A GUIDE FOR PUBLIC-SECTOR RESILIENCE BOND SPONSORSHIP

re:FOCUS PARTNERS

RE bound
INSURING FOR RESILIENCE

TABLE OF CONTENTS

A GUIDE FOR PUBLIC-SECTOR RESILIENCE BOND SPONSORSHIP

www.refocuspartners.com/rebound

ABOUT RE.BOUND

This paper is a product of the RE.bound Program, an initiative of re:focus partners, led by Shalini Vajjhala and James Rhodes (Principal Investigators) with the generous support of the Rockefeller Foundation. The RE.bound Program was designed in two phases. Phase 1 (April-December 2015) brought together a team of leading insurance industry collaborating organizations to validate the conceptual basis for a new class of Resilience Bonds, as originally conceived by the RE.bound Principal Investigators. For more information about the first phase of the RE.bound Program, please visit www.refocuspartners.com/rebound, see our April 2015 program launch announcement, and read the December 2015 final report titled: Leveraging Catastrophe Bonds as a Mechanism for Resilient Infrastructure Finance.

Phase 2 was designed to engage potential public sector sponsors to explore applications of the Resilience Bond model in the public interest. This phase was led exclusively by re:focus partners, and this report and all associated materials were developed solely by re:focus with a charitable purpose intent. The views presented in this report are those of re:focus alone.

Report Contributors

re:focus partners, llc is a design+finance firm dedicated to developing integrated resilience solutions and innovative public-private partnerships for vulnerable communities around the world. The re:focus team works directly with government agencies at all levels to serve as an honest broker of new resilient infrastructure projects and transactions, ensuring that both have sound financial returns and economic, social, and environmental integrity for the communities they serve. To learn more, visit: www.refocuspartners.com.

Program Funder

The Rockefeller Foundation aims to achieve equitable growth by expanding opportunity for more people in more places worldwide and to build resilience by helping them prepare for, withstand, and emerge stronger from acute shocks and chronic stresses. Throughout its 100-year history, The Rockefeller Foundation has enhanced the impact of innovative thinkers and actors working to change the world by providing the resources, networks, convening power, and technologies to move them from idea to impact. In today's dynamic and interconnected world, The Rockefeller Foundation has a unique ability to address the emerging challenges facing humankind through innovation, intervention and influence in order to shape agendas and inform decision making. For more information, please visit www.rockefellerfoundation.org.

OVERVIEW

Governments are typically 'insurers of last resort.' When disaster strikes, vulnerable communities turn to government agencies—domestic and international—for support and recovery assistance. More recently, as the frequency and severity of different types of disasters have grown, the gap between insured losses and total economic losses has also grown. As a result, many local, state, and national government agencies have found themselves in the position of the expected insurers of *first* resort. This is an unsustainable situation for budget-constrained public entities that are already struggling to meet existing needs with current taxpayer dollars, let alone fund unpredictable crises.

This paper offers a path forward for governments at all levels—cities, states, federal agencies, and international aid programs—to align public-sector disaster risk reduction measures with private insurance using Resilience Bonds. This new bond mechanism was developed to (1) expand financial protections—in the form of catastrophe insurance coverage—for vulnerable communities and (2) leverage new project finance for resilient infrastructure projects that measurably reduce risk. The aim of this work is to help improve the speed, availability, and cost-effectiveness of both proactive resilience project finance and reactive disaster recovery funding.

Who Should Read This Report

This report is designed specifically for government officials, NGOs, consultants, design firms, insurance and financial industry experts, and other local stakeholders working to improve communities' physical and financial resilience to perils ranging from hurricanes, tropical storms, coastal and inland floods to earthquake, wind, and fire, among others. All examples, graphics, and recommendations in this report were developed based on ongoing in-depth discussions and question-and-answer sessions with public officials who are currently exploring options for Resilience Bond sponsorship, and they are intended to support other local, state, national and global decision-makers seeking similar solutions, including:

- Federal and state government disaster recovery officials
- City, public utility, and transit authority leaders and financial managers
- International aid agency representatives
- Regional and global development bank & fund managers
- Managers of public insurance pools
- Large asset managers (Ports, Pension Funds, Hospital Systems, Universities, etc.)

Taken together, the examples and recommendations in this report are designed to help public officials explore how Resilience Bonds can support their financial priorities, mobilize capital for diverse on-the-ground risk reduction projects, and enable government agencies to leverage both public funds and private finance for new resilience solutions.

INTRODUCTION

Cities around the world are facing increasingly frequent and severe weather events. Many governments and public utilities are overexposed and underinsured for these risks and others, including earthquakes, floods, and wildfire. In heavily developed urban areas, local leaders are also coping with aging and failing infrastructure systems that increase the potential for cascading failures and devastating losses. In developing countries and regions, officials are struggling to manage rapid growth, meet demand for new services and infrastructure, and manage the consequences of disaster in informal communities.

This means that the rising costs of natural disasters are more frequently passed on to state and national budgets. The funding that local governments do have for both infrastructure and insurance is piecemeal and inadequate, making it difficult for national governments and international aid agencies to anticipate extreme risks and proactively align private insurance with efforts to support local disaster risk reduction measures.

One new financing mechanism that can help bridge the gap is a Resilience Bond. Resilience Bonds are a variation on conventional catastrophe bonds that link insurance and resilience projects to monetize avoided losses—such as, a reduction of hurricane insurance costs and claims—through a rebate structure. The resulting "resilience rebate" can serve as a source of predictable funding which sponsors (insurance policyholders) can proactively invest in projects that strategically reduce risk. If catastrophe bonds are similar to life insurance policies that only pay out when the worst disasters strike, then Resilience Bonds are more like progressive health insurance programs that provide incentives to make healthy choices—quitting smoking or exercising regularly—that reduce long-term risks and the cost of care. In the case of infrastructure, this is like cities upgrading coastal protection systems or reinforcing whole neighborhoods of houses to reduce physical and financial damage from storms and floods, which in turn lowers potential losses passed up the chain to state and federal disaster budgets.

Governments around the world are facing pressure to make major budget decisions on a disaster-by-disaster basis. This is unsustainable. Resilience Bonds offer a new pathway to monetize both public and private benefits of resilient infrastructure projects, stretch disaster recovery funds further, make better use of taxpayer dollars for disaster response, and leverage capital markets to both expand insurance coverage and increase protection for vulnerable communities. This paper offers a collection of ideas on potential global applications of Resilience Bonds. The following sections provide background on the design and structure of Resilience Bonds; summarize key insights from earlier work under the RE.bound Program; extend the approach to a range of potential new resilience applications; and offer ideas for national and international organizations seeking to build resilience and improve the effectiveness of global disaster risk reduction resources.

BACKGROUND

Leveraging Cat Bonds for Resilience Project Finance

A Resilience Bond is a new insurance instrument designed to help cash-strapped governments increase both physical protection and financial insurance against disasters. These bonds link insurance coverage that public sector entities can already purchase (including parametric insurance policies and catastrophe bonds) with capital investments in resilience projects (such as, flood barriers and building retrofits) that reduce expected losses from disasters. This connection between insurance and infrastructure is important, because just as life insurance doesn't actually make you physically healthier, catastrophe bonds do not reduce physical risks and only payout when disasters strike.

In a December 2015 report titled "Leveraging Catastrophe Bonds as a Mechanism for Resilient Infrastructure Project Finance," the RE.bound Program[1] developed and validated a methodology and approach for integrating catastrophe bonds and infrastructure project finance using the detailed coastal surge protection project designs for three US cities. A team of risk experts, insurance industry modelers, and investment banking partners (1) modeled the physical and financial risk reductions from selected resilient infrastructure projects; (2) assessed options for designing and issuing a new type of bond that integrates elements of traditional catastrophe bonds and other relevant social impact bonds; and (3) explored how these new bonds can mobilize capital for a wider portfolio of on-the-ground risk reduction projects. The results of this work are an industry-validated model for a new type of insurance instrument: a Resilience Bond.

The Building Blocks of Resilience Bonds

The main point of departure for a Resilience Bond is a catastrophe bond. Catastrophe bonds, also known as cat bonds, have traditionally been used by large insurance and reinsurance firms to protect themselves against extreme losses. These bonds are more like insurance policies than traditional municipal bonds, and are designed to reduce the financial risks associated with very low-probability, high-consequence natural disasters.[2] For example, if a hurricane strikes, the aim of a catastrophe bond is not to limit the damages on the ground, but instead to reduce the resulting economic disruption.

What makes cat bonds unique is that in the event of a disaster they are designed to be "triggered." This means that when a disaster reaches a predetermined threshold (e.g. $1 billion in losses or a 10-foot surge height) during the bond term (usually 3-5 years), the cat bond policyholder keeps the full value of the bond to pay off losses and investors lose part or all of their principal invested. Cat bonds can cover a wide range of potential disasters, including hurricanes, floods, earthquakes, and multiple catastrophe scenarios. Because of the risk of a triggering event, these bonds provide attractive rates of return to investors. Cat bonds are also appealing because disaster risks are uncorrelated with other investment risks. As of the first quarter of 2017, the Cat Bond market was worth ~$27 billion USD with issuances of approximately $1.4 billion above the ten-year average.[3]

[1] For more information on the RE.bound Program visit: www.refocuspartners.com/rebound

[2] For an easy-to-read overview and history of the evolution of the cat bond market from Hurricane Andrew to Hurricane Katrina, see Michael Lewis' In Nature's Casino (New York Magazine, August 2007).

[3] For more detail see the "Q1 2017 Catastrophe Bond & ILS Market Report" by Artemis (2017).

