requires transfer of local knowledge, of communities helping communities, to increase the penetration of incentive programs. Further, communities need to communicate to their own residents when incentives programs exist, and provide simple explanations of how they work. Arup and the U.S. Resiliency Council (URSC) have rating systems available with benchmarking and disclosure requirements to raise owners' awareness of how their properties perform relative to their peers. In addition to seeing how individual properties perform, stakeholders will need to develop the means of measuring how well

incentive programs generate resilience to increase the effectiveness of penetration, cost-benefits, program awareness, and other metrics. Beyond the incentivization strategies listed in the white paper, this addendum offers strategies in the categories of insurance, mortgages finance, and taxes. This addendum combines these new strategies in tabular form with the existing insurance, mortgage, finance, and tax-based incentives identified in the original white paper.

Incentivization can be even more effective when multiple strategies are combined to increase benefits to the offerer, while also providing consumers with a product they want. Selected programs from the original incentivization white paper and this addendum can be combined with each other, including existing, new and modified programs, to incentivize resilience in residences, businesses, utilities, and communities. This addendum provides examples of layered programs in tabular form that could maximize the impact of incentives to provide a concept for stakeholder construction of comprehensive incentivization programs.

Stakeholders need to come together to begin formulating the mechanisms for incentivization. Communities, in concert with the private sector and with the backing of the state government, will need to conduct pilot studies as test beds for developing incentivization-based resilience. Ultimately, with enough stakeholder involvement and pilot studies, an economy based on the consumer-oriented goal of resilience has the potential of emerging as a six-stage engine, involving private and public organizations in resilience support, planning, incentivization, implementation, evaluation, and communication. Resilience will be achieved through combinations of approaches, some led by the community, some led by the private sector, some as public-private partnerships, and some led by outside entities such as foundations, federal agencies, or states. Ultimately, greater execution of resilience will produce case studies, performance evaluations, peer-to-peer communication, and information that will feed back into research to support developing improved approaches to resilience, better data, and more reliable risk models, mitigation strategy valuations, and valuation modeling. Incentivization can be further enhanced by combining programs for generating energy efficiency and production with resilience strategies, and increasing the internalization of sustainable development factors into financial decision making.

In the year since the white paper came out, interest in the concept of incentivization has grown, reaching a House of Representatives Subcommittee and even the White House. As a concept, incentivization currently holds the most potential for offering a solution to the chronic underfunding of mitigation to reduce the effects of disasters. It is now time for stakeholders to develop the policy, regulatory, and business models to take incentivization from concept to implementation.

Introduction

In October 2015, two programs of the National Institute of Building Sciences—the Multihazard Mitigation Council (MMC) and the Council on Finance, Insurance, and Real Estate (CFIRE)—published the white paper, ***Developing Pre-Disaster Resilience Based on Public and Private Incentivization***. That ground-breaking work described how the nation can achieve resilience in a cost-effective manner through a holistic and integrated set of public, private, and hybrid programs based on capturing opportunities available through insurance; mortgages and loans; finance; tax incentives and credits; grants; regulations; and enhanced building codes and their application. This focus on multiple pathways to incentivize action is called "incentivization." The white paper provided a catalogue of potential incentives to achieve disaster resilience—what insurance, finance, foundations, and government stakeholders can offer in the form of economic incentives for mitigation decision makers, including homeowners, businesses, utilities, and communities. That same month, the *Journal of the National Institute of Building Sciences (JNIBS)* published the article, *Using Public and Private Incentives to Promote Pre-Disaster Resilience*, summarizing the report. This document, *An Addendum to the White Paper for Developing Pre-Disaster Resilience Based on Public and Private Incentivization*, provides a more updated concept of incentivization, as well as additional examples of incentives for the stakeholder community that have been identified through further research, discussion within the MMC, and events since the publication of the white paper. Additionally, the addendum proposes layered approaches using multiple incentivization strategies, and defines a resilience economy to enhance the construction industry.

The MMC and CFIRE intended the incentivization white paper to begin an ongoing dialogue among stakeholders about using a realizable approach to achieve resilience, and such a discussion has begun. In January, during *Building Innovation 2016: The National Institute of Building Sciences Fourth Annual Conference and Expo,* experts from residential and commercial real estate, the business community, finance, insurance, the utility sector, and government convened during two symposia, "Realizing Resilience: Incentives for Owners and Operators" and "Realizing Resilience: Incentives for Local Leaders and Lifelines," to discuss the development and use of resilience incentives. The April 2016 edition of *JNIBS* included the article, *Realizing Resilience through Incentives: Results from the Institute's 2016 Symposium*, which reported on those proceedings.

On May 12, 2016, MMC Chair Kevin Mickey testified about incentivization before the U.S. House of Representatives Committee on Transportation and Infrastructure Subcommittee on Economic Development, Public Buildings, and Emergency Management. The process of developing the oral and written testimony for the hearing further refined the goals and objectives of incentivization. (In addition, the upcoming October 2016 edition of *JNIBS* will include an article, *Widespread Support for Incentivizing Disaster Resilience*, which builds upon the concepts given in Mickey's presentation and provides a survey of private sector, federal agency, state, White House and Congressional representatives supporting incentivization.)

Then, on August 3, the White House Council on Environmental Quality hosted the *White House Forum on Smart Finance for Disaster Resilience,* which addressed insurance, mortgage, tax, and finance-based strategies to support pre-disaster mitigation and community resilience. The forum brought together White House and Administration officials; representatives from federal, state, and local government; mortgage and insurance representatives; codes and standards developers; and others interested in promoting mitigation. The purpose of that event, which focused on many of the same concepts as the original white paper, was to highlight new investment approaches and incentive programs that are currently being deployed in communities, and to explore partnerships and opportunities to leverage additional resources in the future.

During the forum breakout sessions, Institute representatives shared a summarized version of the incentivization white paper, entitled *An Introduction to Pre-Disaster Resilience Based on Public and Private Incentivization*. Throughout the discussions, the key message the representatives received was this: the success of such an incentivization rollout will require public and private participation, but the recommendations and programs proposed in the incentivization white paper are on target.

This addendum begins with further support for the case for incentivization, then redefines the relationship of incentives to definitions of resilience, describes the goal of resilience in a world of incentives, adds to characteristics of incentivization that govern how it is applied, and provides additional insights on technical support for incentivization, including valuations and the flow of information on resilience.

