

IDENTIFYING, VALUING, AND FINANCING
**Climate Resilience
in Multifamily
Affordable Housing**

JUNE 2020



**ENERGY
EFFICIENCY
FOR ALL**

This report is authored by the Climate Resilience Finance Working Group of the Sustainability in Affordable Housing Lender Learning Network, a network under the Energy Efficiency for All Initiative. Members include:

Alliance for National & Community Resilience
Bodaken and Associates
Center for Neighborhood Technology
Community Investment Corporation
Community Preservation Corporation
DNV-GL
Enterprise Community Partners
Local Initiatives Support Corporation
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New Ecology, Inc.
Precovery Labs
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D.C. Department of Energy & Environment

This working paper is a product of the working group's collective discussions to date, and any policies or positions herein do not necessarily reflect the official policy or position of all organizations in the working group.

We welcome feedback on the concepts in this working paper or ideas for implementing them. Please reach out to Bettina Bergöö (bbergoo@nrdc.org), Lindsay Robbins (lrobbins@nrdc.org), and Esther Toporovsky (etoporovsky@enterprisecommunity.org).

Learn more and join the Sustainability in Affordable Housing Lender Learning Network at <https://sahlIn.energyefficiencyforall.org/>.

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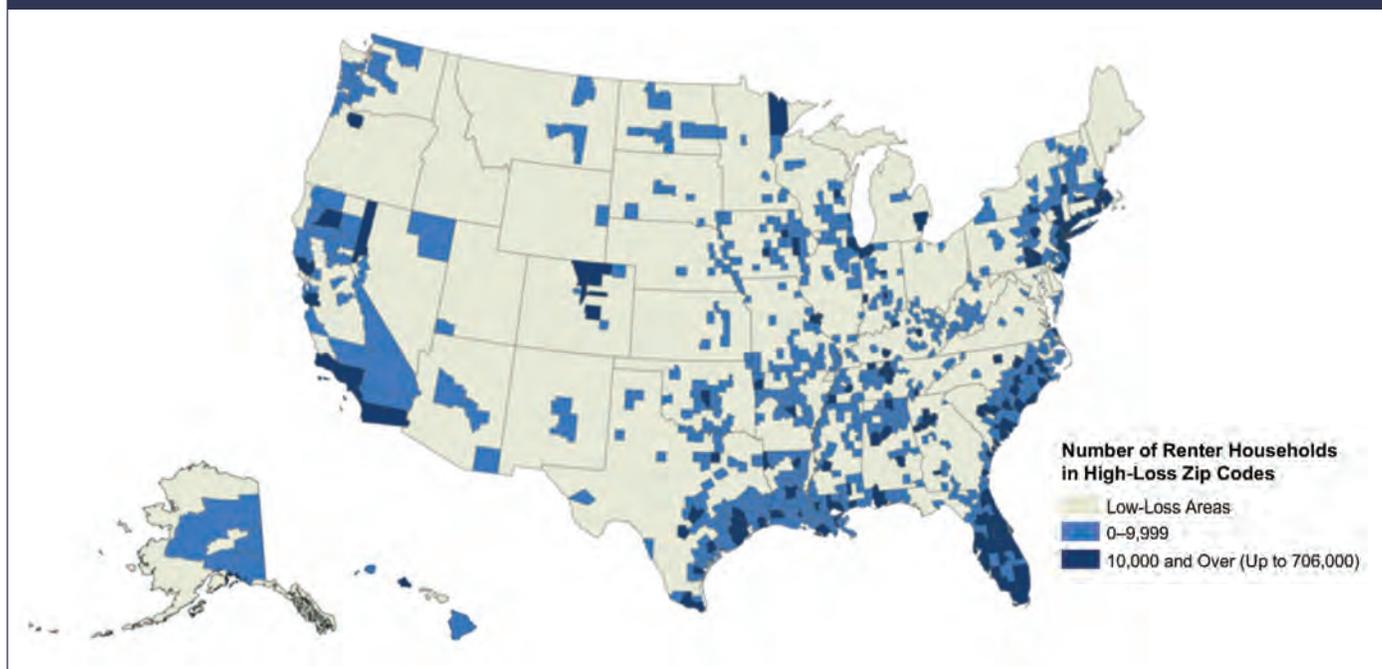
Introduction: The Climate Resilience Imperative in Multifamily Affordable Housing

Across the United States and around the world, many communities are experiencing firsthand the consequences of more frequent and more extreme climate change-driven disasters such as hurricanes, heatwaves, and wildfire events. However, as explained in our working group's October 2019 discussion brief, the consequences of climate change are inequitably experienced. Low-income people of color are more likely than others to be impacted severely by and take longer to recover from disasters. Black and Latinx households are also more likely than white households to be renters, and the majority of rental units are in multifamily properties. According to the Joint Center on Housing Studies at Harvard University, more than 10 million renter households live in ZIP codes prone to natural disasters.¹

Given the vulnerability of renters to climate-related disasters and renters' relative lack of access to disaster recovery funds that prioritize homeowners, multifamily affordable housing must be central to the growing dialogue around climate resilience.²

Heightened vulnerability of low-income communities and people of color to climate impacts has, like most disparate impacts, roots in the past that are perpetuated by current systems. Through racist policies such as redlining, minority households were pushed into poor-quality housing in areas that were vulnerable to hazards ranging from air pollution to flooding.

FIGURE 1: Number of Renter Households in Areas Prone to Natural Disasters



Source: Harvard Joint Center for Housing Studies, America's Rental Housing 2020 www.jchs.harvard.edu. All rights reserved.

Notes: High-loss zip codes had at least \$1 million in disaster-related business and home losses in 2008-2018. Disaster-related losses are adjusted for inflation using the CPI-U for All Items. The number of renters in high-loss zip codes are aggregated to the county level.

BOX 1. Example Climate Resilience Measures for an Existing Multifamily Property

Prevent water from entering the property through leaks in roofing systems or from poor drainage around the property.

Ensure the property has good ventilation, especially in bathrooms and kitchens.

Relocate or protect equipment that shouldn't be exposed to water.

Use moisture-resistant building materials below the design flood elevation (DFE). Seal all cracks and openings in exterior walls below the DFE.

Install backflow prevention devices in floor drains, and permanently seal floor drains that are no longer in use.

Before anticipated flooding, sandbag the floor drains.

Obtain waterproof covers for vents and louvers located under the DFE and install them before an anticipated flood.

Ensure that all equipment located on the roof and attached to the building is properly anchored.

The properties were not built with green space and other features that would help to manage heat and stormwater. Many of those redlined neighborhoods are still home to majority minority populations, and the consequences of that history are being felt every day.

In 2020, natural disasters will occur during a global pandemic. Similar to climate change, although COVID-19 is affecting everyone, people of color, and Black Americans in particular, disproportionately suffer the effects. Contributing factors include crowded housing conditions, inadequate access to healthcare, and stress caused by systemic discrimination.