Figure 1 on the following page illustrates the basic structure of a conventional catastrophe bond, which includes the following parties:

1 Sponsor

The sponsor of a cat bond is the insurance policy holder. Sponsors (or co-sponsors) are responsible for paying premiums and are direct beneficiaries of any payout.[4]

2 Issuer

A cat bond is typically issued by a special purpose vehicle (SPV) established by an insurance firm or major investment bank (or both) that structures the terms of the financial transaction, creates the legal framework for implementation, takes responsibility for getting the bond to market, and manages the money held in the collateral account.

3 Investors

Cat bond investors come in a variety of shapes and sizes, ranging from individual investors to large pension funds. These investors are typically seeking diversification in their portfolios and are willing to take more risk (including the risk of losing their principal invested) for higher returns on investment.

When a catastrophe bond is issued, the capital raised from investors is held in a secure low-yield collateral account for the term of the bond. If there is no triggering disaster during this term, then investors get their money back at the bond's maturity date, just like any conventional bond. This return of principal combined with regular coupon payments (from the sponsor's insurance premiums and interest on the collateral account) provides investors with their return on investment. On the other hand, if a trigger event does happen during the bond term, then the investors lose all or a portion of their principal invested. This money is used to make a payout to the cat bond sponsors.

Figure 2 shows how the addition of a resilient infrastructure project to a conventional cat bond structure can reduce investors' risk (of losing their principal invested) and result in lower premium payments for sponsors. The basic relationships among sponsors, issuers, and investors are similar to conventional cat bonds. The difference is that Resilience Bonds explicitly incorporate the risk reduction value of a specific resilience project on the expected loss to investors. This is a two-step process. The first step is for the issuer to use financial catastrophe models to validate if and how much a resilience project reduces expected losses. This is used to set the value of the resilience rebate from the reduced cost of coupon payments to investors. The second step is to capture the cost savings from the reduction in coupons paid to investors and distribute these savings to bond sponsor(s) in the form of a resilience rebate which can be used to finance risk reduction investments.

[4] Because both catastrophe bonds and Resilience Bonds are insurance products—not municipal bonds—sponsors are only responsible for paying premiums, not for repaying bond principal, which can help public-sector sponsors, such as municipal governments, avoid concerns about debt capacity limits or credit rating impacts.

Resilience Bond Structure

Figure 1.

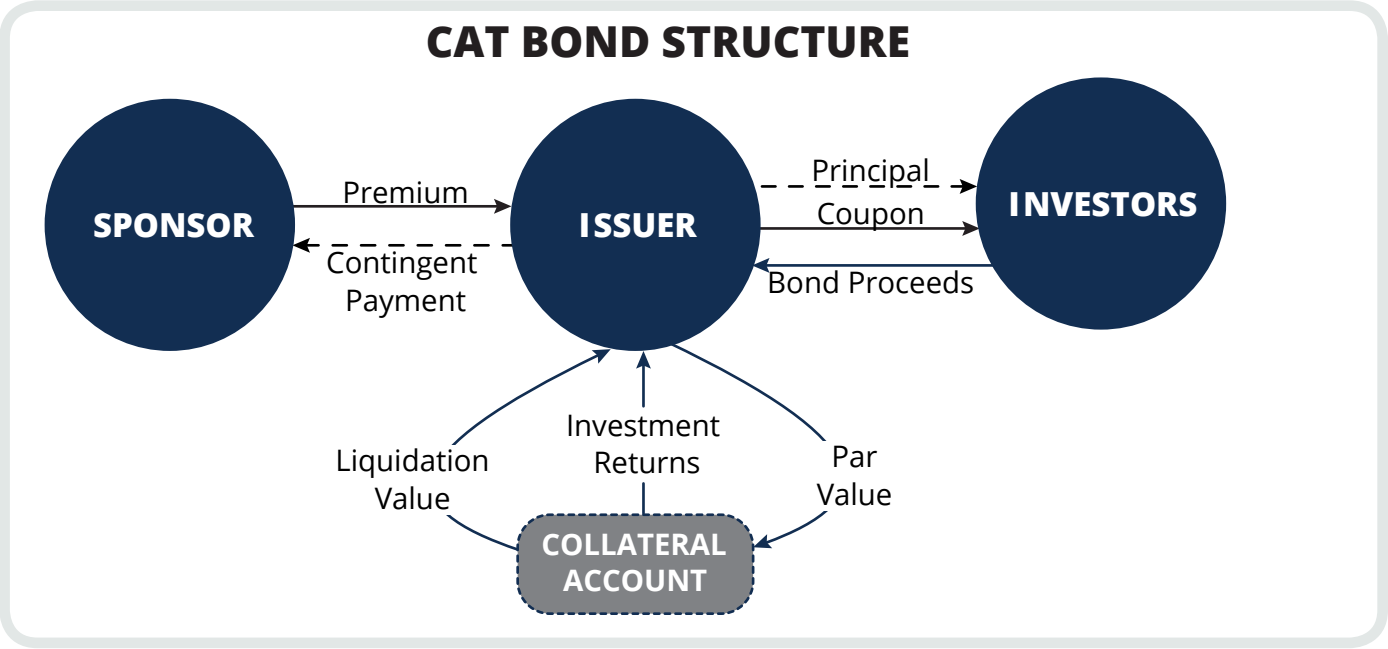
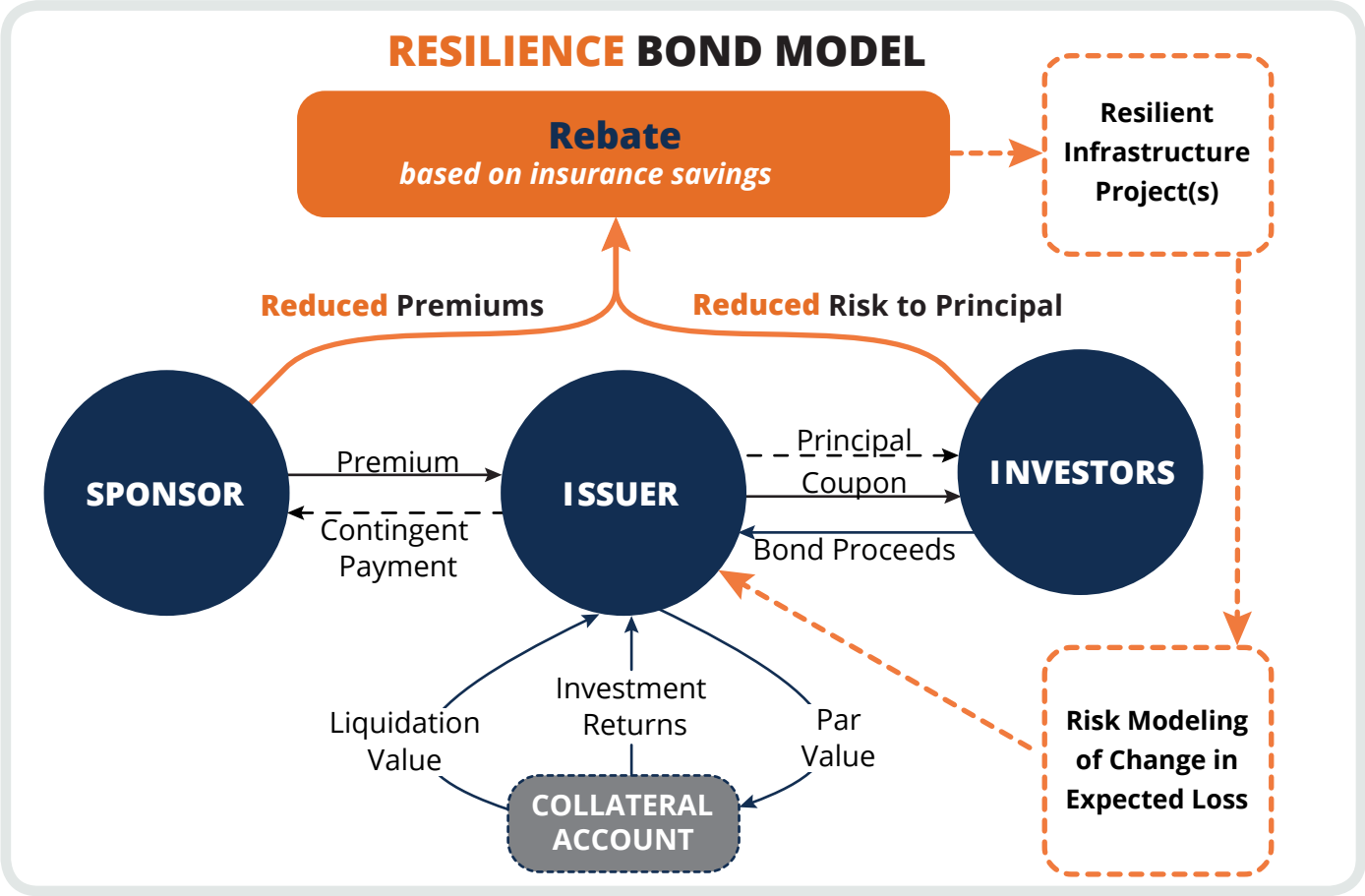


Figure 2.



In recent years, governments have begun to use cat bonds and similar financial instruments, such as parametric insurance policies, to transfer risks from the public sector to the capital markets.[5] The Government of Mexico recently renewed its long-standing cat bond program in collaboration with the World Bank to cover $360 million in tropical storm and earthquake risks. Following Hurricane Sandy in 2012, large public asset holders, including the New York Metropolitan Transit Authority (MTA) and Amtrak, also sponsored cat bonds as part of their overall insurance portfolios. Most recently, the National Flood Insurance Program (NFIP) announced a new reinsurance program designed to transfer federal flood risks to a set of private insurance companies. What all of these public sector catastrophe bond issuances have in common is that their sponsors—the ultimate beneficiaries of any insurance payout—are also entities that manage vast capital programs and funds. Unlike conventional cat bond sponsors, who may or may not control the underlying assets at risk, the public sector sponsors highlighted above have the potential to capture insurance benefits to support resilience upgrades in a virtuous cycle of physical and financial protection.

