FINANCING RESILIENCE IN CONNECTICUT: CURRENT PROGRAMS, NATIONAL MODELS, AND NEW OPPORTUNITIES

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I. INTRODUCTION

Over the last few years, the State of Connecticut has made significant commitments to becoming more resilient to the impacts of climate change and extreme weather, particularly in communities on coastal and inland waterways. In the wake of storms Alfred, Irene, and Sandy, Governor Dannel Malloy formed the Two Storm Panel[2] and the Long-term Recovery Committee.[3] The state legislature,

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[2] TWO STORM PANEL, THE OFFICE OF GOVERNOR DANNEL MALLOY, *REPORT OF THE TWO STORM PANEL* (January 9, 2012), *available at* http://portal.ct.gov/-/media/Office-of-the-Governor/Two-Storm-Panel/two_storm_panel_final_report.pdf?la=en.

[3] STATE OF CONNECTICUT LONG TERM RECOVERY COMMITTEE, http://www.ct.gov/ctrecovers/cwp/view.asp?a=4498&q=528634 (last visited Feb 1, 2016).

led by Representative James Albis, formed the *Shoreline Preservation Task Force*.[4] With the passage of Public Act 13-179, An Act Concerning the Permitting of Certain Coastal Structures by the Department of Energy and Environmental Protection,[5] Connecticut codified the requirement that the state plan of conservation and development, municipal plans of conservation and development, the civil preparedness plan and program, and municipal evacuation or hazard mitigation plans must "consider" the risk of increasing erosion due to the sea level change scenarios from the NOAA OAR CPO-1 report.[6] In October 2015, Executive Order 50[7] created the State Agencies Fostering Resilience Council ("SAFR Council") charged with the creation of a statewide resilience roadmap. In January 2016, the Connecticut Department of Housing released $7 million in funding from Sandy recovery dollars for mitigation and resiliency plans to ten municipalities, the Lower Connecticut River Valley Councils of Government, four state agencies, a nonprofit, and the University of Connecticut.[8] As these planning efforts raise awareness of the challenges facing communities and start the design of solutions – ranging from home and road elevation to hardening critical infrastructure to living shorelines for mitigating coastal erosion (Figure 1) – the next question on many leaders minds might be: how do we pay for it?

[4] KEVIN E. MCCARTHY, REPORT OF THE SHORELINE PRESERVATION TASK FORCE, Conn. Gen. Assemb. 2012-R-0513 (Jan. 11, 2013), *available at* https://www.cga.ct.gov/2012/rpt/2012-R-0513.htm.

[5] An Act Concerning the Permitting of Certain Coastal Structures by the Department of Energy and Environmental Protection, PA 13-179—sSB 1012 §§ 3-6 (2013).

[6] The NOAA OAR CPO-1 Report concluded that "we have very high confidence (>9 in 10 chance) that global mean sea level will rise at least 0.2 meters (8 inches) and no more than 2.0 meters (6.6 feet) by 2100." *See* NOAA CLIMATE PROGRAM OFFICE, GLOBAL SEA LEVEL RISE SCENARIOS FOR THE UNITED STATES NATIONAL CLIMATE ASSESSMENT, NOAA TECHNICAL REPORT OAR CPO-1 (Dec. 6, 2012), *available at* http://scenarios.globalchange.gov/sites/default/files/NOAA_SLR_r3_0.pdf.

[7] Press Release, Exec. Order No. 50, State of Conn., The Office of Governor Dannel Malloy (Oct. 26, 2015) *available at* http://portal.ct.gov/-/media/94273BD61AD24C63B5B07A86638CB68E.pdf (establishing the State Agencies Fostering Resilience Council "SAFR Council" which is responsible for strengthening the state's resiliency from extreme weather events).

[8] Connecticut Department of Housing, *Commissioner Klein Announces Federal Funding to Assist Disaster Recovery Efforts for Residents* (January 15, 2016), *available at* www.ct.gov/doh/lib/doh/sandy_planning_grants2.pdf.

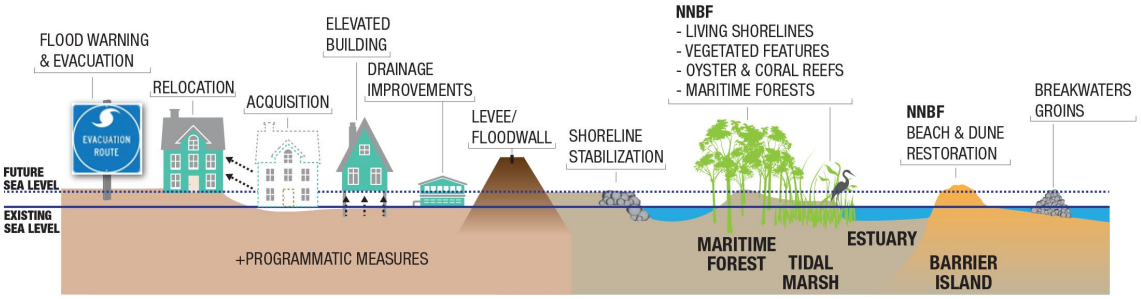

Figure 1. Coastal communities sea level rise and flooding adaptation measures needing federal, state or local funding or long-term financing. NNBF stands for Natural and Nature-based features.[9]

Today in Connecticut, virtually all disaster recovery and climate change adaptation projects are funded through grants from the federal government in response to natural disaster declarations under the Stafford Act.[10] The largest amount of funding comes from disaster recovery programs like the U.S. Department of Housing and Urban Development (HUD) Community Development Block Grant Disaster Recovery (CDBG-DR)[11] or Federal Emergency Management Agency (FEMA) Emergency Assistance.[12] For example, after Sandy, the State of Connecticut received a little over $159 million in CDBG-DR funding, but that payout left at least $158 million in documented unmet repair needs for housing and infrastructure damage alone.[13]

Projects that incorporate resiliency improvements rather than simply repair damage make that cost even higher. In the Rebuild by Design competition, the City of Bridgeport asked for over $290 million to develop citywide resiliency projects.[14] In the National Disaster Resilience Competition, the State of Connecticut requested nearly $115 million for two neighborhood-scale pilot

[9] U.S. Army Corps of Eng'rs, *North Atlantic Coast Comprehensive Study: Natural and Nature-based Features Brochure* (2015), *available at* http://www.nad.usace.army.mil/Portals/40/docs/NACCS/1_15_16_NNBF_Brochure-viewing-format.pdf.
[10] Robert T. Stafford Disaster Relief and Emergency Assistance Act, 42 U.S.C. §§ 5121-5207 [hereinafter *Stafford Act*].
[11] Housing and Community Development Act of 1974, 42 U.S.C. §§ 5301-5321.
[12] 42 U.S.C. §§5121-5207.
[13] Conn. Inst. For Resilience and Climate Adaptation, et al., *SAFR Connecticut Connections: NDRC Phase 1 Application* (June 22, 2015), *available at* http://web9.uits.uconn.edu/circa/ndrc/pubs/FinalSAFRConnecticutConnectionsJune22.pdf.
[14] *Id.*

projects and a regional resilience plan for New Haven and Fairfield counties[15] and was awarded $54.3 million to implement one of the pilots and the resilience plan.[16] Even with this recent grant, lingering recovery needs from Sandy remain, and the question increasingly becomes where do communities turn to fund the long-term resilience projects that ongoing resilience planning efforts encompass? If a community was fortunate not to be hit by the storm and therefore has not received disaster recovery funds, but remains vulnerable to future storms, what are their options for funding the planning, designing, or construction of adaptation measures that improve resiliency to extreme weather, flooding, or future climate change? Financing programs are critical to answering that question.

In August 2013, the Connecticut Department of Energy and Environmental Protection (DEEP) invited a diverse group of stakeholders from Connecticut and the northeast region to discuss flood insurance affordability and the need to develop innovative financing methods to improve community resiliency in areas vulnerable to the impacts of climate change, sea level rise, and flooding.[17] The stakeholders included the authors of this article, academic, government, and private sector leaders from around the region. The stakeholders were involved in risk management research, coastal and riverine floodplain regulation, insurance, engineering, renewable energy and energy efficiency finance, and disaster recovery. That same year, new FEMA flood insurance rate maps that included additional homeowners and small businesses in the floodplains and notices of significant increases in their flood insurance premiums for those currently covered, garnered the attention of policy makers and the media.[18] The debate that ensued soon made it clear that Congress' attempts to address the financial instability of the National Flood Insurance Program (NFIP) in the

[15] Conn. Inst. For Resilience and Climate Adaptation, et al., *National Disaster Resilience Phase 2 Application* (2015), *available at* http://www.ct.gov/doh/ndrc_application/pdf.

[16] Connecticut was one of 13 winners – out of 40 finalists that included states, municipalities, and county governments – in the nationwide National Disaster Resilience Competition run by the Dept. of Housing and Urban Development to distribute the last $1 billion in recovery funds from P.L. 113-2. *See* Dep't. of Hous. & Urban Dev., *National Disaster Resilience Competition Grantee Profiles* (Jan., 2016), *available at* https://portal.hud.gov/hudportal/documents/huddoc?id=NDRCGrantProf.pdf.

[17] Personal communication with Macky McCleary, Deputy Comm'r, Envtl. Quality, Conn. Dep't. of Energy & Envtl. Prot. (Aug., 2013).

[18] Jenny Anderson, *Outrage as Homeowners Prepare for Substantially Higher Flood Insurance Rates*, N.Y. TIMES, July 29, 2013 at A12, *available at* http://www.nytimes.com/2013/07/29/nyregion/overhaul-and-a-hurricane-have-flood-insurance-rates-set-for-huge-increases.html?mcubz=0.

Biggert-Waters Flood Insurance Reform Act of 2012[19] (2012 NFIP Reforms) had become too politically controversial to implement.[20]

The 2012 NFIP Reforms[21] sought to have insurance premiums reflect actuarial risk with a 25% increase in premium rates per year until that assessed rate is achieved.[22] But in 2014 Congress passed the Homeowners Flood Insurance Affordability Act[23] (HFIAA) that repealed or modified some of the more bitter pills, including repealing the implementation of actuarial rates at sale, restoring grandfathering of previous lower insurance rates if a home was assessed as being at a higher risk, and lowering rate increases to 5-15% per year for individual primary homeowners, rather than the 25% increase.[24] However, the 25% annual increase was maintained for commercial buildings and secondary homes.[25] The HFIAA also called for an affordability study led by FEMA with support from the National Academy of Science (NAS).[26] The release of two NAS reports in 2015[27] and 2016[28] fulfilled that mandate. The second report concluded that "policy analysis capacity and necessary data, however, currently are not available to complete a comprehensive analysis of affordability options,"[29] which represents challenges for the upcoming reauthorization of the NFIP in 2017.