In this context of ongoing health and climate crises, those of us fighting for healthy, safe, and affordable housing for all must reckon with the need to prepare rental housing for co-occurring disasters. Fortunately, many measures that make housing better able to

withstand and recover from climate disasters also make homes healthier and safer to live in during a public health-related shelter-in-place order.

Resilience is this ability to withstand and recover from events that threaten the stability of a household, building, or community. Climate resilience is a component of holistic resilience.

Some examples of building-level climate resilience measures are listed in box 1. There are other threats, such as gun violence and displacement, that must be addressed in building long-term community resilience.

Purpose of This Working Paper

In our October 2019 discussion brief, our working group outlined why climate resilience is important to all multifamily affordable housing stakeholders and how housing lenders can help drive a strategic shift toward pre-disaster resilience in the sector. In this working paper, we explore the following questions.

- What are the challenges to enhancing the climate resilience of multifamily affordable housing?
- How are opportunities to enhance the climate resilience of a specific property identified?
- Once identified, what are existing funding sources for resilience projects?
- What value can housing owners unlock through resilience upgrades, even without additional incentives, such that that value can be included in underwriting financing for those upgrades?
- What kinds of incentives could lenders, insurers, and the government offer to housing owners that would accelerate investment in resilient multifamily affordable housing?
- What is the role of building codes, certifications, and disclosures in driving resilience upgrades?



Challenges to Enhancing Climate Resilience in Multifamily Affordable Housing

The authors of this working paper have been advocating for healthy building materials and greater energy and water efficiency and safety in multifamily affordable housing for many years. Now, in attempting to increase the climate resilience of this housing, we see old and new challenges to achieving investments at the needed speed and scale.

The challenges break down roughly into the categories of capacity and capital.

Capacity

- Owners lack experience in determining which resilience measures would be beneficial—and how much so—for a specific building in a specific place.
- Owners lack the capacity to work on a new type of project because of competing priorities.
- Owners have limited awareness of, or interest in, pursuing available incentives that would lower upfront project costs.
- Owners face challenges in gaining resident buy-in for resilience projects, especially if they disrupt residents during construction.

Capital

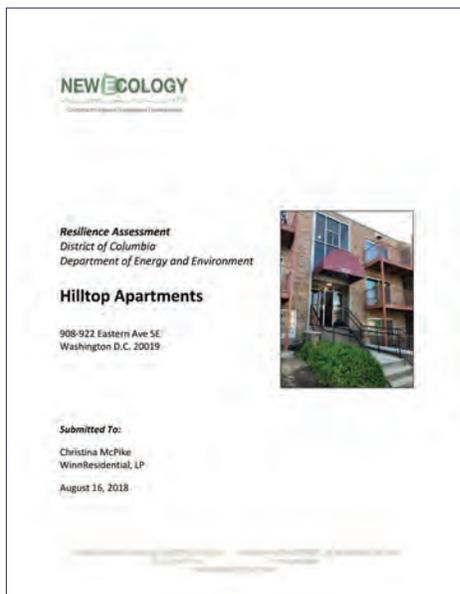
- Multifamily affordable housing generates limited property income that owners can use for installation of resilience measures.
- Debt restrictions limit some owners' options for financing resilience projects.
- Owners and lenders are already navigating complicated processes for financing multifamily affordable housing, especially for subsidized properties, and prefer to avoid further complications.
- Resilience funding sources are disaggregated, and there are limited dedicated funds for the multifamily affordable housing sector. Federal Emergency Management Agency [FEMA] funds, for example, have broad eligibility. Because of other challenges of upgrading multifamily housing, multifamily structures make up only 1.5 percent of the properties mitigated with FEMA Hazard Mitigation Assistance dollars, and the vast majority of those are two- to four-unit properties.
- Owners, investors, and lenders lack confidence that they will see returns or repayments from resilience measures.
- Adding more costs might lead to developers hitting total development cost caps (for low-income housing tax credit [LIHTC] properties).

Identifying Building-Level Pre-Disaster Resilience Enhancement Opportunities

As indicated earlier, one major barrier to multifamily affordable housing owners making their existing properties more resilient is lack of knowledge about which measures they should pursue. This was a challenge for energy and water efficiency when the idea of conducting building efficiency retrofits was still nascent. Over the years, practitioners have developed methodologies for identifying efficiency improvement opportunities in specific buildings and across real estate portfolios. Public and private entities have drawn from experience in developing those energy assessments to create resilience assessments that can be used to identify resilience improvement opportunities.

To know which measures will increase pre-disaster climate resilience in a particular property, the assessor must evaluate its climate vulnerability, starting with the hazards relevant to the property based on where it is located.

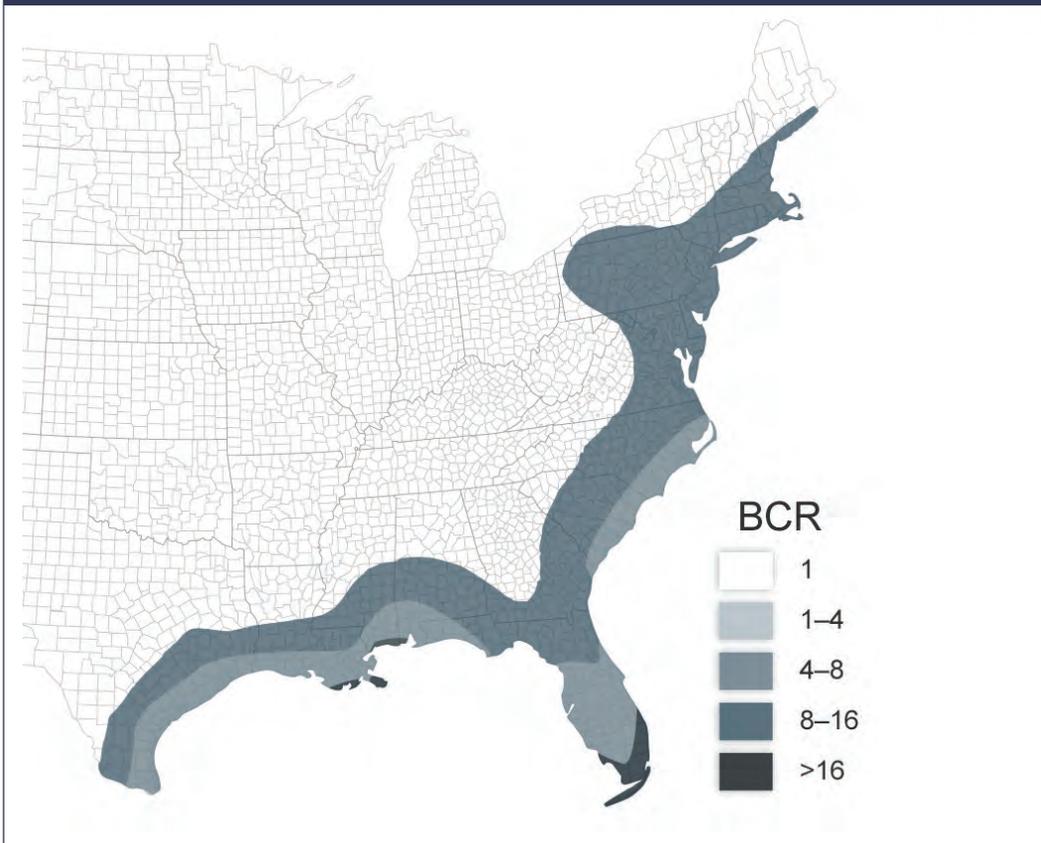
Existing tools can be used to measure climate vulnerability of a multifamily housing property and identify opportunities to mitigate that vulnerability.