Hurricane Sandy & The New York City Subway

The New York MTA experienced significant subway flooding during Hurricane Sandy. MTA's Chairman and CEO noted: "In the aftermath of Superstorm Sandy, the traditional avenues we use for insurance and reinsurance contracted dramatically, making it exceedingly difficult for the MTA to obtain insurance." The MTA was able to secure $200 million in coverage through a catastrophe bond at premium costs well below quotes received for traditional property coverage for the same period. Although catastrophe coverage is a complement to not a replacement for property insurance, this example highlights how cat bonds can serve the public interest by shifting extreme risk to capital markets. The opportunity highlighted on pages 24-26 shows how transit systems, like the MTA, can take advantage of planned capital projects to reduce flood risk (modeled using financial industry catastrophe models) to enable them to re-price cat bond renewals and new issuances to generate a resilience rebate. Without this link, resilient infrastructure investments made by a transit authority to protect its own assets will generate untapped benefits that pass through to private insurers and investors in their bonds, who face lower potential losses.

Because catastrophe bonds become more attractive investments when the probability of loss and damage go down, public sector sponsors are uniquely positioned to benefit from lower on-the-ground risks and more affordable insurance. For example, flood protections designed to divert millions of gallons of floodwater can create both social value (i.e. less basement flooding and mold related health impacts) and environmental benefits (i.e. fewer combined sewer overflows). Separately, the same project has a measureable financial benefit in terms of the "avoided losses" or reduced damages relative to a scenario that does not include the project. The result of this type of resilience project is that a community is

[5] For additional background, see the November 2014 brief titled "Cat Bonds: Cashing in on Catastrophe" by Leigh Phillips of the International Council on Science (ICSU).

physically protected from the worst outcomes on-the-ground, the insurance industry reduces its financial losses, and investors' bonds improve in value over time. The benefits of making this link between insurance and project finance are especially important for public officials representing the following interests:

1. Large asset holders with high insurance compliance requirements
2. Communities seeking to expand the availability or improve the affordability of private property insurance in current government subsidized insurance markets
3. Cities and utilities with major resilience projects that lack funding

In cases when private insurers and policyholders take action to reduce their overall risk (known in the industry as loss mitigation), risk reductions can be priced into insurance policies.[6] The same is not true in the public sector. Public sector risk reduction projects, by virtue of being in the public interest, generally have diffuse benefits covering large populations or areas with varying levels of private insurance coverage, and do not fit neatly into the portfolios of individual private insurers. Consider major infrastructure projects, like Seattle's new multi-billion dollar seawall, or broad environmental mandates, like statewide stormwater management regulations that implicitly incentivize flood risk reduction. The loss mitigation value of these types of projects is rarely characterized in ways that translate into financial models or existing insurance portfolios. Even when resilience projects create significant long-term benefits they can be exceptionally difficult to fund or finance in the absence of near-term revenues. These projects can take years to plan, funding is often uncertain, and schedules shift regularly. The result is a combination of market failures that limit the potential to capture insurance savings. For all of these reasons, Resilience Bonds offer public officials who have visibility and control over resilience projects a new way to leverage private capital to speed along the design, funding, and implementation of high-priority projects.

Unlike private companies that look to mitigate losses for only their covered assets, public sector projects are often far broader. For example, a city may be financially responsible for replacing a floodwall even if the primary beneficiary of the upgrade is the local transit authority that would see significant reductions in both chronic and extreme flooding. This situation regularly results in underfunded projects that remain stuck in the design phase, despite clear aggregate benefits. The following pages offer a hypothetical example of how a multi-beneficiary Resilience Bond can help push these kinds of projects across the finish line. Figures 3 and 4 use the analogy of a condo Homeowners Association (HOA), where projects create proportional shared benefits. In this case, Resilience Bond co-sponsors would share premiums based on their anticipated risk reductions and dedicate proportionate allocations of their rebate to project implementation or cost-recovery.

[6] Catastrophe models generally lack the resolution required for re-pricing based on project-specific loss mitigation measures. Capturing these reductions requires the type of significant up-front work with risk modelers highlighted in the first RE.bound Program report (December 2015).

Sample Bond Design

Excerpted from RE.bound Phase 1 Report "Leveraging Catastrophe Bonds as a Mechanism for Resilient Infrastructure Project Finance"

Designing an effective resilience bond program involves a number of moving parts. In order to provide an illustration of how all the pieces might come together, below is a hypothetical resilience bond program designed for the fictitious City of At-Risk, in the State of Concern. Any perceived similarities between this hypothetical illustration and any actual cities or projects are coincidental, and all pricing is purely illustrative. Actual resilience bond pricing will vary widely depending on a number of factors.

At-Risk has recently become aware of the potential impacts to its community of storm surge events. The city reviewed the schedule of values used for its insurance program, along with those for other quasi-public entities operating in and around the city. This review revealed the following exposures of insurable assets within the city limits:

$75 MILLION IN ASSETS OWNED BY THE CITY OF AT-RISK

$125 MILLION IN ASSETS OWNED BY UNDERWATER ELECTRIC, THE LOCAL ELECTRIC UTILITY

$400 MILLION IN ASSETS OWNED BY SWAMPED WATER AND SEWER, THE LOCAL WATER UTILITY

$1.2 BILLION IN ASSETS OWNED BY SUBMARINER TRANSIT, THE LOCAL TRANSIT / PORT AUTHORITY

The city further commissioned a catastrophe modeling study, which indicated that losses to these assets are, on average, expected to exceed $300 million every 50 years, including the costs of service disruptions. In response to these insights the city is undertaking a coastal protection project, with support from federal public assistance grants.

These grants are associated with various insurance coverage compliance requirements. The proposed projects total $110 million and include a combination of hardening measures and natural protections designed to protect the city from storm surge up to the 200-year surge level. Construction of these coastal protections is expected to take two years, and the city is pursuing a resilience bond program to support the implementation of additional phases of the project in future. The nine key elements for this resilience bond program are summarized below.

Sample Bond Design

Excerpted from RE.bound Phase 1 Report "Leveraging Catastrophe Bonds as a Mechanism for Resilient Infrastructure Project Finance"

INSURANCE

SPONSORS
(Premiums Allocated By Exposure)

City of At-Risk: Lead Sponsor ($0.5-1 million per year)

Underwater Electric: Co-Sponsor ($1-2 million per year)

Swamped Water & Sewer: Co-Sponsor ($3-4 million per year)

Submariner Transit: Co-Sponsor ($10-12 million per year)

COVERAGE

$200 Million resilience bond designed to payout if 50-year surge level is exceeded.

TIMING

First bond to be issued within 3 months of construction start date.

4 year bond term, with a potential coupon reset after year 2 (tied to project completion), generating savings in years 3 and 4 of initial bond term.

Rebates in years 5 through 20 may be generated through additional bond issuances. These subsequent bonds may also satisfy ongoing sponsor insurance compliance requirements.

TRIGGER

A parametric trigger defined in terms of surge height measured at the closest NOAA tide gauge (several back-up gauges are also specified).

Initial trigger set to a height of 5.5 feet above datum (~50-year surge level).

After project completion, the trigger is reset to a height of 10 feet above datum (~200-year storm level), which would likely overtop coastal protections.

MARKET RISK MANAGEMENT

The bonds are issued with an initial coupon of 7% and a reset coupon of 4.5%, which includes explicit compensation for the potential decrease in investor returns in years 3 and 4 of the bond term.

Sponsors are protected from future increases in market rates by their ability to terminate the bond program at any time (after the first bond matures).

Sample Bond Design

Excerpted from RE.bound Phase 1 Report "Leveraging Catastrophe Bonds as a Mechanism for Resilient Infrastructure Project Finance"

RESILIENCE PROJECTS

PROJECT ELIGIBILITY

The coastal protection project undertaken by the City of At-Risk is the only project eligible to generate coupon reductions & receive rebates.

The project is eligible to create coupon reductions (insurance savings) and therefore generate rebates after verification of project completion/delivery by the contractor, but not before year 3 of the bond.

QUALITY OF RISK REDUCTIONS

Project-based risk reductions are evaluated by the issuer's catastrophe modeling firm prior to issuance based on the final pre-construction engineering specifications established for the project.

Project completion will be verified by the execution of final completion documents by the contracted construction firm.

REBATES

REBATE MECHANISM

Rebates will be issued as a side payment designated by the sponsor and co-sponsors based on the insurance savings, computed as the difference between the initial coupon and the reset coupon.

The hypothetical coupon rates above, combined with the $200 million bond size indicate a rebate of ~$5 million per year ($200M * [7%-4.5%]).

Rebates will be paid to a publicly-administered account or fund pre-designated by the sponsors to support additional project finance.

REBATE MANAGEMENT

The coastal protections have an expected useful life of 50 years.

During the first 20 years of the bond program, rebates based on the captured insurance savings are estimated to generate ~$70 million in eligible project finance (assuming a 3% interest rate) that can be applied to any phase of project implementation based on the prior agreement of the sponsors.

During years 21 through 50, the value of project-based risk reductions will be allocated to reducing insurance costs and expanding coverage.

Figure 3.

