CONNECTICUT
GREEN BANK SM

Deployment Committee

Meeting Date

November 16, 2022

Deployment Committee

Vickie Hackett
Deputy Commissioner
Department of Energy and Environmental Protection

Matt Ranelli
Partner
Shipman & Goodwin

Lonnie Reed
Board Chair

Shawn Wooden – Designee, Sarah Sanders
Treasurer
State of Connecticut

Binu Chandy
Deputy Director
DECD

Dominick Grant
Dirt Partners

845 Brook Street, Rocky Hill, CT 06067
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ctgreenbank.com

CONNECTICUT
GREEN BANK

November 9, 2022

Dear Connecticut Green Bank Deployment Committee:

We have a meeting of the Deployment Committee scheduled on Wednesday, November 16, 2022 from 2:00 to 3:00 p.m.

Please take note that this will be an online meeting only.

On the agenda we have the following items:

- **Consent Agenda** – approval of the meeting minutes for the meeting held on February 23, 2022, and transactions approved by staff "under $500,000 and no more in aggregate than $1,000,000" [Note – materials coming by COB on Friday, November 11, 2022];

- **Incentive Programs Updates and Recommendations** – a request to expand the Smart-E Loan measures to include "climate adaptation and resiliency";

- **Investment Updates and Recommendations** – a request to provide financing to Energy Resources for project at Bradley International Airport [Note – materials coming by COB on Friday, November 11, 2022]; and

- **Finance Program Updates and Recommendations** – if we have time, an update on the work being done by the staff to understand how the Inflation Reduction Act, including all of its tax credits, will benefit Connecticut and Green Bank financing products.

If you have any questions, comments or concerns, please feel free to contact me at any time. Looking forward to being with you all online next week.

Have a great weekend.

Sincerely,

Bryan Garcia
President and CEO

AGENDA

Deployment Committee of the
Connecticut Green Bank
75 Charter Oak Avenue
Hartford, CT 06106

Wednesday, November 16, 2022
2:00-3:00 p.m.

Dial +1 860-924-7736,,38772029#

Staff Invited: Sergio Carrillo, Mackey Dykes, Brian Farnen, Bryan Garcia, Bert Hunter, Jane Murphy, and Eric Shrago

1. Call to order
2. Public Comments – 5 minutes
3. Consent Agenda – 5 minutes
4. Incentive Programs Updates and Recommendations – 20 minutes
    a. Smart-E Loan – Expansion to include Environment Infrastructure Measures (Climate Adaptation and Resilience)
5. Investment Updates and Recommendations – 15 minutes
    a. Green Bank Capital Solutions – Energy Resources Proposal for Bradley International Airport Project
6. Financing Programs Updates and Recommendations – 10 minutes
7. Other Business – 5 minutes
8. Adjourn

Microsoft Teams meeting

Join on your computer, mobile app or room device
Click here to join the meeting
Meeting ID: 215 283 638 831
Passcode: yijHda
Or call in (audio only)
+1 860-924-7736,,38772029# United States, Hartford
Phone Conference ID: 387 720 29#

Next Regular Meeting: Wednesday, February 22, 2023 from 2:00-3:00 p.m.
Colonel Albert Pope Board Room at the
Connecticut Green Bank, 75 Charter Oak Avenue, Hartford

RESOLUTIONS

Deployment Committee of the
Connecticut Green Bank
75 Charter Oak Avenue
Hartford, CT 06106

Wednesday, November 16, 2022
2:00-3:00 p.m.

Dial +1 860-924-7736,,38772029#

Staff Invited: Sergio Carrillo, Mackey Dykes, Brian Farnen, Bryan Garcia, Bert Hunter, Jane Murphy, and Eric Shrago

1. Call to order

2. Public Comments – 5 minutes

3. Consent Agenda – 5 minutes

Resolution #1
Motion to approve the meeting minutes of the Deployment Committee for February 23, 2022.

4. Incentive Programs Updates and Recommendations – 20 minutes

   a. Smart-E Loan – Expansion to include Environment Infrastructure Measures (Climate Adaptation and Resilience)

Resolution #2

WHEREAS, in May of 2013, Green Bank launched the Smart-E Loan program, currently operating statewide, with nine local lenders providing low cost and long-term financing for measures that are consistent with the state energy policy and the implementation of the State's Comprehensive Energy Strategy; and

WHEREAS, at the March 25th, 2022 Connecticut Green Bank Board of Directors (the "Board") meeting the Board approved the staff recommendation that the Smart-E Loan term sheet be further enhanced to allow for the addition of environmental infrastructure measures to the list of "eligible improvements," and that the Board authorized the Deployment Committee to determine the specific measures by segment (e.g., water, waste and recycling, etc.) to be supported through the Smart-E program.

NOW, therefore be it:

RESOLVED, that the Deployment Committee approves of the "climate adaptation and resiliency" measures proposed by the Green Bank staff in the memo dated November 9, 2022 be included as "eligible improvements" within the Smart-E Loan.

RESOLVED, that the Deployment Committee seeks review and approval of additional environmental infrastructure measures for consideration as "eligible improvements" within the Smart-E Loan at a future date.

RESOLVED, that the Deployment Committee seeks review and approval of a plan for the staff rollout of environmental infrastructure measures within the Smart-E Loan, including, but not limited to contractor participation, project inspections, loss reserve budgeting, and customer marketing and outreach.

5. Investment Updates and Recommendations – 15 minutes

   a. Green Bank Capital Solutions – Energy Resources Proposal for Bradley International Airport Project

Resolution #3

WHEREAS, the Connecticut Green Bank ("Green Bank") has significant experience in the development and financing of commercial energy efficiency projects in Connecticut;

WHEREAS, the Green Bank continually seeks new ways to facilitate the deployment of energy efficiency and renewable energy in the State; and

WHEREAS, the Green Bank has established the Capital Solutions Open RFP Program (the "Capital Solutions Program") to accommodate clean energy and environment infrastructure capital needs not met by other existing Green Bank programs; and

WHEREAS, Energy Resources USA LLC ("Energy Resources") has applied to the Capital Solutions Program and staff is recommending approval of Energy Resources' application for a construction loan facility (the "Construction Loan"), substantially on the terms and conditions explained in a memorandum to the Deployment Committee of the Green Bank Board of Directors (the "Deployment Committee") dated November 14, 2022 (the "Deployment Committee Memo");

NOW, therefore be it:

RESOLVED, that the Green Bank approves the Capital Solutions application of Energy Resources and the establishment of a construction line of credit for funding its obligations under contracts for energy efficiency retrofits for state projects pursuant to the Eversource Small Business Energy Advantage program in an amount not to exceed $2.5 million on terms substantially similar to those described in the Deployment Committee Memo; and

RESOLVED, that the proper Green Bank officers are authorized and empowered to do all other acts and negotiate and deliver all other documents and instruments as they shall deem necessary and desirable to effect the above-mentioned legal instruments.

6. Financing Programs Updates and Recommendations – 10 minutes

7. Other Business – 5 minutes

8. Adjourn

Microsoft Teams meeting

Join on your computer, mobile app or room device
Click here to join the meeting
Meeting ID: 215 283 638 831
Passcode: yijHda
Or call in (audio only)
+1 860-924-7736,,38772029# United States, Hartford
Phone Conference ID: 387 720 29#

Next Regular Meeting: Wednesday, February 22, 2023 from 2:00-3:00 p.m.
Colonel Albert Pope Board Room at the
Connecticut Green Bank, 75 Charter Oak Avenue, Hartford

ANNOUNCEMENTS

- **Mute Microphone** – in order to prevent background noise that disturbs the meeting, if you aren't talking, please mute your microphone or phone.

- **Chat Box** – if you aren't being heard, please use the chat box to raise your hand and ask a question.

- **Recording Meeting** – we continue to record and post the board meetings.

- **State Your Name** – for those talking, please state your name for the record.

CONNECTICUT GREEN BANK SM

Deployment Committee Meeting

November 16, 2022

Deployment Committee

Agenda Item #1

Call to Order

Deployment Committee

Agenda Item #2

Public Comments

Deployment Committee

Agenda Item #3

Consent Agenda

Consent Agenda

Resolution #1

1. **Meeting Minute** – approve meeting minutes of February 23, 2022

- **Under $500,000 and No More in Aggregate than $1,000,000** – staff approval of transactions consistent with plan and budget to restore the queue

Deployment Committee

Agenda Item #4a

Incentive Programs Updates and Recommendations

Smart-E Loan – Expansion to Include Environmental Infrastructure Measures (Climate Adaptation and Resiliency)

Background
Public Policy and Planning

- **Public Act 21-115** – "An Act Concerning Climate Change Adaptation," led by Governor Lamont (with recommendation from GC3), expanded scope of the Green Bank beyond "clean energy" to include "environmental infrastructure" (e.g., land conservation, agriculture, water).

- **Comprehensive Plan** – CGS 16-245n, requires "…that promote investment in environmental infrastructure in accordance with Comprehensive Plan developed by it to…" and the Board of Directors approved Comprehensive Plan Fiscal Year 2023 on July 22, 2022.

- **Launching New Products** – within the Comprehensive Plan Fiscal Year 2023 includes developing existing financing products for clean energy (e.g., Smart-E Loan, C-PACE) to support environmental infrastructure measures (e.g., climate adaptation and resiliency)

Smart-E Loan

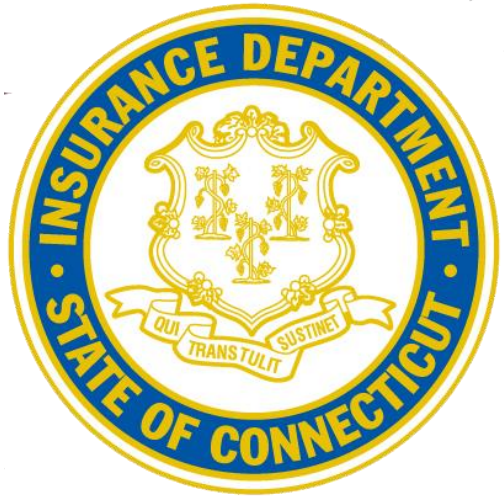
Single Family Unsecured Loan

Market Segment	**Residential Single Family** (Credit Enhancement – IRB, LLR)
Product Summary	Partnership with thirteen (13) local community banks and credit union to provide easy access to affordable financing for comprehensive clean energy measures, including H&S. 5-20-year terms at rates ranging from 4.49-6.99% for $500-$50,000 of borrowing.
Support Needed	▪ Provide 2nd Loan Loss Reserve (LLR) up to 7.5% of losses Class A and 15.0% of losses Class B
CT Results	6,316 projects for $116.3 MM investment, 10.7 MW solar PV, over 85% projects have EE

REFERENCES
Annual Comprehensive Financial Report FY 2022

Collaborators

Climate Adaptation and Resiliency



- **<u>Collaborators</u>** – began mutual engagement on "climate adaptation and resiliency" through a project of the United States Climate Alliance (USCA) in partnership with the European Union (EU) and support by Climate Finance Advisors (CFA) begun in 2020. Expanded project to focus on increasing resilience for single family and multifamily affordable housing in 2022, including identifying measures for Smart-E loan with respect to "climate adaptation and resilience"

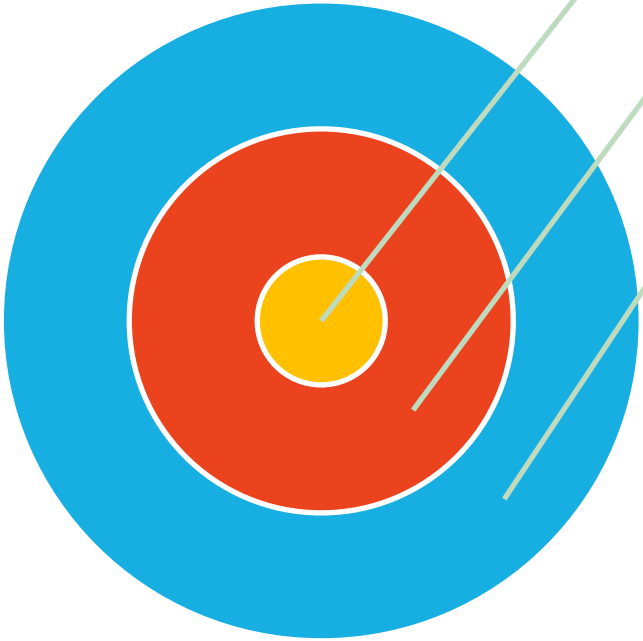
Proposed Measures

Climate Adaptation and Resiliency

- **Research** – identified eighty-two (82) measures, which were shortlisted to thirty-one (31) measures by the Collaborators, including:
  - ❑ **Energy Efficiency** – insultation, solar PV, heat pumps
  - ❑ **Landscaping** – rain barrels, plant native trees, replace grass with native plants, tree trimming
  - ❑ **Loss Prevention** – elevate or relocate service equipment (e.g., HVAC, circuit breaker, septic tank), install battery storage, install storm shutters
  - ❑ **Water Intrusion Reduction** – flood proof basement windows, install sump pump, replace impervious services
  - ❑ **Waterproofing** – apply wall sealant, install wall and flood membranes, install seal penetrations
- **Stakeholder Feedback** – Collaborators vetted the recommended shortlist with State Agencies Fostering Resilience ("SAFR") Council and seeking final review by FEMA regional insurance specialist for a true "gold star" set of recommendations

Stakeholder Feedback

Climate Adaptation and Resiliency Measures



FEMA
Seeking “Gold Star” review from FEMA of final list

SAFR
Vetted shortlisted (31) measures

Collaborators
Identified 82 and shortlisted to 31 measures

Towards an initial set of “climate adaptation and resiliency” measures for the Smart-E Loan

Resolution #2

Including addition in green highlight

NOW, therefore be it:

RESOLVED, that the Deployment Committee approves of the “climate adaptation and resiliency” measures proposed by the Green Bank staff in the memo dated November 9, 2022 be included as “eligible improvements” within the Smart-E Loan.

RESOLVED, that the Deployment Committee requests that the Collaborators seek a final review by the Federal Emergency Management Agency for how “climate adaptation and resiliency” measures may benefit insurance.

RESOLVED, that the Deployment Committee seeks review and approval of additional environmental infrastructure measures for consideration as “eligible improvements” within the Smart-E Loan at a future date.

RESOLVED, that the Deployment Committee seeks review and approval of a plan for the staff rollout of environmental infrastructure measures within the Smart-E Loan, including, but not limited to contractor participation, project inspections, loss reserve budgeting, and customer marketing and outreach.