A Resilience and Solar Assessment developed by New Ecology, Inc. using D.C.'s Resilience Assessment Tool.

- Washington, D.C.'s Resilience Assessment Tool—In fiscal year 2018, the D.C. Department of Energy and Environment (DOEE) awarded a grant to Enterprise Community Partners, New Ecology, and the National Housing Trust to create a tool that would help enhance the climate resilience of the District's affordable housing stock. The resulting tool comprises three main components: a resilience assessment, an energy and water savings opportunity assessment, and a solar plus storage assessment. The tool was tested on 20 affordable housing properties across the District and is available for public use. The tool is accessible at <https://doee.dc.gov/climateready>.
- B-READY—DNV GL, a firm specializing in risk management and quality assurance, developed the B-READY building resilience assessment tool, which helps building owners and managers translate climate-related, site-specific risks into realizable resilience strategies. The results of the assessment are provided in a technical report that includes a set of recommended resilience measures for increasing the building's ability to withstand climate-related events. The recommendations identify probable implications concerning cost, operations, and occupants. B-READY includes a social resilience component to assess how resilient a building's occupants are to climate-related events. To learn more, contact sustainable.energy.use@dnvgl.com.
- Maps from the Natural Hazard Mitigation Saves 2019 Report—Maps in this report from the National Institute of Building Sciences (NIBS) show how the benefit-cost ratio for each of 16 leading mitigation measures varies across the contiguous United States. The maps do not provide data as granular as is collected using the D.C. or B-READY tools, but they can give a quick sense of the degree to which several leading resilience measures are cost-effective on average. The county-level maps (for example, see Figure 2) present benefit-cost ratios for disaster mitigation measures for the perils of wildland-urban interface fires, hurricane winds, storm surge, and earthquakes.

FIGURE 2: Benefit-Cost Ratio (BCR) of Building New Homes Under the FORTIFIED Home Hurricane Program



Source: National Institute of Building Sciences Multi-Hazard Mitigation Council, Natural Hazard Mitigation Saves: 2019 Report, https://cdn.ymaws.com/www.nibs.org/resource/resmgr/reports/mitigation_saves_2019/mitigationsaves2019report.pdf

- **FEMA benefit-cost analysis tool**—This tool estimates the benefit-cost ratio for mitigation of 18 hazards for which FEMA’s Hazard Mitigation Assistance grants are available. FEMA also offers pre-calculated benefit-cost ratios for five eligible project types: property acquisitions and elevations in the Special Flood Hazard Area, residential hurricane wind retrofits, nonresidential hurricane wind retrofits, individual tornado-safe rooms, and the Hazard Mitigation Grant Program for mitigation after a wildfire.

New Ecology, Inc. has written hypothetical case studies of the results of multifamily housing resilience audits using the D.C. Resilience Assessment Tool. Table 1 shows the kind of results that are generated and that help property owners and residents determine which measures to pursue. Results vary depending on responses to 225 questions about location, building systems, and operations.

TABLE 1: Sample Mitigation Measure Ranking for a Multifamily Building in a Northeast Flood Zone

Hazard	Likelihood	Consequence	Sensitivity	Adaptive Capacity	Mitigation Measure	Measure Cost	Measure Rank
Flood	Moderate	High	High	Low	Elevate mechanicals	\$200,000	High
Earthquake	Extremely low	Extremely high	Moderate	Extremely low	Seismic retrofit	\$10M+	Very low

Source: New Ecology, Inc., https://aceee.org/files/proceedings/2016/data/papers/11_812.pdf

How to motivate housing owners to conduct these resilience assessments is an outstanding question. A starting place is to mirror the process of that for energy efficiency and renewable energy assessments that some housing providers have already conducted.

In Washington, D.C., DOE and housing stakeholders are exploring several options. One is to require or incentivize anyone applying for LIHTCs to use the resilience assessment tool. This would reach the typically larger (50+ unit) properties that tend to receive LIHTCs. The [Strategy Map](#) for incorporating resiliency into D.C. affordable housing identifies key stages when resilience can be incorporated in the property preservation and redevelopment process.

In New York State, owners of subsidized multifamily properties must conduct energy assessments along with the traditional property needs assessment when applying for public financial support from housing finance agencies. The state is exploring the possibility of adding a resilience assessment as a requirement for the financing application as well, but a balance must be achieved between identifying opportunities and burdening nonprofit housing developers.

Although some localities are considering ways to require or incentivize resilience assessments for subsidized properties, that challenge remains largely unaddressed for unsubsidized affordable housing properties.



Existing Funding Sources for Resilience Projects

Even once resilience enhancement opportunities are identified and priced, the next challenge is to identify options for funding their implementation.

There are some measures, such as building envelope efficiency and on-site renewable energy generation with energy storage (RE plus energy storage), that contribute to resilience and can be funded using a variety of sources.

- Many electric and natural gas utility programs incentivize investments in envelope efficiency, and some support RE plus energy storage. For example, California's Solar on [Multifamily Affordable Housing Program](#) and Self-Generation Incentive Program provide incentives for solar and energy storage, respectively.
- Many government agencies, green banks, and other public entities also support investments in envelope efficiency and RE plus energy storage. The Connecticut Green Bank, for example, has a [multifamily housing program](#) that helps owners invest in envelope efficiency.
- [Many financing products](#) exist for financing efficiency and RE plus energy storage projects, from traditional products (loans and leases; see box 2) to specialized products (e.g., energy services contracts).
- State revolving funds can provide a source of financing for resilience projects that create savings or a revenue stream. For water-related projects, for example, [clean water state revolving funds](#) can be used to extend loans at below-market rates, refinance debt, provide loan guarantees, and in some cases provide subsidies or grants.

BOX 2. Financing battery storage for the nation's first affordable housing microgrid

The nonprofit New York City Energy Efficiency Corporation (NYCEEC) [provided financing](#) for a microgrid system involving rooftop solar panels, electricity-generating fuel cells, and large-scale battery storage at the 625-unit Marcus Garvey Apartments in Brooklyn, NY. The system was designed to anticipate the complex's periods of highest electricity demand, and then to use stored electricity instead of grid electricity to meet some of that demand. This reduces the demand charges the housing owner sees on their utility bill. Financing the \$1.3 million onsite lithium ion battery through a direct loan served as a pilot for NYCEEC, and the financial performance they track and disseminate over the coming years will help other financiers invest in this type of project. Although deploying the three systems together is new to the affordable housing market, the technologies involved are increasingly well understood.