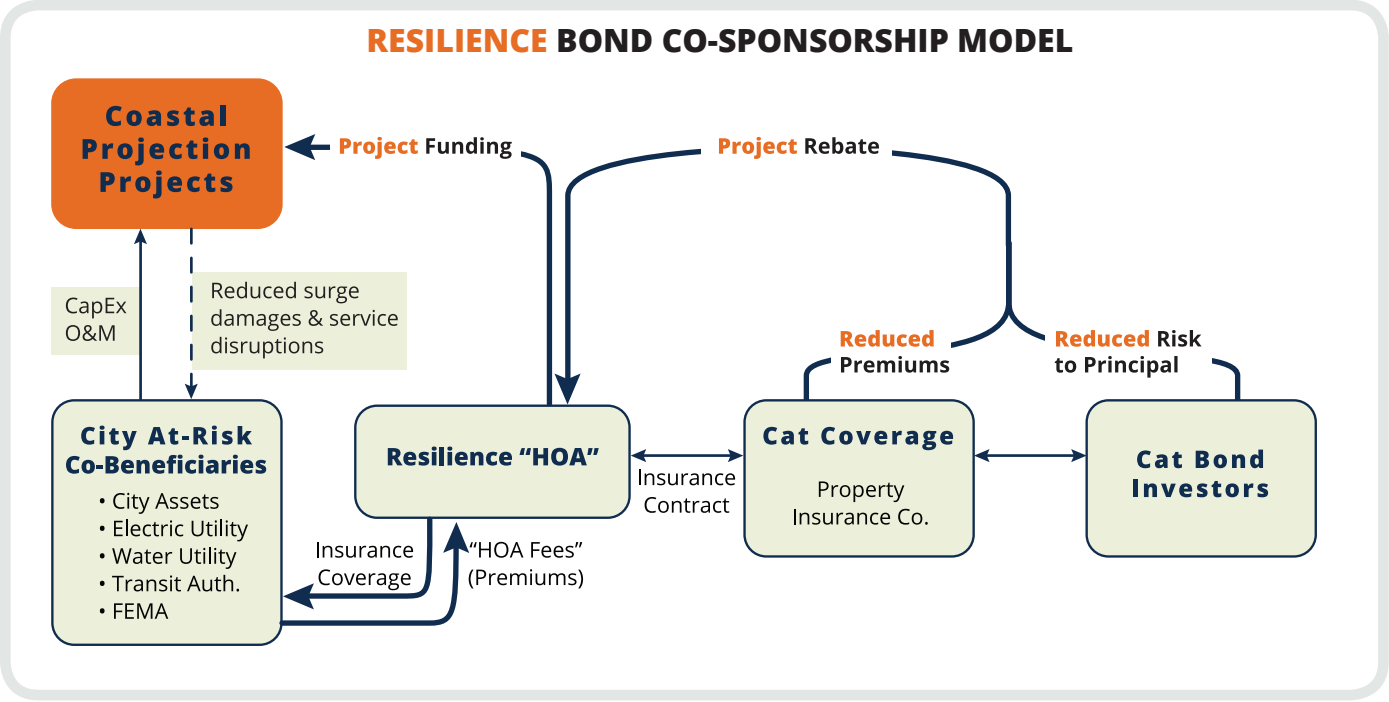
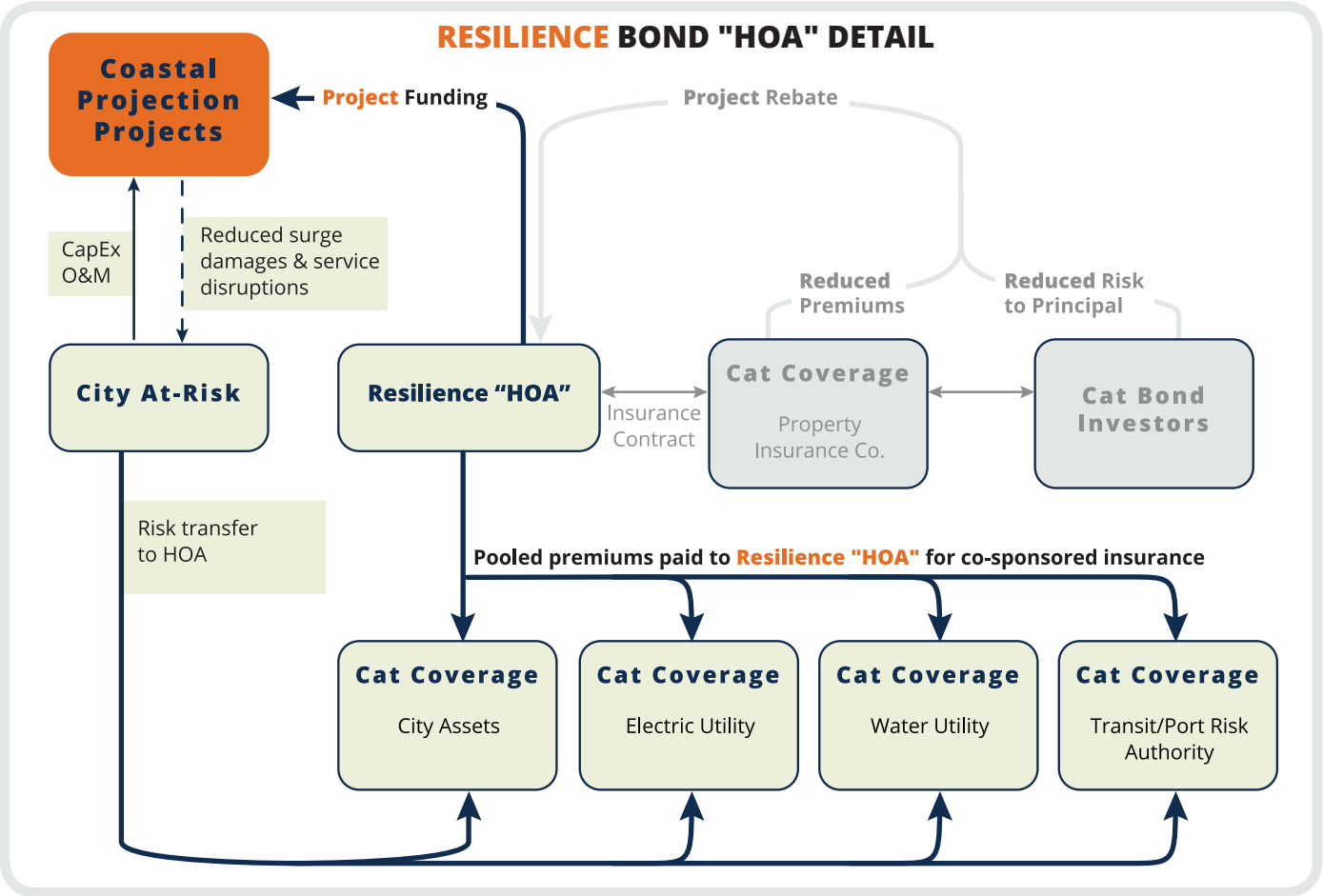


Figure 4.



The previous section highlights several important reasons *why* governments at all levels and public interest entities, like water and electric utilities, ports, and transit systems, should consider Resilience Bonds as part of a broad strategy to build both physical and financial resilience. This section focuses on the *how*.

Three Entry Points to Insuring for Resilience

There are three main drivers for interested Resilience Bond sponsors: increased need for insurance coverage, demand for new resilience project finance, and growing concerns about a major peril. These are not mutually exclusive, but depending on which of these drivers is the primary motivation, a potential public-sector Resilience Bond sponsor will have different priorities for bond design. Each entry point is described below and expanded in the Sponsorship Flowchart (Figure 5) on the following pages.

1 Insurance

Most large asset holders carry property insurance. Some are mandated to hold certain minimum amounts of coverage to comply with regulatory obligations and/or federal grant requirements. Public entities in this category—including cities, water and electric utilities, public housing authorities, ports, large manufacturers, universities, and hospital systems, among others—typically enter a Resilience Bond sponsorship discussion from the perspective of expanding existing financial protections, reducing anticipated premium increases, or filling gaps in coverage, just as the New York MTA did following Hurricane Sandy.

2 Project

Finding funding and/or financing for major infrastructure projects is hard. Public budgets are increasingly constrained and the capital cost of large-scale resilient infrastructure, such as coastal protections or flood barriers, is often too high to be absorbed by individual agencies or public utilities. Too often the benefits are diffuse, long-term, and non-monetized, making the same investments unattractive to private investors. As a result, even projects with potentially significant financial benefits can languish on the drawing board. Public officials with resilience projects in mind—from early stage ideas to detailed plans—generally look to Resilience Bonds as a source of project finance, whether or not they currently have insurance.

3 Peril/Liability

The broadest class of interested Resilience Bond sponsors is those public entities that have growing concerns about a general peril or liability. This category includes, for example, managers of ports with aging, structurally deficient seawalls protecting vast swaths of public and private property. In this case a Resilience Bond co-sponsorship approach can expand options for reducing liability and upgrading protections to a broader base of beneficiaries.

Within the categories described above, there is tremendous diversity in the kinds of projects, perils, or insurance portfolios that could serve as the basis for a new Resilience Bond. Some opportunities are very direct and near-term. Others could take years of design, engineering, and project predevelopment work. The Sponsorship Flowchart on page 16 is intended to serve as a simple decision guide to help interested public officials explore where their agency or organization fits along this spectrum.

Is a Resilience Bond a Good Fit?

Resilience Bonds have many potential benefits, but they are not right for every situation or every type of risk reduction project. Some important threshold questions include:

Peril Is the focus on a catastrophic peril (not a chronic or regularly occurring event)? Are there existing financial catastrophe models for this peril?

Exposure Are adequate baseline data available about potential exposed assets?

Project Are the proposed risk reductions "modelable"? Catastrophe models are well suited to modeling some types of risk reductions, but not others. Depending on the type of resilience project under consideration, it may not be possible to model the anticipated risk reduction in a rigorous enough way to build investor confidence. For example, the value of coastal storm surge protections can be modeled with greater precision than retention basins that reduce inland flood risk.

Beneficiaries Is there enough information about asset ownership to evaluate not just the scale of benefits (reduced expected losses), but also who are the specific beneficiaries? In the absence of a single obvious sponsor (like a transit authority making upgrades to its own system), being able to identify relevant co-sponsors early in the process is essential. Determining who should be the lead sponsor and which entities may have significant co-sponsorship interests requires reliable data on each stakeholder's exposure to specific perils and the distribution of expected losses and benefits across various public and private asset holders.