For clarity and to promote their application, this addendum arranges in tables incentives from the original white paper into five major categories: insurance-based, mortgage-based, finance-based, tax-based, and general (including the use of codes, among other strategies). It then offers, based on further research of existing and proposed programs, additional strategies for potential use, and other possible programs that need to be modified or constructed by stakeholders and their organizations. Five tables of layered incentive programs provide examples for maximizing the impact of incentives for an office building, a utility, a residence, community level housing, and affordable housing, and furnish approaches for stakeholder construction of comprehensive incentivization programs. The addendum then outlines the role of stakeholders for developing incentivization strategies and conducting pilot studies for incentives-based resilience in communities. From these initiatives, an economic engine has the potential of coming to fruition based on the goal of incentivizing resilience. A table describes a six-stage process that defines the role of private and public organizations in resilience support, planning, incentivization, implementation, evaluation and communication.

Additional Incentivization Concepts

The following concepts amend and enhance the description of incentivization found in the original white paper:

The Case for Incentivization Revisited

The incentivization white paper described the mounting losses from disasters in the United States. Further evidence, described below, demonstrates why resilience incentivization is needed to supplement existing public and private sector programs.

From 2005 to 2014, Congressional appropriations for Federal Emergency Management Agency (FEMA) pre-disaster mitigation grants (PDM) averaged just $120 million each year compared to $7.2 billion on average spent on recovery assistance. In 2015, FEMA requested $400 million for PDM but received only $81 million (Miller). Nevertheless, a new study by the University of Pennsylvania's Wharton Risk Management and Decision Processes Center confirms that mitigation exceeds the 1:4 cost-benefit conclusion of the 2005 MMC study, *Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities.* With Florida's adoption and implementation in 2002 of the *Florida Building Code* (FBC), one of the strictest in the nation, insured loss data from 2001 to 2010 demonstrates that the windstorm losses were reduced by up to 72%. A cost-benefit analysis on new construction in Florida found that every dollar spent on mitigation saved 4.8 dollars in losses, with a payback period for the investment in stronger codes estimated at approximately 10 years in a state at high risk for severe windstorms (Simmons et al., p. 1). Another Wharton study of Missouri found that effective and well-enforced building codes in that state reduced hail damage on the order of 10 to 20%, based on 2008-2010 insurance data (Czajkowski and Simmons, p. 1).

Incentivization and the Definition of Resilience

The incentivization white paper used the definition of resilience defined by the National Academies 2012 publication, *Disaster Resilience: A National Imperative*.[1] However, definitions of resilience actually vary from state to state and community to community according to hazard, local infrastructure, economies, demographics, governance, and stakeholders. Incentivization is a process meant to work with and be tailored to any localized approach that supports achieving resilience. A broad assembly of stakeholders involved with the National Institute of Standards and Technology (NIST) prepared the *NIST Community Resilience Planning Guide for Buildings and Infrastructure Systems*[2] to provide a practical and flexible means of helping communities to develop localized approaches to improve their resilience. Varying approaches to resilience will entail selective use of mitigation strategies, which are available from a number of sources, such as the FEMA *Building Sciences* publications[3], Section 12.6 of Volume II of the NIST *Community Resilience Planning Guide*[4], and the MMC Mitigation Clearinghouse[5]. Whatever methods communities devise for achieving resilience, the white paper and this addendum provide the stakeholder community with guidance and potential sources for finding ways to incentivize them.

[1] http://www.nap.edu/catalog/13457/disaster-resilience-a-national-imperative
[2] http://www.nist.gov/el/resilience/guide.cfm
[3] http://www.fema.gov/building-science-publications
[4] http://www.nist.gov/el/resilience/upload/Community-Resilience-Planning-Guide-Volume-2.pdf
[5] http://mitigationclearinghouse.nibs.org/

The Goal of Resilience Incentivization

Simply stated, the goal of using incentives to achieve resilience is to create a product that consumers demand. There is already evidence that this is occurring in the marketplace. The white paper provided the example of State Farm Insurance, which offers a premium discount to its Texas customers that install impact resistant roofs (IRRs). This program has generated an expansion in the availability of IRR products, from ten in 1998 to more than 1,000 by 2003. According to State Farm, consumers now demand the IRR product, and are disappointed if a contractor does not provide it. The May 10 White House Conference on Resilient Building Codes provided another example. Tim Kant, Mayor of Fairhope, Alabama, one of the conference presenters, talked about how his community, which implemented the FORTIFIED Program, is now considered one of the most desirable communities to live in because the homes are resilient. Estimates show that switching from a conventional construction standard to a FORTIFIED designation increases a home's value by nearly 7%, holding all other variables constant and not considering other direct benefits such as insurance premium discounts (Awondo et al., pp. 4-6).

A report from General Accountability Office (GAO) further supports consumer preference for resilience. In the report, a participant at a GAO forum talked about a community where homes that were built 3 feet above the floodplain, in accordance with a resilience standard implemented by the community, tended to sell faster than other comparable homes (GAO, p.15.) The Urban Land Institute Center for Sustainability has identified seven recently developed medical, resort, and mixed use office and residential facilities that were constructed to account for hazards, such as coastal storms, storm surge, sea-level rise, hurricanes, and river flooding. The utilitized resilience strategies included impact resistant glass; locating mechanical and electrical systems on upper floors; secondary and emergency power supplies; and natural barriers. These projects were able to benefit from better financing options and more competitive insurance rates. They also experienced greater marketing, sales, and leasing success because of assurances that the buildings could function or recover quickly after a disaster (Marshall and McCormick, pp. 3-5).

Regardless of how resilience is defined, it is clear that unless consumers (including property owners, building operators, and residents) believe that there is a benefit in investing in it, little will happen. Incentivization is a pathway to alter the internal cost analysis that consumers perform, which in turn should improve resilience within our community and nation.

Updated Characteristics of Incentives

In the white paper, MMC and CFIRE recommended that stakeholder offerers develop incentives with the following characteristics to ensure their successful application:

- *Use of Optimal Resilience Measures* that are not currently required by law or custom.
- *Flexibility.* Incentives should be tailored according to such factors as hazard, risk, locality, business size, and the value of resilience strategies.
- *Coordination.* Incentives and mandates should function as an integrated set of solutions.
- *Facilitation.* Any incentives program should be well-coordinated, with defined entry points and streamlined processes that can be easily understood and applied.

The Resilient Design Institute has championed three new Leadership in Energy and Environmental Design (LEED) pilot credits for resilient design that potentially could help support achieving the first characteristic, use of optimal resilience measures. They include: Credit 1 for assessment and planning for resilience, Credit 2 for design for enhanced resilience for the top three hazards, and Credit 3 for design for passive survivability, including secondary and emergency power supplies and access to potable water. LEED credits for resilient design could be used by insurers, mortgage bankers, and financiers as developers and building owners plan new residential and commercial buildings. (Wilson). The second characteristic, flexibility, also should take into account government services and infrastructure capacity.