Deployment Committee

Agenda Item #5a

Investment Updates and Recommendations

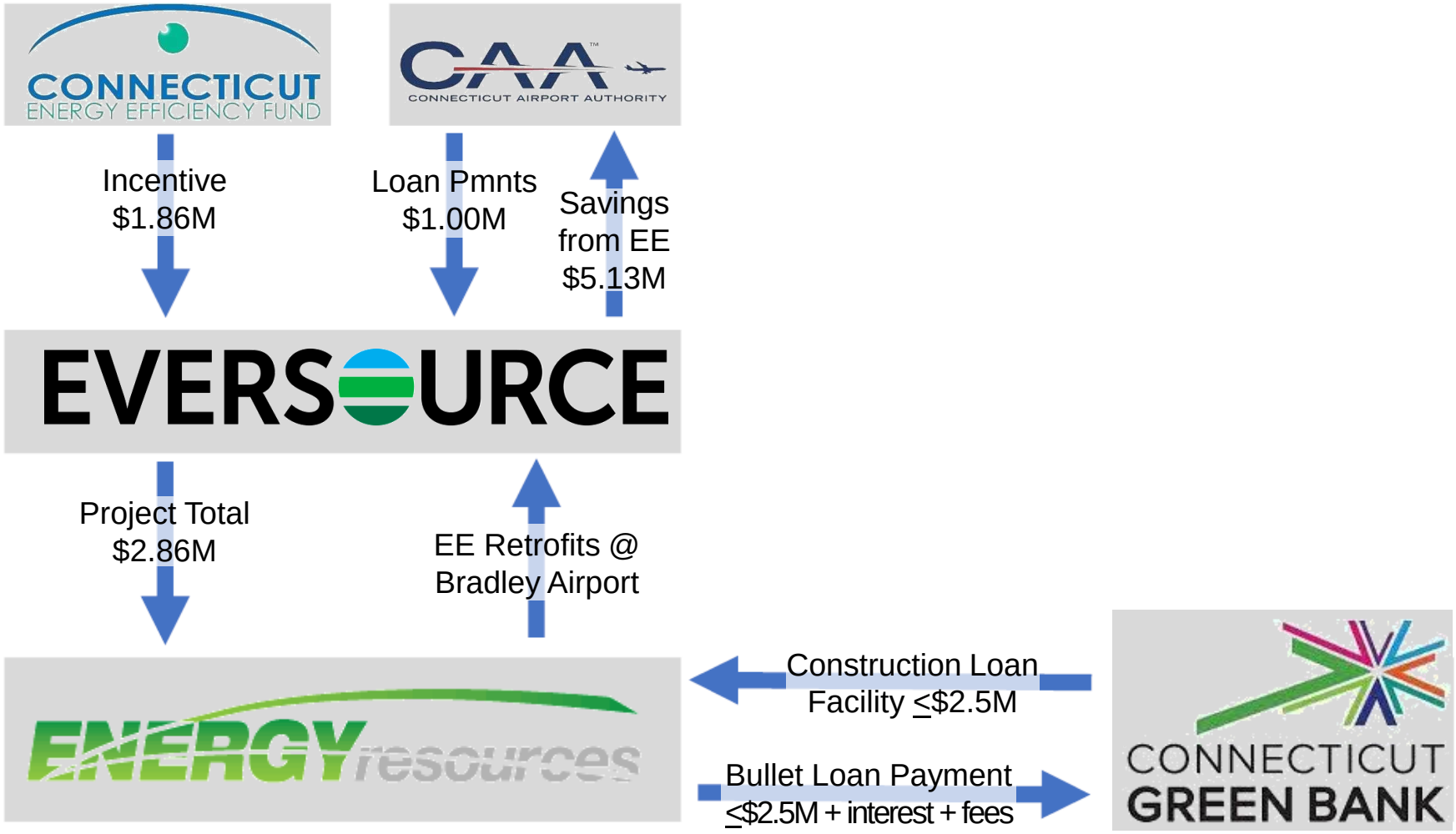
Green Bank Capital Solutions

Energy Resources Proposal for Bradley International Airport

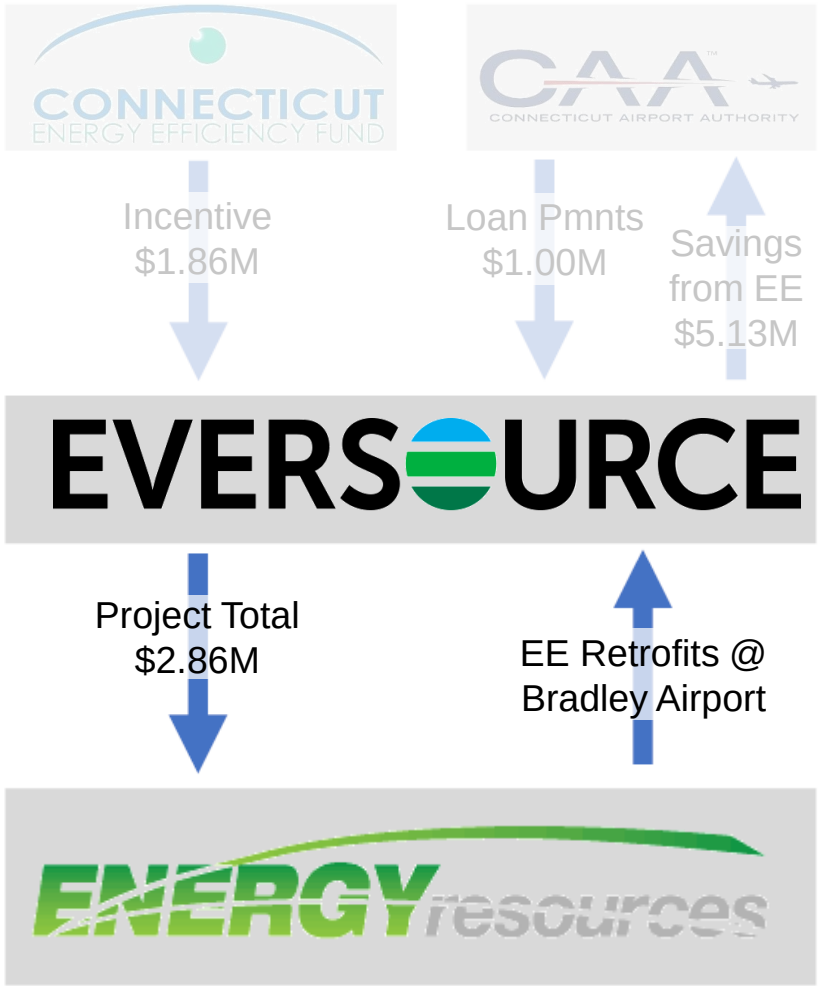
Overview of Proposed Debt Facility

Project Overview	• 12 energy efficiency measures (lighting, refrigeration and HVAC) • Estimated construction period: 18 months
Borrower	• Energy Resources USA • Thomaston, CT HQ
Debt Terms	• Size: Up to $2.5 million • Tenor: Up to 2 years • Bullet Loan: Principal and interest due at maturity • Interest rates and fees: TBD • Security: In addition to Energy Resources being 100% responsible for all advances, Eversource is providing collateral assignment of payments
Expected Lifetime Savings	• $5.1 million • 845,624 mmBTU (kWh & gas savings)

Transaction Overview

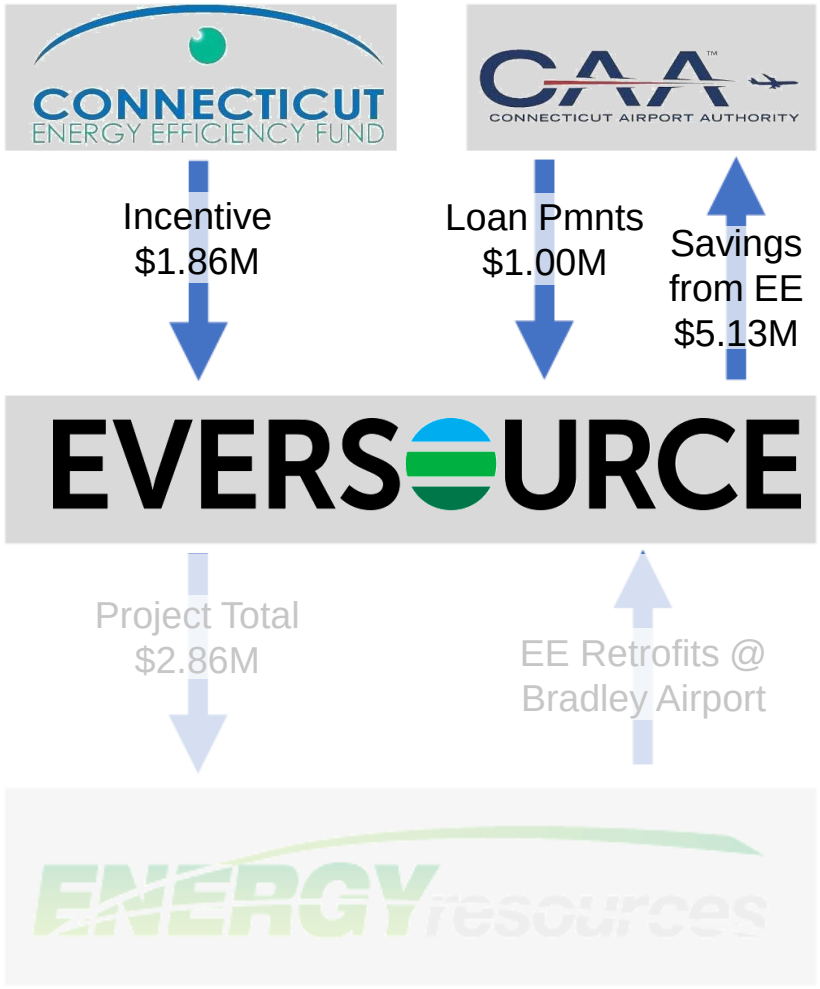


Transaction Overview



Eversource awarded Energy Resources a $2.86 million contract under the Small Business Energy Advantage program to install EE retrofits at Bradley International Airport

Transaction Overview



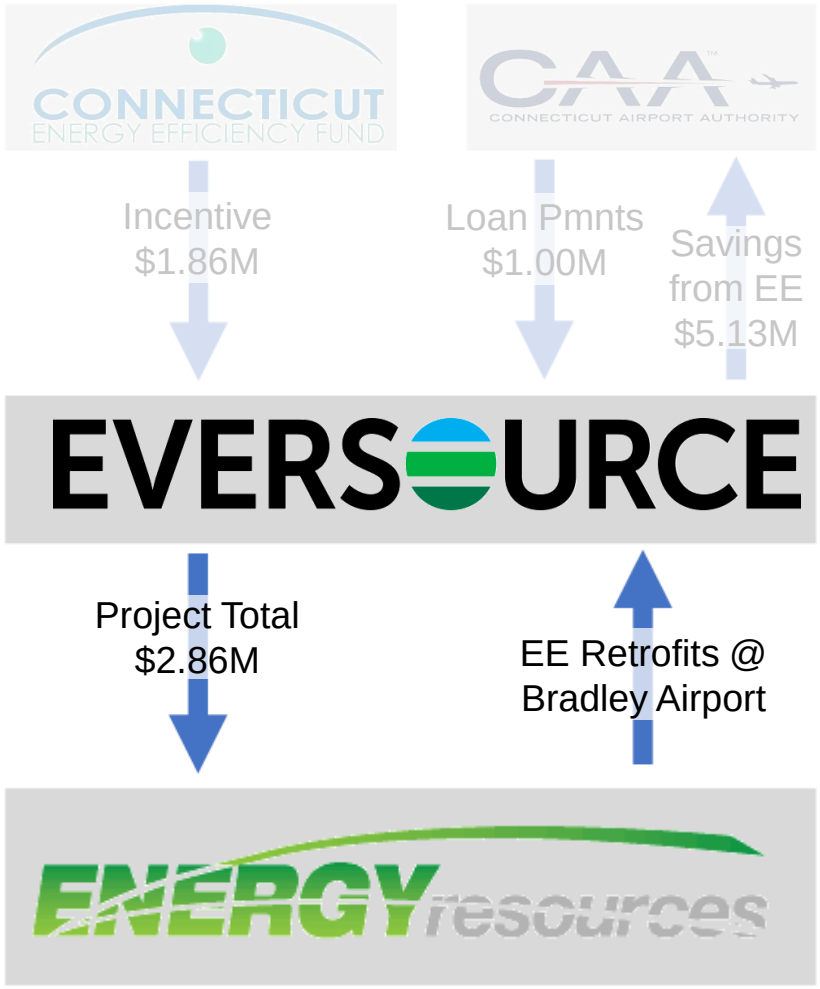
Project Funding =

CEEF: $1.86M Incentive

+

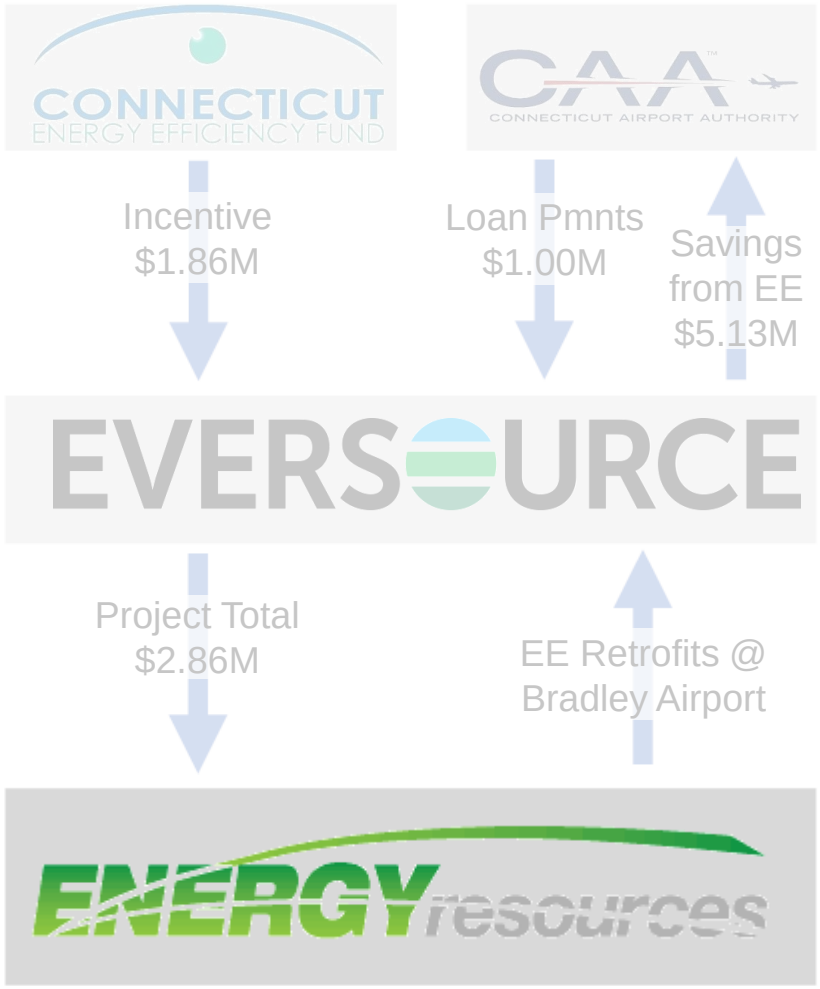
Airport Authority: $1.0M
SBEA Loan

Transaction Overview



Capital need: Eversource only pays when project is complete, while equipment vendors and labor require payment in short term