Funding available for climate resilience measures beyond building envelope efficiency and RE plus energy storage are overwhelmingly from public sources, and most of those funds are only available after a disaster.

There are limited public resources available specifically for pre-disaster resilience projects. They include the following:

- The [Disaster Recovery Reform Act of 2018](#) created FEMA's Building Resilient Infrastructure and Communities (BRIC) program, a pre-disaster mitigation program funded from a 6 percent set-aside from federal post-disaster grant funding. It allows FEMA to support states that have had major disaster declarations in the past seven years

to undertake new and innovative infrastructure projects that reduce the risks they face from disasters. Funding will vary from year to year, but FEMA has been estimating hundreds of millions of dollars in an average year. The BRIC program will replace FEMA's Pre-Disaster Mitigation program.

- Other FEMA pre-disaster programs are available to states and tribal governments with an approved FEMA Hazard Mitigation Plan (and to local governments, public districts, and nonprofits as sub-applicants to the state or tribal government):
 - Fire Mitigation Assistance Grant (FMAG)
 - Flood Mitigation Assistance (FMA) planning and project grants
- The Department of Housing and Urban Development Community Development Block Grant—Mitigation (CDBG-MIT) program allows eligible grantees in areas affected by recent disasters to perform strategic, high-impact activities to mitigate disaster risks and reduce future losses. Grantees must coordinate their programs or projects with other planned federal, state, regional, or local capital improvements. Half of CDBG-MIT funds must be used to benefit low- to moderate-income people.³ Nearly \$16 billion in funding has been allocated to this mitigation-focused program.
- Subnational public grant programs are emerging in places that are especially vulnerable to certain hazards, such as flooding or earthquakes. For property owners in earthquake-prone California, there are many nonstructural mitigation measures that are inexpensive, but some structural measures are very costly. Several communities and states offer grants to help pay for the costly measures.

Berkeley, California, provides up to 0.5 percent of the value of a residential property in the form of a refund on a transfer tax for the owner to pay for a seismic retrofit. Several states, such as Colorado, offer grants to mitigate fire risk at the wildland-urban interface.

Given the scale and speed of investment needed, it is imperative to increase private investment in the full suite of pre-disaster climate resilience measures for multifamily affordable housing.

Over the past several years, we have learned a lot about how to increase private investment in efficiency and renewable energy in multifamily affordable housing. Large volumes of capital have flowed into multifamily housing resource efficiency as financiers are learning to value the benefits of efficiency (e.g., future utility bill and maintenance cost savings) and include that value in underwriting. Now is the time to leverage that experience to increase investment in pre-disaster climate resilience, as well.

Although the value of pre-disaster resilience is intuitive, it is difficult to quantify for use in financial analysis, which limits private investment. How can we assign value to climate resilience for use in financial decision-making?

Increasing Private Investment by Valuing Resilience

As the cost of inaction on climate change rises, the cost-effectiveness of pre-disaster resilience measures is becoming clearer. Qualitative and quantitative data demonstrate that investing in resilience pays back individuals, building owners, communities, cities, and our entire country in multiples.

Several entities have researched how to value the benefits of climate resilience – resilience dividends – financially, with most of the analysis deriving this value from avoidance of electric power interruptions. Entities interested in this research include utilities, regulators, and electric customers with a heightened need to avoid interruption, such as military bases and hospitals. The [NIBS Natural Hazard Mitigation Saves 2019 Report](#) considers benefits far beyond avoiding electric power interruptions.

The report finds that the nation could save \$11 in future disaster costs for every \$1 spent on adopting model building codes that include climate resilience.

Table 2 displays the benefit-cost ratios of other mitigation strategies. These benefit-cost ratios reflect the aggregate benefits and costs to all stakeholders.

The NIBS study includes charts that show how much of the aggregate benefit from a mitigation measure accrues to each of five stakeholder groups (Figure 3). This and other studies make county-, state-, and national-level calculations based on classifying buildings in a geographic area in terms of characteristics such as building type, era of construction, and occupancy class.

This research is foundational to helping property developers and owners answer a key question:

What are the resilience dividends of climate resilience measures that a property owner could use in financial analysis, including calculating return on investment?⁴

TABLE 2: Benefit-Cost Ratio by Hazard and Mitigation Measure

	ADOPT CODE	ABOVE CODE	BUILDING RETROFIT	LIFELINE RETROFIT	FEDERAL GRANTS
					
Overall Benefit-Cost Ratio	11:1	4:1	4:1	4:1	6:1
Cost (\$ billion)	\$1/year	\$4/year	\$520	\$0.6	\$27
Benefit (\$ billion)	\$13/year	\$16/year	\$2200	\$2.5	\$160
 Riverine Flood	6:1	5:1	6:1	8:1	7:1
 Hurricane Surge	not applicable	7:1	not applicable	not applicable	not applicable
 Wind	10:1	5:1	6:1	7:1	5:1
 Earthquake	12:1	4:1	13:1	3:1	3:1
 Wildland-Urban Interface Fire	not applicable	4:1	2:1	not applicable	3:1

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Source: National Institute of Building Sciences Multi-Hazard Mitigation Council, Natural Hazard Mitigation Saves: 2019 Report, https://cdn.ymaws.com/www.nibs.org/resource/resmgr/reports/mitigation_saves_2019/mitigationsaves2019report.pdf

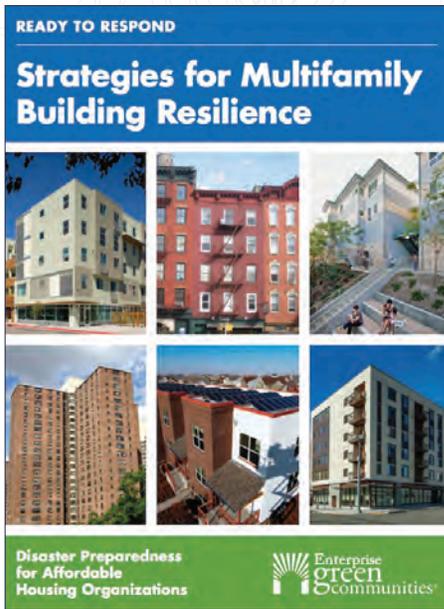


Table 3 conveys our working group’s thinking regarding the extent to which resilience dividends could be reliably quantified for the resilience measures put forth in Enterprise’s seminal resource *Ready to Respond: Strategies for Multifamily Building Resilience*. The list does not include the important strategy of RE plus energy storage systems because this analysis aims to explore the benefits of lesser-known measures. The measures listed mitigate the climate-related perils of flooding, extreme temperatures, winter storms and blizzards, and severe high-wind events. Similar analyses could be performed for mitigants of other perils such as earthquakes, pollution, and deferred maintenance.