To ensure that incentives are utilized and contribute to achieving resilience, stakeholders should consider the following additional characteristics:

- *Ensuring Mitigation*. Investing in mitigation for buildings and infrastructure and efforts to raise risk awareness are two separate, but essential, components of achieving community resilience. However, the surest way to save lives, reduce disaster losses, and ensure continuity after a disaster is to specifically target incentives that will realize mitigation, correctly implemented and verified, in buildings and infrastructure. Incentives as defined in the white paper are intended to produce a tangible product (e.g., houses with hurricane straps), with benefits to both the offerers and the decision makers. When mitigation is performed to code or with optimal resilience measures, in many cases it only needs to be done once. This outcome differs from awareness programs, which motivate people to conduct mitigation by making them aware of the risk and potential losses, but they do not necessarily produce tangible mitigation, and usually need to be repeated with multiple approaches for effectiveness.

- *Expanding Application*. At a minimum, the use of incentives for mitigation on an individual scale will protect a single property from damage and loss. However, if a community is going to have any chance of achieving true resilience, multiple properties will need to be retrofitted and made resilient. Broadening the use of incentives for mitigation to a neighborhood or community scale will begin to address the maintenance of supply lines and access to utilities, thereby supporting continuity beyond what could be accomplished in terms of property protection for individual facilities.

- *In the Public Interest*. Ultimately, stakeholders should construe incentives to be in both the public and private interest, providing consumer-based mitigation for the largest number of decision makers. Incentives should avoid government mandates that benefit private interests at the expense of decision makers. Programs that benefit special interests weaken favor for any program, in addition to being an inefficient use of scarce resources.

Additional Technical Support for Incentivization

As described in the original white paper, in order to effectively implement resilience strategies, stakeholders must be able to determine the value of incentivization strategies and enhance the flow of information to promote their implementation.

Valuations. The incentivization white paper proposed that the MMC potentially develop a methodology for valuation as part of the update to its 2005 *Mitigation Saves* study. As this addendum is in production, FEMA; the U.S. Economic Development Administration (EDA), a bureau within the U.S. Department of Commerce; and the U.S. Department of Housing and Urban Development (HUD) are currently considering funding Version 2.0 of *Mitigation Saves*, with support from the International Code Council (ICC) and the Insurance

Institute for Business and Home Safety (IBHS). The new study will examine the benefits associated with federal mitigation grant programs and the effects of code enhancements to support mitigation in the private sector, and will explore with stakeholders in insurance, finance, and government the use of mitigation valuations for supporting incentivization strategies.

Flow of Information. The original white paper described the flow of resilience information by organizations such as Smart Home America and the Federal Alliance for Safe Homes (FLASH). ICC has also been a conduit for resilience outreach. Participants at the *White House Forum on Smart Finance for Disaster Resilience* reinforced that message, citing a need for a transfer of local knowledge, of communities helping communities, to increase the penetration of incentives programs. Additionally, communities need to communicate with their own residents about the existence of incentive programs, provide simple explanations of how incentives work, and highlight the benefits of participation.

Benchmarking and disclosure requirements help raise owners' awareness of how their properties perform relative to their peers. Currently, Both Arup and the U.S. Resiliency Council (USRC) have rating systems available oriented to resilience. The USRC building rating system identifies the expected consequences of how an earthquake or other hazard would affect a building and how it would perform. The rating system assigns one to five stars for three performance measures: safety (the potential for people to get out of a building unharmed); damage (estimated cost to repair the property); and recovery (time to regain basic building function). An earthquake rating considers the performance of a building's structure; its mechanical, electrical and plumbing (MEP) systems; and architectural components such as cladding, windows, partitions, and ceilings. The USRC ratings are based on the ground shaking intensity expected to occur during the lifetime of the building and is consistent with the benchmarks in the *International Building Code*[6].

Arup's rating system, REDi™, involves assessing criteria for three resilient design and planning categories — organizational resilience (contingency planning for utility disruption and business continuity); building resilience (expected reduction of damage to structural, architectural, and MEP components through enhanced design); and ambient resilience (risks that external earthquake induced hazards damage surrounding buildings or restrict site access). The rating system uses loss estimation to evaluate the success of design and planning measures in meeting the resilience objectives for downtime, direct financial loss, and occupant safety. Arup assigns platinum, gold, and silver ratings based on the level of performance achieved for each metric (Almufti and Willford, pp. 8-11).

Beyond performance of properties, stakeholders will need to develop the means of measuring how well incentive programs actually generate resilience to increase the effectiveness of penetration, cost-benefits, program awareness, and other metrics.

[6] http://www.usrc.org/files/What%20is%20a%20USRC%20Rating.pdf

Additional Stakeholder Incentives

The original white paper organized the incentives by stakeholders. This addendum instead offers various strategies by the type of incentive. In addition to the incentivization strategies listed in the white paper, following are strategies that a variety of stakeholders can use to encourage resilience for potential use in insurance programs and for mortgage lending. Also included are strategies for finance programs (both for buildings and infrastructure) and for tax incentive programs.

Insurance

1. To encourage resilience for more residents in wildfire risk areas, United Services Automobile Association (USAA) provides a discount on the homeowner's insurance premium for its members who live in communities recognized by the Firewise Communities/USA program in California, Colorado and Texas where USAA is approved to offer the discount. The Firewise program is administered by the National Fire Protection Association (NFPA), which provides a 5-step template for wildfire safety at the neighborhood level. Participating communities follow these guidelines to achieve initial recognition and then commit to annual activities to maintain this status (NFPA).

2. The Village of South Holland, Illinois gives residents who purchase Federal Flood Insurance a 25% discount. In a unique program, property owners in the Village also receive a 25% rebate on flood control projects, with a maximum rebate of $2,500 per home. Qualifying projects include: repair of foundation cracks; waterproofing of foundation walls; installation of drain tiles; diversion of downspouts; construction of flood walls; removal of sump pump and downspout connectors from sanitary sewers; and installation of backflow devices and lift stations. The properties must be owner-occupied and the Village pre-approves all projects. (Village).

3. With projects in Alabama and South Carolina, MyStrongHome provides financing for residential mitigation, using insurance premiums reductions to pay for the cost of construction within a five-year period. MyStrongHome does the construction, verified to meet the Insurance Institute for Business & Home Safety (IBHS) FORTIFIED certification program. For the homeowner, the program provides mitigation with less difficulty and little or no upfront cost. Projects include enhanced roof deck attachments, sealed roof decks, high-wind rated roof coverings, gable end wall bracing, and opening protection systems (MyStrongHome).