Transaction Overview



CGB's $2.5 million debt facility would provide Energy Resources liquidity to meet equipment and labor expenses

Energy Resources would repay principal + interest at maturity in one bullet payment

Energy Resources Overview

- Energy efficiency and solar installer based in Thomaston, CT
- Commercial-scale customers: state, munis, industrial, retail, non-profits
- Served as a contractor for Eversource and United Illuminating for >10 years
- Completed projects for Connecticut state agencies including DAS, DOC, DOL, DOT, Dept of Mental Health, CT State Police, and CT State Library
- Since 2017, completed seven C-PACE projects in CT ($312k to $3.1M)
  - Three projects financed directly by the Connecticut Green Bank
  - Four projects financed by third party C-PACE capital providers
- Rich Cardita, President, and Matt James, CEO, own [redacted] of equity, combined
  - Five other senior managers own the remaining minority equity

Summary Balance Sheet

Balance Sheet (Accounting Books)			
	2021	2020	2019
Cash	[redacted]		
ST Assets			
LT Assets			
Other Assets			
Total Assets			
ST Liabilitiies			
PPP Loan			
LT Liabilities			
Total Liabilities			
Partners' Capital Accounts			
Current Ratio (excl PPP Loan)			
Trade Receivables			
Trade Payables			
Net Trade Working Capital			
Trade Ratio			

Summary Income Statement

	2021	2020	2019
Revenue (excl 481(a) adj)	[redacted]		
COGS			
Gross Profit			
Total Deductions (excl 179D)			
Income (Loss) before 481(a), p/s & 179D			
179D Deduction			
481(a) adjustmnet			
Income from other partnerships			
Ordinary Business Income (Loss)			
EBITDA			
Income (Loss) per books (schedule M-1)			
Interest			
Tax			
Depreciation			
Amortization			
Add Backs			
EBITDA			

Resolution #3

NOW, therefore be it:

RESOLVED, that the Green Bank approves the Capital Solutions application of Energy Resources and the establishment of a construction line of credit for funding its obligations under contracts for energy efficiency retrofits for state projects pursuant to the Eversource Small Business Energy Advantage program in an amount not to exceed $2.5 million on terms substantially similar to those described in the Deployment Committee Memo; and

RESOLVED, that the proper Green Bank officers are authorized and empowered to do all other acts and negotiate and deliver all other documents and instruments as they shall deem necessary and desirable to effect the above-mentioned legal instruments.

Deployment Committee

Agenda Item #6

Financing Programs Updates and Recommendations

IRA Tax Credits Generally

- IRA expanded, extended and introduced many tax credits for efficiency, renewables, EVs, and hydrogen
- Direct Pay Election – Applicable entities generally only include tax-exempt organizations, State or political subdivisions (**CGB**), tribal governments, and rural cooperatives may elect to receive certain credits in the form of an IRS refund.
- Transferability Election – Certain credits allow taxpayers to make an irrevocable election to transfer credits to an unrelated third party
- CGB “Dream Big” Products team is working on proposals for incorporating tax credits into programs

Spotlight: Section 25C Credit

Energy Efficient Home Improvement Credit

- 30% of investment (including labor) through 2032. To qualify for this credit, installed items must meet highest applicable Energy Star, International Energy Conservation Code (“IECC”), or Consortium for Energy Efficiency (“CEE”) standards for the year the item is placed in service. Subject to following limits:

$1,200	**for the maximum credit of all types of property; 25C(b)(1)**
$600	for any item of qualified energy property 25C(b)(2)
$600	for all exterior windows and skylights; and 25C(b)(3)
$250	for any single exterior door with an annual aggregate limit of $500 for all exterior doors 25C(b)(4)
$2,000	for electric or natural gas heat pump, electric or natural gas heat pump water heaters, biomass stoves, or biomass boilers. 25C(b)(5)

- Home energy audits covered up to $150
- Limits are now annual (previously this section had a lifetime limit) based on when the improvement was made or placed in service. No carryforward provisions.

Spotlight: Section 48 Credit
Energy Investment Credit (ITC)

- 30% of investment through 2032
- Prevailing wage and apprenticeship requirements must be satisfied to claim the full credit for any projects larger than 1 MW that begin construction 60 days after guidance is issued
- Credit can be increased with “adders” or “bonus credit”:
  1. Domestic Content +10%
  2. Energy Community +10%
  3. Low Income Communities +10% or 20% (projects <5MW, 1.8 gigawatts annual allocation, a project must be allocated capacity – Treasury 180-day deadline to implement guidelines)
- Transferability for tax-exempt and state governmental entities
- Stand-alone storage and interconnection costs now qualify
- Replaced by technology neutral tax credit starting in 2025 (48C “Clean Electricity Investment Credit”)

IRS Request for Comments

CGB Comments

- Many IRS provisions require Treasury/IRS guidance
- Treasury/IRS published general requests for comments, thousands of comments were submitted
- CGB submitted comments focused on:
  - Elective Payment (Direct Pay) – need clarity on process and timing of return as well as CGB structures that could utilize this option (i.e., subsidiaries and partnership)
  - Energy community definition – need clarity on brownfield definition and coal-fired electric generating unit retirement
  - ITC Low-income adder – suggest allocation by state and simple application process. Need clarity on how to demonstrate eligibility, suggest coordination with state affordable housing programs and electric tariffs programs

IRS Request for Comments

Other Stakeholder Comments

- **ACORE** recommended (1) that the pre-IRA beginning of construction and safe harbor guidance continue to applied consistently to IRA requirements, (2) Low-income adder - (a) projects be required to demonstrate commercial certainty via executed documents, (b) give priority based on expected commercial operation dates (c) coordination with sate-level programs (3) apprenticeship - allow for non-DOL register programs, (4) energy communities – (a) offshore wind should qualify based on point of interconnection, (b) clarify how long a designation will last, (c) brownfields clarification (5) direct pay – similar to CGB comments, (6) transferability allow partnerships to determine which credits otherwise allocable to a partner are transferred, and which are flowed through to other partners.
- **CESA** recommended coordination with state energy and housing policies and programs.
- **SEIA** recommended (1) Low-income adder – (a) draft implementation program for public notice and comment prior to the 180-day deadline in the IRA. (b) program design and application process that: (i) recognizes low-income customers have different circumstances and different needs; (ii) is based on existing, implementable, and successful state solar incentive programs; and (iii) recognizes the different business models of qualified solar and wind companies that serve low-income customers.
- **NYSERDA** recommended (1) Low-income adder – (a) community solar project can also be considered an eligible “qualified low-income economic benefit project” regardless of project’s physical location (b) state programs and tariffs should be used to qualify, (c) bucket capacity by sector, (d) prioritizing allocations for low-income residential building projects and low-income economic benefit projects (e) give utmost consideration to “stage of completion” (2) energy communities should include DACs and other state designations, and may be used by offshore wind.

Other IRA Provisions

- $4.3 billion to State Energy Offices to establish rebates for a variety of home energy upgrades under the “Home-Owner Managing Energy Savings” (HOMES) rebate program
- $4.3 billion to energy offices for rebates to low-income single and multi-family homes which meet low-income eligibility criteria to be used for electrification upgrades under “High-Efficiency Electric Home Rebate Program”
- Increased Energy Efficient Commercial Buildings Deduction (Section 179D) and now allows ax-exempt entities to get the benefit by allocating the credit to the person primarily responsible for designing the property
- Manufacturing production credits for certain components based on the volume of product manufactured and sold
- Climate Pollution Reduction Grants to state and local governments totaling $5 billion
- Environmental and Climate Justice Block Grants: $3 billion for disadvantaged communities
- Extension, expansion, and changes to electric vehicle tax credits, including a new credit for purchasing used EVs

Deployment Committee

Agenda Item #7

Other Business

Deployment Committee

Agenda Item #8

Adjourn

Subject to Changes and Deletions

DEPLOYMENT COMMITTEE OF THE
CONNECTICUT GREEN BANK
Regular Meeting Minutes

Wednesday, February 23, 2022
2:00 p.m. – 3:00 p.m.

A regular meeting of the Deployment Committee of the **Connecticut Green Bank (the "Green Bank")** was held on February 23, 2022.

Due to COVID-19, all participants joined via the conference call.

Committee Members Present: Dominick Grant, Matt Ranelli, Lonnie Reed, Sarah Sanders

Committee Members Absent: Binu Chandy (DECD), Victoria Hackett (DEEP)

Staff Attending: Sergio Carrillo, Shawne Cartelli, Bryan Garcia, Bert Hunter, Alexei Kovtunenko, Cheryl Lumpkin, Jane Murphy, Ariel Schneider, Eric Shrago, Dan Smith

Others present: Joe Buonannata from IPC, Giulia Bambara, Claire Sickinger as a proxy for Victoria Hackett

1. Call to Order

- Bryan Garcia called the meeting to order at 2:02 pm.

2. Public Comments

- No public comments.

3. **Consent Agenda**

Resolution #1

Motion to approve the minutes of the Deployment Committee meeting for November 17, 2021.

Upon a motion made by Lonnie Reed and seconded by Dominick Grant, the Deployment Committee voted to approve Resolution 1. None opposed or abstained. Motion approved unanimously.

4. Incentive Programs Updates and Recommendations
a. Smart-E Loan – ARRA Restructuring from Loan Loss Reserves to Interest Rate Buydowns

- Joe Buonannata from IPC summarized the Smart-E Loan program and history including who is eligible to finance, how much can be borrowed, the rates and terms, and the process to onboard contractors.
- Bert Hunter reviewed the request to change which programs the ARRA-SEP funds support. Currently they allocate to a loan loss reserve and programs which no longer need them, and he reviewed the changes to which funds would be allocated to various programs.
    - Matthew Ranelli asked when the ARRA funds are transferred if the funds will be considered to be used in full to end the reporting requirements. Bert Hunter answered that for the reporting requirements, they keep going until all the money is expended. He stated this is actually a benefit to direct the funds away from loan loss reserves to the interest rate buydowns since the Green Bank knows the funds will be used for the buydowns. Matt Ranelli also asked if the ARRA funds had restrictions attached, and if so if those restrictions will be an issue. Mr. Garcia responded that as far as Davis Bacon and NEPA are concerned, there is a categorical waiver for residential properties. To another question, Bert Hunter clarified that the $300,000 comes from the balance sheet. Matt Ranelli asked if there was anything in particular that the auditors would look at when they look at this transfer. Bert Hunter answered no and that most of the time they would not stop to examine this more closely. However, if they did, it may be just to review Board approvals to do so, which is the reason to be very explicit concerning the proposal for approval to move the funds from program to program and for specific purposes (such as interest rate buydowns).
    - Bryan Garcia added that for the Board Meeting, all the info will be summarized and should show that as a result of the ARRA-SEP funds, the Green Bank will have mobilized over $160 million in private investment into residential clean energy, thereby strengthening the Green Bank's ability to compete for federal resources.

Resolution #2

WHEREAS, at a Special Meeting of the Connecticut Green Bank's ("Green Bank") Deployment Committee ("the Deployment Committee") held on November 30, 2012, the Deployment Committee passed resolutions to approve the Smart-E Loan Program (originally called the "CT HELPs Program");

WHEREAS, in February of 2013, the Connecticut Department of Energy and Environmental Protection released the Comprehensive Energy Strategy ("CES") for Connecticut that includes developing financing programs that leverage private capital to make clean energy investments more affordable, including the pilot Smart-E Loan residential financing program;

WHEREAS, in May of 2013, the Green Bank launched the Smart-E Loan program, operating statewide, with nine local lenders providing low cost and long-term financing for measures that are consistent with the state energy policy and the implementation of the CES;

WHEREAS, in October of 2013, the Green Bank's Board of Directors ("Board") approved full use of $8,361,620 of American Recovery and Reinvestment Act State Energy Program ("ARRA-SEP") funds across a mix of Loan Loss Reserves, Interest Rate Buydowns, and Third Party Insurance Products – credit enhancements for the Green Bank's newly developed residential financing products;

WHEREAS, in February of 2017, the Deployment Committee recommended approval of the Green Bank's request to repurpose ARRA-SEP funds across loan loss reserves and interest rate buydowns ("Credit Enhancements") for the Green Bank's Cozy Home Loans, Smart-E Loans, CT Solar Lease, CT Solar Loan, and LIME Loan programs (the "Programs") in amounts materially consistent with the Memorandum presented to the Deployment Committee dated February 21, 2017;

WHEREAS, in February of 2017, the Deployment Committee recommended approval of replacing ARRA-SEP funds with Green Bank balance sheet funds for certain program Loan Loss Reserves in amounts materially consistent with the Memorandum presented to the Deployment Committee dated February 21, 2017;

WHEREAS, staff request that $300,000 of the $600,000 in ARRA-SEP funds currently allocated to loan loss reserves be repurposed with Green Bank balance sheet funds and that ARRA-SEP funds be reallocated to Smart-E loan loss reserves and for future interest rate buydowns, as more fully explained in the memorandum to the Deployment Committee dated February 18, 2022.

NOW, therefore be it:

RESOLVED, that the Deployment Committee recommends approval of payment of approximately $164,927.82 in ARRA-SEP funds to Smart-E lenders for loan losses.

RESOLVED, that the Deployment Committee recommends approval of repurposing $300,000 in ARRA-SEP funds currently allocated to the LIME Loan program's loan loss reserves with Green Bank funds.