Enterprise Green Communities’ groundbreaking guide to multifamily resilience strategies. The resilience measures in Table 3 are the strategies presented in this guide.

FIGURE 3: Stakeholder Net Benefits Resulting from One Year of Constructing All New Buildings to Exceed Select Requirements



Source: National Institute of Building Sciences Multi-Hazard Mitigation Council, Natural Hazard Mitigation Saves: 2019 Report, https://cdn.ymaws.com/www.nibs.org/resource/resmgr/reports/mitigation_saves_2019/mitigationsaves2019report.pdf

TABLE 3: Sources of Resilience Dividends from Resilience Measures

Resilience Measure	Resilience Dividends				
	Lower utility bill costs	Lower ongoing operation and maintenance costs	Lower costs of post-disaster recovery	Lower insurance premiums	Higher occupant satisfaction and lower vacancy
Wet floodproofing	-	-	✓	✓	✓
Dry floodproofing	-	-	✓	✓	✓
Site perimeter floodproofing	-	-	✓	✓	✓
Resilient elevators	-	-	✓	✓	✓
Backflow prevention valves	-	-	✓	✓	✓
Sump pumps	-	-	✓	✓	✓
Envelope efficiency	✓	✓	✓	✓	✓
Elevated equipment	-	-	✓	✓	✓
Elevated living space	-	-	✓	✓	✓
Surface stormwater management	-	✓	✓	✓	✓
Window shading	✓	✓	✓	✓	✓
Distributed heating and cooling	✓	✓	✓	✓	✓
Maintaining backup power to critical systems	-	-	✓	✓	✓
Emergency lighting	-	-	✓	✓	✓
Access to potable water	-	-	✓	✓	✓
Building community ties	-	-	✓	✓	✓
Creating community resilience spaces	-	-	✓	✓	✓
Developing an emergency management manual	-	-	✓	✓	✓
Organizing for community resilience	-	-	✓	✓	✓

KEY:

- ✓ There are well-known methodologies for quantifying this dividend for this measure, and the dividend is widely available to owners and lenders for inclusion in financial analysis.
- ✓ There are well-known methodologies for quantifying this dividend for this measure, but the dividend is not widely available to owners and lenders for inclusion in financial analysis.
- ✓ This resilience dividend theoretically exists for this measure, and it seems feasible to develop a methodology for quantifying this dividend for inclusion in financial analysis.
- ✓ In theory, this resilience dividend exists for this measure, but it would be exceedingly difficult to develop a methodology for quantifying this dividend for inclusion in financial analysis.
- ☐ There is no resilience dividend of this type for this measure.

What We Have Learned About Resilience Dividends

The analysis summarized in Table 3 illuminates the extent to which multifamily affordable housing lenders could (potentially) underwrite debt for resilience projects if they are accounting for resilience dividends in underwriting.

- **A few resilience measures, such as distributed heating and cooling, lower utility bill costs and operation and maintenance costs.** There are well-known methodologies for quantifying this dividend for these few measures, and the dividend is widely available to owners and lenders for inclusion in financial analysis. Most resilience measures do not deliver lower utility bills or operation and maintenance costs.
- **Many measures may lower a housing owner's expenditures on fixing physical damage and relocating tenants due to displacement after a disaster.** It seems feasible to develop a methodology for quantifying this dividend that could be used in financial analysis, but we do not believe such a method has been developed yet. A key consideration is the likelihood of disaster-related expenses over a given period. The resilience dividend increases as the likelihood of disaster-related expenses increase over the period, and thus it is important for lenders to understand what percentage of the resilience dividend to underwrite. Analysis and demonstration projects in partnership with partners such as the Insurance Institute for Business & Home Safety (IHBS) would help insurers and multifamily housing lenders understand the opportunity this resilience dividend presents.
- **Many measures could lower a housing owner's expenses on insurance premiums.** There are well-known methodologies for quantifying this, but the dividend is not widely available to owners and lenders for inclusion in financial analysis for the following reasons.
 - There is insurance for many different hazard types, and buildings may have multiple kinds or none. For instance, properties located in a FEMA floodplain must have flood insurance. Floodplain maps are not only outdated, but also do not consider future effects of climate change. One of the lessons learned through developing and using

D.C.'s resilience assessment tool is that properties at risk of recurring and increasing stormwater flooding and power outages were rarely in the FEMA 1 percent flood zone and did not carry flood insurance.

- Although there are cases in the multifamily sector in which reduced insurance premiums can unlock funding for resilience, that funding has been limited. Flood insurance–holding multifamily properties DOEE worked with, for example, typically paid \$15,000 to \$40,000 per year in insurance premiums. Resilience measures often tied to stormwater flooding and power outages ranged from \$100,000 to \$1 million in estimated total cost per property. Even if insurance premiums could be halved, in many cases, the insurance savings would not cover the incremental cost of resilience measures and thus justify financing. Still, it could be an added inducement when bundled with other expected savings. More research should be done on which premiums can be reduced and which broad categories of measures might be financed with reduced premiums.

An important consideration related to updating FEMA's floodplain maps and accounting for climate risk in insurance premiums is that doing so will require the owners of some buildings to purchase flood insurance for the first time, and premiums will rise for many others. Increasing premiums across the board to generate savings from resilience improvements is not the right way to address climate risk in affordable housing unless and until robust resources are in place to help housing owners make resilience upgrades.

- **Many measures may increase a housing owner's income by decreasing vacancy and increasing occupant satisfaction.** It seems feasible to develop a methodology for quantifying this dividend that could be used in financial analysis. For instance, an underwriter could reduce the assumed vacancy losses, which is usually a percentage of gross income on a project's proforma, in a resilient building. An underwriter who uses a standard of 5 percent for residential vacancy could reduce this percentage if confident that resilience measures would reduce vacancy. To build the knowledge base and inspire that confidence, several studies have

been conducted on the price and rental benefits of ENERGY STAR® and LEED® (Leadership in Energy and Environmental Design) buildings. Examining the benefits of resilience measures specifically, the University of Alabama published a [study](#) indicating that homes built to the [FORTIFIED](#) construction standard rather than a conventional standard increases its resale value by 6.8 percent. Additional studies of this kind, and on multifamily housing properties specifically, would be useful.

Table 3 is not an exhaustive list of potential resilience dividends (see box 3). Still, it is clear from Table 3 that many measures have the potential to unlock not just

one, but multiple resilience dividends. An example of this concept put into practice comes from south Florida, where cities that sponsor property-assessed clean energy (PACE) programs are already [expanding](#) their programs from financing solely efficiency to also financing residential storm-hardening improvements. Resilience measures eligible for PACE financing include hurricane-resistant windows, new roofs and existing roof reinforcement, and water barriers for protection against floods. Proponents state that the resilience measures can generate savings through reductions in utility bills and insurance bills and that these savings can offset much, if not all, of the financing repayment costs.