4. Zurich Insurance Group has endorsed the concept that insurance could be coupled with a long-term loan tied to the property to enhance community resilience. If the loss-reduction measure is cost-effective, and if insurance premiums are risk-based, then the reduction in the price of coverage to reflect the lower claims payments might, over time, fund the entire cost of the loan. Insurance could be required and linked to the mortgage to reduce the voluntary cancellation of policies over time. This strategy could be complemented by well-enforced building codes that require cost-effective loss reduction measures on new property. Real estate agents could point to the short- and long-term benefits of having these measures in place. Making the community more resilient to disasters will increase property values over time (Wharton/Zurich, p. 14).

5. Zurich also proposes that a means-tested voucher could be used by a property owner to cover part of the cost of a multi-year loan to invest in mitigation measures, and cover a portion of the risk-based insurance premium. The voucher, in particular, could support a homeowner where affordability is an issue (Wharton/Zurich, p. 14).

Table 1 lists summary characteristics of the above insurance strategies (shown in gray) along with those found in the original white paper for several hazards and the mitigation strategies they support. The first seven are existing programs; the last two are public policy proposals based on a paper produced by Zurich in conjunction with the Wharton Risk Management and Decision Processes Center. They offer benefits to the consumer in the form of either a premium discount, a deductible reduction, support for paying off the loan that covers installation costs, or resilient rebuilding. Some programs offer combinations of these benefits. Note, the California Earthquake Authority, USAA, South Holland and MyStrongHome programs apply only to homeowners.

Table 1: Insurance-Based Incentivization Programs[7]

Insurance Program	Hazard	Mitigation Strategy	Effect on Premium	Effect on Deductible	Effect on Loan/Costs
Insurance companies[8]	Wind storm	IBHS FORTIFIED standards	Discount		
State Farm	Hail	Impact resistant roof (IRR)	Discount $500/year	Reduced by 1 to 2% of home value	
Florida mandate for insurance companies	Wind storm	Wind-resistant strategies	Discount		
California Earthquake Authority[9]	Earthquake	Retrofits	5% discount		
USAA	Wildfire	5-step wildfire safety template	Discount		
South Holland, Illinois	Flood	Flood resistant strategies	25% discount		Rebate up to $2,500
MyStrongHome	Wind storm	Retrofits	Discount		Payback with insurance premium reduction
Zurich: risk based	Non-specific	Built to code			Payment support
Zurich: vouchers[10]	Non-specific	Built to code	Payment support		Payment support

[7] Insurance discounts or credit programs also exist in Louisiana, Maryland, Mississippi, New York, South Carolina, and Texas.
[8] Alabama, Georgia, Mississippi, and North Carolina provide laws and regulations to lower the cost of a home's property insurance wind premium for using FORTIFIED standards (IBHS).
[9] It is important that all programs reference the latest model building codes. On January 1, 2017, the California Earthquake Authority will begin referencing the *2016 California Building Code* (CBC), which is based on the *2015 International Codes*. The current edition of the CBC references the *1997 Uniform Building Code* and 2000 and 2003 versions of the *International Codes* for certain mitigation strategies.
[10] This program is for low-income communities.

Mortgages

1. Fannie Mae designed its current Green Refinance Plus Program to address barriers to financing energy efficiency upgrades in multi-family buildings. As a public-private sector venture, Fannie Mae delegates lending to private third-party lenders. Under the program, eligible buildings coming up for refinancing are able to stretch traditional lending ratios to encourage green renovations. For applicants, Loan to Value (LTV) maximums have pushed upward from 80% to 85% of asset value—meaning building owners may be able to put 5% less equity down. Debt service coverage ratios (DSCR), which represent a ratio of a building's annual cash flow to what it owes the bank, can also be lowered to 1.15 from 1.20. For borrowers, 5% of refinance loan proceeds must be applied to property renovation or energy retrofits (McEwen and Miller, pp. 18-19). A similar program could be developed to finance resilience efforts.

2. Freddie Mac's Green Advantage program rewards multi-family borrowers who improve their properties to save energy or who already have green-certified properties and are looking for new financing. Green Up borrowers who commit to making improvements based on a Green Assessment and are able to save 15% in energy or water usage get up to 50% of projected energy savings underwritten. Green Up Plus borrowers who commit to making improvements based on a highly detailed property analysis based on an ASHRAE Level 2 energy audit get up to 75% of projected energy savings underwritten (Freddie Mac). A similar program could be developed to finance resilience efforts.

Table 2 lists summary characteristics of the above mortgage strategies (shown in gray), along with those found in the original white paper. The programs listed are existing, and currently apply to energy reducing strategies and retrofits, but could be applied to mitigation, based on long-term valuations for loss avoidance. All apply to residential construction except for the Fannie Mae Program and Freddie Mac Green Advantage program, which apply to multi-family housing construction, but could be extended to one and two-family dwellings.

Table 2: Mortgage-Based Incentivization Programs

Program	Loan Source	Construction Approach	Interest Rate Reduction	Increase Loan to Value/Less Equity	Lower DSCR[11]	Cost Payment Support
FHA 203k Rehab Loan	Government	Major retrofit	x			
Fannie Mae Home Style Renovation Loan	Government	Retrofit				Borrow up to improvement value/no minimum
Fannie Mae Program	Government	New construction and retrofit	10 basis points			
Fannie Mae Green Refinance Plus Program	Private lender	Retrofit		x	x	5% of loan proceeds applied to retrofit
Green Advantage	Government	Retrofit				50-75% of retrofit savings

Finance

1. Over 1,000 community development financial institutions (CDFIs), among them banks, credit unions, loan funds, or venture capital providers, currently promote economic revitalization and community development in low-income communities through mission-driven, locally-informed investments, but could incorporate a financing program to support mitigation strategies in their projects. For example, following Hurricane Katrina, AMCREF Community Capital, a Community Development Entity based in New Orleans, provided nearly $13 million of New Markets Tax Credit financing to create 150 affordable homes that used environmentally safe materials and reduced homeowner energy costs by 75% (LEED Platinum). The base elevation of the homes were raised to avoid future flood damage and built to withstand hurricane force winds, rebuilding in a way that will be safer for the long term (Goldfuss and Donovan, p. 2).