RESOLVED, that the Deployment Committee recommends reallocating ARRA-SEP funds from various programs to the Smart-E Loan program to be deployed and expended through loan loss reserves and interest rate buydowns that support the state's clean energy policy, as more fully explained in the memorandum to the Deployment Committee dated February 18, 2022.

Upon a motion made by Matthew Ranelli and seconded by Lonnie Reed, the Deployment Committee voted to approve Resolution 2. None opposed or abstained. Motion approved unanimously.

b. Smart-E Loan – Expansion to include Environmental Infrastructure Measures

- Bert Hunter summarized the proposal to expand the Smart-E Loan program underwriting term sheet to include environmental infrastructure measures to the list of eligible improvements. As well, there is a proposal to increase the maximum loan amount from $45,000 to $75,000 to compensate for additional needs that homeowners may have and to help cover the electric storage program funding. With incentives, homeowners may be more capable of completing energy storage projects, so a higher loan amount would be helpful. Additionally, the threshold for loans that require additional approvals from Green Bank staff would be increased from $40,000 to $50,000.
- Joe Buonannata reviewed the structure of the program if environmental infrastructure is approved to be included. He noted that no ratepayer funds or ARRA funds will be used for environmental infrastructure, so for a project that includes both, there would be two loans so keep them separate.

- Sarah Sanders asked what kinds of projects qualify for environmental infrastructure. Bryan Garcia answered that for resiliency, raising a home could be considered though more research is needed, but also basement issues such as sealing it from floods, well-water and pipe testing could also be considered. The plan is to start with resiliency and climate adaptation and then expand from there.
- Sarah Sanders asked if crumbling foundations would qualify. Bryan Garcia answered that environmental markets is included in the EI definition, though it hasn't been thoroughly researched yet. Crumbling foundations may fit in broadly. Bert Hunter noted that it may be included from a water incursion issue. Sarah Sanders commented that there is a program already in existence through CHFA, but she was just curious, and Lonnie Reed added that given all the things involved in that sort of project it may be best to avoid it since a program already exists.
- Lonnie Reed commented that field trips for legislators to various programs and sites may be helpful. Bryan Garcia agreed and made note of the idea.
- Matt Ranelli asked for more clarification about the transition to include environmental infrastructure as it affects the limits of how these loans could be used. Bert Hunter answered that it will be a bit of a process to make sure that contractors don't go overboard with what is eligible for funding, but it does seem manageable. Matt Ranelli asked about the process to determine what will or won't be covered, and Bert Hunter answered that work will be done internally first and then externally to determine which stakeholders it affects. Bryan Garcia added that the recommendation of up to $75,000 was based on solar with battery storage or solar with ground-source heat pumps, which is information that the Green Bank is familiar with. There will a range of cost for the measures that are better understood as projects are proposed and evaluated, and for a while, large infrastructure projects will raise some flags but as those projects are found, guidance from the Deployment Committee and other sources will be sought out. Matt Ranelli expressed his concern with the process of how the program will be determined and built.
- Dominick Grant asked how the rollout for the program is being imagined. Bryan Garcia answered with an overall timeline of how the program will be built. Matt Ranelli commented that he would be more comfortable with a gradual rollout. Bryan Garcia added that he will add a rollout timeline for the segments at the next Board Meeting and certain amendments to the proposed resolutions were agreed by the Committee (the resolutions approved being inclusive of these amendments).

Resolution #3

WHEREAS, at a Special Meeting of the Connecticut Green Bank's (Green Bank) Deployment Committee ("the Deployment Committee") held on November 30, 2012, the Deployment Committee passed resolutions to approve the Smart-E Loan Program (originally called the "CT HELPs Program");

WHEREAS, in February of 2013, the Connecticut Department of Energy and Environmental Protection released the Comprehensive Energy Strategy ("CES") for Connecticut that includes developing financing programs that leverage private capital to make clean energy investments more affordable, including the pilot Smart-E Loan residential financing program;

WHEREAS, in May of 2013, Green Bank launched the Smart-E Loan program, currently operating statewide, with nine local lenders providing low cost and long-term financing for measures that are consistent with the state energy policy and the implementation of the CES;

WHEREAS, in March of 2014, the Deployment Committee approved revisions to the Smart-E lender term sheet regarding program loan amounts and loan duration, and certain incremental program upgrades from Smart-E's first 15 months;

WHEREAS, in October of 2015 and January 2017, the Board of Directors (Board) approved an alternate underwriting term sheet which expanded the Smart-E Loan applicant pool beyond the standard underwriting criteria, so as to include credit-challenged borrowers;

WHEREAS, program staff request that the term sheet be further enhanced to allow for the addition of environmental infrastructure measures to the list of "eligible improvements" and to increase the maximum loan amount from $45,000 to $75,000 to accommodate larger projects and to raise the Green Bank approval threshold from $40,000 to $50,000 as more fully explained in a memorandum to the Board dated February 16, 2022.

NOW, therefore be it:

RESOLVED, that the Deployment Committee approves amending the Smart-E "eligible improvements" category to include residential "environmental infrastructure" improvements as defined in Public Act 21-115; and

RESOLVED, that the Deployment Committee approves amending the Smart-E maximum loan amount from $45,000 to $75,000 and raising the Green Bank approval threshold from $40,000 to $50,000 as it applies to clean energy projects.

RESOLVED, that the staff will come back to the Deployment Committee in the future with recommendations for "environmental infrastructure" measures by segment (e.g., water, waste and recycling, etc.) to be supported through the Smart-E program.

Upon a motion made by Matthew Ranelli and seconded by Lonnie Reed, the Deployment Committee voted to approve Resolution 3 as amended. None opposed or abstained. Motion approved unanimously.

5. Other Business

- None

6. Adjourn

Upon a motion made by Lonnie Reed and seconded by Matthew Ranelli, the Deployment Committee Meeting adjourned at 2:59 pm.

Respectfully submitted,

_____

Victoria Hackett, Vice Chairperson

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CONNECTICUT
GREEN BANK

Memo

To: Board of Directors of the Connecticut Green Bank – Deployment Committee of the Connecticut Green Bank

From: Bryan Garcia (President and CEO)

CC:

Date: November 10, 2022

Re: Approval of Funding Requests below $500,000 and No More in Aggregate than $1,000,000 – Update

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At the October 20, 2017 Board of Directors (BOD) meeting of the Connecticut Green Bank ("Green Bank") it was resolved that the BOD approves the authorization of Green Bank staff to evaluate and approve funding requests less than $500,000 which are pursuant to an established formal approval process requiring the signature of a Green Bank officer, consistent with the Comprehensive Plan, approved within Green Bank's fiscal budget and in an aggregate amount not to exceed $1,000,000 from the date of the last Deployment Committee meeting. This memo provides an update on funding requests below $500,000 that were evaluated and approved. During this period, 5 projects were evaluated and approved for funding in an aggregate amount of approximately $963,800. If members of the board or committee would be interested in the internal documentation of the review and approval process Green Bank staff and officers go through, then please request it.

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128 West Road, Ellington, CT 06029

Project Description	Installation of an ELM Fieldsight battery storage system of 0.71 power rating to peak demand ratio and 125 kW of power capacity to reduce electric bills and provide backup power to the facility during power outages.

Customer / Site information

Customer Name	Schneider Bros LLC
Address	128 West Road, Ellington, CT 06029
Business Purpose	Solar Energy Company
Incentive Application No.	ESS-00026
Incentive Application Date	2/16/2022
Customer Peak Demand (kW)	175 kW
Customer Class (S / M / L)	Small
Project Developer / Installer	Earthlight Technologies

Program Eligibility

Critical Facility	No
Small Business	Yes
Onsite Fossil Fuel Generator	No
Grid Edge Customer	No
Participation in FCM Allowed	Yes
Participation in FCM Declared	Yes
Resiliency Plan on File (N/A if Grid Edge Customer)	Yes

Battery Energy Storage System (BESS) Characteristics

System Configuration	Paired with new onsite generation
Expected Program Participation	Passive and Active Dispatch
BESS Make / Model	ELM Fieldsight MGC125
BESS Power Rating (kW)	125 kW
BESS Energy Capacity (kWh)	660 kWh
BESS Technology Approval Status	Pre-Approved
Power Rating to Peak Demand Ratio	0.71
Interconnection Application Filed	Yes
Interconnection Study Required	Distribution and Transmission study needed
Estimated Project Cost	$435,929.00

Benefit / Cost Ratios

RIM – Ratepayer Impact Measure	0.38

PCT – Participant Cost Test	1.28
PACT – Program Administrator Cost Test	0.78
SCT – Societal Cost Test	0.47
TRC – Total Resource Cost Test	0.47

Upfront Incentive Information

Incentive Application Status	▪ Application Submitted ▪ Approved Reservation of Funds Letter (ROF) ▪ Approved Confirmation of Funds Letter (COF)
Incentive Calculation Method	Single Rate
Estimated Upfront Incentive	$132,000.00

404 Taconic Road, Greenwich, CT 06831

Project Description	Installation of an ELM Fieldsight battery storage system of 3.29 power rating to peak demand ratio and 125 kW of power capacity to reduce electric bills and provide backup power to the facility during power outages.

Customer / Site information

Customer Name	Lionshare Farm
Address	404 Taconic Road, Greenwich, CT 06831
Business Purpose	Farm
Incentive Application No.	ESS-00028
Incentive Application Date	2/15/2022
Customer Peak Demand (kW)	38 kW
Customer Class (S / M / L)	Small
Project Developer / Installer	Earthlight Technologies

Program Eligibility

Critical Facility	No
Small Business	Yes
Onsite Fossil Fuel Generator	No
Grid Edge Customer	No
Participation in FCM Allowed	Yes
Participation in FCM Declared	Yes
Resiliency Plan on File (N/A if Grid Edge Customer)	Yes

Battery Energy Storage System (BESS) Characteristics

System Configuration	Paired with new onsite generation
Expected Program Participation	Passive and Active Dispatch
BESS Make / Model	ELM Fieldsight MGC125
BESS Power Rating (kW)	125 kW
BESS Energy Capacity (kWh)	880 kWh
BESS Technology Approval Status	Pre-Approved
Power Rating to Peak Demand Ratio	3.29
Interconnection Application Filed	Yes
Interconnection Study Required	Distribution and Transmission study needed
Estimated Project Cost	$739,977.00

Benefit / Cost Ratios

RIM – Ratepayer Impact Measure	0.51
PCT – Participant Cost Test	0.69
PACT – Program Administrator Cost Test	0.68
SCT – Societal Cost Test	0.29
TRC – Total Resource Cost Test	0.29

Upfront Incentive Information

Incentive Application Status	▪ Application Submitted ▪ Approved Reservation of Funds Letter (ROF) ▪ Approved Confirmation of Funds Letter (COF)
Incentive Calculation Method	Single Rate
Estimated Upfront Incentive	$176,000.00

1050 Day Hill Road, Windsor, CT 06095

Project Description	Installation of a Tesla Mega Pack battery storage system of 1.17 power rating to peak demand ratio and 1,341 kW power capacity to reduce electric bills and provide backup power to the facility during power outages.

Customer / Site information

Customer Name	Aero Gear
Address	1050 Day Hill Road, Windsor, CT 06095
Business Purpose	Manufacturer of precision gears and gearboxes
Incentive Application No.	ESS-00039
Incentive Application Date	1/20/2022
Customer Peak Demand (kW)	1,150 kW
Customer Class (S / M / L)	Large
Project Developer / Installer	174 Power Global NE

Program Eligibility

Critical Facility	No
Small Business	No
Onsite Fossil Fuel Generator	No
Grid Edge Customer	No
Participation in FCM Allowed	No
Participation in FCM Declared	No
Resiliency Plan on File (N/A if Grid Edge Customer)	No

Battery Energy Storage System (BESS) Characteristics

System Configuration	Paired with new onsite generation
Expected Program Participation	Passive and Active Dispatch
BESS Make / Model	Tesla Megapack
BESS Power Rating (kW)	1,341 kW
BESS Energy Capacity (kWh)	2,682 kWh
BESS Technology Approval Status	Pre-Approved
Power Rating to Peak Demand Ratio	1.17
Interconnection Application Filed	Yes
Interconnection Study Required	Distribution and Transmission study needed
Estimated Project Cost	$1,312,000.00

Benefit / Cost Ratios

RIM – Ratepayer Impact Measure	1.69
PCT – Participant Cost Test	1.24
PACT – Program Administrator Cost Test	2.28
SCT – Societal Cost Test	1.76
TRC – Total Resource Cost Test	1.77

Upfront Incentive Information

Incentive Application Status	▪ Application Submitted ▪ Approved Reservation of Funds Letter (ROF) ▪ Approved Confirmation of Funds Letter (COF)
Incentive Calculation Method	Non-Tiered (Initial oversized system)
Estimated Upfront Incentive	$268,200.00

105 Breault Road, Unit 105A, Beacon Falls, CT 06403

Project Description	Installation of a Telsa Megapack battery storage system of 2.7 power rating to annual average demand ratio and 1,284 kW of power capacity to reduce electric bills and provide backup power to the facility during power outages.

Customer / Site information

Customer Name	O&G Industries Inc.
Address	105 Breault Road, Unit 105A, Beacon Falls, CT 06403
Business Purpose	Sand and gravel supplier
Incentive Application No.	ESS-00155
Incentive Application Date	3/7/2022
Customer Average Annual Demand (kW)	476 kW
Customer Class (S / M / L)	Medium
Project Developer / Installer	Enel X North America, Inc.

Program Eligibility

Critical Facility	No
Small Business	No
Onsite Fossil Fuel Generator	No
Grid Edge Customer	No
Participation in FCM Allowed	No
Participation in FCM Declared	No
Resiliency Plan on File (N/A if Grid Edge Customer)	No

Battery Energy Storage System (BESS) Characteristics

System Configuration	Standalone
Expected Program Participation	Passive and Active Dispatch
BESS Make / Model	Tesla Megapack
BESS Power Rating (kW)	1,284 kW
BESS Energy Capacity (kWh)	2,568 kWh
BESS Technology Approval Status	Pre-Approved
Power Rating to Average Annual Demand Ratio	2.7
Interconnection Application Filed	Yes
Interconnection Study Required	None
Estimated Project Cost	$1,749,739.00

Benefit / Cost Ratios

RIM – Ratepayer Impact Measure	1.79
PCT – Participant Cost Test	0.88
PACT – Program Administrator Cost Test	2.30
SCT – Societal Cost Test	1.53
TRC – Total Resource Cost Test	1.53

Upfront Incentive Information

Incentive Application Status	▪ Application Submitted ▪ Approved Reservation of Funds Letter (ROF) ▪ Approved Confirmation of Funds Letter (COF)
Incentive Calculation Method	Tiered Rate
Estimated Upfront Incentive	$331,800.00

105 Breault Road, Unit 105A, Beacon Falls, CT 06403

Project Description	Installation of a Socomec SUNSYS HES L battery storage system of 0.20 power rating to peak demand ratio and 250 kW of power capacity to reduce electric bills and provide backup power to the facility during power outages.