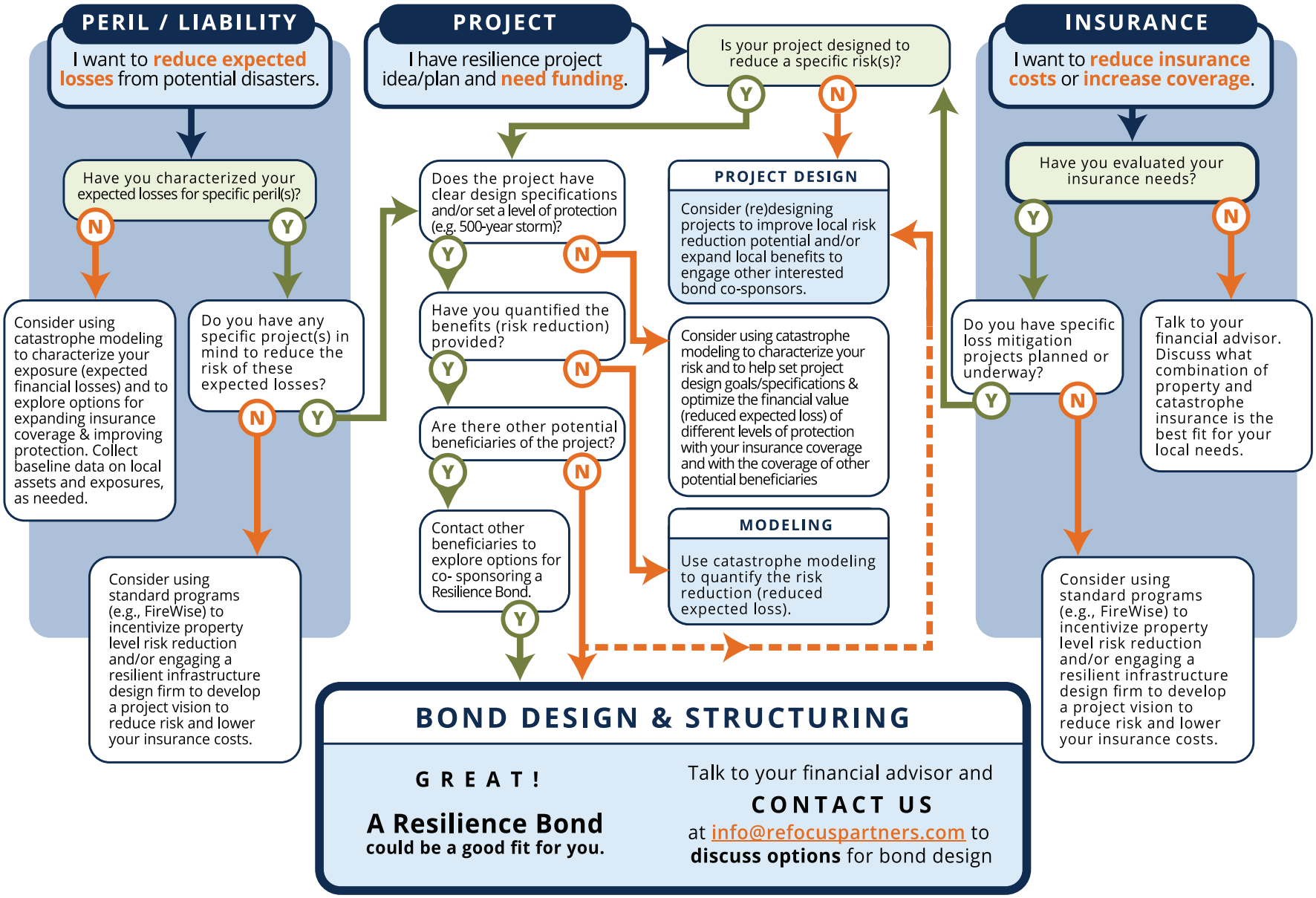
Based on these questions, the next section of this report offers several highlights of project types that are potentially well-suited for new Resilience Bonds. Note these are general examples intended to serve as inspiration for decision-makers facing similar risks; they are not descriptions of any specific Resilience Bond transactions.

It is equally important to note that not all resilience projects are a good fit for Resilience Bonds. Below are a few examples that are either too difficult to model, too small, or too diffuse to create the kinds of quantifiable risk reductions required for Resilience Bond design.

Too difficult to model (peril or project)	Water retention or detention basin projects	Inland flooding perils
Too small (size of project or level of risk reduction)	Rebuilding a damaged fire station	Wildland brush clearing for residential wildfire risk
Too diffuse	Best practices or capacity building programs	Emergency preparedness plans/planning processes
Chronic (not catastrophic) risk	Green stormwater infrastructure	Tidal flood gates
High operational uncertainty	Transit system backups (e.g. buses on standby)	Removable or flexible flood barriers

The questions and caveats above are just a few of the issues that interested sponsors should consider up front. For potential sponsors with existing insurance portfolios or complex public insurance compliance obligations, there are also financial threshold questions to determine if catastrophe insurance is an appropriate financial instrument to support an integrated public insurance and capital planning strategy. In these cases, officials should consult their financial advisors. The Sponsorship Flowchart on page 16 provides a more detailed breakdown of this process and next steps.

WHAT IS YOUR **MAIN REASON** FOR EXPLORING A **RESILIENCE BOND**?



To download this image as a separate file, click here

OPPORTUNITIES FOR NEW RESILIENCE BONDS

Because Resilience Bonds are one of the only financial instruments that link catastrophe insurance with project finance, they offer some unique opportunities for public sector leaders to meet multiple objectives with an integrated financial strategy. Below are three categories where we think Resilience Bonds could enable significant improvements in how public entities around the world currently invest in physical and financial resilience.

re:issue

- Wind
- Earthquake

Public sector interests are heavily represented in the cat bond market. Two major perils that are currently covered by public and quasi-public sector cat bond sponsors are Wind and Earthquake. In this category, existing cat bonds that are coming up for renewal could be paired with predefined portfolios of resilience projects and re:issued as Resilience Bonds to capture insurance savings and create new risk reductions.

Highlight: The Texas Windstorm Insurance Association (TWIA) sponsored a $400 million cat bond in May 2017. Reissuing this bond as a Resilience Bond could help reinforce the most vulnerable/riskiest properties covered by TWIA's subsidized insurance and make them eligible for more cost-effective private coverage, where such coverage would otherwise be unavailable.

re:balance

- Transit Systems
- Flood Protections

Often the largest at-risk asset holders in the public sector are not cities, but the utilities and transit authorities that serve them. Because of their quasi-public nature, these entities are typically required to hold insurance coverage for their assets and operations. Introducing Resilience Bonds into these existing portfolios of property coverage, could help these entities re:balance their overall financial protection for both chronic and catastrophic losses and capture the benefits of any risk reduction projects in capital plans.

Highlight: After Hurricane Sandy, the New York MTA and New Jersey Transit experienced extensive losses, including railway tracks corroded by seawater, damage to expensive electrical controls, and other structural failures. The MTA sponsored its own $200 million cat bond and separately pursued extensive resilience retrofits as part of its recovery strategy. Modeling the risk reduction value of relevant upgrades and rebalancing current coverage to take into account new resilience projects can generate both insurance savings and new resources for expanded upgrades.

re:align

- Small Islands & Urban Slums

Disaster risk reduction is a global priority for international aid agencies and development banks. The Sendai Framework (2015-2030) sets seven goals for reducing the human and economic toll of disasters. Integrating Resilience Bonds into related development programs offers an opportunity for foreign aid agencies to proactively work with interntional development banks and organizations to support large-scale portfolios of risk reduction projects.

Highlight: BuildChange works to retrofit housing in at-risk areas, informal communities, and urban slums to reduce earthquake risk. Strategically realigning these types of retrofits with disaster relief funds, like the Government of Mexico's FONDEN cat bond, using a Resilience Bond can bring more predictability and efficiency to disaster recovery aid flows, transfer risk to private insurers, and generate new resources for protection.

By generating flexible project funding outside of traditional silos, budget-constrained government agencies at all levels can use Resilience Bonds to get more "bang for the buck" out of existing resources and tackle underfunded priorities. The following highlights aim to serve as inspiration for public officials in all of the areas above.

Existing cat bonds for wind storms can be re:issued as new Resilience Bonds to help fund property-level retrofits—like new reinforced roofs and windows—that protect communities at risk of significant wind damage and also improve the availability of private insurance.

PERIL: Wind

Wind is a major contributor to property damage from hurricanes and thunderstorms. Losses from wind damage are covered by a variety of property insurance policies, and in 2016, storms with a significant wind component (thunderstorms and tropical cyclones) accounted for 75% of insured losses due to natural disasters in the US. The risk of wind damage and associated financial losses can be substantially reduced through property-level upgrades, such as stronger roofing materials, new roofs, stronger windows, and other similar building upgrades. Aggregating these types of upgrades across a large portfolio of homes could serve as the basis for a Resilience Bond program that delivers insurance benefits and large-scale risk reductions for exposed communities.

PROJECT: Portfolio of FORTIFIED home upgrades

Property-level upgrades can significantly reduce the risk of wind damage to individual homes. These upgrades have been standardized through initiatives like the FORTIFIED Home program, developed by Insurance Institute for Business & Home Safety. The cost-effectiveness of these upgrades has been established by new retail insurance firms, like MyStrongHome. Resilience Bonds are instruments designed to protect much larger assets than individual homes, but aggregating standardized upgrades across a large portfolio of homes could provide the basis for an effective Resilience Bond program.