BOX 3. Opportunity: Using Stormwater Management Credits to Fund Resilience Projects



Although the types of income and expenses outlined in this paper are relevant to most housing properties, some may have other opportunities to reduce expenses or increase income by investing in resilience. For example, Washington, D.C., charges stormwater management fees calculated by determining the volume of stormwater runoff generated from a regulated site. The District has also set up a stormwater retention credit [trading program](#) through which projects that reduce stormwater runoff can sell credits that they generate to properties that can use the credits to meet the stormwater management regulation. [Galen Terrace Apartments](#), which the National Housing Trust Enterprise owns, has demonstrated how a stormwater planter with natural infiltration materials and native plants enhances the property and improves the health of D.C.'s Anacostia River. The stormwater system will reduce the building's growing water bill by lowering stormwater management fees and could be a source of revenue via the stormwater retention credit trading program. This opportunity is not limited to Washington; stormwater utilities across the country use [stormwater fee](#) and [credit programs](#) to encourage similar projects.

Incentivizing Resilience

We have explored the possibility of housing lenders extending financing for resilience projects by accounting for the quantifiable resilience dividends available to their borrowers, housing owners. This dialogue between owners and their lenders should begin now, if it has not already.

Still, the additional financing that this would unlock will not lead to the requisite level of investment in resilient multifamily affordable housing. The reason is simple.

When owners pay extra to make a building resilient, other stakeholders (lenders, insurers, taxpayers) enjoy some of the benefits. Thus, there is a need to reduce the upfront cost of resilience upgrades to building owners by reallocating some of the cost to other stakeholders.

If these other stakeholders provide incentives to building owners to make upgrades, the leftover expense will be reasonable given the benefits they realize from the upgrade.

This concept has been explored in two papers published by NIBS' Multi-Hazard Mitigation Council and Council on Finance, Insurance and Real Estate: *Developing Pre-Disaster Resilience Based on Public and Private Incentivization* and its *addendum*.

These papers describe how a holistic, integrated set of public, private, and hybrid programs can incentivize building owners to invest in resilience measures. NIBS' papers apply the incentivization framework to the entire economy, whereas our working group focuses on property- and portfolio-level projects. We have used the incentivization framework to think about how to develop a suite of public and private incentives that would increase total investment in resilience upgrades in multifamily affordable housing properties. Incentives can be finance-based, insurance-based, or tax-based.

FINANCE-BASED INCENTIVES

Lenders that recognize climate risks will be motivated

to incentivize their borrowers to pursue projects that mitigate that risk.

Finance-based incentives for climate-resilient housing can be delivered through traditional housing finance products or specialized green finance products.

Financiers of multifamily affordable housing have encouraged integration of energy and water efficiency into their traditional financing products for many years. The most widely used examples of this are Fannie Mae's [Green Rewards](#) program and Freddie Mac's [Green Advantage](#) program, which incentivize green mortgage lending by offering preferential terms. Because there is financial risk in not mitigating climate risks, a natural and necessary next step is for Fannie Mae and Freddie Mac to integrate resilience further into their multifamily mortgage products.

Fannie Mae and Freddie Mac mortgage products reach a significant portion of the multifamily affordable housing market, but not the entire market. A second significant source of multifamily housing finance is housing finance agencies (HFAs), which provide a variety of financing offerings. [Minnesota Housing](#), Minnesota's HFA, has been particularly proactive in facilitating the [inclusion of efficiency](#) in projects they finance.

A third is non-agency lending through affordable housing-focused community development financial institutions (CDFIs), many of which have also incorporated energy and water efficiency into their [lending products and programs](#). Affordable multifamily housing lenders leading in green lending include [Community Investment Corporation](#), [Community Preservation Corporation](#), [Inclusive Prosperity Capital](#), [Enterprise Community Loan Fund](#), [Local Initiatives Support Corporation](#), [National Housing Trust Community Development Fund](#), and [Reinvestment Fund](#).

HFAs and CDFIs must now move beyond efficiency to consider how to integrate climate risk into their lending. One data point mortgage lenders should consider is that, over the course of a 30-year mortgage, a property in a 100-year floodplain has a [26 percent](#) chance of being flooded at least once. One way to encourage CDFI

housing lenders to do more climate-resilient lending is to for banks to receive additional credit for pre-disaster resilience investments under the Community Reinvestment Act.

As the global community continues to experience the effects of natural disasters, we anticipate that utility and government programs will increasingly provide incentives for resilience measures in response to demand from policymakers and customers. For example, the state of Washington's climate response strategy includes a section with steps to "Increase resilience to climate changes in housing and site design" that includes weatherization, resilient building materials, and updating building codes. Alameda, CA's climate action plan includes implementing building retrofit programs for earthquake resilience. These new and expanded programs will need to be aligned with the traditional housing finance streams outlined earlier so that all resources can be used together to maximize benefits.

In addition to traditional multifamily affordable housing finance streams, there are many specialized efficiency and renewable energy financial products that can be used to finance resilience upgrades. Two of the most widely used are commercial property assessed clean energy (C-PACE) and energy services agreements (ESAs). C-PACE, which must be locally enabled through legislation, allows property owners to secure long-term financing for energy upgrades to their buildings, and the loan is paid back on the property tax bill. C-PACE has taken off in the commercial sector broadly, but few owners in the multifamily affordable housing sector have taken advantage of it for reasons outlined in a 2018 paper commissioned by Energy Efficiency for All. San Francisco has, however, helped multifamily property owners use C-PACE to comply with a seismic retrofit mandate.

Similar to C-PACE, ESAs provide a way for customers to make retrofits with no upfront capital expenditures. Generally, under an ESA contract, the customer pays an energy services company based on actual savings, reducing customer risk. In 2018, Reinvestment Fund financed a portfolio-level ESA project, bringing the benefits of this model to the multifamily housing market. These financial products provide long-tenor financing—oftentimes 20 to 25 years—which can extend the payback for capital investment well into the future and thereby reduce the effect on the building's profit and loss statement. In addition, these programs are tied to the building, not the owner, so the costs accrue to the party benefiting from the improvements if the property is sold.

Financiers using both traditional and specialized financial products can incentivize owners to invest in resilience upgrades by helping them combine quick-payback measures (e.g., lighting upgrade) with resilience measures that have longer or less certain paybacks, a process called "bundling."

Bundling can happen through a mid-cycle retrofit or through a larger rehabilitation at a refinance event. If more financiers follow the lead of Fannie Mae and Freddie Mac and offer preferential financing terms for green projects, even more owners will be attracted to pursue bundling opportunities.

INSURANCE-BASED INCENTIVES

An incentive from an insurer can come in the form of an insurance premium reduction or grant.