Customer / Site information

Customer Name	Hanwha Aerospace USA LLC
Address	275 Richard Street, Newington, CT 06111
Business Purpose	Transportation and Warehousing
Incentive Application No.	ESS-00165
Incentive Application Date	3/8/2022
Customer Peak Demand (kW)	1,280
Customer Class (S / M / L)	Large
Project Developer / Installer	HQCA Energy Solutions, LLC

Program Eligibility

Critical Facility	No
Small Business	No
Onsite Fossil Fuel Generator	No
Grid Edge Customer	No
Participation in FCM Allowed	No
Participation in FCM Declared	No
Resiliency Plan on File (N/A if Grid Edge Customer)	No

Battery Energy Storage System (BESS) Characteristics

System Configuration	Paired with new Solar PV
Expected Program Participation	Passive and Active Dispatch
BESS Make / Model	Socomec SUNSYS HES L
BESS Power Rating (kW)	250 kW
BESS Energy Capacity (kWh)	558 kWh
BESS Technology Approval Status	Pre-Approved
Power Rating to Peak Demand Ratio	0.20
Interconnection Application Filed	Yes
Interconnection Study Required	Fast Track
Estimated Project Cost	$431,359.00

Benefit / Cost Ratios

RIM – Ratepayer Impact Measure	1.82

PCT – Participant Cost Test	0.85
PACT – Program Administrator Cost Test	2.34
SCT – Societal Cost Test	1.28
TRC – Total Resource Cost Test	1.28

Upfront Incentive Information

Incentive Application Status	▪ Application Submitted ▪ Approved Reservation of Funds Letter (ROF) ▪ Approved Confirmation of Funds Letter (COF)
Incentive Calculation Method	Tiered Incentive
Estimated Upfront Incentive	$55,800.00

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CONNECTICUT GREEN BANK

Memo

To: Deployment Committee of the Connecticut Green Bank

From: Bryan Garcia

Cc Sara Harari, Bert Hunter, Eric Shrago, Ashley Stewart of the Green Bank, and Ralph Mesite, Kerry O'Neill, and Madeline Priest of Inclusive Prosperity Capital

Date: November 9, 2022

Re: Smart-E Loan Program – Inclusion of "Climate Adaptation and Resiliency" Measures

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Purpose

The purpose of this memorandum is to request programmatic approval from the Connecticut Green Bank's ("Green Bank") Deployment Committee to allow for the addition of environmental infrastructure measures to the list of "eligible improvements" within the Smart-E Loan program, with a focus on "climate adaptation and resiliency" measures. At the March 25, 2022, meeting of the Board of Directors of the Green Bank, it was resolved that the Deployment Committee was authorized to determine the specific measures by segment (e.g., climate adaptation and resiliency, water, waste and recycling, etc.) to be supported through the Smart-E Loan program.

It should be noted that this request is solely for "climate adaptation and resiliency" measures, and that additional environmental infrastructure measures (e.g., "water") are forthcoming.

Background

The passage of Public Act 21-115 "An Act Concerning Climate Change Adaptation," led by Governor Lamont, and based on a recommendation from the Governor's Council on Climate Change ("GC3"), expanded the scope of the Green Bank beyond "clean energy"[1] to include

[1] "Clean energy" means solar photovoltaic energy, solar thermal, geothermal energy, wind, ocean thermal energy, wave or tidal energy, fuel cells, landfill gas, hydropower that meets the low-impact standards of the Low-Impact Hydropower Institute, hydrogen production and hydrogen conversion technologies, low emission advanced biomass conversion technologies, alternative fuels, used for electricity generation including ethanol, biodiesel or other fuel produced in Connecticut and derived from agricultural produce, food waste or waste vegetable oil, provided the Commissioner of Energy and Environmental Protection determines that such fuels provide net reductions in greenhouse gas emissions and fossil fuel consumption, usable electricity from combined heat and power systems with waste heat recovery systems, thermal storage systems, other energy resources and emerging technologies which have significant potential for commercialization and which do not involve the combustion of coal, petroleum or petroleum products, municipal solid waste or nuclear fission, financing of energy efficiency projects, projects that seek to deploy electric, electric hybrid, natural gas or alternative fuel vehicles and associated infrastructure, any related storage, distribution, manufacturing technologies or facilities and any Class I renewable energy source, as defined in section 16-1.

"environmental infrastructure".[2] In FY22, the Green Bank staff underwent an extensive planning process to support the expansion of its scope, including the development of a Comprehensive Plan that includes environmental infrastructure. Within the FY23 Comprehensive Plan,[3] is the task "Launching New Products," which includes developing existing financing products for clean energy (e.g., Smart-E Loan, C-PACE) to support environmental infrastructure measures (e.g., climate adaptation and resiliency).

Through an extensive stakeholder engagement process, with the purpose of identifying suitable "climate adaptation and resiliency" measures that can be financed through the Smart-E Loan in support of public policy, eighty-two (82) measures were identified, of which thirty-one (31) measures are being recommended for inclusion – see Attachment A. These "climate adaptation and resiliency" measures were categorized into five (5) categories, including energy efficiency (i.e., many of which are already included within the Smart-E Loan), landscaping, loss prevention, water intrusion reduction, and waterproofing measures. Also included within the detail of the recommended measures are the climate hazards addressed (e.g., extreme temperature, flood), measure descriptions, source of information for the measures, affected component of property (e.g., roof, yard), stage of resilience (i.e., preparation, response, and/or recovery), estimate of the cost range of the measure, estimate of the useful life of the measure, and an estimate of the difficulty of the homeowner to adopt the measure.

With respect to the Green Bank's "climate adaptation and resiliency" efforts, it is collaborating with several state agencies (a.k.a. "the Collaborators"),[4] including:

- **Department of Energy and Environmental Protection** ("DEEP") – specifically, Dr. Rebecca French, Director of the Office of Climate Planning;

- **Insurance Department** – specifically, George Bradner, Assistant Deputy Commissioner and Director of the Property and Casualty Division; and

- **Connecticut Institute for Resilience and Climate Adaptation** ("CIRCA") – specifically, Jim O'Donnell, Executive Director, and John Truscinski, Director of Resilience Planning at the University of Connecticut.

The Collaborators are undertaking a number of different initiatives to increase resilience from the impacts of climate change, including:

- **Pilot Program** – designing a pilot program, Home Resiliency Solutions, to drive investment and capital access to incentivize homeowners to make their properties – and thereby their communities – more resilient to the impacts of climate change (e.g., floods, extreme wind);

- **Federal Funding** – identifying the top sources of federal funding (e.g., Building Resilient Infrastructure and Communities – "BRIC") through the Infrastructure Investments and Jobs Act ("IIJA") and Inflation Reduction Act ("IRA") to fund a pilot program; and

[2] "Environmental Infrastructure" means structures, facilities, systems, services, and improvement projects related to water, waste and recycling, **climate adaptation and resiliency**, agriculture, land conservation, parks and recreation, and environmental markets (e.g., carbon offsets, ecosystem services).

[3] https://www.ctgreenbank.com/wp-content/uploads/2022/08/Comprehensive-Plan_FY-2023_FINAL_080122-1.pdf

[4] It should be noted that these agencies participated in a United States Climate Alliance ("USCA") technical assistance program with the European Union ("EU") to exchange "best practices" on climate resilience. This effort led to the relationship building of these Connecticut organizations, with a focus on improving resilience against flooding.

- **Smart-E Loan** – identifying "climate adaptation and resiliency" measures for the Smart-E Loan, that can provide access to capital to homeowners today, that seek to install and finance resiliency improvements on their properties.

In an effort to identify suitable "climate adaptation and resiliency" measures for the Smart-E Loan, the Green Bank continued its relationship with Climate Finance Advisors ("CFA"), a subsidiary of WSP,[5] the consultant on the USCA and EU project for the Collaborators. CFA underwent an extensive process to identify and prioritize "climate adaptation and resiliency" measures for consideration, including:

1. **Literature Review and Research** – undergoing extensive reviews of measures recommended by the Federal Emergency Management Agency ("FEMA"), state programs (e.g., Cambridge, Massachusetts' Resilient Cambridge Plan, Washington, DC's RiverSmart Homes Program), and other sources.

2. **Measure Review** – vetting by the Collaborators, including Inclusive Prosperity Capital ("IPC"),[6] of the list of identified measures for consideration; and

3. **Stakeholder Feedback** – presentation, review, and feedback from State Agencies Fostering Resilience ("SAFR") Council.[7][8]

As a result of this process, various members of the SAFR Council requested that the Green Bank consider additional measures beyond "climate adaptation and resiliency" (e.g., "water") be included within the Smart-E Loan. The Green Bank expressed that there is a separate effort to identify additional environmental infrastructure measures for consideration being supported by Quantified Ventures.

Request

The staff is requesting the following from the Deployment Committee:

1. **Climate Adaptation and Resiliency Measures** – review and approve the measures proposed by staff to be included within the Smart-E Loan list of "eligible improvements";

2. **Additional Environmental Infrastructure Measures** – any additional "environmental infrastructure" measures (e.g., "water") be brought to the Deployment Committee for review and approval at a future date; and

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[5] https://www.wsp.com/en-US

[6] IPC supports the Green Bank with the administration of the Smart-E Loan

[7] On October 29, 2015, former Governor Malloy announced an executive order making permanent a working group - comprised of state agency heads and experts - that is responsible for strengthening the state's resiliency from extreme weather events, including tropical storms, hurricanes, storm surges, flooding, ice storms, extreme high winds, extreme heat, and slow onset events such as sea level rise. Created under Governor Malloy's Executive Order No. 50, the State Agencies Fostering Resilience Council ("SAFR Council") will be responsible for working to create a Statewide Resilience Roadmap based on the best climate impact research and data and assisting the state Office of Policy and Management in the creation of a state policy on disaster resilience. The organization of SAFR changed in 2019 under a new gubernatorial administration. Governor New Lamont's Executive Order No. 3 identified the SAFR Council as a subcommittee of the Governor's Council on Climate Change (GC3).

[8] https://resilientconnecticut.uconn.edu/engagement/safr/

3. **<u>Environmental Infrastructure Rollout</u>** – approval of "environmental infrastructure" measures does not constitute approval for the staff to allow the Smart-E Loan to be able to finance such measures until such time as an appropriate rollout plan (e.g., contractor participation, project inspection) is completed and presented for review and approval by the Deployment Committee.

It should be noted that no ratepayer funds will be used towards Smart-E Loans for environmental infrastructure projects. The loans will be funded using private capital (i.e., from participating lenders – community banks, credit unions, community development financial institutions), and the lenders will have access to a loan loss reserve provided by the Green Bank, but those loan loss reserve accounts will be funded using interest income and other portfolio earnings that come to the Green Bank.

Additionally, funds from the American Recovery and Reinvestment Act ("ARRA") will not be used for interest rate buydown campaigns on environmental infrastructure projects. Lenders, contractors and homeowners will be advised that projects that include both a clean energy and environmental infrastructure component should be financed as separate Smart-E Loans in order to qualify for the loan loss reserve once the official program is launched.

Conclusion

Nearly 10 years after the Deployment Committee's approval to create the Smart-E Loan, the program has helped over 6,300 Connecticut households by providing them with $116.3 million in funds needed to make critical home energy improvements – from small insulation upgrades to whole home electrification including air and ground source heat pumps, solar, battery storage, and electric vehicle charging stations. The program team now seeks the Deployment Committee's approval to advance Smart-E to its next phase, where homeowners will be able to finance clean energy as well as critical environmental infrastructure improvements focused on resiliency, water, and more to support the public policy of Connecticut. By providing homeowners with access to capital to finance clean energy and environmental infrastructure improvements, the Green Bank has another funding mechanism to meet its mission to confront climate change.

Resolution

WHEREAS, in May of 2013, Green Bank launched the Smart-E Loan program, currently operating statewide, with nine local lenders providing low cost and long-term financing for measures that are consistent with the state energy policy and the implementation of the State's Comprehensive Energy Strategy; and

WHEREAS, at the March 25th, 2022 Connecticut Green Bank Board of Directors (the "Board") meeting the Board approved the staff recommendation that the Smart-E Loan term sheet be further enhanced to allow for the addition of environmental infrastructure measures to the list of "eligible improvements," and that the Board authorized the Deployment Committee to determine the specific measures by segment (e.g., water, waste and recycling, etc.) to be supported through the Smart-E program.

NOW, therefore be it:

RESOLVED, that the Deployment Committee approves of the “climate adaptation and resiliency” measures proposed by the Green Bank staff in the memo dated November 9, 2022 be included as “eligible improvements” within the Smart-E Loan.

RESOLVED, that the Deployment Committee seeks review and approval of additional environmental infrastructure measures for consideration as “eligible improvements” within the Smart-E Loan at a future date.

RESOLVED, that the Deployment Committee seeks review and approval of a plan for the staff rollout of environmental infrastructure measures within the Smart-E Loan, including, but not limited to contractor participation, project inspections, loss reserve budgeting, and customer marketing and outreach.

CLIMATE FINANCE ADVISORS
MEMBER OF WSP

Catalog of Climate Resilience Measures for Property Owners

This "Final Measures" sheet is comprised of 31 climate resilience measures proposed for the Home Resiliency Program pilot to incentivize property owners to make their properties more resilient to climate hazards. Connecticut property owners could voluntarily implement these measures with support from the Smart-E Loan program, which offers long-term, low-cost financing for eligible measures up to $75,000.

The following "All Considered Measures" sheet provides the 82 climate resilience measures considered and more information about the process for selection.