INSURANCE: Current cat bond programs covering wind and storm perils

Many established cat bond programs cover wind-based perils. A good example is the program sponsored by the Texas Windstorm Insurance Association (TWIA), which is a publicly sponsored insurer-of-last-resort for wind policies in 14 coastal Texas counties. TWIA currently has over $1 billion dollars worth of bonds outstanding (see table below). Because wind-related damages are a major contributor to insurance losses from storms, wind coverage is generally included within cat bonds that cover hurricanes and severe storms, including those issued by publicly-backed insurers in Florida and Louisiana.

Reinsurance equivalent to what is currently being provided by these cat bond programs could be provided through Resilience Bonds that generate rebates as property-level FORTIFIED Home upgrades are implemented across the bond sponsor's policy portfolio. This creates an opportunity for established cat bond programs to reissue maturing bonds as Resilience Bonds and support property-level upgrades that help protect communities against wind damage.

Resilience Solution Provider: MyStrongHome

MyStrongHome is a US insurance company that uses savings on annual insurance premiums to help finance standardized wind upgrades to residential properties.

- FORTIFIED Home upgrades for qualifying homes are paired with property insurance.
- The upgrades reduce the homeowner's risk from wind damage.
- The property insurance carrier also benefits from reduced financial risk, and the resulting savings on insurance premiums are used to repay the upgrade costs.
- Upgrade costs are typically repaid within seven years, after which homeowners keep the full benefit of annual premium savings.

OPPORTUNITY: Strategically reissuing existing cat bonds as new Resilience Bonds could unlock private capital to deliver FORTIFIED Home upgrades for large numbers of homes at risk, especially in marginalized communities with limited access to private insurance.

A program of Resilience Bonds delivering this type of protection could have additional benefits for state-sponsored insurers of last resort, such as TWIA, that provide wind-related coverage in many of the most exposed communities. In particular, FORTIFIED Home upgrades supported by a Resilience Bond program could improve the insurability of upgraded homes and accelerate the transition of property coverage from publicly backed insurers to private carriers. Like some other state sponsored insurance carriers, TWIA has active programs—known as depopulation programs—to transition their policyholders to private insurance with a goal of reducing the risk of losses assessed to all taxpayers. Reissuing these types of maturing cat bonds as Resilience Bonds can help meet this objective and improve the cost-effectiveness of coverage overall.

Cat Bond Programs Covering Wind-Related Perils

Cat Bond Program (Coverage Area)	Sponsor	Bonds Issued	Annual Coupon Payments
Alamo Re (Texas) *(14 coastal counties)*	Texas Wind Insurance Association (TWIA)	$1,100 million	$51 million/yr
Everglades Re (Florida)	Florida Citizens Insurance	$600 million	$30 million/yr
Pelican Re (Louisiana)	Louisiana Citizens Insurance	$200 million	$8 million/yr

Disclaimer: All of the opportunities highlighted in this report are general examples intended to serve as inspiration for decision-makers facing similar risks and situations; they are not descriptions of ongoing projects or specific Resilience Bond transactions.

Reissuing existing earthquake cat bonds as Resilience Bonds can help fund upgrades to critical infrastructure that protect "downstream" communities from cascading failures and reduce potential liabilities for public entities that maintain infrastructure with known vulnerabilities.

PERIL: Earthquake

Earthquakes pose serious risks for communities in seismically active areas. In addition to damages from ground shaking, major earthquakes can create risks or other types of ground movement, ranging from landslides to liquefaction of soils. These risks are often amplified in areas near critical infrastructure, such as major dams or seawalls. Infrastructure damage during a quake can create cascading failures—fires resulting from downed power lines or flooding caused by water main breaks—leading to escalating losses in exposed communities. It can also create legal risks and potentially outsized liabilities for governments and public agencies that are charged with maintaining these kinds of infrastructure systems, especially if maintenance is deferred and known vulnerabilities are not properly addressed. Despite the well-understood risks and growing liability concerns, funding infrastructure maintenance, retrofits, and upgrades is a constant challenge for local governments and utilities. Reissuing existing earthquake cat bonds as Resilience Bonds can help mobilize capital for targeted risk reduction projects that protect communities at risk from seismically-induced infrastructure failures.

PROJECT: Earthquake upgrades for critical infrastructure

California's Oroville Dam crisis in February of 2017 triggered widespread evacuations in downstream communities. Those communities were ultimately spared from catastrophic losses, but the episode highlighted the unique risks and contingent exposures that can result from damage to critical infrastructure. Simply put, downstream communities would have been swept away if the dam had failed.

This is not an isolated example. Public agencies have long lists of infrastructure assets in need of earthquake retrofits and upgrades. Examples range from dams and seawalls that physically protect communities from inundation to ports, bridges, and utilities that enable interstate commerce and service delivery. Earthquake upgrades to these types of assets can deliver well-defined risk reductions, but chronic budget constraints make funding these upgrades difficult at best. Earthquake upgrades to existing infrastructure rarely generate new revenue that can help finance upfront capital investments. Instead the value

of these investments is in their ability to prevent future catastrophic losses. As a result, infrastructure owners often face the uncomfortable reality that downstream communities will remain vulnerable to catastrophic losses and that public agencies may face significant legal liabilities if a disaster should occur.

INSURANCE: Established cat bond programs covering earthquake perils

Many established cat bond programs cover seismic perils. A good example is the program sponsored by the California Earthquake Authority (CEA), which is a state-sponsored insurer-of-last-resort for earthquake policies in California. Other examples include programs sponsored by the Government of Turkey and Zenkyoren in Japan (see table below). Equivalent coverage for these outstanding bonds could be secured with Resilience Bonds that provide rebates for earthquake upgrades to infrastructure that protect properties in the bond sponsor's insurance portfolio. This creates an opportunity for established cat bond sponsors to reissue maturing bonds as Resilience Bonds that support earthquake upgrades and help protect communities downstream from vulnerable infrastructure. By enabling property coverage to help finance infrastructure upgrades, this type of Resilience Bond could also provide an opportunity more equitably distribute post-event liabilities for cascading failures and limit costly post-event legal actions.

Opportunity: Reissuing existing cat bonds as Resilience Bonds could unlock private capital to fund earthquake upgrades that protect downstream communities from seismically vulnerable critical infrastructure (e.g. large dams).

Resilience Bonds provide new ways to protect communities against risks from earthquake-induced infrastructure failure. They can help address one of the most vexing challenges facing publicly owned infrastructure—providing a source of funding for essential maintenance, upgrades, and retrofits—while at the same time offering a path to more equitably distribute the costs and financial impacts of cascading losses.

Cat Bond Programs Covering Earthquake Perils

Cat Bond Program (Coverage Area)	Sponsor	Bonds Issued	Annual Coupon Payments
Bosphorus (Turkey)	Turkish Cat Insurance Pool	$100 million	$3.25 million/yr
IBRD / FONDEN 2017 A (Mexico)	World Bank & Government of Mexico Natural Disaster Agency (FONDEN)	$150 million* *(earthquake tranche only)*	$6.75 million/yr* *(earthquake tranche only)*
Nakama Re (Japan)	Zenkyoren	$1,675 million	$43 million/yr
Ursa Re (California)	California Earthquake Authority (CEA)	$2,475 million	$102 million/yr

Disclaimer: All of the opportunities highlighted in this report are general examples intended to serve as inspiration for decision-makers facing similar risks and situations; they are not descriptions of ongoing projects or specific Resilience Bond transactions.

Resilience Bonds offer a way for public transit authorities to rebalance their existing insurance portfolios (between property and catastrophe insurance) to help fund high-priority resilience projects and integrate strategic cost-saving risk reductions into capital plans.

PERIL: Storm surge and earthquake risks

New York City's subway system experienced extreme flooding due to storm surge during Hurricane Sandy. The event demonstrated the unique risks faced by transit agencies like the NY Metropolitan Transit Authority (MTA). Damage sustained by MTA during Sandy motivated New York's state legislature to approve a $4.8 billion repair budget and pushed MTA to allocate an additional $5.8 billion for projects designed to fortify the system against damage from future storms.

The geography and structure of transit systems—with critical infrastructure located both above and below grade—make them vulnerable to a wide range of hazards, including flooding and earthquakes. These risks are compounded by factors including the age of the system, the extent of deferred maintenance backlogs, sensitivity of electrical and communications equipment, and stringency of safety standards. The complex nature of transit system operations mean that losses are often magnified by "network effects," where damages to individual assets can ripple out into crippling system-wide impacts. Because transit systems are the underpinning of dozens of other economic sectors, major service interruptions can also create cascading disruptions and disproportionate losses throughout a whole regional economy.

PROJECT: Risk reduction projects in transit authority capital plans

In response to the extensive damage caused by Hurricane Sandy, MTA embarked on an extensive adaptation program to address its growing exposure to storm-related flood risks. These efforts range from developing new operational protocols and emergency preparedness initiatives to a series of projects in the MTA Capital Program that are designed to permanently fortify vulnerable assets. Many of the capital projects are designed to protect MTA assets up to FEMA's 500-year flood level. Examples include elevating sensitive equipment, sealing openings to transit system facilities, and installing permanent flood barriers. These projects are designed to significantly reduce flood risks. If these kinds of projects are integrated into a transit authority's risk management strategy, they can also deliver significant insurance benefits for the agency. Similarly, any transit authority pursuing resilience upgrades has an immediate opportunity to model its planned

risk reductions and capture the associated insurance benefits using Resilience Bonds. Rebalancing an agency's existing insurance portfolio can help ensure that its coverage is well aligned with its ongoing resilience investments and unlock additional capital for further risk reduction investments.

INSURANCE: Existing public transit authority insurance portfolios

The availability and affordability of conventional insurance plummeted after Hurricane Sandy. To address these difficult market conditions, MTA reconfigured its insurance portfolio to include a new cat bond program, MetroCat Re, which issued its first bonds in 2013. This was followed by a second issuance in 2017, which expanded the bond's coverage to include earthquake risks as well as storm surge. Just as MTA rebalanced its existing property insurance coverage to include a new layer of catastrophe insurance, Resilience Bonds provide an opportunity for transit authorities to rebalance their insurance portfolio in order to maximize support for near-term resilience projects. This rebalancing would generally involve shifting a portion of catastrophe coverage to Resilience Bonds and aligning that coverage with project-generated risk reductions expected from approved capital program projects or investments. Such rebalancing would help ensure that risk reductions are properly valued by the Resilience Bond rebate mechanism and maximize the value of resulting rebates.