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[19] Biggert-Waters Flood Insurance Reform Act of 2012, 126 Stat. 916 (codified as amended at 42 U.S.C. §§ 4001-4131 (2012)) [hereinafter *Biggert-Waters*].
[20] Annie Linskey, *Good News: The Government Will No Longer Make You Put Your House on Stilts*, BLOOMBERG BUSINESSWEEK, Mar. 14, 2014.
[21] *Biggert-Waters*, *supra* note 19.
[22] Diane Ifkovic, *National Flood Insurance Program Changes – BW12 & HFIAA* (Oct. 10, 2014) *available at* http://clear.uconn.edu/climate/docs/Ifkovic_DEEP.pdf (presenting to Conn. Climate Adaptation Academy for Conn. Dep't. of Energy & Envtl. Prot.) [hereinafter *Ifkovic NFIP Changes*].
[23] Homeowner Flood Insurance Affordability Act of 2014, Pub. L. No. 113-89, 128 Stat. 1020 (2014) [hereinafter *HFIAA 2014*].
[24] *Ifkovic NFIP Changes, supra* note 22.
[25] *Ifkovic NFIP Changes, supra* note 22.
[26] *HFIAA 2014*, *supra* note 23, at § 23(a).
[27] NAT'L RESEARCH COUNCIL OF THE NAT'L ACADEMIES, AFFORDABILITY OF NATIONAL FLOOD INSURANCE PROGRAM PREMIUMS: REPORT 1 (National Academies Press 2015), *available at* https://www.nap.edu/catalog/21709/affordability-of-national-flood-insurance-program-premiums-report-1.
[28] NAT'L ACAD. OF SCIENCES, ENG'G & MED., AFFORDABILITY OF NATIONAL FLOOD INSURANCE PROGRAM PREMIUMS: REPORT 2 (National Academies Press 2016), *available at* https://www.nap.edu/catalog/21848/affordability-of-national-flood-insurance-program-premiums-report-2.
[29] *Id.*

With increasing flood insurance rates, albeit at a slower pace, and the big price tags of recovery, Connecticut has been looking at financing for resilience. Connecticut is already a leader in using finance to address climate change. Connecticut Green Bank's[30] innovative financing program for climate mitigation measures in the commercial real estate market has exceeded expectations. In 2014, Connecticut became the first state to create a low-interest loan program for home elevation, Shore Up Connecticut.[31] Financing was also listed as one of the priority research areas when the Connecticut Institute for Resilience and Climate Adaptation (CIRCA)[32] was created in 2014 as a partnership between the University of Connecticut and the Department of Energy and Environmental Protection.

This article aims to educate Connecticut municipalities, regulators, policymakers, and legislators on the need to collaborate on developing financing methods for resiliency, including innovative public-private partnership (P3) models and adapting existing public and private finance models for resiliency. These actions will proactively address flood insurance affordability and promote voluntary climate adaptation measures (Figure 1) to reduce and avoid future losses to life, property and casualty, property taxes, critical infrastructure, and business continuity. Most importantly, Connecticut needs these financing methods in place prior to the next natural disaster when motivation to rebuild resiliently is high. Developing effective financing methods for resiliency now will benefit vulnerable residents, natural ecosystems, businesses, and governments on the local, state, and federal levels. Investments in the short-term will create taxpayer savings for disaster recovery costs and lead to more affordable flood insurance over the long-term.

The authors are not providing an endorsement of any one approach to financing resilience and there may be other opportunities that could be considered that are not reviewed here. Resilience financing is an emerging area of policy research and new ideas are put forward every day. The authors hope that this article will serve as a starting point for a growing list of finance options for

[30] CONNECTICUT GREEN BANK, http://www.ctgreenbank.com/ (last visited August 4, 2017).
[31] Press Release, The Office of Governor Dannel P. Malloy, Gov. Malloy Announces Launch of Program to Help Shoreline Homeowners and Businesses Prepare for Future Severe Weather and Flooding (July 28, 2014), *available at* http://portal.ct.gov/Office-of-the-Governor/Press-Room/Press-Releases/2014/07-2014/Gov-Malloy-Announces-Launch-of-Program-to-Help-Shoreline-Homeowners-and-Businesses-Prepare-for-Futur [hereinafter *Shore Up Connecticut Launch*].
[32] UNIV. OF CONN., CONNECTICUT INSTITUTE FOR RESILIENCE AND CLIMATE ADAPTATION, http://www.circa.uconn.edu (last visited Mar. 3, 2017).

Connecticut and that the local talent in insurance, finance, science, and engineering can be leveraged to create a national and global model for innovative and sustainable resilience financing.

II. RESILIENCE FINANCING PROGRAMS IN CONNECTICUT

Connecticut has several existing low interest, affordable, state-run resilience financing programs, including Shore Up Connecticut, the microgrid grants and loan program, and the Connecticut Clean Water Fund. Also reviewed is tax increment financing districts, a new opportunity for local government to capture the value of resilience projects and use that value to pay back an investment.

A. *Shore Up Connecticut Low-Interest Loans*

Shore Up Connecticut was announced[33] in July 2014 as a low-interest loan program for small businesses and homeowners located in the FEMA Flood Zones VE and AE in Connecticut's coastal municipalities.[34] The legislature authorized $25 million in bonding for the program, which was the first program in the nation that used non-federal resources to finance home elevations.[35] The program was created in part to fill a funding gap for residents who were not eligible or prioritized for disaster recovery services from federal resources. The terms of the loan are a 2.75% fixed interest rate with a 1% origination fee. The loan can provide between $10,000 and $300,000 in funds with a 15-year term.[36] There are no principal or interest payments for the first 12 months and the borrower must maintain property, hazard, and flood insurance for the life of the loan.[37] The program stopped accepting new applications in December 2016.

The Shore Up Connecticut program requires elevations of residential structures and utilities to meet the estimated 500-year recurrence interval storm event elevation plus one additional foot of freeboard in order to reduce the likelihood of future losses while the loan is being paid back.[38] Commercial

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[33] *Shore Up Connecticut Launch, supra* note 31.

[34] FEMA Flood Zone Definitions, *available at* https://www.fema.gov/sites/default/files/images/flood_zones_limwa.jpg (last visited Jan. 16, 2017) [hereinafter *FEMA Flood Zones*].

[35] *Shore Up Connecticut Launch, supra* note 31.

[36] *Shore Up Connecticut Launch, supra* note 31.

[37] *Shore Up Connecticut Launch, supra* note 31.

[38] Hous. Dev. Fund: Shore Up Conn., *Project Information Form, Shore Up Connecticut: Connecticut's Shoreline Resiliency Loan Fund,* CONN. DEP'T OF HOUSING, 1-24 (2014),

property must be elevated to the 100-year floodplain reoccurrence interval storm event Base Flood Elevation (BFE) level elevation plus one foot of freeboard.[39] Additional and partial flood and wind protection measures, such as utility elevation alone and installing storm shutters, can also be financed, provided that they are part of an elevation project or evidence is provided that structural elevation is not feasible.[40]

B. *Microgrids Grants and Green Bank Financing Program*

In its inaugural round in July 2013, the microgrids grants program provided $18 million in grants to nine projects across Connecticut.[41] This was the first statewide microgrids program in the United States[42] and was a direct response to widespread power outages in the state after storms Alfred and Irene,[43] and Sandy.[44] Microgrids have a local power source that can operate as part of the larger grid, but during power outages they can be disconnected from the grid and operate in "island" mode, providing power to critical infrastructure and emergency facilities.[45] Microgrids can be powered by renewable energy resources like solar panels, wind, and hydropower, as well as fuel cells, batteries, or fossil fuels.[46] For example, one of the nine inaugural projects in the Town of Fairfield received funding for a 50 kW natural gas reciprocating engine, a 250 kW natural gas reciprocating engine, and 47 kW of PV solar to power the police station, emergency operations center, cell tower, fire headquarters, and a public shelter.[47] A project like the one in Fairfield offers the potential to increase resiliency during storms by providing emergency backup, but also while reducing emissions on a daily basis. In October 2014, Governor Malloy announced $5.1 million in funding

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http://shoreupct.org/wp-content/uploads/2014/08/HDF-Form-with-attachments.pdf.

[39] *Id.*

[40] *Id.*

[41] Connecticut Department of Energy and Environmental Protection, *Microgrid Program*, (last updated August 2016), *available at* http://www.ct.gov/deep/cwp/view.asp?a=4120&Q=508780 [hereinafter *Microgrid Program]*.

[42] Press Release, The Office of Governor Dannel P. Malloy, Governor Malloy Announces Nation's First Statewide Microgrid Pilot (July 24, 2013) *available at* http://www.ct.gov/deep/cwp/view.asp?Q=528784&A=4380 [hereinafter *Microgrid Announcement*].

[43] JOE MCGEE ET AL., REPORT OF THE TWO STORM PANEL PRESENTED TO: GOVERNOR DANNELL P. MALLOY (Jan. 9, 2012), *available at* http://portal.ct.gov/-/media/Office-of-the-Governor/Two-Storm-Panel/two_storm_panel_final_report.pdf?la=en.

[44] *Microgrid Announcement, supra* note 43.

[45] *Microgrid Program, supra* note 42.

[46] *Microgrid Program, supra* note 42.