There have been successful models for using premium reductions to finance climate resilience upgrades. MyStrongHome, for example, allows single-family homeowners to use insurance savings for roof repairs, and the insurance company Chubb Ltd. compensates policy holders when they take preemptive measures to reduce damage from extreme weather events, such as placing hurricane shutters on buildings or choosing to live in less flood-prone areas.

To enable insurance-based incentives, state insurance commissions must allow insurance premium reductions, which is an area for potential advocacy. The Alabama Legislature requires insurers to offer discounts to owners of homes meeting the FORTIFIED standards, which have been proven to offer protection against wind damage. Although more states could mandate insurance premium reductions, current best practice observed by our working group is for housing owners and advocates to engage directly with insurers for premium reductions based on site-specific resilience measures and community-level assessments. In either approach, additional research on performance and benefits of resilience measures is critical.

Our working group's experience to date indicates that the payback from lower insurance premiums would cover only a portion of the added cost of implementing resilience.

Plus, given that insurance is typically offered annually, the long-term discounts may not be reflected enough to make many projects economic.

Perhaps noting these limitations, insurers in North Carolina have taken their incentive beyond a premium reduction. The North Carolina Insurance Underwriting Association's [Strengthen Your Roof](#) pilot program provides grants up to \$6,000 for roof replacement of coastal homes as part of a pilot project. The association is conducting it to assess the financial benefits of policy holders having more resilient properties.

TAX-BASED INCENTIVES

There is a significant opportunity to increase investment in climate-resilient multifamily affordable housing through tax-based incentives.

This is because tax credits are a major source of financing for affordable housing through the LIHTC program. For longer than 30 years, HFAs have used the LIHTC program to develop and preserve affordable rental housing that is energy and water efficient. One of the main ways they do so is by [including](#) energy and water efficiency-related items in the state's Qualified Allocation Plan, which details the selection criteria

and application requirements for LIHTCs. Some states require some level of efficiency efforts (e.g., conducting an energy assessment in conjunction with the property needs assessment), and others provide incentives but do not require them. It is a natural extension of these efforts to include climate resilience measures beyond efficiency.

To a lesser but still meaningful extent, housing is also financed using historic rehabilitation tax credits, and critical community development assets beyond rental housing, such as community centers and small businesses, are financed using new markets tax credits (see box 4). Neither of these has program elements that require or provide incentives for any climate resilience measures in the projects they finance, but they could do so by following the example of the LIHTC program.

Other tax-based opportunities to incentivize resilience include:

- Using [opportunity zones](#), which provide tax incentives to investors in underserved communities, to channel investments into climate resilience in those communities
- Increasing the real estate transfer tax to support resilience in affordable housing (an adaptation of the [proposed](#) real estate transfer tax in Massachusetts)
- Amending the Internal Revenue Code of 1986 to provide a tax credit to individuals and businesses for disaster mitigation expenditures (as proposed in the [SHELTER Act](#))

Although innovative underwriting and a suite of public and private incentives have the potential to drive investments in resilience, there will always be a need for regulation, certification, and data transparency when it comes to developing high-performance buildings at scale.

BOX 4. Using New Markets Tax Credits to Finance Resilient Homes in New Orleans

After Hurricane Katrina, AMCREF Community Capital, a community development entity based in New Orleans, provided nearly [\\$13 million](#) in new markets tax credit financing to create 150 affordable homes that used environmentally safe materials and reduced homeowner energy costs by 75 percent (achieving LEED® Platinum certification). The homes were also raised to avoid floods and built to withstand hurricane-force winds, rebuilding in a way that will be safer for the long term.

Foundations of Resilient Investment

BUILDING CODES, CERTIFICATIONS, AND RATINGS

Model building codes in the United States mostly aim to provide a minimum set of criteria for safe, affordable construction and operation of buildings. They represent a community's formal expectations in addressing its building-related risks and should be applied consistently to all buildings in the community. Model building codes are developed through a consensus-based process that ensures the results are cost-effective and widely applicable. Although model codes are developed at the national level, they must be adopted and enforced at the state and/or local levels. These codes should apply to all buildings in all communities, not leaving certain structures and whole populations behind. As identified in NIBS' *Natural Hazard Mitigation Saves 2019 Report*, keeping up to date on building codes provides an \$11 benefit for every \$1 invested.

Communities that are not operating under the most recent building code are not capturing the full benefit of the latest regulations.

Nevertheless, model building codes favor affordability (lower upfront costs) over lifecycle costs (lowest total societal cost of ownership). Favoring lifecycle costs over affordability could raise first costs but more than offset them with future resilience benefits to tenants, owners, and others. NIBS found that optimizing model building codes for the lowest total societal cost of ownership would provide an additional \$4 of benefit for every \$1 invested.

The 2021 International Energy Conservation Code update will require more insulation, electrification readiness, and other resilience-enhancing requirements, but it must be implemented at the local level. State-level adoption, compliance, and enforcement are constant challenges. Governments must use an array of policies to affect building energy use at multiple points throughout a building's lifecycle, from design through years of operation. The key is to identify "trigger points" at which an owner (or prospective owner) may be willing to make investments. The NIBS *Life-Cycle Policy for Cities* can help identify those trigger points.



One way to encourage use of more stringent codes is to require them as a condition of accessing public financial assistance. FEMA is taking this approach; communities that use FEMA aid to rebuild public facilities must follow new construction codes to make them resilient to future calamity.

Voluntary certifications and rating systems also help deploy building resilience beyond minimum code requirements.

Certifications and ratings that are already doing so include the following.

- [Enterprise Green Communities 2020](#) Criterion 1 is Integrative Design, under which 10 points are awarded for achieving the criteria under the Resilient Communities: Multi-Hazard Risk/Vulnerability Assessment. The assessment must:

- Prioritize evaluation of applicable hazards (e.g., wildfires, flooding, seismic) identified in the state or county hazard mitigation plan for which a project is located
 - Identify strategies that will be implemented that address at least the top three risk factors identified for a project
 - Ensure that these implemented strategies that have been included in the project are referenced, documented, and explained
- Insurance Institute for Business & Home Safety [FORTIFIED](#) is a building method that goes beyond building codes to strengthen residential and commercial buildings against specific natural hazards such as high winds and hurricanes. It is currently applicable only to single family homes.
 - [RELi](#) is a rating system and leadership standard that takes a comprehensive approach to resilient design.
 - The [U.S. Resiliency Council Building Rating System](#) assigns one to five stars for safety, damage, and recovery. It has been earthquake focused but is evolving to incorporate other hazards.
 - The [REDi Rating System](#) assesses organizational resilience, building resilience, and ambient resilience, with a focus on earthquakes.

BENCHMARKING AND DISCLOSURE

Like building codes, certifications, and ratings, benchmarking and disclosure of information related to resource consumption and climate vulnerability is critical to increasing investment in climate-resilient multifamily affordable housing.

Many properties across the United States are already required to disclose their energy performance in comparison with that of other similar buildings (benchmark). This has led property owners and their financiers to see the performance improvement opportunities in their own portfolios.