Climate Resiliency Measure Intent	Climate Hazard Addressed	Resiliency Measure Action	Description of Climate Resilience Measure	Sources for More Information	Affected Component of Property	Stage of Resilience (Preparation/Response/Recovery)	Cost of Measure (Very High/High/Medium/Low)	Average Useful Life of Measure (years)	Difficulty of Property Owner Adoption and Contractor Market Awareness (High/Medium/Low)
Energy efficiency	Extreme temperature	**Add or replace insulation**	Adding additional, new insulation or replacing old insulation with higher R-value works to keep conditioned air in and unconditioned air out. Insulation can be applied to exterior walls, basements, and roofs or attics by the property owner or professional installer. Fiber insulation (wood, mineral wool, hemp, sheep wool, straw, cellulose, etc.) is not water resistant but foam (spray in or board) can be, making it the more sustainable option. As a resiliency measure, the insulation will provide more comfortable interior spaces for longer periods with less energy.	https://www.cambridgema.gov/-/media/Files/CDD/Climate/resilientcambridge/toolkithomeowners.pdf https://wires.onlinelibrary.wiley.com/doi/epdf/10.1002/wat2.1404	Exterior Walls; Attic	Preparation	Medium ($10k-$25k)	Lifetime of home	Low
Energy efficiency	Extreme temperature	**Install solar photovoltaic (PV) array**	A photovoltaic solar array (solar panels) produces electricity that can be used directly by the resident, fed back to the electric grid, or fed into a battery backup power system. The system is sized based on the property's "solar potential," the available roof space, and the energy needs of the property. As a resiliency measure, solar panels help reduce the load on the electric grid, particularly during peak use times.	https://www.cambridgema.gov/-/media/Files/CDD/Climate/resilientcambridge/toolkithomeowners.pdf	Electrical system; Roof	Response	Medium ($10k-$25k)	30 years	Medium
Energy efficiency	Extreme temperature	**Replace asphalt with light colored shingles**	Dark colored, asphalt shingles have a long life and are a cheap roofing option; however, this material absorbs light and traps heat in attic and upper-story levels of a property. Replacing these with light colored shingles or metal roofing (standing seam or exposed fastener) can keep these spaces cooler, reducing the energy load required to cool. As a resiliency measure, this option reduces the load on the electric grid during peak-use times.	https://www.cambridgema.gov/-/media/Files/CDD/Climate/resilientcambridge/toolkithomeowners.pdf	Roof	Response	Medium ($10k-$25k)	Asphalt: 10-20 years; Metal: 40-75 years	Low
Energy efficiency	Extreme temperature	**Replace boiler with mini-split**	Replacing a natural gas boiler system with a ductless mini-split provides the property with a cleaner heating and cooling option with no ductwork required. As a resiliency measure, the system is elevated (mounted at ceiling level), so it is resistant to flood damage. Additionally, mini-split systems can be "zoned," allowing for individual control of rooms, reducing the energy load the property draws from the grid, particularly during peak-use times.	https://www.cambridgema.gov/-/media/Files/CDD/Climate/resilientcambridge/toolkithomeowners.pdf	HVAC System	Response	Low ($500-$10k)	10-30 years	Medium
Energy efficiency	Extreme temperature	**Replace caulking**	Caulking around penetrations from the interior to exterior of a property is used to seal the opening from outside air coming in and conditioned air leaking out. It also seals against water penetration and keeps pest out. Over time, exposure to the elements can deteriorate caulking. As a resiliency measure, this will aid in conditioned air retention, reducing the load on the electric grid and safeguarding against water and pest damage.	https://www.cambridgema.gov/-/media/Files/CDD/Climate/resilientcambridge/toolkithomeowners.pdf https://www.fema.gov/sites/default/files/2020-07/fema_homeowners-guide-to-retrofitting_guide.pdf	Façade; Openings (Doors, Windows)	Response	Low ($500-$10k)	5-10 years	Low
Landscaping	Flood (rainfall collection & stormwater runoff)	**Install rain barrels or planters**	Rain barrels capture and store rainwater runoff from a rooftop. They are fed from the downspout and are fitted with a filtration device (i.e., mesh) to keep debris out. The harvested rainwater can be reused as gray water for watering landscaped areas or washing cars, or it can be slowly released into the storm system once the threat of overloading has passed. As a resiliency measure, rain barrels help mitigate water damage to the property and surrounding properties by eliminating runoff to the public storm drain.	https://www.riversmarthomes.org/rainbarrels fema.gov/media-library/assets/documents/13261 https://marydhonau.com/wp-content/uploads/2022/02/Landmark-KYFR-Guide-jan-2021-v4.pdf	Yard	Response	Low ($500-$10k)	20-75 years	Low
Landscaping	Flood	**Install rain gardens**	A rain garden is a strategically located and landscaped area into which stormwater runoff from the property is fed. This option of rainwater mitigation enhances the look of the home, without aiding to the maintenance and upkeep of a traditional flowerbed. These gardens are capable of filtering out debris from runoff as well as reducing the amount of water exiting the property to the storm drain. Rain gardens are installed in the lowest point on the property and may require re-grading to adequately drain away from the house and into the garden. As a resiliency measure, this reduces the load on the local storm drain and redirects water away from the property.	https://www.riversmarthomes.org/raingardens https://www.cambridgema.gov/-/media/Files/CDD/Climate/resilientcambridge/toolkithomeowners.pdf	Yard	Response	Low ($500-$10k)	Varies	Low
Landscaping	Extreme temperature Flood (stormwater runoff)	**Plant trees, including native and shade trees**	Adding native trees to the property reduces stormwater runoff, provides shade, and contributes to the community's overall tree canopy inventory. Trees should be selected based on whether they are native, have deep growing root systems, and are not susceptible to breaking under heavy winds, rains, or snow loads. Shade trees also contribute to reducing the energy load of the property and may be a good alternative to properties unable to produce sufficient solar to warrant a solar array.	https://www.cambridgema.gov/-/media/Files/CDD/Climate/resilientcambridge/toolkithomeowners.pdf https://www.smarthomeamerica.org/resources/homeowners-handbook-to-prepare-for-natural-disasters	Yard	Response	Low ($500-$10k)	30-100 years	Low
Landscaping	Flood (stormwater runoff)	**Replace grass with native plants**	Replacing impervious surfaces, non-native plants, and ornamental species with native species benefits the property in several ways. Native plants and grasses are able to thrive in the location without maintenance (i.e., watering). Native plants have deeper root systems, which allow them to absorb more stormwater, reduce erosion, increase infiltration, and provide beneficial habitat for pollinators, native bugs, and insects.	https://www.riversmarthomes.org/bayscaping	Yard	Preparation	Low ($500-$10k)	Varies	Low
Landscaping	Extreme wind (hurricane, micro bursts, derecho)	**Trim or remove dead, damaged, or rotting trees and limbs**	Older, rotting, damaged, and dead trees all pose the risk of damaging the property if/when a limb or whole tree comes down. This can be due to high or sustained winds, heavy snows, ice storms, and droughts. A professional should assess trees close to powerlines and roofs or structures and trim back or remove, if necessary, to prevent damage to the property or public infrastructure.	https://www.fema.gov/sites/default/files/2020-11/fema_protect-your-property_severe-wind.pdf	Yard	Preparation	Low ($500-$10k)	N/A	Low
Loss prevention (critical assets)	Flood Extreme wind (hurricane, micro bursts, derecho)	**Elevate or relocate all service equipment**	Critical equipment stored below ground or in areas prone to flooding need to be raised or relocated to protect against damage. Items that should be above flood elevation include: • HVAC (heating, ventilation, and air conditioning) system and components (e.g., condensers, compressors, heat pumps, boilers, furnaces, ductwork, fuel lines) • Electrical systems and components (e.g., wiring, switches, outlets, fuses, circuit breaker panels, battery storage, electric meter) • Sewage management systems and components (e.g., lines, drains, septic tanks, drainage fields) • Potable water system (e.g., water lines, private wells, storage tanks, water heaters) When relocating equipment, clearances around and above as well as venting requirements must be considered. Equipment that cannot be relocated should be placed on newly constructed or installed pedestals or should be mounted to the walls.	https://www.fema.gov/sites/default/files/2020-07/fema_homeowners-guide-to-retrofitting_guide.pdf fema.gov/media-library/assets/documents/13261 https://www.fema.gov/sites/default/files/2020-11/fema_protect-your-property_severe-wind.pdf https://www.cambridgema.gov/-/media/Files/CDD/Climate/resilientcambridge/toolkithomeowners.pdf	Mechanical, electrical, and plumbing (MEP)	Preparation	Varies - depends on the service equipment	N/A	Medium-to-High
Loss prevention (critical assets)	Flood	**Install an air vent protection system**	Vents penetrating the exterior wall can allow for water intrusion during a flood event, damaging the appliance or interior of the property. Protection systems can be installed to raise the level of the vent above flood elevation. Vents used for combustion systems require the consultation of a licensed professional.	https://www.befloodready.uk/pfr-products	Vents	Preparation	Low ($500-$10k)	Varies	Low
Loss prevention (critical assets)	Flood Extreme heat	**Install an electric subpanel for critical utilities on backup power**	Installing an electrical subpanel, powered by a back-up system, can provide power to critical utilities and appliances during power outage events. Electricity can be a life or death matter for some, whether to provide cool air during extreme temperatures, heat during ice storms, or power to the refrigerator to keep medication at an appropriate temperature. Adding a subpanel will require owners to determine which electrical loads are critical during a blackout. Generation through a sustainable source (e.g., solar) will allow for continuous backup power during these extreme weather events.	https://www.cambridgema.gov/-/media/Files/CDD/Climate/resilientcambridge/toolkithomeowners.pdf	Electrical system	Response	Medium ($10k-$25k)	20-30 years	Medium

Loss prevention (critical assets)	Flood	**Install a sustainable battery backup**	Installing a battery backup system, powered by a sustainable source (e.g., solar), provides the property with clean power during blackout and extreme weather events. A battery system can also allow for the property to reduce load on the electric grid during peak use times.	WSP technical knowledge	Electrical system	Response	Medium ($10k-$25k)	10-30 years	Medium
Loss prevention (critical assets)	Flood	**Install unions, fittings, and valves to service equipment**	Installing unions, fittings, and valves to service equipment allows for faster replacement of equipment, if damaged, or rapid disconnection to move equipment prior to a flood event. This will elevate costly repairs in the event of storm damage and will quickly get a property back to working service.	https://www.fema.gov/sites/default/files/2020-07/fema_homeowners-guide-to-retrofitting_guide.pdf	Mechanical, electrical and plumbing (MEP)	Preparation	Low ($500-$10k)	50-100 years	Low
Loss prevention (critical assets)	Flood Extreme wind (hurricane, micro bursts, derecho)	**Purchase or install alternative power station**	Power stations can be found in many hardware stores. These stations include safety and emergency equipment (e.g., radio, flashlight, air compressor, battery jump starter, AC outlet, and/or DC outlet built around a modified car battery).	https://www.smarthomeamerica.org/resources/homeowners-handbook-to-prepare-for-natural-disasters	Electrical system	Response	Low ($500-$10k)	1-10 years	Low
Loss prevention (critical assets)	Flood	**Retrofit electrical wiring and elevate sockets and switches**	Retrofitting electrical wiring to isolate lower levels can allow the property owner to turn off power on an entire level during flooding events. This wiring should be relocated to the ceiling for higher elevation in the event of flooding.	https://www.befloodready.uk/pfr-products https://bregroup.com/expertise/resilience/flood-resilience/bre-flood-resilient-repair-house/	Electrical system	Preparation	Medium ($10k-$25k)	N/A	Medium
Loss prevention (misc.)	Flood Extreme wind (hurricane, micro bursts, derecho)	**Inspect solar photovoltaic (PV) anchor system**	Over time, the expansion and contraction of materials holding photovoltaic solar arrays to roof structures may loosen the overall support system. To ensure the system can withstand extreme storm events, it is beneficial to get the system inspected. This inspection should also ensure flashing and roof penetrations are sufficient to protect against water intrusion.	https://www.smarthomeamerica.org/resources/homeowners-handbook-to-prepare-for-natural-disasters	Roof	Preparation	Low ($500-$10k)	N/A	Medium
Loss prevention (misc.)	Extreme wind (hurricane, micro bursts, derecho)	**Install storm shutters**	The installation of storm shutters can not only be used to enhance a property's curb appeal but work to protect the home's windows from impact during high-wind events.	https://www.fema.gov/sites/default/files/2020-11/fema_protect-your-property_severe-wind.pdf	Facade, Openings (windows & doors)	Response	Low ($500-$10k)	Lifetime of home	Low
Loss prevention (misc.)	Flood	**Install vents in foundation walls, garages, and other enclosed areas**	Wet floodproofing requires installation of vents into designated non-livable areas (e.g., via garages or basement walls) to allow water to penetrate during flood events. This designated area is intended to flood with minimal damage to the rest of the property. This often requires the addition of a sump pump system to extract the water after the flood waters have receded. As a resiliency measure, directing water into a designated area will protect from erosion and can reduce the load on the storm sewers.	fema.gov/media-library/assets/documents/13261 https://www.fema.gov/sites/default/files/2020-07/fema_homeowners-guide-to-retrofitting_guide.pdf	Basement	Preparation	Medium ($10k-$25k)	Inspect and repair after each extreme storm	High
Loss prevention (misc.)	Extreme wind (hurricane, micro bursts, derecho)	**Replace windows with high-impact glass**	When choosing new windows for a property, in addition to high efficiency thermal capabilities, the windows should include high-impact glass to resist impact from flying debris during high-wind events.	https://www.fema.gov/sites/default/files/2020-11/fema_protect-your-property_severe-wind.pdf	Openings (windows & doors)	Response	Medium ($10k-$25k)	15-40 years	Low
Water intrusion reduction	Flood	**Floodproof basement windows**	Replacing basement windows with floodproof windows allows for watertight sealing to the basement. These windows work by opening outward, so when flood waters push against them, the seals become watertight. The materials used for the frames have to be able to resist corrosion, typically aluminum and galvanized steel. Some systems can be installed with an automatic closing system.	https://wires.onlinelibrary.wiley.com/doi/epdf/10.1002/wat2.1404	Openings (windows)	Response	Low ($500-$10k)	Sealants, 10-15 years; Windows, life of the home	Low
Water intrusion reduction	Flood	**Install French drainage system**	Installing a French drain system can be done on the exterior or interior of the property. Either location consists of a drain channel with a perforated pipe to collect and direct water. The channel is covered typically with gravel or other permeable filtration mediums. An exterior system runs along the perimeter of the property and directs water into the public storm system or an underground water retention system if applicable. An interior system runs along the perimeter of the room and directs water to a sump pump.	https://bregroup.com/expertise/resilience/flood-resilience/bre-flood-resilient-repair-house/	Landscaping	Response	Low ($500-$10k)	N/A	Low
Water intrusion reduction	Flood	**Replace impervious surfaces**	Retrofitting a property to replace impervious surfaces (e.g., pavers, driveways, and patios) with permeable options reduces the water runoff the property generates. This reduces the impact on the public drainage system. Permeable options can include material and easily penetrating vegetation options. An added bonus of reducing heat retention of the property is to replace asphalt with a lighter, permeable option.	https://www.riversmarthomes.org/permeablepavers https://www.riversmarthomes.org/isr https://www.cambridgema.gov/-/media/Files/CDD/Climate/resilientcambridge/toolkithomeowners.pdf	Driveway; Patio	Response	Medium ($10k-$25k)	N/A	Medium
Water intrusion reduction	Flood	**Install sump pump**	Sump pump systems are critical for flood-prone and made-to-flood areas. Sump pumps can be installed in the lowest lying area of the house or property and fitted with automatic pumps to pump water to the exterior, away from the home. Sump pumps can be installed, and in some instances required, for other resiliency measures. Sump pumps can be installed with drains to rapidly remove water that gets into the property and pump it outside at a higher elevation to the flood.	https://bregroup.com/expertise/resilience/flood-resilience/bre-flood-resilient-repair-house/ https://wires.onlinelibrary.wiley.com/doi/epdf/10.1002/wat2.1404	Drainage system	Response	Low ($500-$10k)	10-15 years	Low
Water intrusion reduction	Flood	**Install floodproof seals and locks**	Water intrudes along the path of least resistance, which is at openings. Replacing seals and locks with floodproof versions creates watertight seals to protect the interior of the property.	https://bregroup.com/expertise/resilience/flood-resilience/bre-flood-resilient-repair-house/	Openings (windows & doors)	Response	Low ($500-$10k)	5-10 years	Low
Waterproofing	Flood	**Apply wall sealant**	Applying water sealant to flood prone areas (e.g., basements and garages) can protect structural material from deterioration, leading to costly repairs. Waterproofing compounds, water repellent coatings, water resistant exterior sheathing, waterproof membranes, water sealant paints, and waterproof concrete are options for property owners. Some walls may require engineering analysis demonstrating that walls can withstand the expected hydrostatic and hydrodynamic loads and impact forces (particularly in the case of wet flood proofing). Floor slab buoyance effects must be considered.	https://marydhonau.com/wp-content/uploads/2022/02/Landmark-KYFR-Guide-jan-2021-v4.pdf fema.gov/media-library/assets/documents/13261 https://www.fema.gov/sites/default/files/2020-07/fema_homeowners-guide-to-retrofitting_guide.pdf	Façade; Basement; Garage	Preparation	Medium ($10k-$25k)	15-20 years with high quality workmanship and sealants	Medium
Waterproofing	Flood	**Conduct repointing**	Old, weathered, deteriorated mortar within walls or around windows can result in voids in the joints of masonry construction. Repointing renews the pointing (external part of mortar joints). This reseals the critical system of the cladding of the property to protect against water intrusion and aid in reducing air infiltration.	https://www.befloodready.uk/pfr-products	Façade	Preparation	Medium ($10k-$25k)	20-30 years	Low
Waterproofing	Flood	**Install seal penetrations**	In addition to floodproof basement windows, installing seal penetrations to light shafts at the basement level can be a resiliency measure. Moveable steel covers with rubber gaskets can then be manually deployed to close off the shaft in case of a flood event. If these shafts are not required for ventilation only for lighting, glass bricks can be used to close off the vent, allowing for better air quality inside, protecting against flood waters, but still letting in light.	https://wires.onlinelibrary.wiley.com/doi/epdf/10.1002/wat2.1404 fema.gov/media-library/assets/documents/13261	Penetrations	Preparation	Low ($500-$10k)	5-10 years	Low
Waterproofing	Flood	**Install wall and floor membranes**	Installing wall and floor membranes work by diverting water that may seep through adjacent areas or properties. The diversion channels water away to prevent damage.	https://bregroup.com/expertise/resilience/flood-resilience/bre-flood-resilient-repair-house/	Exterior walls; Floors	Preparation	High ($25k-$40k)	10-40 years with proper maintenance	Medium-to-High
Waterproofing	Flood	**Replace basement or flood-prone area flooring and wall coverings**	Replacing materials within flood-prone areas with water resistant options (e.g., concrete, tile, or terrazzo) can reduce the damage floodwaters can have on the property's interior. Additionally, the risk of mold significantly decreases due to the reduced condensation potential, creating a healthy air quality within the inhabitable space. This would most typically entail the replacement of flooring material but could also include wall finishes and insulation.	https://www.cambridgema.gov/-/media/Files/CDD/Climate/resilientcambridge/toolkithomeowners.pdf fema.gov/media-library/assets/documents/13261	Basement	Preparation	Medium ($10k-$25k)	Quality product will last the lifetime of home	Low