[47] *See Microgrid Announcement, supra* note 43.

for two additional projects,[48] bringing Connecticut's total microgrids projects to eleven. In November 2016, the state bond commission approved $30 million in state bonds for additional new projects to be awarded.[49]

A partnership with the Connecticut Green Bank allows for financing components of the microgrid projects, including onsite power generation, thermal energy distribution infrastructure, and end use facility improvements.[50] Microgrid applicants and grantees can use the Green Bank's financial programs, which use private capital, to further finance their microgrid projects. These programs include the Commercial Property-Assessed Clean Energy (C-PACE) program and potential future applications of the DEEP's Lead by Example program for performance contracting in state buildings.[51] Energy Savings Performance Contracts can also play a role.[52] Further grants, loans, and loan enhancements or power purchase incentives are available for onsite power generation from anaerobic digestion of wastes from wastewater treatment facilities and combined heat and power projects.[53]

C. *Clean Water Revolving Loan Funds*

The Clean Water State Revolving Funds were set up in 1987 in Connecticut.[54] The DEEP administers the Connecticut Clean Water Fund, but the U.S. Environmental Protection Agency has oversight and regulatory authority

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[48] Press Release, The Office of Governor Dannel P. Malloy, Gov. Malloy: Microgrid Projects in Bridgeport and Milford Awarded $5 Million in State Funding to Harden Energy System (Oct. 8, 2014) *available at* http://portal.ct.gov/office-of-the-governor/press-room/press-releases/2014/10-2014/gov-malloy-microgrid-projects-in-bridgeport-and-milford-awarded-5-million-in-state-funding-to-harden.

[49] Press Release, The Office of Governor Dannel P. Malloy, Gov. Malloy Advances Commitment to Storm Resiliency with Funding for New Microgrids (Nov. 14, 2016) *available at* http://portal.ct.gov/en/Office-of-the-Governor/Press-Room/Press-Releases/2016/11-2016/Gov-Malloy-Advances-Commitment-to-Storm-Resiliency-With-Funding-for-New-Microgrids.

[50] Conn. Dep't of Energy and Envtl. Prot., *Microgrid Grant Program-Round 2-FAQ Third Installment-Financing,* ENERGIZECT.COM (Feb. 19, 2014), https://www.energizect.com/sites/default/files/uploads/FAQs%20-%20Round%202%20-%20Third%20Installment%20-%20Project%20Financing%20FINAL.PDF [hereinafter *Microgrid Grant Program Round 2 FAQs*].

[51] *Id.*

[52] Chris Lotspeich, *Stamford, Connecticut: a City on the Cutting-Edge of Sustainable Development*, NESEA BLOG (Jan. 4, 2016), http://nesea.org/conversation/masters-blog/stamford-connecticut-city-cutting-edge-sustainable-development.

[53] *Microgrid Grant Program Round 2 FAQs, supra* note 51.

[54] 33 U.S.C. § 1383 (2016).

over the programs.[55] A Congressional appropriation and a required match from the state provide the capital funding for the programs.[56] Connecticut allocates the funding as a mix of grants and loans, and the mix is project dependent. All loans must be repaid back at a 2% interest rate over no more than 20 years.[57] The FY14-FY15 Priority List called on municipal wastewater treatment plant planning applications to consider "assessment of the risk to existing wastewater infrastructure from climate change (rising sea levels, increased storm frequency and intensity and coastal flooding) and an evaluation of alternatives for remedial actions."[58] According to the FY14-FY15 Priority List, planning funds are allocated on a 55% grant/45% loan basis. There were also two reserve programs for Construction of Resiliency Projects of $4 million per year allocated as 20% grant/80% loan to "mitigate the impacts of sea level rise."[59] Additionally, $20 million per year was allocated for a reserve for construction of green infrastructure for combined sewer overflow communities (CSO) with the opportunity to receive funding for demonstration projects as a 50% grant/50% loan.[60]

In the FY 2016-2017 Clean Water Fund Priority List,[61] funding for these specific programs is no longer present. However, the report mentions that the bond authorizations for "$20 million in FY16 for a Long Island Sound stewardship and resiliency program; and $20 million in FY16 for a grant-in-aid program to encourage low-impact design of green municipal infrastructure to reduce non-point source pollution" are now available, but they will be administered separately from the Clean Water Fund. Furthermore, the DEEP now requires all Clean Water Fund projects to have an energy audit if they have not already signed an agreement for a complete upgrade.[62] The climate change assessment and evaluation of remedial actions also became a requirement for plants.[63]

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[55] *Connecticut's Clean Water Fund*, CT.GOV, http://www.ct.gov/deep/cwp/view.asp?a=2719&q=325578&depNav_GID=1655 (last visited Mar. 10, 2014).
[56] Conn. Dep't of Energy and Envtl. Prot., *Clean Water Fund: Financial Assistance Programs, Municipal Water Pollution Control, State Fiscal Years 2014 and 2015*, CT.GOV (July 7, 2014), http://www.ct.gov/deep/lib/deep/water/municipal_wastewater/final_fy2014_2015cwf_pl.pdf.
[57] *Id.*
[58] *Id.*
[59] *Id.*
[60] *Id.*
[61] Conn. Dep't of Energy and Envtl. Prot., *Clean Water Fund: Financial Assistance Programs, Municipal Water Pollution Control, State Fiscal Years 2016 and 2017*, CT.GOV (Mar. 10, 2016), http://www.ct.gov/deep/lib/deep/water/municipal_wastewater/cwf_final_priority_list_2016_2017.pdf.
[62] *Id.*
[63] *Id.*

D. *Tax Increment Financing Districts*

Tax increment financing (TIF) uses the future value to private owners or developers from local government improvements to a specific geographic area to finance the government's investment in that area.[64] The local government captures that value through leveeing district-level taxes or fees on the private owners or developers in the TIF district. Although not yet widely used for this purpose, the principle of TIF districts could also be applied to public investments to reduce disaster risk to private landowners.[65] If an adaptation or resilience measure can increase the property value, then TIF could be used to finance the resilience project.

In 2015, the Connecticut General Assembly passed Public Act 15-57, An Act Establishing Tax Increment Financing Districts.[66] The relatively new statute[67] allows municipalities to establish tax increment districts to finance economic development projects through using real property tax revenue to repay the costs of the project, assessing the benefits to the property from the public improvements or issuing bonds backed by these revenue sources.[68] The Act requires that the district include property that is blighted, needing rehabilitation or conservation, or is suitable for downtown or transit-oriented development.[69]

Although the tax increments district statute makes no specific mention of resiliency to climate change or the impacts of extreme weather, transit-oriented development[70] can be an element of a municipality's community resilience strategy.

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[64] RICHARD BRUGMAN, ICLEI GLOBAL REPORTS, FINANCING THE RESILIENT CITY: A DEMAND DRIVEN APPROACH TO DEVELOPMENT, DISASTER RISK REDUCTION, AND CLIMATE ADAPTATION - AN ICLEI WHITE PAPER (2011), *available at* http://resilient-cities.iclei.org/fileadmin/sites/resilient-cities/files/Frontend_user/Report-Financing_Resilient_City-Final.pdf.

[65] *Id.*

[66] An Act Establishing Tax Increment Financing Districts, PA 15-57—sSB 677 (2015), *available at* https://www.cga.ct.gov/2015/sum/2015SUM00057-R01SB-00677-SUM.htm (citing summary provided by Planning and Development Committee and Finance, Revenue and Bonding Committee).

[67] CONN. GEN. STAT. §§ 7-339cc to kk.

[68] An Act Establishing Tax Increment Financing Districts, *supra* note 67.

[69] An Act Establishing Tax Increment Financing Districts, *supra* note 67.

[70] CONN. GEN. STAT. § 7-339cc (2015) (defining transit-oriented development as "the development of residential, commercial and employment centers within one-half mile of walking distance of a transit facility, including rail and bus rapid transit and services that meet transit supportive standards for land uses, built environment densities and walkable environments, in order to facilitate and encourage the use of those services. Transit-oriented development includes, but is not limited to, transit vehicles such as buses, ferries, vans, rail conveyances and related equipment; bus shelters and other transit-related structures; benches, signs and other transit-related

For example, the State of Connecticut put forward the concept of resilient transit-oriented development for its Phase 2 grant application for the National Disaster Resilience Competition,[71] which was recently awarded $54.3 million to implement a pilot project in Bridgeport built on this concept.[72] Additionally, the December 2015 call for proposals from the Connecticut Office of Policy and Management, entitled the Responsible Growth and Transit-Oriented Development Grant Program, included "projects that promote community resiliency in response to extreme weather events, and that are supportive of responsible growth and/or TOD" as eligible activities.[73]

III. MODEL PROGRAMS FOR FINANCE

Although Connecticut has made great strides in developing resilience financing programs, there are other programs within the state and from neighboring New Jersey that could serve as models for additional future programs. These models include financing renewable energy and energy efficiency using a property assessment, leveraging recovery grant dollars to create a resilience bank, and tweaking catastrophe insurance bonds to create resilience bonds.

A. *Connecticut Green Bank C-PACE Program*

Connecticut's Commercial-Property Assessed Clean Energy (C-PACE) program was the first such statewide program of its kind and is now one of the most successful in the country. The program has been widely adopted by Connecticut municipalities. 125 out of 169 cities and towns have signed up to participate, and $97 million worth of projects have been financed through the C-PACE program as of September 2016.[74]

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infrastructure; bicycle lane construction and other bicycle-related improvements; pedestrian improvements such as crosswalks, crosswalk signals and warning systems and crosswalk curb treatments and the industrial, commercial, residential, retail and mixed-use portions of transit-oriented development projects.")

[71] Press Release, U.S. Dep't of Housing and Urban Dev., HUD Awards $1 Billion Through National Disaster Resilience Competition, HUD No. 16-006 (Jan. 21, 2016) *available at* https://portal.hud.gov/hudportal/HUD?src=/press/press_releases_media_advisories/2016/HUDNo_16-006.

[72] *See* Presentation, Rebecca French et al., 2015 American Geophysical Union Fall Meeting, Safe Shores and Resilient Transit Corridors: Using Science, Design, and Stakeholder Partnerships to Address Connecticut's Coastal Vulnerabilities (Dec. 14-18, 2015), https://agu.confex.com/agu/fm15/webprogram/Paper85050.html.

[73] *Request for Application: Responsible Growth and Transit-Oriented Development Grant Program*, STATE OF CONNECTICUT OFFICE OF POLICY AND MANAGEMENT, http://www.ct.gov/opm/lib/opm/secretary/rfp/opm-igp-20151209-rg-tod.pdf (Dec. 9, 2015).

[74] Data Request to Connecticut Green Bank (Oct. 14, 2016) (on file with author).