2. The National Development Council (NDC) American P3 Model utilizes tax-exempt debt to finance projects. Using a group exemption letter from the IRS, the NDC sets up a not-for-profit owner to issue tax-exempt bonds, then hires a developer, architect, and contractor to develop a facility. After construction is completed, the facility is leased to a government client and then transferred to the client at no risk, when the debt is retired. The NDC has financed over $2.5 billion in social infrastructure project through its public-private partnerships, including municipal office space, city halls, justice centers, student housing, libraries and hospitals (Webster). A similar type of financing program could be used to support resilience in projects.

[11] Debt Service Coverage Ratio.

3. In a Property Assessed Clean Energy (PACE) program, local governments or designated financial institutions provide loan capital, which is paid back through an assessment tied to property taxes. Similarly, tax increment financing could utilize bond financing as the source of capital for resilience strategies via issuance of bonds against anticipated tax revenue. Under tax increment financing communities also can provide loans supported by increased property taxes (McEwen and Miller, p. 24), only in this case a community provides funds or assurance to a lender, which adds security to a loan. In contrast to a direct loan program, a credit enhancement can be specifically designed to leverage private lending. The issuer of the credit enhancement provides a lender with a promise to cover certain losses in the event a borrower defaults. As a result of the credit enhancement, private lenders are able to lower borrowing costs (such as the interest rate) below the rate that would otherwise apply to borrowers and projects that might otherwise be too risky or priced out. A credit enhancement can thus be used to reach a larger group, and magnify an investment to create five or ten times the total amount of capital lent for efficiency measures, compared to a direct loan program. Credit enhancements can be conveyed in a variety of forms, including loan loss reserves, interest rate buy-downs, and loan guarantees (McEwen and Miller, p. 24).

4. Green banks are public finance authorities that use limited public dollars to leverage greater private investment in clean energy. Their goal is to accelerate clean energy market growth while making energy cheaper and cleaner for consumers, driving job creation, and preserving taxpayer dollars. Green banks deploy public capital efficiently through financing to maximize private investment, and lower the costs of clean energy to spark consumer demand (Coalition, p. 1). Green banks can utilize both credit enhancements and PACE as financing mechanisms. For the complexities of implementing PACE, green banks can act as administrator, which would make it easier to attract private lenders. A green bank could also offer a credit enhancement to further entice reluctant private lenders into the PACE market (Coalition, pp. 8-9). Resilience banks, modeled after green banks, could be another potential source of financing for resilience.

5. Catastrophe bonds or 'cat bonds' are financial instruments designed to help manage the financial risks associated with disasters, not with the aim of limiting physical damages, but instead to reduce the economic disruption of financial losses. Cat bonds are designed to be 'triggered' when a disaster reaches a predetermined dollar threshold during a bond term (usually three to five years) in which case the bond sponsor (the insurance purchaser) keeps a portion of the bond value to pay off losses, and investors lose some (or potentially all) of their invested principal (Vajjhala and Rhodes, p. 2). Cat bonds are now regularly used by government-sponsored insurance programs, including the California Earthquake Authority, Florida Citizens Property Insurance, Louisiana Citizens Insurance, and the Texas Windstorm Insurance Association (Vajjhala and Rhodes, p. 3). Resilience bonds, a new concept intended for infrastructure projects based on the better known catastrophe bond, could be another source of financing for resilience.

   Cat bonds are typically structured with catastrophe models that are widely used in the insurance industry to evaluate disaster risk and the potential damage and loss. However, these analyses are disconnected from efforts by infrastructure developers and the investing community to monetize more abstract benefits of resilience projects. These parallel efforts are often framed in terms of potential dollar savings or avoided losses, but are often not grounded in a valuation method that is accepted in established markets. Connecting these two types of analyses offers an opportunity to link physical protection measures to financial insurance benefits (Vajjhala and Rhodes, p. 3).

> The resilience bond reflects an approach for integrating catastrophe bonds and infrastructure project finance. Insurance companies model the physical and financial risk reductions associated with specific resilient infrastructure projects, which provide the basis for designing and issuing a resilience bond. The bond integrates elements of traditional catastrophe bonds with features of social impact bonds to capture insurance savings that can be converted into a resilience rebate to support implementation of mitigation strategies (Vajjhala and Rhodes, p. 5).
>
> Stated another way, a resilience bond is an instrument that evaluates the impact of a resilience project on the investor's expected loss, then provides funds for communities seeking to construct the project. Proceeds from the issuance of the resilience bond [insurance savings] are earmarked for specific resilience strategies designed to reduce the risk of future damages. Given the reduced risk-profile of the resilience bond, investors accept a lower payout after the project is completed. This risk reduction may also result in lower insurance costs to communities, a benefit not associated with catastrophe bonds (OER, pp. 3-4).

Table 3 lists summary characteristics of these existing and proposed finance strategies (shown in gray), along with those found in the original white paper. The South Carolina Safe Home, the California Earthquake Authority, the CDFI, and the resilience bond programs directly address resilience incentivization. The American P3 model and the tax increment financing programs are available for use in incentivization. PACE and green banks, which are used for energy retrofits, would need to be modified to address resilience.

South Florida cities that sponsor PACE programs already are evolving their programs to include hazard mitigation and are financing residential storm-hardening improvements, in addition to energy efficiency. Improvements eligible for PACE financing include hurricane-resistant impact windows, new roofs and existing roof reinforcement, and water barriers for protection against floods. Proponents state that the improvements funded by PACE can generate enough savings from reductions in energy and insurance bills to offset much, if not all, of the repayment costs. Mortgage lenders collect payments as part of a homeowner's mortgage escrow account (Hurtibise). PACE is showing even greater promise as a financing mechanism for resilience. PACE loans are available to homeowners in 15 states and over 1,000 municipalities. The Federal Housing Administration (FHA) and the U.S. Department of Veteran Affairs Department (VA), which together back 23% of all residential mortgages, are now accepting mortgages and refinances based on PACE loans (Kiplinger). The proposed resilience bank strategy also would need to make the crossover from green bank energy applications.