Process
1) WSP/CFA researched climate resilience measures from various sources, noting the climate hazard addressed, description, and sources for more information.
2) WSP/CFA, CT Green Bank, and Inclusive Prosperity Capital (IPC) screened the measures and identified as Yes/Maybe/No for Smart E-Loan financing.
3) Other CT Collaborators, DEEP, Insurance Department, and CIRCA, also screened the climate resilience measures and identified as Yes/Maybe/No in terms of interest.
5) For majority Yes measures (i.e., all Yes, all but one Yes), WSP/CFA moved to the final measures sheet and filled out more data fields.

Climate Hazard	Climate Resiliency Measure Intent	Resiliency Measure Action	Notes on Climate Resilience Measure	Sources for More Information	WSP/CFA - (Yes/Maybe/No)	CTGB (Yes/Maybe/No)	IPC - Financeable by Smart E-Loan (Yes/Maybe/No)	Department of Energy & Environmental Protection (DEEP) - (Yes/Maybe/No)	Insurance Department - (Yes/Maybe/No)	Connecticut Institute of Resilience and Climate Adaptation (CIRCA) - (Yes/Maybe/No)	Include as Final Measure (Yes/No)?
Extreme temperature	Energy efficiency	**Add or replace insulation**	"Insulate roof, basement and exterior walls. How: Ask an energy auditor or utility provider to complete an attic-to-basement evaluation and provide a custom home energy report outlining recommended energy efficiency improvements. Select which measures could be most effective for your home. Why: It will keep your house cooler during extreme heat and will also maintain interior temperature during energy shortage due to flooding." Unsuitable building materials (not water-resistant): - Fiber insulation materials (wood fiber, mineral wool, hemp, sheep wool, straw, cellulose, etc.) Suitable building materials (water-resistant): - Foam glass - Yellow foundation insulation board	https://www.cambridgema.gov/-/media/Files/CDD/Climate/resilientcambridge/toolkithomeowners.pdf https://wires.onlinelibrary.wiley.com/doi/epdf/10.1002/wat2.1404	Yes	Yes	Yes-already have	Yes	Yes	Yes	Yes
Extreme temperature	Energy efficiency	**Install metal roofing**	- metal roofs, with SRI > 78 are cooler and retain less heat	WSP technical knowledge	Yes	Yes	Maybe	Yes	Yes	Maybe	
Extreme temperature	Energy efficiency	**Install solar photovoltaic array (PV)**	"Install solar panels on roof. How: Discover your sun potential by using [your city's] solar map then contact a solar installer for panels and a storage power system. Why: This will reduce the risk of brownout during extreme heat and could provide your building autonomy during energy shortages due to flooding or extreme heat if you also install storage power systems and separate circuits."	https://www.cambridgema.gov/-/media/Files/CDD/Climate/resilientcambridge/toolkithomeowners.pdf	Maybe - already covered by Smart-E?	Yes	Yes-already have	Yes	Yes	Yes	Yes
Extreme temperature	Energy efficiency	**Replace asphalt with light colored shingles**	"Replace asphalt roofing with light-color reflective shingles to meet LEED standards. How: Use light color material to minimize heat gain. Ask your roofer about the rating of proposed material for solar reflectance. Why: This will maintain your roof at cooler temperature and help your house be more comfortable during extreme heat and potentially reduce your energy bill."	https://www.cambridgema.gov/-/media/Files/CDD/Climate/resilientcambridge/toolkithomeowners.pdf	Yes	Yes	maybe-cool roof tech?	Yes	Yes, Also reference IBHS study on best roofing shigles that perform better for wind and hail and overall effectivness	Yes	Yes
Extreme temperature	Energy efficiency	**Replace boiler with mini-split**	"Replace or complement your boiler with a ductless mini-split system. How: Contact a contractor specialized in air-heat pumps for a condenser outside your home—above the identified flood elevation—and air handlers that provide heat and cooling. Why: No ductwork is required for easy and unobtrusive installation... Your system will be protected from flooding and will provide clean energy for cooling during extreme heat."	https://www.cambridgema.gov/-/media/Files/CDD/Climate/resilientcambridge/toolkithomeowners.pdf	Maybe - covered by Smart-E?	Yes	yes already have	Yes	Yes	Yes	Yes
Extreme temperature	Energy efficiency	**Replacement caulking**	"Make your windows and doors airtight. How: Replace all the caulking around your windows and doors. Or when replacing, ask how they perform for energy loss. Make sure that replacement windows meet or exceed energy requirements. Why: It will keep your house cooler during extreme heat and will also maintain interior temperature during energy shortage due to flooding."	https://www.cambridgema.gov/-/media/Files/CDD/Climate/resilientcambridge/toolkithomeowners.pdf https://www.fema.gov/sites/default/files/2020-07/fema_homeowners-guide-to-retrofitting_guide.pdf	Yes	Yes	yes already have	Yes	Yes	Yes	Yes
Flood	Land conservation	**Install green roofs**	- Even "light weight" are a lot of load, would require structural engineer to assess sub structure - "Green roof (lightweight) on garden shed."	https://marydhonau.com/wp-content/uploads/2022/02/Landmark-KYFR-Guide-jan-2021-v4.pdf	Yes	Yes	maybe-not appropriate for single family in CT	maybe	Maybe, more appropriate for Commercial buildings	Yes	
Flood (rainfall collection & stormwater runoff)	Land conservation	**Install rain barrels/planters**	-"Rain barrels capture and store the rainwater runoff of a rooftop. The harvested rainwater can be stored for later use, released slowly over time, or be used immediately for watering lawns and landscaped areas, or washing cars. Rainwater collected in rain barrels can be used in various ways, but the key is to use it. Draining your rain barrel periodically will help ensure it is ready to collect more stormwater the next time it rains." - "Rain planter for runoff from garage roof." - added benefit of reducing runoff to stormwater system - "Water butts for collecting rain from roofs."	https://www.riversmarthomes.org/rainbarrels fema.gov/media-library/assets/documents/13261 https://marydhonau.com/wp-content/uploads/2022/02/Landmark-KYFR-Guide-jan-2021-v4.pdf	Maybe - might be too low in price	Yes	yes	Yes	yes	Yes	Yes
Flood	Land conservation	**Install rain gardens**	- added benefit of reducing runoff to stormwater system "A rain garden is a landscaped area strategically placed and connected to a downspout to collect and absorb stormwater from your rooftop. Connecting the downspout to the rain garden directs stormwater away your home's foundation and holds it there until it can naturally infiltrate into the ground. The rain garden dips slightly into the ground and has soil engineered to increase infiltration. In addition to improving drainage, rain gardens also help keep polluted runoff out of local streams." - "Have a rain garden. How: Replace your landscaping in the low areas of your property with native plants and soil that can temporarily hold and soak in rain water runoff that flows from roofs, driveways, or patios. Why: By capturing stormwater away from your house foundation, you will reduce your flooding risk. If you are replacing asphalt, you will also make your yard cooler during extreme heat."	https://www.riversmarthomes.org/raingardens https://www.cambridgema.gov/-/media/Files/CDD/Climate/resilientcambridge/toolkithomeowners.pdf	Maybe - might be too low in price. Wide range of prices from DIY to using a landscape architect and civil engineer ($15,000).	Yes	yes	Yes	Yes	Yes	Yes
Flood	Land conservation	**Install swales or berms**	- to divert water from where rainwater tends to settle	https://www.smarthomeamerica.org/resources/homeowners-handbook-to-prepare-for-natural-disasters	Maybe - possibly too low of a price tag. Usually need backhoe.	Yes	maybe-for discussion	maybe	maybe	Yes	
Flood Extreme heat	Land conservation	**Install vegetated lawns**	- added benefit of reducing runoff to stormwater system - Homeowners may be tempted to install a watering system, which could strain water resources in area - Vegetation reduces overall heat-island effect - "~~Grass~~ Vegetate rather than paved areas." (unless its native grasses, typical grass for lawns needs a lot of water.)	https://marydhonau.com/wp-content/uploads/2022/02/Landmark-KYFR-Guide-jan-2021-v4.pdf	Maybe	Maybe	no-would need more defined native plant	maybe	Maybe	No	