According to the Connecticut Green Bank, C-PACE uses a voluntary assessment on a property tax bill to finance energy efficiency and clean energy projects.[75] The assessment is used to spread the cost of the project over "the expected life of the measure" and the "repayment obligation transfers automatically to the next owner if the property is sold."[76] The capital invested by a C-PACE loan is secured by a lien on the property, which in the event of default, provides the security for "low-interest, long-term capital to be raised from the private sector with no government financing required."[77] C-PACE is considered useable for multiple commercial business types: retail, manufacturing, office, agricultural, non-profit, and faith institutions, as well as many multi-family residential properties.[78] Applying the PACE model to 1-4 family residential properties remains a challenge, but there are proposals in the policy pipeline as described below.

B. *Connecticut's Proposed R-PACE Program*

The Green Bank revisited its PACE enabling statute during Connecticut's 2016 Regular Legislative Session. Originally passed in 2011,[79] 1-4 family residential PACE (R-PACE) financing was held up for years by federal policy uncertainty over lien seniority and survivability through property transfers. The 2016 proposed House Bill 5563[80] updates the existing statute to make the Green Bank a central program administrator for operating an R-PACE program, removing the administrative burden from municipalities that were enabled to create their own programs, but none of which had launched them. The proposal subordinated the lien position to other debt on the property, specifically first mortgages and property tax obligations.[81] The change made transferability of the payment obligation – the R-PACE lien – the key long-term financing concept, rather than lien seniority.[82] House Bill 5563 was not passed and was reintroduced in 2017 as Substitute Senate Bill 973[83] with revisions to the lien position no longer being subordinate to first mortgages and with transferability of the payment

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[75] *C-PACE Financing High Performance Building Upgrades*, CONN. GREEN BANK, http://www.ctcleanenergy.com/YourBusinessInstitution/CommercialPropertyAssessedCleanEnergyCPACE/tabid/642/Default.aspx (last visited Apr. 12, 2016) [hereinafter *C-PACE Financing*].
[76] *Id.*
[77] *Id.*
[78] *Id.*
[79] An Act Concerning the Establishment of the Department of Energy and Environmental Protection and Planning for Connecticut's Energy Future, PA 11-80—SB 1234 § 100 (2011).
[80] An Act Concerning the Residential Sustainable Energy Program, H.B. No. 5563 (2016).
[81] *Id.*
[82] *Id.*
[83] An Act Concerning a Residential Sustainable Energy Program, SB 973 (2017).

obligation as optional at the discretion of the parties involved in purchase of the property. Senate Bill B 973, An Act Concerning a Residential Sustainable Energy Program, did not advance out of the Finance Committee to a vote by the legislature in the 2017 general session.

Lenders on mortgages backed by the government-sponsored enterprises Fannie Mae and Freddie Mac are accountable to the guidance of the Federal Housing Finance Agency (FHFA).[84] The FHFA has formally indicated - with the advent of a successful R-PACE program in California[85] - that the super seniority design of PACE-liens challenge the first-lien position of Fannie Mae and Freddie Mac mortgages.[86] FHFA General Counsel Alfred Pollard has also indicated that the presence of PACE liens altogether is a type of seniority and would therefore throw PACE-encumbered mortgages out of compliance with FHFA standards.[87] While C-PACE programs have been very successful, R-PACE programs across the country have been stifled by FHFA's prohibition on purchasing any mortgages with first-lien PACE-loans attached.[88] The Obama Administration had encouraged states to advance R-PACE policy, and the Federal Housing Authority (FHA) issued formal guidance supportive of their mortgage lenders working with PACE-encumbered properties to ensure consumers can access credit in sale or refinance scenarios.[89] The key barrier to policy implementation is with the banking industry serving loans backed by Fannie Mae or Freddie Mac, as banks tend to transact with

[84] Clean Energy Finance and Investment Authority, *Residential Property Assessed Clean Energy: A Connecticut Program Viability Assessment*, CLEAN ENERGY STATES ALLIANCE at 3 (Jan. 30, 2015), http://cesa.org/assets/Uploads/R-PACE-CT-Viability-Assessment.pdf.
[85] *Id.* at 25.
[86] Press Release, Federal Housing Finance Agency, Statement of the Findings of the Federal Housing Finance Agency on Certain Super-Priority Liens, (Dec. 22, 2014), *available at* https://www.fhfa.gov/Media/PublicAffairs/Pages/Statement-of-the-Federal-Housing-Finance-Agency-on-Certain-Super-Priority-Liens.aspx [hereinafter *FHFA Statement*].
[87] Statement from Alfred M. Pollard, General Counsel, Federal Housing Finance Agency, to California Legislature, Assembly Banking and Finance Committee and Assembly Local Government Committee, *Keeping Up with PACE: A Joint Oversight Hearing on Residential PACE Programs* (June 9, 2016), *available at* https://www.fhfa.gov/Media/PublicAffairs/PublicAffairsDocuments/PACEStatementCalifAssembly_testimony_FINAL692016.pdf.
[88] Stroock & Stroock & Lavan LLP, *A Tale of Two PACEs: Commercial Success vs. Residential Repose*, STROOCK SPECIAL BULLETIN, Mar. 15, 2013, http://www.stroock.com/siteFiles/Pub1306.pdf.
[89] Press Release, The White House, Office of the Press Secretary, Fact Sheet: Obama Administration Announces Clean Energy Savings for All Americans Initiative (July 19, 2016), *available at* https://obamawhitehouse.archives.gov/the-press-office/2016/07/19/fact-sheet-obama-administration-announces-clean-energy-savings-all.

portfolios of residential mortgages and have concerns about PACE-encumbered mortgages being returned to them after a sale due to FHFA non-compliance.[90]

C. *A Model for Finance Based on PACE: Property Assessed Resilience Financing*

In 2011, Kunreuther and Michel-Kerjan[91] proposed that PACE could be used as a model for financing resilience projects through multiyear flood insurance contracts. In PACE, the retrofit project's lower energy use is tied to a tax assessment that reflects the increased value of the property. Much of that value is the resulting savings in energy costs.[92] If a resilience project were being financed, then the tax assessment could be combined with reduced flood insurance premiums to create the value to finance resiliency projects and repay that additional special assessment charge on the property tax bill.[93] The Kunreuther proposal, which was advanced by the Connecticut DEEP stakeholder group in 2013, is referred to here as Property Assessed Resilience (PAR). PAR is like PACE in that the financing contracts for resilience retrofit projects would be attached to a property, not the individual person(s) owning that property.[94] Insurance rates for the property with improved resilience could be lowered in recognition of the mitigation and resilience actions, therefore any PAR loans taken out to cover the cost of the flood loss control actions would be offset by the corresponding reduction in premiums for flood insurance.[95]

PAR financing attaches home improvement resiliency costs to the property tax bill through a special public benefits assessment like PACE.[96] Such obligations, when secured to the property and assigned a lien position on the assessed property subordinate to the first mortgage and property tax, create a stable security interest for the investor or lender that conforms to guidance on the use of certain super priority liens from the FHFA.[97] This PAR obligation, like a PACE obligation, is transferrable to subsequent property owners and would not need to be paid in full when a property

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[90] Personal communication with Matthew Macunas, Legislative Liaison and Marketing Manager, Connecticut Green Bank (Mar. 12, 2017).
[91] Howard Kunreuther & Erwann Michel-Kurjan, *People Get Ready: Disaster Preparedness*, ISSUES IN SCIENCE AND TECHNOLOGY- VOLUME 28 at 1-7 (Fall 2011), *available at* http://opim.wharton.upenn.edu/risk/library/J2011IST_PeopleGetReady.pdf.
[92] *Id.* at 6.
[93] *Id.* at 5.
[94] *Id.* at 6.
[95] *Id.* at 5.
[96] *C-PACE Financing, supra* note 76.
[97] *FHFA Statement, supra* note 87.

is sold.[98] We propose that the public benefit is derived from: (1) reduced future disaster recovery expenses to taxpayers; (2) market value preservation or increase of a resilience home improvement project to a homeowner; (3) improved property tax stability of the more resilient residential property that benefits the municipality; (4) lower flood insurance premiums for the property owner; (5) increased likelihood of the homeowner's ability to pay their primary mortgage in the event of a natural disaster; and (6) increased Community Rating System (CRS)[99] score for any municipality's participating CRS program, potentially lowering flood insurance premiums for all others in that community.

At the time that the authors first outlined this article, PAR only existed as an idea, but that changed in the 2016 Connecticut legislative session. The 2016 House Bill 5563[100] included resiliency improvements as eligible measures for R-PACE financing, including: flood and hurricane resistant construction retrofits; water conservation; health and public safety measures like asbestos, mold and lead-based paint remediation; and renewable energy and energy efficiency improvements.[101]

D. *Energy Savings Performance Contracts*

Owners of properties with large energy usage can hire an Energy Services Company (ESCO) and an Owner's Representative to help assist the owner in procuring financing, and the installation, operation, and maintenance of building retrofits involving onsite energy generation, energy efficiency, and water conservation related capital improvements.[102] The ESCO can access long-term financing methods such as Tax-Exempt Lease Purchase (TELP) commercial loans or bonds for these projects with limited or no upfront costs to the owner.[103] Cash flow to the ESCO from the energy savings can pay down the financing over the term of the TELP.[104] These programs are referred to as Energy Savings Performance Contracts (ESPCs).[105] ESPCs can help municipalities and institutions like hospitals and first

[98] *C-PACE Financing, supra* note 76.
[99] FEDERAL EMERGENCY MANAGEMENT AGENCY COMMUNITY RATING SYSTEM, https://www.fema.gov/community-rating-system (last visited Mar. 7, 2017).
[100] H.B. No. 5563*, supra* note 81.
[101] H.B. No. 5563*, supra* note 81, at § 1a-1.
[102] Lotspeich, *supra* note 53.
[103] Lotspeich, *supra* note 53.
[104] Lotspeich, *supra* note 53. For a chart looking at the conceptual framework for ESPCs, see Satish Kumar, *IPMVP—from a DOE-Funded Initiative to a Not-for-Profit Organization*, 3 Environmental Energy Technology Division News, Lawrence Berkeley National Lab, n.3 (2002), *available at* https://eta.lbl.gov/sites/all/files/related-files/eetd-nl10.pdf.
[105] Lotspeich, *supra* note 53.

responders make their public building, storm shelters, and emergency management command centers more resilient. The City of Stamford, CT is using an ESPC to construct a microgrid at the Government Center building.[106]