Opportunity: Resilience Bonds provide opportunities to rebalance existing transit authority insurance portfolios in order to mobilize additional private capital for resilience and risk reduction projects in near-term capital plans.

Transit agencies that have experienced recent disasters, like MTA and Amtrak, are particularly well positioned to benefit from rebalancing their insurance portfolios to incorporate Resilience Bonds for several reasons. First, these agencies generally have significant continued exposure to storm surge and earthquake hazards. Second, after a major disaster they are typically recipients of significant relief and recovery funds that are specifically intended to support reconstruction projects that can deliver large risk reductions. Third, most transit systems are required to hold significant amounts of insurance subject to federal and state funding compliance requirements. Integrating Resilience Bonds into these established insurance portfolios could help transit authorities more easily meet compliance requirements.

Both MTA and Amtrak have insurance portfolios that already include cat bonds, which could be reissued as Resilience Bonds and generate rebates for risk reduction projects. However, having existing cat bonds is not a prerequisite for rebalancing an insurance portfolio to include Resilience Bonds. Other transit authorities without existing catastrophe coverage could rebalance their insurance by consolidating their catastrophe risk into a pool that can be covered by Resilience Bonds. Once a rebate mechanism is created, transit authorities can work with other regional stakeholders, such as electric utilities, water utilities, and port authorities whose operations can have significant impacts on adjacent transit assets, to prioritize projects that deliver the highest value risk reductions. This is true even if the projects are not owned by or located at transit system facilities. For example, a Resilience Bond covering transit assets could support upgrades to a nearby port seawall that protects transit assets alongside other properties in the area.

Cat Bond Programs Covering Transit Systems

Cat Bond Program (Coverage Area)	Sponsor	Bonds Issued	Annual Coupon Payments
Metro Cat Ltd. (MTA Service Area)	New York MTA	$125 million	$4.6 million/yr
PennUnion Re Ltd. (NY, DE, CT, MD, MA, NJ, & RI)	Amtrak	$275 million	$12.4 million/yr

Disclaimer: All of the opportunities highlighted in this report are general examples intended to serve as inspiration for decision-makers facing similar risks and situations; they are not descriptions of ongoing projects or specific Resilience Bond transactions.

Resilience Bonds offer a way for coastal municipalities to rebalance existing insurance portfolios of exposed asset-holders to help fund flood barriers and coastal protections that protect multiple beneficiaries and reduce insurance costs for local residents.

PERIL: Coastal flooding

The 2017 hurricane and tropical storm season, which brought Hurricanes Harvey and Irma to the Caribbean and Gulf Coast, focused renewed attention on the flood risks faced by coastal communities. After Hurricane Sandy in 2012, dozens of analyses were completed characterizing the losses in communities along the entire Eastern Seaboard. The devastation motivated whole new government programs focused on building long-term resilience, including the US Housing and Urban Development Authority's Rebuild by Design Competition and National Disaster Resilience Competition, and spurred the launch of new institutions including the 100 Resilient Cities (100RC), which supports the appointment of new Chief Resilience Officers in cities around the world. New York City and other coastal 100RC cities have used the lessons from Sandy and past disasters to establish comprehensive resilience strategies. Many of these strategies identify flooding, storm surge, and sea-level rise as top priorities.

Although wind damage often dominates probabilistic measures of expected losses from hurricanes and tropical storms, the damage from surge-induced flooding can be devastating when it occurs. This risk is being amplified by rising sea levels and land subsidence, which are forcing coastal cities and 100RC members, like Norfolk and Miami Beach, to manage regular "fair weather" or "sunny day" flooding during high tides. These rising flood risks are forcing coastal cities to ask difficult questions about their long-term sustainability. Some are considering options for managed retreat to higher ground, while others—like Norfolk—are pushing back with resilience strategies that include robust Dutch-style systems of flood barriers and coastal protections.

PROJECT: Urban flood barriers and coastal protections

Cities across the world are evaluating their options for improving their coastal protections and promoting smart coastal development. Proactive cities like Norfolk are working to address their rising flood risks with a comprehensive portfolio of flood barriers and coastal protection measures. In the US, Norfolk is not alone. Hoboken is in the process of upgrading its seawall; Jersey City is working to fortify parts of its river frontage; New York City is laying plans for a new "Big-U" to protect Lower Manhattan; and New Orleans has undertaken over a decade of water system upgrades and coastal protection investments following Hurricane Katrina. These types of projects can dramatically reduce the risk of storm surge events and extreme tidal flooding in coastal communities. In the case of Norfolk, coastal protections could reduce surge-related flood damages in the city by over $10 million per year on average.[7] Despite the political support for these new protection measures, infrastructure project funding remains a challenge. Local capital budgets are increasingly constrained, and federal funds are likewise limited and spread thin. Meanwhile, each year a project is delayed for want of funding or financing means another year of increasingly severe chronic flooding and another hurricane season that could bring the next Katrina, Sandy, Harvey, or Irma. Resilience Bonds offer coastal cities the opportunity to rebalance existing insurance portfolios across multiple beneficiaries to secure near-term funding for protections that address rising flood risks.

INSURANCE: Existing urban flood and business interruption insurance coverage

Municipal agencies, utilities, transit authorities, and large infrastructure owners located in coastal areas typically have risk management plans that include property insurance coverage for flooding and business interruption. Looking at this coverage in aggregate can help a city rebalance existing insurance portfolios across the largest beneficiaries so that risks from catastrophic flooding are aggregated into a pool that could be covered with a Resilience Bond program. In some cases, insurance for residential and commercial properties may also be included in the risk pool. Resulting rebates could be used to help fill funding gaps in the city's capital plan for coastal protection measures.

[7] Based on catastrophe modeling results from the first phase of work under the RE.bound Program. For more detail see pages 20-26 of the report "Leveraging Catastrophe Bonds as a Mechanism for Resilient Infrastructure Project Finance" (December 2015).

OPPORTUNITY: Resilience Bonds provide opportunities for coastal communities to rebalance existing insurance portfolios and mobilize funding for municipal flood barriers and coastal protection measures.

Norfolk and other US coastal cities in the 100RC network are particularly well positioned to benefit from rebalancing their insurance portfolios using Resilience Bonds. These cities all have significant exposure to surge-related flooding and they have also created specific plans and strategies to reduce these risks with comprehensive systems of engineered and natural flood barriers and coastal protection measures. Other 100RC coastal cities around the world can similarly benefit by integrating insurance considerations into their wider resilience strategies.

Resilience Programs Covering Urban Flood Risks

Project Location (Awardee)	Exposure / Risk	Funding source	Award
Reshaping the Urban Delta (City of New Orleans)	$180 Billion Average Annual Loss to NFIP	HUD National Disaster Resilience Competition	$141 million
Lower Manhattan & Connect Projects (New York City)	$1.5 Billion Average Annual Loss to NFIP	HUD National Disaster Resilience Competition	$176 million
Ohio Creek Watershed & Coastal Resilience Lab (State of Virginia)	$2 Billion Average Annual Loss to NFIP *(all Norfolk)*	HUD National Disaster Resilience Competition	$120 million
Coastal Embankment Improvement Project - Phase I (Bangladesh)	42 Million coastal residents	World Bank	$400 million (loans & grants)

Disclaimer: All of the opportunities highlighted in this report are general examples intended to serve as inspiration for decision-makers facing similar risks and situations; they are not descriptions of ongoing projects or specific Resilience Bond transactions.

Vulnerable populations, including those on small-islands and in urban slums, face some of the greatest risks from natural disasters. "Today, more than 820 million urban dwellers live in slum-like conditions or informal settlements and the absolute numbers are increasing every year."—UN Habitat, 2017 Goal 11 of the United Nations Sustainable Development Goals (SDGs) prioritizes making cities and human settlements safer and more resilient. International development bank backed catastrophe risk pools can use Resilience Bonds to leverage new resources for building retrofits in at-risk communities in support of this global goal.

PERIL: Earthquakes and Tropical Storms

In developing nations, rapidly urbanizing cities, and small-island states around the world, communities with substandard housing and infrastructure face the most devastating potential impacts from earthquakes and tropical storms. Within high poverty at-risk areas, one major disaster can set back development goals by decades. Damage from storm surge, wind, rainfall-induced flooding, ground shaking, and other cascading failures, such as landslides, regularly result in catastrophic loss of life and property. The 2010 earthquake that devastated the island of Haiti led to the loss of over 220,000 lives. The human toll of these types of events is greatest in urban slums and communities that lack essential services, let alone insurance. In these areas, development agencies and multi-lateral development banks have a lot to lose financially, having invested millions in basic services, from human security to health and education initiatives and institutions. These agencies also benefit from proactive investments in risk-reduction measures, such as reinforcing buildings, that cement long-term development gains. Resilience Bonds can serve as a mechanism for aligning proactive development resources and disaster risk reduction investments with reactive aid for reconstruction and post-disaster recovery.

PROJECT: Targeted building retrofit & upgrade programs

Property-level upgrades can significantly reduce the risk of tropical storm and earthquake damage to individual buildings. Programs of basic upgrades targeting substandard housing in developing countries have been successfully implemented in dozens of countries through organizations like Build Change. Aggregating upgrades across large portfolios of buildings in areas that also receive significant international development assistance could provide the basis for an effective international development bank backed Resilience Bond program. These bonds could capitalize proactive risk reduction projects for the most vulnerable and lock-in insurance to support rapid recovery after a disaster.