Climate vulnerability disclosure could be added to existing benchmarking requirements.

Expanding disclosure of housing properties' climate vulnerability helps illuminate the value of mitigation measures, increasing consumer interest and the market value of resilience.

It is important to note, however, that most benchmarking regulations apply to large (25,000 square foot or more) buildings, which does not include many multifamily affordable housing properties.

Specific climate vulnerability disclosure requirements could be modeled after existing resilience rating systems like those listed earlier. There are also some requirements already in place. Since Hurricane Harvey, [Houston](#) has required disclosure of a property's flood risk upon sale. California [requires](#) disclosure of seismic attributes upon the sale of existing homes.

Multifamily affordable housing financiers should also be required, or at least encouraged by the housing community, to assess and disclose climate risk exposure of their building portfolios.

An increasing number of resources is available to help financiers disclose climate risk exposure. The [Sustainability Accounting Standard Board](#) has developed an approach to how to do so on a mortgage portfolio, and the international Financial Stability Board's [Task Force on Climate-related Financial Disclosures](#) is developing recommendations on how financial services companies should make climate-related financial risk disclosures. The task force's recommendations include physical, liability, and transition risks associated with climate change.

Of note is that even if housing owners and financiers are motivated to assess and disclose climate vulnerability, available data inputs not accurately reflecting risks can limit the accuracy of those assessments. For example, insurers currently use FEMA floodplain maps, which are outdated and do not reflect future risks in the context of climate change. The multifamily affordable housing community, along with all other sectors of the economy, are relying on up-to-date climate modeling and other information to inform their efforts.

Conclusions

Pre-disaster resilience in multifamily affordable housing means increasing a property's ability to support residents in absorbing and recovering from disruptions. In the context of increasing frequency and severity of climate-related disasters and other disruptive events, now is the time to invest in resilience that addresses the fact that disasters disproportionately burden low-income renters, who also have fewer resources to recover. We have explored how to encourage investments in appropriate property-level improvements by underwriting resilience dividends available to property owners and by creating incentives that shift costs from those who bear the upfront costs of mitigation measures (property owners) to those who reap their benefits (lenders, insurers, taxpayers).

The most readily quantifiable resilience dividends are savings and revenue from building envelope efficiency and on-site renewable energy plus energy storage systems. These measures provide resilience benefits on their own, but because they have readily quantifiable financial value, that value could be leveraged to support additional resilience investments.

As with efficiency measures, lenders should consider bundling resilience measures that have more reliable or quicker payback with ones that are less reliable or have slower payback.

Many other measures may deliver dividends in the form of lowering a housing owner's expenditures on insurance premiums, fixing physical damage, and relocating tenants who are displaced after a disaster. It may be possible to have insurance premiums reflect climate risk, but given that insurance is typically offered annually, the long-term discounts may not be reflected enough to make many projects economic. What may be even more promising is the possibility of considering the cost of recovery from disasters in underwriting resilience projects, starting with lower-consequence but more-

frequent events such as urban flooding.

Many resilience measures also have the potential to increase a housing owner's income by decreasing vacancies and increasing occupant satisfaction. These resilience dividends could be used in financial analysis, but more data need to be collected to support inclusion of these dividends in underwriting.

Based on this analysis, there is definite opportunity for housing lenders to extend financing for resilience projects by accounting for the quantifiable resilience dividends available to housing owners. Still, the additional financing that this would unlock will not lead to the requisite level of investment in resilient multifamily affordable housing. It is necessary for lenders, insurers, and the public (through the government and utilities) to provide incentives to building owners that make projects economic.

When assessing resilience dividends, multifamily affordable housing developers, owners, lenders, and insurers should consider compounding probability, which recognizes that there is an increasing chance of experiencing a disaster over an increasing number of years. This compounding probability is limited by the fact that an owner typically holds a multifamily property for less than 10 years. Owners who hold properties for longer will have a greater likelihood of seeing a positive return on investment from resilience investments.

Although innovative underwriting and a suite of public and private incentives have the potential to drive investments in resilience, there will always be a need for regulation, certifications, and data transparency when it comes to retrofitting buildings at scale. Building codes and certifications, benchmarking, and disclosure of climate risks are fundamental to accelerating investment in resilient multifamily affordable housing.

Questions for Future Research

- What do different resilience measures cost, what benefits do they provide, who enjoys those benefits, during what time period? Which companies and organizations are working to answer these questions?
- What information is available related to incurred and avoided disaster recovery costs?
- Is recovery from commonly occurring, destructive events (e.g., urban flooding) included in income and expense reports being reviewed when lenders are considering new loans? If not, why, and could it be?
- Although the focus in this paper is on identifying and implementing resilience measures in individual properties, community-level resilience requires that many properties be improved, along with the utilities and transportation infrastructure on which buildings rely. What is the most cost-effective balance between resilient community-level green infrastructure and building-level retrofits? The Alliance for National & Community Resilience [benchmark system](#) aims to identify that balance.
- What is needed to ensure that there is a ready workforce to support resilience upgrades?
- Some important resilience benefits cannot yet be quantified. How can we measure people's peace of mind and protection of pets, culture, and memorabilia?
- What are best practices for engaging residents in the process of selecting and installing resilience measures?
- A study for the U.S. Geological Survey's [HayWired](#) disaster planning scenario found that, even if all buildings in a metropolitan area met the requirements of the latest seismic design provisions in the current building code, a virtually inevitable earthquake could render 25 percent of the building stock unusable for months or more. What is the proper balance among affordability, lifecycle ownership costs, and the existential threats that single, large disasters pose to communities?

By becoming more resilient, multifamily housing properties become pillars in the overall system of infrastructure, benefitting not only residents, property owners, and property investors, but also the broader community. However, [a body of research](#) indicates that making those investments can also lead to displacement as property values, and potentially rents, rise. As affordable housing stakeholders work together to pursue efforts to increase investment in climate resilience in multifamily affordable housing, we must be clear-eyed about both the opportunities and the risks of those efforts so that we achieve climate-resilient community stabilization without displacement. In doing so, we take a step in making sure that climate resilience is contributing to holistic community, regional, and national resilience.

ENDNOTES

- 1 ZIP codes prone to natural disasters are those in which homes and businesses suffered losses of at least \$1 million due to disasters from 2008–2018.
- 2 We use the term “multifamily affordable housing” to refer to public housing, subsidized housing, and market rate housing that is affordable to low-income renters (i.e., naturally occurring affordable housing) with five or more units. This paper is focused on existing buildings and thus does not cover issues related to siting and building of new construction, even though these issues are important to consider in the broader dialogue about the resilience of multifamily affordable housing to climate and other shocks.
- 3 The program defines low- to moderate-income as having income of less than 80 percent of the local area median income.
- 4 Return on investment = benefit-cost ratio minus 1, so a benefit-cost ratio of 11:1 equates to a return on investment of 10, or 1,000 percent, over the life of the property.



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