E. *New Jersey Energy Resilience Bank*

The New Jersey Energy Resilience Bank[107] intends to fund "distributed energy resource" (DER) technologies that can operate in island mode with black start capabilities, both of which allow for operation of critical facilities during power outages to the grid. According to the Bank's program guide, technologies include combined heat and power systems, fuel cells, natural gas micro turbines, and renewable fuels such as methane digesters, solar panels with off-grid inverters, and storage systems.[108] All resilient energy systems in the program require elevation above FEMA base flood elevation for resilience to flooding.[109] The program guide encourages the use of additional tools for assessing flood risk due to sea level rise, including the NOAA Sea Level Rise tool for Sandy Recovery and Rutgers University's NJ Flood Mapper.[110] Emergency generators and fossil fuel storage for those generators are not considered eligible projects.[111]

New Jersey received $200 million in funds from the Department of Housing and Urban Development (HUD) Community Development Block Grant-Disaster Recovery (CDBG-DR) program for Sandy.[112] The funds provide the capital for the Energy Resilience Bank. CDBG-DR funding rules stipulate, however, that funding may only go to public entities, non-profits, and small businesses.[113] Priority for funds must be for low-moderate incomes (LMI) areas[114] and for those most-impacted by the disaster.[115] The small business definition resulted in the limited use of these funds for

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[106] Lotspeich, *supra* note 53.
[107] Press Release, New Jersey Board of Public Utilities, NJ Energy Resilience Bank Now Accepting Applications: Critical Facilities Can Begin Process to Secure Resilience Grant Funds (Oct. 20, 2014), *available at* http://www.state.nj.us/bpu/newsroom/announcements/pdf/20141020_erb_press.pdf [hereinafter *NJ Energy Resilience Bank Announcement*].
[108] State of New Jersey Board of Public Utilities, *New Jersey Energy Resilience Bank Grant and Loan Financing Program Guide*, ERB FINANCING PROGRAM GUIDE (Oct. 14, 2014), http://www.state.nj.us/bpu/pdf/erb/Final%20ERB%20Program%20Guide.pdf.
[109] *Id.*
[110] *Id.*
[111] *Id.*
[112] *NJ Energy Resilience Bank Announcement, supra* note 108.
[113] 42 U.S.C. § 5305(a) (2014).
[114] HUD Community Development Block Grants Eligible Activities, 24 C.F.R. § 570.200 (2016).
[115] Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1974, 42 U.S.C. §§ 5121-

energy resilience because for-profit entities or a mix of for-profit and non-profit entities provide many utilities and critical services.[116] As a result, New Jersey decided to apply for a waiver from HUD from the small business rule. On August 25, 2015, New Jersey was granted the waiver allowing for-profit applicants to apply for funds, if they provide critical public services and meet the following conditions of HUD. [117] The Bank must provide preferential treatment to LMI areas and populations in its scoring methodology, require an equity contribution for for-profit critical facilities, and establish a mix of financing terms (loan, forgivable loan, and/or grant) for each assisted for-profit facility to safeguard against the potential over-subsidization of for-profit facilities.[118] The Energy Resilience Bank currently has funding available for water and wastewater treatment facilities[119] and hospitals or other related healthcare facilities.[120]

F. *Resilience Bonds*

Modeled after catastrophe bonds ("cat bonds"), resilience bonds may provide funding for large-scale resiliency projects. Re:focus partners, LLC described the concept of resilience bonds in a 2015 report[121] in cooperation with RMS and Swiss Re, with funding provided by the Rockefeller Foundation, one of the foundations championing resilience policy and planning.

Cat bonds are financial instruments designed to help reduce the economic disruption of financial losses experienced by businesses and governments when a disaster reaches a predetermined financial threshold or a physical threshold such as a storm surge height of ten feet or greater above a elevation datum during the bond term, which may be three to five years.[122] In effect cat bonds are used as

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5207 (1988).
[116] Additional Clarifying Guidance, Waivers, and Alternative Requirements for Grantees in Receipt of Community Development Block Grant Disaster Recovery Funds Under the Disaster Relief Appropriations Act, 80 Fed. Reg. 51589-01 at § 2-2 (Aug. 25, 2015).
[117] *Id.*
[118] *Id.*
[119] New Jersey Energy Resilience Bank, *ERB Funding Round 1: Water and Wastewater Treatment Facilities,* ERB FINANCING PROGRAM GUIDE (OCT. 15, 2015) (revised Apr. 12, 2016), http://www.njeda.com/pdfs/ERB/ERB_WWWTF_Funding_Program_Guide_4_21_16.aspx.
[120] New Jersey Energy Resilience Bank, *ERB Funding: Hospitals and Related Healthcare Facilities*, ERB FINANCING PROGRAM GUIDE (Oct. 15, 2015) (revised Apr. 12, 2016), http://www.njeda.com/pdfs/ERB/ERB_Hospitals_Funding_Program_Guide_4_21_16.aspx.
[121] RE:FOCUS PARTNERS, REBOUND INSURING FOR RESILIENCE REPORT: LEVERAGING CATASTROPHE BONDS – AS A MECHANISM FOR RESILIENT INFRASTRUCTURE PROJECT FINANCE (Dec. 9, 2015), *available at* http://www.refocuspartners.com/wp-content/uploads/2017/02/RE.bound-Program-Report-December-2015.pdf.
[122] *Id.* at 2-3.

insurance after a triggering event such as a hurricane, flood, earthquake, or typhoon strikes.[123] A sponsor issues the bond and pays investors a coupon, much like an insurance premium.[124] Also, similar to traditional insurance, if an agreed upon trigger event occurs, those who hold the bond pay a previously set amount. If the trigger event does not occur over an established time period, no payment from the investor to the sponsor is required. Therefore, there is potential for a significant payout for either the sponsor or the investor. Typically bonds issued for inherently riskier hazards, those more likely to occur, pay higher coupon values. However, when risk can be diminished the bond investment may be more valuable as investors are less likely to have to pay the triggered amount.[125]

A resilience bond differs from a cat bond in that resilience bonds anticipate the risk reduction of resiliency projects.[126] Cat bond coupon pricing is set by expected outcomes generated by catastrophe models.[127] These models determine the risk level of the particular hazard(s) covered by the bond. In a resilience bond, the coupon price is determined pre- and post-resilience project implementation.[128] With a resilience project in place, the risk of the hazard hitting the trigger event is assumed to decrease, and the coupon price is therefore reduced, freeing up the difference in value to be used for the implementation of the resilience project.[129] The model could also be thought of as a rebate to invest in resilient infrastructure projects.[130]

Resilience bonds are structured like cat bonds when a sponsor(s) partners with a bond issuer.[131] The bond issuer creates the bond parameters, accepts premium payments from the sponsor, and pays coupons to the investors.[132] They may also pay rebates for resilience project execution. There is no one-size-fits-all resilience bond format, each must be tailored to meet the specific situation.[133]

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[123] *Id.* at 3.
[124] *Id.* at 31-33.
[125] *Id.*
[126] *Id.* at 34.
[127] *Id.* at 33.
[128] *Id.* at 34.
[129] *Id.* at 34-38.
[130] Shalina Vajjhala, *Financing infrastructure through resilience bonds*, THE AVENUE BLOG (Dec. 16, 2015), https://www.brookings.edu/blog/the-avenue/2015/12/16/financing-infrastructure-through-resilience-bonds/.
[131] RE:FOCUS PARTNERS, *supra* note 123, at 47.
[132] RE:FOCUS PARTNERS, *supra* note 123, at 47.
[133] RE:FOCUS PARTNERS, *supra* note 123, at 31.

We argue that resilience bonds can provide a variety of benefits to meet recovery and resilience needs, including rapid response funding in the wake of a disaster, a more affordable insurance model (for example, in 2013 the MTA secured $200 million in catastrophe bond coverage[134] for an affordable alternative to traditional insurance), a path for meeting regulatory insurance compliance obligations, an incentive for performance based design for risk reduction, and a way to monetize success for future public investment in resilience.[135]

IV. OPPORTUNITIES AND CHALLENGES FOR FINANCING RESILIENCE

This article has reviewed current programs and potential programs, but questions remain as to why Connecticut should make the investment in resilience financing and what barriers and challenges need to be overcome to implement programs. The return on investment for resilience is obvious in theory, but less obvious to quantify and monetize. However, studies have shown how one might attack that problem. Appropriately using flood insurance as a monetization tool, creating financing programs that result in resilience at the neighborhood scale, and making standards for resilient building are also all challenges that must be addressed.

A. *Opportunity: Return on Investment for Resilience*

Resilience investment might viably scale by bundling financing for such resilience measures with financing for faster-payback energy efficiency or renewable energy measures. The evaluation, measurement and verification standards used in the energy industry support the value of these future streams of energy savings as tradable commodities. The Connecticut Green Bank transacts with these markets, and in 2014 pioneered the first securitization of a commercial efficiency portfolio of C-PACE loans.[136] After five years of activity, the Connecticut Green Bank has attracted over $1 billion in private capital investment into Connecticut clean energy projects, using just a fraction of public ratepayer dollars in support.[137] The Green Bank's leverage ratio has been during fiscal year

[134] *N.Y. MTA buys insurance protection for future 'Sandy' storms*, METRO FOR TRANSIT & MOTORCOACH BUSINESS MAGAZINE, July 13, 2013, http://www.metro-magazine.com/management-operations/news/290796/n-y-mta-buys-insurance-protection-for-future-sandy-storms.

[135] RE:FOCUS PARTNERS, *supra* note 123, at 47.

[136] *In a 'Watershed' Deal, Securitization Comes to Commercial Efficiency*, Green Tech Media (May 19, 2014), *available at* http://www.greentechmedia.com/articles/read/the-first-known-commercial-efficiency-securitization.

[137] Personal communication with Matthew Macunas, Legislative Liaison and Marketing Manager,

2017 has been $6 in private capital investment for every $1 in government public funding.[138] The Green Bank estimates that the multiplier for private investment to public investment in climate change adaptation and resilience projects may need to be 50:1 or 100:1, given the scope of need.[139]

In Section II.C. of this article, the PAR (property assessed resilience) finance model was evaluated in Connecticut to incorporate a community benefit assessment derived from improving building resilience and reaping the cumulative community benefits from insured and uninsured loss avoidance (or taxpayer savings) in future natural disasters, municipal property tax stability during and after future storm events, and NFIP financial stability.