Table 3: Finance-Based Incentivization Programs

Program	Target	Funding Source	Finance Method	Mitigation Strategy	Loan Payback Source	Other Incentives
South Carolina Safe Home	Homes	Government	Allocation	Wind retrofits		Matching Grants to $3,000
California Earthquake Authority	Pre-1979 homes[12]	Publicly managed/ privately funded	Allocation	Bolt and brace earthquake retrofits		Matching grants to $3,000
Property Assessed Clean Energy (PACE)	Homes and small business	Local government or financial institution	Loan	Construction and retrofits	Premium reduction and property tax	
Small Business Administration (SBA)[13]	Small business	Government or financial institution	Loan credit	Retrofits		
Community Development Financial Institution (CDFI)[14]	Non-specific	Publicly established/privately run financial institution	Capital through grants	Construction and retrofits		
American P3 Model	Non-specific	Not-for-profit	Tax-exempt bond	Construction	Lease	
Tax increment financing	Non-specific	Community	Tax-exempt bond	Construction	Property tax	
Tax increment financing	Non-specific	Community	Loan with assurance	Construction	Property tax	
Tax increment financing	Non-specific	Community	Loan with credit enhancement	Construction		Interest rate reduction
Resilience bank based on the green bank	Non-specific	Community/ investors	Loan/loan with credit enhancement	Construction and retrofits	Property tax	
Resilience bond	Infra-structure	Community/ investors	Tax-exempt bond	Construction	Premium reduction	

[12] http://www2.earthquakeauthority.com/earthquakerisk/Pages/Retrofit-Discounts-and-Incentives.aspx

[13] Currently used for retrofits other than mitigation.

[14] Program for low-income communities.

Taxes

1. In Colorado, homeowners who live on property within a wild land-urban interface area may deduct certain costs of wildfire mitigation measures from their federal taxes. The deduction, available until 2024, cannot exceed 50% of the homeowner's out-of-pocket expenses, $2,500, or taxable income, whichever is less. Such wildfire mitigation measures, which must meet or exceed Colorado State Forest Service standards or any other applicable state rules, include creating and maintaining a defensible space around structures; establishing fuel breaks; and, thinning woody vegetation for the primary purpose of reducing risk to structures from wildland fire (Colorado).

2. On May 1, 2015, Rep. Dennis Ross (R-FL) introduced in the House of Representatives the Disaster Savings Accounts Act of 2015 (H.R. 2230)[15], which would amend the Internal Revenue Code to allow establishment of tax-exempt disaster savings accounts for homeowners to pay for disaster mitigation and recovery expenses, and allow a deduction from gross income up to $5,000 (adjusted annually for inflation) for cash contributions to the accounts. Disaster mitigation expenses apply to tornado safe rooms; wind-resistant opening protection, roof-to-wall and floor-to-wall connections reinforcement and roof coverings; cripple and shear walls to resist seismic activity; flood-resistant building materials and elevating structures and utilities above base flood elevation; fire-resistant exterior wall assemblies/systems; and, whole-home standby generators. The bill has been referred to the House Committee on Ways and Means.

Table 4 lists summary characteristics of these tax strategies (shown in gray), along with those found in the original white paper. The first four programs listed are existing, and the fifth is proposed. All apply to residential construction.

Table 4: Tax-Based Incentivization Programs

Sponsor	Hazard	Mitigation Strategy	Tax Deduction	Other Tax Incentives
Louisiana	Wind storm	Retrofit for building code compliance	Up to 50% of cost	Sales tax exemption on storm shutters
Alabama	Wind storm	Retrofit to IBHS FORTIFIED standards	Up to $3,000	Tax credit for a contribution to a catastrophe savings account[16]
Berkeley, California	Earthquake	Seismic retrofit	Refund on the 1.5% real property transfer tax for residences	
Colorado	Wildfire	Defensible space	Up to $2,500	
U.S. Congress	Wind storm, earthquake, flood and wildfire	New construction and retrofit	Up to $5,000	

[15] https://www.congress.gov/bill/114th-congress/house-bill/2230/all-info

[16] Under consideration by the Alabama State Legislature.

Integrating and Implementing Incentivization

The original white paper and this addendum provide a broad set of resilience strategies. The following pages present a layered approach that integrates those resilience strategies, and describes the role of stakeholders in developing incentives-based resilience, and a potential future resilience economy.

Layered Incentivization Strategies

Incentivization can be most effective when multiple strategies are combined to increase benefits to the offerer and provide a product that the consumer wants. Current examples of this approach include the existing IBHS FORTIFIED program, which associates with both insurance premium reductions and tax deductions through state programs, and the Village of South Holland program, which offers an insurance premium reduction and a rebate.

Various stakeholders can develop layered strategies using the insurance, mortgage, finance, and tax strategies described in this addendum. To round out the sources for incentivization strategies, Table 5 summarizes other possible programs from the original incentivization white paper that would need to be constructed to incentivize damage and loss mitigation in residences, businesses, utilities, and communities. The table arranges the four incentivization categories already identified, and adds a fifth "General" category. Details on each of these strategies are provided in the original white paper.

Three programs that would come under "Grants" in Table 5 demonstrate another method of financing that could be leveraged with incentivization strategies to address flood and wildfire hazards. The Center for Neighborhood Technology (CNT) is using its RainReady Home program across six communities in Cook County, Illinois' southern suburbs to mitigate the risk of future flooding and build broader resiliency. RainReady Home provides fast, low-cost flood control and mitigation to individual homes and businesses most impacted by heavy rainstorms and runoff. It offers landscaping, building, and plumbing services, and improvements coordinated in the form of a one-stop service that encompasses a risk assessment, access to reliable contractors, and financial services. Mitigation strategies include disconnecting downspouts, installing backwater valves or overhead sewer pumps, regrading land to take water away from the foundation, and installing cisterns or rain gardens to manage water onsite. The Metropolitan Water Reclamation District (MWRD) is considering a cost-share program for property upgrades that are 25% funded by MWRD, 25% funded by a municipality, and 50% funded by the homeowner. MWRD also anticipates a sliding scale of cost-sharing depending on household income (CNT).

Mecklenburg County, North Carolina's retroFIT (Floodproofing Improvements Together) program serves to reduce flood damage to existing buildings in the regulated floodplain by offering financial and technical floodproofing assistance to owners. The program provides competitive grants that reimburse expenses for qualified floodproofing projects, up to 95% of the total project. Approved methods eligible for retroFIT grant funding include structure elevation and relocation, wet and dry flood proofing, equipment elevation, basement abandonment, and house demolition (Charlotte-Mecklenburg).

Lane County, Oregon offers financial grants to residents who are interested in making landscaping or structural improvements to their properties to increase the survivability of their home in the event of a wildfire. Residents now have the opportunity to apply for thousands of dollars in financial assistance to replace roofs, siding, windows, and doors with fire-resistant building materials and to make "Firewise" improvements to their landscaping. This program is administered by the Lane County Land Management Division's Long Range Planning and Building programs, with funding provided through Title III of the

Federal Secure Rural Schools and Community Self-Determination Program - Section 601 of the Emergency Economic Stabilization Act of 2008 (Lane County). Adoption of the *International Wildland Urban Interface Code*®, which would fall under a "Code Enhancement" within the General category of Table 5, also could provide a legal framework for localities to effect community-wide consistency of wildfire resistance standards that align with community-wide protection strategies.[17]

[17] A Presidential Executive Order issued May 18, 2016 mandates the use of the *International Wildland Urban Interface Code*® on all Federal projects more than 5,000 sq. ft. within the wildland-urban interface at moderate or greater wildfire risk.