Resilience Solution Provider: Build Change

Build Change is a global NGO that works to "reduce deaths, injuries, and economic losses caused by housing and school collapses due to earthquakes and typhoons in emerging nations."

- Global teams of engineers design disaster-resistant houses & schools in at-risk regions
- Teams train local builders, homeowners, engineers, and government officials to build them, leaving behind a skilled workforce that can support further improvements
- Communities and government agencies benefit from local economic development
- International development agencies and foreign aid agencies benefit from reduced disaster risk and potential loss of development gains

INSURANCE: Current multilateral development bank backed insurance programs

Over the last decade, the World Bank and other global development agencies have pioneered new insurance programs around the world. In 2006, the Government of Mexico's disaster preparedness agency FONDEN, sponsored its first in a series of cat bonds facilitated by the World Bank.[8] Since then Mexico has expanded the coverage and complexity of its cat bond program to its most recent IBRD / FONDEN bond issued in August 2017 for $360 million USD of coverage for earthquakes and named storms. The World Bank has also created two regional risk pools for small islands in the Caribbean and the Pacific— the Caribbean Catastrophe Risk Insurance Facility (CCRIF) and the Pacific Catastrophe Risk Assessment and Financing Initiative with the PCRAFI Facility.

[8]For more background on FONDEN's cat bond program, see "Mexico Multicat Bond" (GFDRR, 2013).

OPPORTUNITY: Strategically realigning international development funds with existing development bank/agency backed insurance programs using new Resilience Bonds can (1) attract private capital for reconstructing buildings and infrastructure in small-island states and urban slums recovering from recent disasters and (2) support a new revolving fund for retrofits to reduce future social and economic losses.

Development is proactive. Aid is reactive. Both are important, but rarely are leaders rewarded for disasters that did not happen. Resilience Bonds can help realign incentives to jointly leverage resources for both rapid response funds (parametric catastrophe insurance) and long-term disaster risk reduction (resilience rebate). Using catastrophe models to assess where strategic risk reduction projects can create the greatest insurance savings within existing insurance programs and risk pools can (1) help prioritize development assistance within existing risk pools and bond sponsors' coverage areas and (2) ensure that rapid response funds are available if and when (the next) disaster strikes. This creates an opportunity for development bank backed sponsors to integrate Resilience Bonds into ongoing programs and attract new and additional resources to protect small-island nations, urban slums, and other marginalized communities.

International Development Bank Backed Insurance Programs

Catastrophe Risk Pool / Insurance Program	Sponsor	Bonds Issued	Insurance Payouts
IBRD FONDEN Multi -Cat Mexico	FONDEN (Mexico Natural Disaster Fund)	$360 million (2017) $315 million (2012) $290 million (2009) $160 million (2006)	Hurricane Patricia - $50 million (2015) ** EarthquakeTBD (2017)*
CCRIF (16 Island Nations)	CCRIF	$30 million (2014)	Hurricane Irma - $15.6 million (2017)
PCRAFI Members (14 Island Nations)	PCRAFI Facility	$38.2 million (2016)	Cyclone Ian – Tonga $1.27 million (2014) Cyclone Pam- Vanuatu v$1.9 million (2015)

Disclaimer: All of the opportunities highlighted in this report are general examples intended to serve as inspiration for decision-makers facing similar risks and situations; they are not descriptions of ongoing projects or specific Resilience Bond transactions.

The bulk of this report focuses on helping government officials, infrastructure providers, NGOs, and public finance experts evaluate if and how Resilience Bond sponsorship can support their various communities' insurance and infrastructure needs. This section zooms out to highlight a few broader areas where Resilience Bonds have the potential to catalyze large-scale policy change. The recommendations below are shaped by where we think national governments and international development programs can use existing authorities and resources to promote risk reduction and improve financial protections against catastrophic risks across large at-risk regions and/or vulnerable populations.

Use Resilience Bonds to bolster government subsidized insurance programs

The US National Flood Insurance Program (NFIP) recently launched a pilot to transfer $1 billion of flood risk to a set of private insurers. For a program near insolvency that relies on ad-hoc political decisions about its funding, shifting a segment of the NFIP's risk to the capital markets is an important step toward creating some certainty in an otherwise uncertain political and funding landscape. Strategically incorporating Resilience Bonds into this type of public reinsurance portfolio can have several additional benefits, including: (1) directly incentivizing local risk reductions, (2) expanding insurance coverage, and (3) helping to transition especially high-risk areas to private insurance, where it would otherwise be unavailable or unaffordable without risk reductions. This approach can also benefit state insurance programs, like the Texas Windstorm Insurance Association (see pages 18-20) and the California Earthquake Authority (see pages 21-23).

Local leaders are (rightfully) worried that rather than being recognized for taking proactive steps to protect their communities, they will be last in line for disaster aid. These regions should be recognized and rewarded for investing in their own resilience. Likewise, state and national insurance programs should be applauded for exploring new avenues for transferring risk to the capital markets and pursuing policy options for expanding local protection, such as FEMA's new "disaster deductible" proposal. Resilience Bonds can help realign incentives to encourage this kind of protection within existing programs using existing resources for disaster relief and recovery.

Some specific actions that all major funders—including government agencies, international aid agencies, development banks, and large philanthropies, among others—should consider to help vulnerable communities are: (1) offer a 'resilience match' or incentive to supplement local budgets for insurance premiums and loss mitigation, (2) designate a small percentage of any disaster assistance package for the purchase of insurance aligned with risk reduction measures, (3) create a seed fund to support targeted risk reductions in marginalized communities where they could significantly improve the affordability and availability of private insurance and/or (4) apply Resilience Bonds as "credit" toward any eligible compliance, cost-share, or deductible requirements.

Integrate Resilience Bonds into international disaster aid & development assistance packages after major disasters

Development banks and international aid agencies have invested billions in foreign assistance to support basic economic and social programs in developing nations and marginalized communities. These development investments and gains are often threatened by natural disasters. Hurricanes Irma, Jose, and Maria in the Caribbean are devastating recent examples, where, for example, the island of Barbuda was fully evacuated and left uninhabited for the first time in 300 years.

The Government of Mexico's catastrophe bond program with the World Bank is a model for how a national disaster response agency can use private insurance to benefit local communities. Following Hurricane Patricia in 2015, Mexico's cat bond was triggered and a partial distribution of $50 million was made to the Mexican disaster agency (FONDEN). Another payout is expected following Mexico's 8.1-magnitude earthquake in September 2017. The World Bank led the way in supporting Mexico's cat bonds and creating other innovative catastrophe insurance programs, including the Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI), the Caribbean Catastrophe Risk Insurance Facility (CCRIF SPC), and the African Risk Capacity (ARC) multi-country risk pool. While these programs include some risk reduction activities, there is lots of potential to expand these efforts using Resilience Bonds and leverage additional funding for new resilience projects in concert with national and regional development assistance packages. The World Bank and regional development banks have the opportunity to integrate Resilience Bonds into both development assistance agreements and catastrophe risk insurance pools to leverage capital for new and additional resilient infrastructure investment.

Leverage Resilience Bonds to create large-scale resilience revolving loan funds

Funding for long-term disaster recovery often comes from a variety of sources each with their own requirements and rules. Aligning these funds to invest in building back better can be a challenge for even the highest capacity recipients. Evaluations of disasters as different as the 2010 earthquake in Haiti, the 2011 Japanese earthquake and tsunami, and Hurricane Sandy in 2012 illustrate the challenge of deploying relief and recovery funds efficiently and effectively. Resilience Bonds can help connect the dots between funding immediate rebuilding efforts and investing in longer-term risk reduction projects.

International development agencies and large donors to multilateral development banks should consider establishing a global revolving loan fund or "Resilience Trust" that allows project investments to be paid back by regional Resilience Bond rebates. This can support new pre-disaster risk reductions and post-disaster reconstruction and recovery programs. Using seed funding from foreign aid commitments after every disaster to support new rounds of risk reductions can kickstart a virtuous cycle of resilience retrofits, upgrades, and associated rebate payments that can then be used to consistently grow and increase the size of the revolving loan fund to support larger and more complex projects. For example, development funders supporting small-island states devastated by Hurricane Irma should consider linking reconstruction projects to CCRIF insurance pool premiums to help improve both future coverage and protections. More broadly, this type of revolving fund has the potential to improve the alignment between development assistance and ad-hoc disaster aid around the world and advance the goals of global efforts, such as the G20 Global Partnership for Climate and Disaster Risk Finance and Insurance Solutions.

Each of the recommendations above offers an ambitious yet pragmatic path forward for applying the Resilience Bond model to create a transformative impact for vulnerable communities around the world. Insurance has become an increasingly prominent topic in national and global policy dialogues. For example, in May 2017, the UN Environment Programme Finance Initiative and Principles for Sustainable Insurance Initiative partnered with ICLEI Local Governments for Sustainability and outlined the following priorities to create new "Insurance Development Goals for Cities":

- Closing the disaster risk reduction gap
- Closing the insurance protection gap
- Closing the financing gap

Members of the G20 have since announced additional funding commitments to support global climate risk insurance priorities. Resilience Bonds have the potential to support all of these global priorities and perhaps most concretely reinforce the implementation of Goal 11 of the Sustainable Development Goals (SDGs) to *make cities and human settlements inclusive, safe, resilient and sustainable.*

CONCLUSION

As of the release of this report, the 2017 is set to become one of the costliest years for disasters on record in the US. The damages from Hurricanes Harvey and Irma have yet to be fully tallied, but the total losses are expected to run into the billions of dollars. Globally, governments at all levels can no longer afford to ignore catastrophic risks. The human cost of doing so is too high. Nor can public officials prioritize long-term risks over immediate needs. Resilience Bonds can help public sector leaders break free of this zero-sum game and take steps to both protect against future risks and invest in resilient economic development today.