In January 2013, FEMA Region VI conducted a loss avoidance study of southeast Louisiana on 95 properties that were elevated above base flood elevation (BFE) post Hurricane Katrina in 2005 and then experienced Hurricane Isaac in 2012.[140] The conclusion was that one flood event over that 7-year period already demonstrated an average losses avoided ratio of 0.81,[141] where a ratio greater-than-one would have meant that the project mitigation benefits already exceeded the mitigation costs. Given that home elevation projects have an expected useful life exceeding thirty years and the storm prone history of southeast Louisiana, the cost of elevation or mitigation could have a significant positive return on investment over the next twenty-two years.[142]

Understanding the payback that the above example shows can be challenging for decision makers. FEMA recognized this need, and in 2015 they funded a research study by Fatemech Orooji and Carol Friedland of Louisiana State University[143] to examine the behavioral economics and budgetary decision-making process of consumers posed with an opportunity to invest in a wind

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Connecticut Green Bank (July 15, 2017).

[138] *Id*.

[139] Personal communication with Brian Garcia, President and Chief Executive Officer, Connecticut Green Bank (September 9, 2015).

[140] John E. Bourdeau, et al., *Loss Avoidance Study, Southeastern Louisiana, Hurricane Isaac 2012, DR-4080-LA,* FEDERAL EMERGENCY MANAGEMENT AGENCY (Jan. 2013), https://www.fema.gov/media-library-data/20130726-1910-25045-9289/las_study__southeastern_louisiana.txt.

[141] *Id*. at 2.

[142] *Id*.

[143] Fatemah Orooji, Risk-Based Wind Loss and Mitigation for Residential Wood Framed Construction (2015) (unpublished Ph.D. dissertation, Louisiana State University) (on file with LSU Digital Commons).

resistant retrofit for their homes. The *Wind Hazard Mitigation Framework*, as they called it, has the potential to serve as a return on investment worksheet to help consumers make informed resilience investment decisions and provide underwriters the ability to calculate the benefit-cost of a resilience loan.[144]

B. *Challenge: Underinsured Properties*

FEMA has been challenged to persuade homeowners of the value of investing in NFIP insurance. On average, in Connecticut only 20-23% of eligible properties have flood insurance policies and that number dropped between 2013 and 2015.[145] A number of factors may contribute to the low levels of insured properties in the State, including increasing premiums and older homes with no mortgages, and therefore, no requirement to have flood insurance.[146] The payments for financing resilience can be based on insurance savings.[147] Without the prospect of savings from lower insurance premiums there may be little motivation to make a resilience investment despite the real risk of flooding to the property. The 1% annual chance flood event is estimated to occur at a probability of 51% over the average 70-year useful lifespan of a single family located in the Special Flood Hazard Areas (Figure 2).[148] With increasing sea levels, today's 1% annual chance flooding event will occur more frequently in the future.[149] Educating homeowners about these issues may increase demand for resilience projects and potentially new ways to fund them through financing. In Old Saybrook, Connecticut, for example, the town formed the Sea Level Rise and Climate Adaptation Committee (SLRCAC).[150] After becoming educated about the impacts of sea level rise and storm surge on their town now and in the future, the SLRCAC made recommendations to the Town Selectman that included budgeting

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[144] *Id.*
[145] Jan Ellen Spiegel, *Flood insurance hikes arriving at a waterfront near you,* THE CT MIRROR, May 4, 2015, https://ctmirror.org/2015/05/04/flood-insurance-hikes-arriving-at-a-waterfront-near-you/.
[146] *Id.*
[147] Kunreuther & Michel-Kerjan, *supra* note 92, at 5.
[148] James F. O'Connell & Stacey Justus, *Model Coastal Floodplain Development Bylaw: Effectively Managing Coastal Floodplain Development*, CAPE COD COMMISSION (Dec. 14, 2009), http://www.capecodcommission.org/resources/bylaws/Coastal_Floodplain_Bylaw_Dec2009.pdf.
[149] U.S. ARMY CORPS OF ENG'RS, NORTH ATLANTIC COAST COMPREHENSIVE STUDY: RESILIENT ADAPTATION TO INCREASING RISK MAIN REPORT (Jan. 2015), *available at* http://www.nad.usace.army.mil/Portals/40/docs/NACCS/NACCS_main_report.pdf.
[150] TOWN OF OLD SAYBROOK, REPORT OF FINDINGS FROM A STUDY OF THE EFFECTS OF SEA LEVEL RISE AND CLIMATE CHANGE ON OLD SAYBROOK, CONNECTICUT (Dec. 2015), *available at* http://www.oldsaybrookct.org/Pages/OldSaybrookCT_Conservation/SLRCAC2/SLRCAC_Resources/SLRCAC%20Report%20of%20Findings.pdf.

for the design and construction of physical solutions to address the challenges that Old Saybrook will face.[151]

C. *Challenge: Providing Resilience at the Neighborhood Scale*

Financing models that work on a property-by-property basis face the challenge of not being able to improve resilience for an entire neighborhood or area that faces a shared risk. For example, if $25 million in approved bond funds was made available to Shore Up, then the loan program could fund approximately 200 home elevations with an average loan of $125,000.[152] Unfortunately, more than 32,000 homes in the state lie within the FEMA FIRM 100-year floodplain.[153] This program was a great step forward and the first of its kind in the nation, but at its initial approved funding level, Shore Up loans would be a drop in the bucket. Without additional funding and motivation by all homeowners to use the Shore Up program, Connecticut will have large gaps in home elevation within neighborhoods (Figure 4). Affordability of the program is also an issue that needs to be addressed. Even with a low interest rate, taking on a loan may not be possible for low or moderate-income property owners. Herbert et al. found that low income households may not have the cash on hand for down payments and closing costs, cannot pay down debts, have low credit scores, and could be subject to higher borrowing costs. [154] Moreover, home and commercial property elevation alone does not address the infrastructure needs that make an entire neighborhood resilient. Programs like Shore Up could be paired with a TIF district for elevating the roads or instituting a flood protection strategy. A revolving loan fund project to finance a resilient wastewater utility could be added as well. There are many combinations that could apply, but the point is that in isolation none of these programs will address the entire problem.

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[151] *Id.*
[152] *Shore Up Connecticut Launch, supra* note 31.
[153] Conn. Dep't of Energy and Envtl. Prot., *Natural Hazards Mitigation Plan, For 2007-2010*, CT.GOV (Dec. 2007), http://www.ct.gov/deep/lib/deep/water_inland/hazard_mitigation/plan/hazardmitigationplan.pdf.
[154] Christopher E. Herbert et al., Joint Center for Housing Studies of Harvard University, *Critical Housing Finance Challenges for Policymakers: Defining a Research Agenda*, WHAT WORKS COLLABORATIVE (2012), *available at* http://www.jchs.harvard.edu/sites/jchs.harvard.edu/files/w12-2_herbert_belsky_apgar.pdf.

Figure 2. Two houses in the coastal municipality of Old Saybrook, Connecticut. The house on the right is in the process of being elevated.[155]

D. *Challenge: Setting Appropriate Building Codes for Resilience*

Financing resilience will require predictable and uniform building construction standards and codes and guidance for efficient loan underwriting. The Department of Homeland Security published the report *Including Building Codes in the National Flood Insurance Program, Fiscal Year 2013 Report to Congress* as an impact study for the proposed Biggert-Waters Flood Insurance Reform Act of 2012.[156] In this report the agency concluded that, "the overall impacts of including building code as part of NFIP would be positive in helping to reduce physical flood losses and other hazard losses."[157] In addition:

- 22 states, including Connecticut, mandate local enforcement of statewide building codes.[158]

[155] Photo courtesy of Rebecca French taken in the fall of 2014 on a tour of the Town of Old Saybrook Connecticut's shoreline.
[156] DEP'T OF HOMELAND SEC., FED. EMERGENCY MGMT. AGENCY, INCLUDING BUILDING CODES IN THE NATIONAL FLOOD INSURANCE PROGRAM: FISCAL YEAR 2013 REPORT TO CONGRESS IMPACT STUDY FOR BIGGERT-WATERS FLOOD INSURANCE REFORM ACT OF 2012 at 21-30 (Jan. 2013), *available at* https://www.fema.gov/media-library-data/1385728818014-f08e55ee83590650103995b2c66e2285/Incl_Bldg_Codes_NFIP2.pdf.
[157] *Id.* at 21-24.
[158] *Id.* at 27-30.

- 28 states have a shared responsibility with localities (partial) or no shared responsibility with localities (complete code adoption) and enforcement shared between state and local levels. (Connecticut has a single statewide code.)[159]
- The benefits to communities that initially incur the costs associated with establishing building departments to perform permitting and inspection include: generally increased property values, reduced losses during flood and other hazard events, which reduce insurance rates over a 5- to 10-year period, and a more actuarially sound NFIP and insurance industry.[160]
- The most significant benefits would likely arise from the required added elevation above base flood elevation levels (freeboard) for dwellings in certain special flood hazard areas, such as coastal A and V zones.[161]
- The reduction of NFIP insured losses would lower actuarially rated insurance premiums for those code compliant structures, making insurance more affordable, attracting more participation in the NFIP, enhancing the program's financial soundness, and reducing the subsidy needs of the NFIP.[162]
- The statutory enforcement authority of building officials would increase code compliance by builders and designers of new structures and substantially damaged or substantially improved structures as part of the NFIP.[163]

The general concern with enforcing the nationally recognized building codes was the regulatory and financial impacts on communities that do not already have the enforcement programs in place since they have not yet adopted the national building codes.[164] However, the report found that these costs could be offset by the collection of permit fees and reimbursement from the federal government and net economic benefit over time.[165]

Nationally recognized building codes applicable to flood resistant design and construction include: the American Society of Civil Engineers (ASCE) 24, *Flood Resistant Design and Construction*, as a reference standard in the International Residential Code and International Building Code® (IRC, IBC or I-Codes).[166] In addition ASCE/SEI 7-10, *Minimum Design Loads for Buildings and Other*

[159] *Id.*
[160] *Id.*
[161] *Id.*
[162] *Id.*
[163] *Id.*
[164] *Id.* at 10.
[165] *Id.*
[166] FLOOD RESISTANT DESIGN AND CONSTR. COMM. OF THE CODES AND STANDARDS ACTIVITIES DIV. OF THE STRUCTURAL ENG'G INST. OF ASCE, FLOOD RESISTANT DESIGN AND CONSTRUCTION ASCE/SEI 24-14 (Am. Soc'y of Civil Eng'rs, 2014).