Table 5: Potential Incentivization Programs

Incentive Strategy	Target (Decision Maker)	Provider (Offerer)	Incentive
Insurance-Based			
Business interruption insurance	Business	Insurance company	Premium reduction
Utility insurance	Utility	Insurance companies	Premium reduction
Mortgage-Based			
Resilience mortgage	Homeowner and business	Bank and loan agency	Increased loan amount, increased appraised value, reduced interest rate and down payment, and reduced associated insurance premium
Secondary mortgage market	Bank, loan agency, and (indirectly) homeowner and business	Financial institution	Credit quality of security-backed mortgages
Finance-Based			
PACE and SBA mitigation support	Small business	Public-private partnership	Loan
Corporate bond	Large business and utility	Bond rating agency	Favorable bond rating
Municipal and revenue bonds	Utility and community	Bond rating agency	Favorable bond rating
REIT[18]	Large business	Financial institution	Capital provided for asset risk reduction
Private equity real estate fund	Large business	Financial institution	Capital provided for asset risk reduction
Tax & Grants-Based			
Taxes	Homeowner, business, utility, and community	Federal, state and local government	Tax deduction, tax credit and fee waiver
Grants	Homeowner, business and utility in insurance and mortgage programs	Federal, state and local government	Allocation and low-interest loan program (revolving fund)
General			
Code and zoning adoption and enhancements	Community	Community and state	Desirable community; favorable BCEGS[19] and CRS[20] ratings
Developer agreements	Developer	Community and economic development corporation	Tax deduction; design standard modifications planning; zoning and fee waivers; accelerated permitting process
Contractor-based financing	Small business and homeowner	Contractor	Loan
Utility rates	Utility	Public utility commission	Rate increase

[18] Real Estate Investment Trust
[19] Building Code Effectiveness Grading Schedule
[20] Community Rating System

Tables 6 through 10 provide examples of layered programs to maximize the impact of incentives, using the existing incentive programs or those that could be modified or constructed. These examples apply to an office building, a utility, a residence, housing at the community level, and affordable housing. They provide models for opening discussions, analysis, and strategizing by the broad cross-section of stakeholders for defining working strategy combinations and developing the policy, regulatory, and business models for their implementation.

Table 6: Combined Incentivization Program No. 1
America P3 Model for a New Resilient Office Building

Finance		**Offsets**		
Finance Source	**Payback Source**	**Insurance**	**Tax Incentive**	**Other Incentive**
Tax-exempt bond	Lease payments	Premium discount	Property tax reduction	Density increase

Table 7: Combined Incentivization Program No. 2
Resilience Bond Model for a Resilient Utility

Finance		**Offsets**	
Finance Source	**Payback Source**	**Grant Incentive**	**Other Incentive**
Resilience bond	Premium reduction	Allocation	Rate increase
			Enhanced bond rating

Table 8: Combined Incentivization Program No. 3
Refinance Model for an Existing Residence Retrofitted for Resilience

Finance		**Offsets**		
Finance Source	**Payback Source**	**Insurance**	**Mortgage**	**Tax Incentive**
Mortgage Refinance (Refi)	Homeowner	Premium discount	Reduced down payment	Property tax reduction
		Reduced deductible	Interest rate reduction	State tax deduction
				Disaster Savings Account tax avoidance

Table 9: Combined Incentivization Program No. 4
PACE Program for Housing Retrofitted for Resilience with
Enhanced Codes at the Community Level

Finance		Offsets		
Finance Source	**Payback Source**	**Insurance**	**Tax Incentive**	**Other Incentive**
Loan	Property tax	Premium discount	State tax deduction	Desirable community
		Reduced deductible	Federal tax deduction	Enhanced community bond rating

Table 10: Combined Incentivization Program No. 5
CDFI/Insurance Voucher Model for New Resilient Affordable Housing at the Community Level

Finance			Homeowner Offsets		
Construction Finance Source	**Finance Source**	**Payback Source**	**Voucher**		**Tax Incentive**
Capital/grant	Low down-payment mortgage	Homeowner	**Insurance**	**Mortgage**	Property tax reduction
			Payment support	Payment support	State tax deduction
					Federal tax deduction

Developing Incentivization

According to a Wharton/Zurich report (p. 17), "Hurricane Katrina forced all sectors of society to face the following truth: The United States does not have a comprehensive and systematic approach for mitigating and managing large-scale natural disasters. 'Katrina raised multiple questions regarding not only the specific role insurance can play in addressing these types of events, but also what role the public sector should embrace in partnering with the private sector and NGOs [non-governmental organizations],' says Sean Kevelighan, Group Head of Public Affairs, Zurich Insurance Group. 'Only by leveraging the collective strengths, expertise and financial capacity of all these players can we really impact the potential losses of future natural disasters and increase the speed and efficiency of recovery from them.'"

The original white paper addressed the need to develop and coordinate new and revised regulatory and economic processes to make incentivization part of the nation's economic fabric. Such an effort calls for input, consensus, leadership, and action from a broad spectrum of stakeholders—financial institutions, insurance companies, foundations, federal and state governments, business, utilities, and homeowners—that represent the entire U.S. incentivizing community.

As a first step, stakeholders need to come together to begin formulating the mechanisms for incentivization. Dialogue must occur at high enough levels in the public and private sectors to ensure enactment. For

example, the banking industry could devise a resilience mortgage in which increased monthly payments provide payback for implementing mitigation. A potentially more resilient home would provide for a lower interest rate on the loan and a lower down payment. The industry would have to determine the parameters of the mortgage, such as the dollar amount allowed for mitigation and the time limit for implementation, and develop the valuations of loss reduction associated with mitigation strategies that would inform how loans are structured. Mortgage paperwork would need to be adjusted to reflect the rate reduction, down payment, and clauses applicable to mitigation. As the public becomes informed on the benefits of resilience, markets would see an upturn in market values. Educating appraisers and mortgage providers to be aware of, and understand, this market effect would be important so that these values are not overlooked. The resilience mortgage could be one of the most formidable tools in the arsenal of incentivization, because of its potential for widespread application.