Structures, "provide requirements for general structural design and includes means for determining dead, live, soil, flood, snow, rain, atmospheric ice, earthquake, and wind loads, as well as their combinations suitable for including in building codes and other documents."[167] The International Mechanical Code, International Plumbing Code, and International Fuel Gas Code also include codes for design for flooding per ASCE 24.[168]

Figure 3. Helical pile foundations installed by GZA GeoEnvironmental, Inc. for elevated residence in Milford, Connecticut to withstand 100 mph wind load and 500-year occurrence interval storm flood elevation plus one foot freeboard.[169]

[167] FLOOD RESISTANT DESIGN AND CONSTR. COMM. OF THE CODES AND STANDARDS ACTIVITIES DIV. OF THE STRUCTURAL ENG'G INST. OF ASCE, MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES, ASCE/SEI 7-10 (2013).
[168] FED. EMERGENCY MGMT. AGENCY, ENGINEERING PRINCIPLES AND PRACTICES FOR RETROFITTING FLOOD-PRONE RESIDENTIAL STRUCTURES, FEMA P-259 (3d ed. Jan. 2012), *available at* https://www.fema.gov/media-library-data/20130726-1506-20490-2593/fema259_complete_rev.pdf.
[169] Photo courtesy of James Davis, GZA GeoEnvironmental (provided by co-author Wayne Cobleigh, Vice President- GeoEnvironmental).

The Connecticut State Building Inspector, State Fire Marshal and the Codes and Standards Committee are currently conducting a code review process to adopt the 2018 State Building and Fire Safety Codes based on the 2015 editions of the International Code Council (ICC) and National Fire Protection Association (NFPA) documents.[170] The process was initiated in January 2017 and it was planned to be completed in July 2017.

ASCE 24-14 is a referenced standard in the 2015 International Building Code® (IBC) and the 2015 International Residential Code® (IRC).[171] Building and structures within the scope of the IBC proposed to be constructed in flood hazard areas must be designed in accordance with ASCE 24-14.[172] The IRC requires dwellings in floodways to be designed in accordance with ASCE 24-14 and includes an alternative that allows communities to require homes in any flood zone to be designed in accordance with ASCE 24-15.[173] Sections of the ASCE 24-14 that complement the NFIP minimum requirements include: Building Performance; Flood-Damage Resistant Materials; Utilities and Service Equipment and Siting Considerations.[174]

The FEMA has worked since 1998 to include flood provisions into the International Building Codes.[175] The flood provisions of the 2015, 2012, 2009, and 2006 editions of the I-Codes are consistent with the minimum requirements of the NFIP for buildings and structures.[176] The Design Flood Elevation (DFE) term used in ASCE 24 and ASCE 7 is defined as the Base Flood Elevation (BFE), which is the height of the corresponding water level on the 100-yr FIRMs flood event plus any additional elevation above that BFE as established by a regulatory authority, and

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[170] *Building and Fire Safety Code Adoption*, DEPT. OF ADMIN. SERVICES (Apr. 3, 2017, 8:26:12 AM), http://www.ct.gov/dcs/cwp/view.asp?a=4447&q=523368.
[171] FED. EMERGENCY MGMT. AGENCY, HIGHLIGHTS OF ASCE 24-14 FLOOD RESISTANT DESIGN AND CONSTRUCTION (July 2015), *available at* https://www.fema.gov/media-library-data/1436288616344-93e90f72a5e4ba75bac2c5bb0c92d251/ASCE24-14_Highlights_Jan2015_revise2.pdf.
[172] *Id.*
[173] *Id.*
[174] *Id.*
[175] BUILDING SCIENCE BRANCH, FEMA FED. INS. AND MITIGATION ADMIN., FLOOD PROVISIONS OF THE INTERNATIONAL CODES SERIES: HIGHER STANDARDS AND MORE SPECIFIC REQUIREMENTS THAN THE MINIMUM REQUIREMENTS OF THE NATIONAL FLOOD INSURANCE PROGRAM (June 2013), *available at* https://www.fema.gov/media-library-data/20130726-1921-25045-5477/icodes_asce24_higherstnds_paper_060713.pdf [hereinafter *Flood Provisions of the International Code Series*].
[176] *Id.* at 1.

represents a level of flood protection exceeding the BFE.[177] Most NFIP communities adopt the FIRM as their regulatory DFE, making the DFE and BFE the same, but the DFE will always be the BFE or higher.[178] The DFE has become integrated into land use permitting requirements and a design basis for new buildings and structures, as well as a standard for elevating buildings and structures substantially damaged by floods subject to insurance under the NFIP.[179]

FEMA's Building Science Branch reports that using ASCE 24 for design for dwellings in coastal high-hazard areas (Zone V), where wave heights of over three feet are expected during the base flood, has several benefits,[180] which include:

- Foundation designs must account for erosion and scour;
- Pile design specification details are provided; and
- Requirements are provided for elevated structures in relation to the orientation of the lowest horizontal structural member to be one foot above the elevation of a wave crest that could impart a load during the base flood.

Concerns with the use of FEMA's FIRMs as a design basis elevation is that only past flood and hurricane events are evaluated and maps may be updated infrequently.[181] In addition, FEMA does not currently evaluate the impact of sea level rise or future climate change impacts when establishing the BFE.[182]

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[177] *Id.* at 1-2.
[178] *Id.* at 2.
[179] CHRISTOPHER P. JONES ET AL., AMERICAN INSTITUTES FOR RESEARCH, EVALUATION OF THE NATIONAL FLOOD INSURANCE PROGRAM'S BUILDING STANDARDS (Oct. 2006), *available at* https://www.fema.gov/media-library-data/20130726-1602-20490-5110/nfip_eval_building_standards.pdf.
[180] *Flood Provisions of the International Code Series, supra* note 177, at 7-8.
[181] According to FEMA's website: "Each year, FEMA initiates studies and restudies of flood hazards in communities across the U.S. for the creation, as well as the revision, of community flood hazard maps. Because of funding constraints, however, FEMA can study or restudy only a limited number of communities each year. As a result, FEMA prioritizes study and restudy needs based on a cost-benefit approach whereby the highest priority is given to studies where development is greatest and where the maps are most outdated." *See Flood Map Revision Processes,* FED. EMERGENCY MGMT. AGENCY (Jan. 11, 2017), https://www.fema.gov/flood-map-revision-processes#1.
[182] According to FEMA's website: "FEMA maps coastal flood hazards based on existing shoreline characteristics, and wave and storm climatology at the time of the flood study. In accordance with the current Code of Federal Regulations, FEMA does not map flood hazards based on anticipated future sea levels or climate change. Over the lifespan of a study, changes in flood hazards from sea level rise and climate change are typically not large enough to affect the validity of the study

The 2016 State Building Code adopted on October 1, 2016 is considered rigorous in respect to flood and wind hazards protection by combining several international building codes, including the 2012 International Building Code (IBC).[183] The current State Building Code meets the minimum requirements of the NFIP. Since the first state building code was adopted in 1970, periodic revisions have generally increased the level of protection required for flooding and wind protection in coastal hazard areas.[184] Structures built before 1970 (pre-existing structures) are considered at the highest risk of damage from coastal hazards such as flooding, wind, and precipitation.[185] Structures built between 1970 and 1990 are also at high risk of flood and wind damage, because 1990 was the first year the state code included provisions from international building codes.[186] Of all the coastal structures in Connecticut, structures built since 2005 are likely to have the best protection from flood and wind damage from hurricanes and winter storms.[187]

New building codes, designs, and construction methods for flood resistance and resilience will require consumer outreach, consumer protection, and training programs for inspectors, design professionals, and contractors. There are several professional training and guidance resources available. FEMA's Building Science Branch of the Risk Reduction Division at FEMA's Federal Insurance and Mitigation Administration (FIMA) has a helpline and online resources.[188] The Insurance Institute for Business & Home Safety® (IBHS) also provides online resources.[189]

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results." *See Coastal Frequently Asked Questions*, FEMA.GOV (Aug. 17, 2016), *available at* https://www.fema.gov/coastal-frequently-asked-questions (citing questions asked "How is FEMA accounting for sea level rise and climate change on the FIRMs?; Does sea level rise/climate change affect the FIRMs?").

[183] Press Release, International Code Council, Updated Building Code Adopted Statewide in Connecticut (Nov. 21, 2016) *available at* http://das.ct.gov/images/1090/NR_Connecticut_Codes_Final.pdf.

[184] JOEL JOHNSON, STATE OF CONN., DEP'T OF ENVTL. PROT., OFFICE OF LONG ISLAND SOUND PROGRAMS, COASTAL HAZARDS IN CONNECTICUT : THE STATE OF KNOWLEDGE: 2009 -VERSION 2 at 17 (2010) *available at* http://www.ct.gov/deep/lib/deep/long_island_sound/coastal_hazards/ct_coastal_hazards.pdf.

[185] *Id.*

[186] *Id.*

[187] *Id.*

[188] *See generally Building* Science, FED. EMERGENCY MGMT. AGENCY (Nov. 12, 2015), https://www.fema.gov/building-science.

[189] *See generally* INS. INST. FOR BUS. & HOME SAFETY (2016), http://disastersafety.org/about/.

IBHS studies and reports address FORTIFIED Home™ [190] programs for hurricane, high-wind, and hail prone areas. FORTIFIED Home™ Technical Guides and training programs are offered to inspectors, design professionals, and contractors.[191] IBHS also has a FORTIFIED Commercial Standards program.[192] Both the residential and commercial standards include Bronze, Silver, and Gold designations for addressing budgetary and inspection constraints to meet three tiers of storm resilience goals. IBHS publishes Technical Requirements for Hurricane and High-Wind/Hail Construction Methods[193] that have been field tested in IBHS's building testing facility, which simulates hurricane force winds. IBHS also rates building materials as FORTIFIED.[194] IBHS has collaborated with DHS to pilot a Resilience STAR designated homes program using IBHS construction standards.[195]

ASCE[196] provides technical training on Floodplain Management and NFIP, and develops standards ASECE 7 and ASCE 24 for continuing education for maintaining Professional Engineer licensure.

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[190] *See generally* FORTIFIED HOME, INS. INST. FOR BUS. & HOME SAFETY, https://disastersafety.org/fortified/ (last visited 2017) for more information.
[191] *Id.*
[192] *See generally* FORTIFIED COMMERCIAL, INS. INST. FOR BUS. & HOME SAFETY (2016), http://disastersafety.org/fortified/commercial/.
[193] *See* FORTIFIED HOME, INS. INST. FOR BUS. & HOME SAFETY, HURRICANE STANDARDS (2012), *available at* https://disastersafety.org/wp-content/uploads/fortified-home-hurricane-standards.pdf; FORTIFIED HOME, INS. INST. FOR BUS. & HOME SAFETY, HIGH WIND & HAIL STANDARDS (2015), *available at* http://disastersafety.org/wp-content/uploads/2015/10/FORTIFIED-High-Wind-Hail-Standards-2015.pdf; FORTIFIED HOME, INS. INST. FOR BUS. & HOME SAFETY, HIGH WIND STANDARDS (2015), *available at* http://disastersafety.org/wp-content/uploads/2015/07/FORTIFIED-High-Wind-Standards-2015.pdf; *See also* FORTIFIED HOME, INS. INST. FOR BUS. & HOME SAFETY, HIGH WIND & HAIL TECHNICAL SUMMARY: NEW CONSTRUCTION (2015), *available at* http://disastersafety.org/wp-content/uploads/2015/10/FORTIFIED-High-Wind-Hail-New-Technical-Summary_10.9.pdf; FORTIFIED HOME, INS. INS. FOR BUS. & HOME SAFETY, TECHNICAL REQUIREMENTS SUMMARY (2016), *available at* https://disastersafety.org/fortified/resources/#standards.
[194] *See generally* FORTIFIED HOME, INS. INST. FOR BUS. & HOME SAFETY, *available at* https://disastersafety.org/fortified/ (2017).
[195] Press Release, Insurance Institute for Business Home & Safety, New Resilience STAR Home Program Uses IBHS Construction Standards (December 5, 2013) (on file with disastersafety.org), *available at* https://disastersafety.org/ibhs-news-releases/new-resilience-star-home-program-uses-ibhs-construction-standards/.
[196] *See generally* AM. SOC'Y OF CIVIL ENG'RS, www.asce.org (last visited 2015) for more information.

The U.S. Green Building Council recently introduced resilience credits for LEED that are in the pilot stage right now.[197] There are three credits available: Credit 1 - Assessment & Planning for Resilience; Credit 2 – Design for Enhanced Resilience; and Credit 3 – Design for Passive Survivability.[198] Under Credit 2, a building designed for resilience to flooding must follow ASCE 24-14, the lowest occupied floor must be 5 feet above the FEMA BFE or dry floodproofing for commercial buildings, sewers must contain backflow preventers, and mechanical and electrical equipment must be protected[199] as per FEMA P-55 guidelines for coastal construction.[200]

Consistent with Connecticut's policy leadership on initiatives to address the challenges posed by climate change, Governor Dannel P. Malloy announced on April 22, 2016 a new Executive Order No. 53[201] in which he is directing state agencies to develop new building code standards and training programs for builders and inspectors that will better protect residential and commercial structures from damage caused by flooding and high winds. The Governor is instructing the Department of Administrative Services (DAS), the Department of Energy and Environmental Protection (DEEP), and the Connecticut Insurance Department (CID) to work with the State Building Inspector to ensure that the next revision to the State Building Code includes standards that increase the resiliency of new and renovated homes and commercial buildings.[202]

Executive Order No. 53 will accelerate updating the State Building Code to address resiliency through evaluating the numerous international, federal, and state standards and guidance summarized herein by the authors and through collaboration with public officials and technical experts in wind and flood resistant design and construction. Establishing a new State Building Code will benefit the public by avoiding costly and repetitive property and casualty and

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[197] Alex Wilson, *LEED Pilot Credits on Resilient Design Adopted*, RESILIENT DESIGN INST. (Nov. 13, 2015), http://www.resilientdesign.org/leed-pilot-credits-on-resilient-design-adopted/.
[198] *Id.*
[199] *Id.*
[200] FED. EMERGENCY MGMT. AGENCY, *Coastal Construction Manual: Principles and Practices of Planning, Siting, Designing, Constructing, and Maintaining Residential Buildings in Coastal Areas*, FEMA P-55, 4th Edition (2011).
[201] Press Release, The Office of Governor Dannel P. Malloy, Gov. Malloy Signs Order Strengthening State Building Code to Limit Storm Damage as a Result of Climate Change (Apr. 22, 2016), *available at* http://portal.ct.gov/en/Office-of-the-Governor/Press-Room/Press-Releases/2016/04-2016/Gov-Malloy-Signs-Order-Strengthening-State-Building-Code-to-Limit-Storm-Damage-as-a-Result-of-Climat.
[202] *Id.*

disaster recovery losses, whether those losses are insured or uninsured. Taxpayers will also benefit by reducing the budgets they contribute to fund NFIP insured losses in Connecticut over the life span of these new and renovated buildings. Future economic losses will be mitigated when residential and commercial buildings throughout Connecticut are designed, constructed, and inspected in compliance with a State Building Code that results in more residential and commercial buildings that are less vulnerable to the impacts of flooding, extreme wind conditions, severe weather, sea level rise, and climate change.

V. CONCLUSION: HOW POLICY CAN MOTIVATE RESILIENCE FINANCING

This article began with a description of how the federal government is currently paying out hundreds of millions of dollars to Connecticut – and in neighboring states, billions of dollars – to recover from Sandy. But that model may change. Currently, when a State is declared as a Presidential major disaster, FEMA provides Public Assistance,[203] but the agency is now considering a disaster deductible in a Supplemental Advance Notice of Proposed Rulemaking.[204] Under the current Public Assistance program, FEMA provides a 75% federal cost share of the cost of recovery for public facilities damaged by a storm.[205] Under a disaster deductible policy, the State of Connecticut would commit funds up front before FEMA would provide any financial assistance for recovery under the Public Assistance program.[206] The Notice from FEMA calculated Connecticut's deductible as $20.85 million, although FEMA would phase this amount in over five years.[207] The deductible would start at $5.04 million in year one.[208] FEMA would allow states to satisfy their deductible through a credit system. The goals of the credits are to, "incentivize States to dedicate resources on activities that are demonstrated to promote and support readiness, preparedness, mitigation, and

[203] FEMA administers the Public Assistance program under Section 406 of the Stafford Act to "make contributions—(A) to a State or local government for the repair, restoration, reconstruction, or replacement of a public facility damaged or destroyed by a major disaster and for associated expenses incurred by the government." *See* 42 U.S.C. § 5172 (a)(1)(A).
[204] Establishing a Deductible for FEMA's Public Assistance Program, 82 Fed. Reg. 4064, 4064-97 (Jan. 12, 2012) (codified at 44 C.F.R. § 206), *available at* https://www.federalregister.gov/documents/2017/01/12/2017-00467/establishing-a-deductible-for-femas-public-assistance-program.
[205] The Federal share for FEMA public assistance "shall be not less than 75 percent of the eligible cost of repair, restoration, reconstruction, or replacement" of a public facility. 42 U.S.C. § 5172(b)(1).
[206] 82 Fed. Reg. 4064, *supra* note 206.
[207] 82 Fed. Reg. 4064, *supra* note 206, at 4086 (referencing Table 11).
[208] 82 Fed. Reg. 4064, *supra* note 206, at 4086 (referencing Table 11).

resilience. Such activities could include adopting and enforcing building codes that promote disaster resilience, funding mitigation projects, or investing in disaster relief, insurance, and emergency management programs."[209]

FEMA gave particular weight to the credits for investment by states in mitigation projects, providing a $3.00 credit for every $1.00 spent.[210] The $2.00 in savings that the State of Connecticut would gain on their investment in mitigation versus other options to meet the deductible, not only strongly incentivizes this option for credits, but that savings could also be used to pay back the investment in the resilience project. By establishing the 2:1 return on investment ratio, FEMA has also established the market value of a qualifying resilience project for states. For example, under the $20.85 million deductible, an investment of $6.95 million dollars leads to a savings of $13.9 million. That savings pays the state back for its investment in mitigation projects two times over.

FEMA also proposed a higher incentive for creating tax incentives relative to other credits – $2.00 in credit for every $1.00 spent on administering a tax incentive program and any lost tax revenue.[211] FEMA notes that these tax incentives could provide an income tax credit for home elevation, for example.[212] This type of tax savings could again be used for financing. For example, the tax savings could be used by the homeowner to pay off the cost of a private loan for the construction, thereby leveraging public investment to attract private investment.

Even without the incentives for investment that this FEMA proposal outlines, the state of Connecticut's recovery and resiliency needs cannot be completely covered by federal grant dollars alone now or going forward. Resilience financing can be part of the solution, but in order for financing programs to work effectively and proactively, public policies encouraging resiliency investments need to be in place that monetize the value that comes with implementing a qualifying resilience project, as one that demonstrates measurable and cumulative social welfare, public safety, and financial returns on investment. This monetizing capacity for preventing economic losses to property, increasing real estate market value, and stabilizing property tax is what the FEMA disaster deductible credit, lower insurance premiums, and increased property values all have in common.

[209] 82 Fed. Reg. 4064, *supra* note 206, at 4064-66.
[210] 82 Fed. Reg. 4064, *supra* note 206, at 4076.
[211] 82 Fed. Reg. 4064, *supra* note 206, at 4078.
[212] 82 Fed. Reg. 4064, *supra* note 206.

The multiple financing mechanisms described in this article all hinge on creating an equitable method to pay back these long-term investments in our future welfare. The federal government can play a role here as can states, but without loss prevention policies, insurance, and funding programs being integrated to incentivize investing in resilience, a state's disaster recovery unmet budgetary needs will increase. As the climate changes and the seas rise, those unmet costs increase even more. With a track record of innovation and success from the Connecticut Green Bank, the launch of Shore Up as the first residential elevation loan program of its kind nationwide, the creation of the Connecticut Institute for Resilience and Climate Adaptation as a resource for program evaluation and impact, state agencies committed to resiliency through SAFR, and R-PACE legislation and building codes to address extreme winds and coastal flooding under review, Connecticut is on the right track and is leading the way in creating methods for financing resilience that can become model programs for the country.