As a second step, communities, in concert with the private sector, and with the backing of the state government, need to conduct pilot studies as test beds for developing incentivization-based resilience. Realizing these studies will entail identifying a set of the most-promising incentivization strategies; developing layered incentives with broadening application in the public interest and other incentivization characteristics previously described; incorporating enhanced valuations, data, software tools, and flow of information to support incentives-based programs; engaging developers and non-profits interested in engaging in mitigation construction and retrofit; and utilizing performance measures to assess resilience strategies and program effectiveness to generate resilient structures.

The Resilience Economy

Ultimately, with enough stakeholder involvement and pilot studies, an economy based on the consumer-oriented goal of resilience has the potential of emerging as a six-stage engine that can produce a series of economic activities as outlined in Table 11. The recipients of this engine will be communities, corporations, utilities, commercial building owners, and homeowners—the decision makers and consumer base that benefit from the protection and sustainability that resilience affords.

Table 11: The Resilience Economy

Operation	Organization	Activity	Output
Resilience support	Federal agencies, universities, non-profits	Resilience techniques and mitigation strategies	Studies, journal articles, website articles, and software tools
		Performance indices and metrics	
		Resilience and mitigation strategy valuations	
		Risk assessment models	
		Data gathering and analysis	
	Codes and standards bodies	Codes and standards development	Codes and standards publications, training, and certifications
Resilience planning	Communities and states	Resilience planning, code and zoning adoption, and regulatory modifications	Resilience plans, data, codes, ordinances, and regulations
Resilience incentivization	Insurance and mortgage companies, secondary insurance and mortgage organizations, and industry organizations	Insurance underwriting, mortgage origination	Policies, mortgages, and company and industry guidelines and models
	Communities	Zoning-based incentives, developer agreements, and bonds	Ordinances, agency guidelines, and offerings
	Utilities	Rate increases	Guidelines
	Communities, state legislatures, U.S. Congress	Tax incentives, new programs, and regulatory modifications	Legislation, ordinances, agency guidelines
	Financial organizations	Loans, loan support, bond investment and ratings, and financial management	Prospectuses, industry guidelines, offerings, and models
	Contractors	Financing, , one-stop shopping bundling financing and mitigation strategy implementation	Brochures, contracts, and consumer education
Resilience implementation	Communities, states, foundations, and public-private partnerships	Resilience programs, data development and zoning and code enforcement	Resilient buildings, data, and case studies
	Developers, construction companies, non-profits	Construction, retrofits, project management, and building information modeling (BIM)	Resilient buildings, real estate information, and case studies
Resilience evaluation	Private companies, non-profits, and state and federal agencies	Performance evaluations of resilience programs and supporting insurance, mortgage, finance, and tax-based programs	Reports, studies, journal articles, website articles
	Appraisers and real estate brokers	Identification and promotion of increased property values based on implementation of resilience measures	Appraisal reports, reporting resilience measures in property descriptions/MLS
Resilience communication	All stakeholders	Peer-to-peer communication on methods for achieving resilience	Conferences, web meetings, webinars, and website articles
	Media	Reporting on resilience activities (particularly in context of pre- and post-hazard reporting) to build a culture of resilience	News stories, public service announcements, community fairs

The MMC and CFIRE recognize that resilience will be achieved through a variety of approaches and activities that Table 11 describes, some led by the community; some led by the private sector; some as public-private partnerships; and, some led by entities such as foundations or federal or state agencies. Incentivization is a grassroots approach, involving decision makers, integrated with a top down approach, involving government and private sector companies. From whichever direction incentives come, the top or the bottom, the process is designed to work with both private and public sector players, and within the existing economy and governmental systems.

There is growing recognition that communities can expand the reach of resilience by developing a closer relationship with local businesses. "Businesses make up something that matters dearly to any city or state government: their economies. If businesses are not adequately shielded from disasters, the economy—and therewith tax revenues and even electoral prospects—may take many years to recover, if they ever do (the population of New Orleans is still only half what it was prior to Hurricane Katina, for example). Equally, governments provide infrastructure and services that matter no less dearly to any business." (Williams). The public and private sectors need to begin acknowledging their interdependence in order to achieve disaster resilience, and begin to develop and use incentivization mechanisms such as zoning waivers and tax incentives.

Table 11 represents a cyclical process. Ultimately, increasing the execution of resilience will produce performance evaluations, peer-to-peer communication, and information that will feed back into research that supports developing improved approaches to resilience, better data, and more-reliant risk models, and mitigation strategy valuations, and valuation modeling. To reinforce that cycle, it is in the interest of the major stakeholders, including federal agencies, corporations, and industry organization, to invest in the research activities in the initial part of the cycle. Better mitigation strategies provide for more resilience, which better protects the assets in both insurance and mortgage company portfolios. Better risk models, data, and mitigation valuations insure more-reliant risk-based investments. Better performance metrics ensure that programs are producing the best cost-benefit ratios and benefits to offerers. These research activities also support the states and the federal government in ultimately reducing the amount of public funding that will need to be applied to emergency management and response.

As described in the original white paper, incentivization can be further enhanced by combining programs for generating energy efficiency and production with resilience strategies. The finance section in this addendum provides an example of such an integration that is already occurring in the PACE program. Resilience strategies differ from energy strategies only in construction solutions and how they are valued over time. Incentivization also can be extended to other aspects of building performance. For example, major property insurance companies in seven states already discount homeowners' premiums up to 10% when residential fire sprinklers are installed in accordance with the *International Residential Code*® (Fire Protection). Combined incentives for resilience, energy strategies, and building performance will require another new approach to the nation's insurance, mortgage, finance, tax, and regulatory systems. But this would not be unlike what the rest of the world is wrestling with in attempting to align its financial systems with sustainable development. A report issued by the United Nations Environment Programme (UNEP), advocates strengthening resilience, along with other sustainability objectives such as energy for all, food security, safe drinking water, and adequate sanitation, by developing a financial system that goes beyond business-as-usual, described as a "quiet revolution" that is seeking to increase the internalization of sustainable development factors into financial decision making (UNEP).

Conclusion

The concept of incentivization that the MMC and CFIRE began deliberating in the fall of 2014, and became a white paper in October 2015, has now reached the attention of the White House and Congress. It is an approach that currently holds the most potential for reaching a solution to the nation's chronic problem of underfunding for much-needed mitigation to reduce the effects of disasters. Going forward, it will be important to frame incentivization in terms of its overall goal and characteristics so that policymakers and stakeholders understand how best to proceed in implementing the incentivization mechanisms to support achieving resilience. The white paper and this addendum have offered many ideas for incentivization strategies. It is now time for policymakers and stakeholders to convene the meetings, hold the discussions, and document the guidelines and procedures that will lead to the implementation of these, and other yet-to-be-designed incentives, in order to improve our nation's resiliency to the impacts of disasters.

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