Extreme temperature Flood (stormwater runoff)	Land conservation	**Plant trees, including shade trees**	"Plant/preserve trees. How: Water and trim trees as needed. Why: To improve urban tree canopy, reduce extreme heat in the city, and save energy." - Choose trees or shrubs with deep growing root systems, but not susceptible to breaking under heavy winds or rain/snow loads "Shade trees are large trees with widespread, dense canopies. A shade tree is taller than 25 feet at maturity. Commonly planted shade trees in the District include maples, hickories, birches, and oaks. These types of trees are an important method for controlling stormwater runoff. The leaves of trees are like cups and can hold up to one-tenth of an inch of rainwater. This captured rainwater is critical as a rainfall of only a half an inch can cause sewer overflows."	https://www.cambridgema.gov/-/media/Files/CDD/Climate/resilientcambridge/toolkithomeowners.pdf https://www.smarthomeamerica.org/resources/homeowners-handbook-to-prepare-for-natural-disasters https://www.riversmarthomes.org/shadetrees	Yes	Yes	maybe-align with utility recommendations	Yes	Yes	Yes	Yes
Flood	Land conservation	**Regrade land**	- "Effective site drainage and managing surface water runoff can reduce the flood risk of a property by adapting the area surrounding the building at risk (CIRIA, 2007). This can include the process of greening surrounding surfaces in order to increase the subsurface drainage (Zevenbergen et al., 2011)."	https://wires.onlinelibrary.wiley.com/doi/epdf/10.1002/wat2.1404 fema.gov/media-library/assets/documents/13261	Yes	Yes	maybe	maybe	Yes	Maybe	
Flood (stormwater runoff)	Land conservation	**Replace grass with native plants**	"Landscaping that replaces grass with plants native to the [location's] watershed. Native plants have deeper root systems that absorb more stormwater, reduce erosion, increase infiltration, and are more drought tolerant than turf grass or ornamental species. BayScaping also provides beneficial habitat for pollinators like butterflies and honey bees."	https://www.riversmarthomes.org/bayscaping	Yes	Yes	maybe	Yes	Yes	Yes	Yes
Extreme wind (hurricane, micro bursts, derecho)	Land conservation	**Trim or remove dead/damaged/rotting trees and limbs**	- having a professional assess tress close to powerlines and roofs/structures and trim back or remove, if necessary, to prevent damage from falling	https://www.fema.gov/sites/default/files/2020-11/fema_protect-your-property_severe-wind.pdf	Yes	Yes	yes-already have	Yes	Yes	Yes	Yes
Flood	Loss prevention (critical assets)	**Anchor oil tanks and replace old tanks with double walled tanks on proper housekeeping pad**	"In case of a flood event, damages to oil tanks and the consequent leakage can lead to property contamination and pollution (Thieken, Müller, Kreibich, & Merz, 2005). Such tanks have to be secured from uplift using proper anchorage, which can be realized in both existing buildings and new structures. In general, it becomes apparent that measures which are integrated during the planning process of a new building will be more cost-effective than if they are implemented retrospectively for buildings already existing. Temporary measures can always be implemented retrospectively, whereas measures such as elevation and sealing building openings/walls are costly and technically demanding to add in retrospect. It becomes evident that only a combination of several [property-level flood risk adaptation] measures can provide sufficient protection. A study by de Ruig, Haer, de Moel, Botzen, and Aerts (2019) demonstrated that a combination of dry flood-proofing and elevation could serve as the most cost-efficient solution for homeowners. However, the cost-efficiency of PLFRA measures strongly depends on the flood probability, the type of house and type of flood as well as on the scale."	fema.gov/media-library/assets/documents/13261 https://wires.onlinelibrary.wiley.com/doi/epdf/10.1002/wat2.1404	Yes	Yes	maybe-fossil fuel conversation	no-would rather see conversion to heat pump than doubling down on oil tanks	Yes	Maybe	
Flood	Loss prevention (critical assets)	**Elevate or relocate all service equipment**	a. Includes: i. HVAC systems 1. Air conditioning condensing unit 2. Compressors 3. Heat pumps 4. Boilers 5. Furnaces 6. Ductwork 7. Fuel systems a. Natural gas lines b. Fuel storage tanks ii. Electrical systems 1. Wiring 2. Switches 3. Outlets 4. Fixtures 5. Fuses and circuit breaker panels 6. Battery storage 7. Electric Meter iii. Sewage management systems 1. Sewer lines 2. Drains 3. Septic tanks 4. Drainage fields iv. Potable Water Systems 1. Water lines 2. Private wells 3. Storage tanks	https://www.fema.gov/sites/default/files/2020-07/fema_homeowners-guide-to-retrofitting_guide.pdf	Yes	Yes	yes	YES!!! Although may want to narrow the list. How do you elevate a septic tank or drainage field?	Yes	Yes	Yes
Flood	Loss prevention (critical assets)	**Install air vent protection system**	"Water can enter the property through any vents connected to internal appliances (e.g., log burner or boiler). Vents can be blocked if redundant or raised above the flood level. Snorkel type measures can also be installed to raise the level of the vent. For any measures associated with combustible fuel sources, a Gas Safe engineer must be consulted." Temporary Covers can be installed prior to storm.	https://www.befloodready.uk/pfr-products	Yes	Yes	yes	Yes	Yes	Yes	Yes
Flood Extreme heat	Loss prevention (critical assets)	**Install an electric subpanel for critical utilities on back-up power**	"Install electric subpanel for critical utilities to operate on back-up power. How: Decide which electrical loads are critical to power during a blackout to be connected to a separate sub-panel. Circuits feeding the refrigerator, lighting circuits and any other necessary loads will be pulled from the main breaker panel into the isolated subpanel to be powered from a generator or solar panel. Why: This will maintain minimal comfort in your home during a blackout or power outage due to flooding or extreme heat."	https://www.cambridgema.gov/-/media/Files/CDD/Climate/resilientcambridge/toolkithomeowners.pdf	Yes	Yes	Yes-already have	Yes	Yes	Yes	Yes
Flood	Loss prevention (critical assets)	**Install battery backup**	- with residential solar or wind harvesting to be used as backup during power outages - some utilities won't allow to be tied into the grid and have battery backup	WSP technical knowledge	Maybe - covered by Smart-E?	Yes	Yes-already have	Yes	Yes	Yes	Yes
Flood	Loss prevention (critical assets)	**Install unions, fittings, and valves to service equipment**	- allows for faster replacement of equipment when damaged or disconnecting equipment prior to a flood event - see "Elevate or Relocate all Service Equipment" for full list of critical assets. - "Critical Service Equipment" will vary per-household. For a the elderly, an working AC Unit can be the difference between life and death; those with medications that need to be kept at cool temps require refrigerators to stay running	https://www.fema.gov/sites/default/files/2020-07/fema_homeowners-guide-to-retrofitting_guide.pdf	Yes	Yes	yes incorporated in other items	Yes	Yes	Yes	Yes
Flood Extreme wind (hurricane, micro bursts, derecho)	Loss prevention (critical assets)	**Purchase and/or install alternative power source for critical need systems**	- "Generators for critical need systems, which would be family-dependent - "For example, the elderly, disabled, or sick may require a respirator, dialysis machine, or other medical equipment. Some medicine such as insulin, which is stored for over a month, may need to be refrigerated. For many families, the most important major power requirement is to run a refrigerator or freezer."""	https://www.smarthomeamerica.org/resources/homeowners-handbook-to-prepare-for-natural-disasters	Yes	Maybe	no-unless electric generators/battery backup	maybe in addition to battery storage which cannot operate for four days straight - typical length of outage in a major disaster	Yes	Maybe	
Flood Extreme wind (hurricane, micro bursts, derecho)	Loss prevention (critical assets)	**Purchase and/or install alternative power station**	- "Power stations are found in many hardware stores and may have a radio, flash light, air compressor, battery jump starter, AC outlet, and/or DC outlet built around a modified car battery. These units can come in handy during a power outage, since they can form part of your stock of emergency supplies and also provide limited emergency power. If your cordless phone does not work because the base of the unit has no power, a power station could supply electricity so that calls could be made (an alternative is to use a corded phone). It should be noted that after an emergency, there may be many reasons the phone does not work that are beyond your control, such as heavy traffic or loss of function with the phone system."	https://www.smarthomeamerica.org/resources/homeowners-handbook-to-prepare-for-natural-disasters	Maybe - possibly too low of a price tag	Yes	yes	yes	yes	Yes	Yes

Flood	Loss prevention (critical assets)	**Raise kitchen appliances**	-Raise (6"+) appliances on pedestals; requires construction or installation of pedestals, potentially hired help to move and re-install equipment - "Appliances in the kitchen (fridge, oven, washing machine etc.) mounted at worktop height." - "Appliances such as ovens can be installed above flood level."	https://bregroup.com/expertise/resilience/flood-resilience/bre-flood-resilient-repair-house/	Yes	Yes	maybe	maybe	Yes	Maybe	
Flood Extreme wind (hurricane, micro bursts, derecho)	Loss prevention (critical assets)	**Raise or relocate electrical utility systems**	"Elevate or relocate main utilities. How: When replacing or upgrading your heating and electrical utility systems, raise all components at least 1 foot above the anticipated flood level if you are in a flood area, and as much as affordable otherwise. Why: Avoid costly flood damage by preventing your electrical system components, including service panels (fuse and circuit breaker boxes), meters, switches, and outlets to be in contact with flood water. These are easily damaged by flood water." - Prevent power-surge damage by unplugging electrical appliances Re-wire breaker to ensure appliances that need to be turned off can do so via breaker '- 1' above FEMA base flood elevation (BFE)	https://www.cambridgema.gov/-/media/Files/CDD/Climate/resilientcambridge/toolkithomeowners.pdf fema.gov/media-library/assets/documents/13261 https://www.fema.gov/sites/default/files/2020-11/fema_protect-your-property_severe-wind.pdf	Yes	Yes	yes	yes	yes	Yes	Yes
Flood	Loss prevention (critical assets)	**Raise or relocate HVAC equipment**	- raise equipment on pedestals; requires construction or installation of pedestals, potentially hired help to move and re-install equipment - clearances around equipment must be verified - venting requirements must be verified - "Boilers can be relocated to a place where flood risk is reduced. For example, boilers could be wall mounted above the flood level or re-installed on the first floor rather than the ground floor. This will reduce the risk of the boiler being damaged during a flood event."	https://www.befloodready.uk/pfr-products	Yes	Yes	**yes**	**yes**	Yes	**Yes**	**Yes**
Flood	Loss prevention (critical assets)	**Retrofit electrical wiring and elevate sockets and switches**	"Electrics for the ground floor can be separated from other floors so power can be turned off in isolation. Wiring and plug sockets can be raised up above floor level to improve resilience." '- "Sockets and switches placed higher up the wall, and the wiring to them all coming from the ceiling."	https://www.befloodready.uk/pfr-products https://bregroup.com/expertise/resilience/flood-resilience/bre-flood-resilient-repair-house/	Yes	Yes	yes	**yes**	Yes	Yes	Yes
Flood	Loss prevention (critical assets)	**Retrofit kitchen materials**	- a water damaged kitchen would prevent its use of a critical function - "Kitchen units and doors made from resin-bonded board, and fitted with all-ceramic worktops." - "The lower kitchen cupboards fitted with slide-out baskets so that they can be taken out and placed on the worktop if flooding is imminent." - "Cupboards constructed from stainless steel or other resilient materials. Use of wall mounted cupboards."	https://bregroup.com/expertise/resilience/flood-resilience/bre-flood-resilient-repair-house/ https://www.befloodready.uk/pfr-products	Yes	Yes	no	No	Yes	No	
Flood Extreme wind (hurricane, micro bursts, derecho)	Loss prevention (misc.)	**Anchor yard items**	- having an inspect inspect structural anchors of sheds, coverings, solar PV, etc.	fema.gov/media-library/assets/documents/13261	Maybe - cost may be too low	Yes	no	maybe	Yes	No	
Flood Extreme wind (hurricane, micro bursts, derecho)	Loss prevention (misc.)	**Inspect solar PV anchor system**	- Ensure proper mounting with lag bolts going into the truss of the roof, not the sheathing; and ensure proper fastening of the racking system to the roof and solar panels to the racking system - Flashing and roof penetrations should be sufficiently durable and compatible to last the life of the installation. A polycarbonate sealant can be used to seal the gap, or fill the hole, between the lag bolt penetration and flashing for asphalt shing roofs.	https://www.smarthomeamerica.org/resources/homeowners-handbook-to-prepare-for-natural-disasters	Yes	Yes	yes	yes	Yes	Yes	Yes
Extreme wind (hurricane, micro bursts, derecho)	Loss prevention (misc.)	**Install storm shutters**	- Protect windows/doors from impact via storm shutters and high-impact glass	https://www.fema.gov/sites/default/files/2020-11/fema_protect-your-property_severe-wind.pdf	Yes	Yes	yes	yes	Maybe, very expensive only selectad coastal areas	Yes	Yes
Flood	Loss prevention (misc.)	**Install vents in foundation walls, garages, and other enclosed areas**	- requires elevating all critical assets or removing from "wet floodproof" designated areas - "Wet Floodproofing" refers to designating an area that is intended to flood with minimal damage to protect the rest of the asset - "Basement should be retrofitted to allow for water to enter but not cause significant damage, such as moving equipment to higher ground" - "Requires water to be pumped out by system or homeowner"	fema.gov/media-library/assets/documents/13261 https://www.fema.gov/sites/default/files/2020-07/fema_homeowners-guide-to-retrofitting_guide.pdf	Maybe - may conflict with flood insurance policies	Yes	yes	yes	Yes	Yes	Yes
Flood	Loss prevention (misc.)	**Relocate bookshelves**	Store bookshelves above the flood level or an upper floor.	https://www.befloodready.uk/pfr-products	Yes	Yes	no	no	Yes	No	
Flood	Loss prevention (misc.)	**Relocate valuables**	- Keep/move valuables/memorabilia on high shelves or in upstairs rooms. Raise valuables on tables/plinths - Use quick-release hinges, or avoid painting over door hinges, to permit easy removal; doors may then be placed on top of tables etc. to create storage above water level (in low level flooding)	https://marydhonau.com/wp-content/uploads/2022/02/Landmark-KYFR-Guide-jan-2021-v4.pdf	Yes	Yes	no	no	Yes	No	
Extreme wind (hurricane, micro bursts, derecho)	Loss prevention (misc.)	**Replace garage door with reinforced garage door**	- Protect from impact - Can replace with high-impact or add a reinforcing system (bracing kit)	https://www.fema.gov/sites/default/files/2020-11/fema_protect-your-property_severe-wind.pdf	Yes	Yes	maybe if attached	Yes - check with insurance as to whether this measure is needed with wind speeds typical in CT	Yes	Maybe	
Extreme wind (hurricane, micro bursts, derecho)	Loss prevention (misc.)	**Replace windows with high-impact glass**	- Protect windows/doors from impact via storm shutters and high-impact glass	https://www.fema.gov/sites/default/files/2020-11/fema_protect-your-property_severe-wind.pdf	Yes	Yes	yes	Yes - check with insurance as to whether this measure is needed with wind speeds typical in CT	Maybe, very expensive only selectad coastal areas	Yes	Yes
Extreme wind (hurricane, micro bursts, derecho)	Loss Prevention (structure)	**Uplift foundation**	- requires removal of interior finishes; home is required to be inspected first to understand the materials and methods used to construct the home and calculated the uplift requirements - older homes may not be achored to foundation. Add anchorage to foundation.	https://www.smarthomeamerica.org/resources/homeowners-handbook-to-prepare-for-natural-disasters	Yes	Yes	maybe	Yes - check with insurance as to whether this measure is needed with wind speeds typical in CT	Maybe, very expensive only selectad coastal areas	Maybe	
Extreme wind (hurricane, micro bursts, derecho)	Prevent roof damage	**Achieve FORTIFIED Roof standard**	Enhanced roof deck attachment: "When severe weather hits, keeping your roof deck attached to your home is key to blocking storm pressure and rain from entering your home. IBHS testing shows that switching from common smooth nails to 8D ring-shank nails and decreasing the space between nails can double the uplift your roof can withstand." Sealed roof deck: "If the wind rips off your roof covering (like shingles, metal panels or tiles), it exposes the wood beneath and allows water to pass through the gaps and enter your home. IBHS testing shows that for every inch of rain to hit an exposed roof deck, the equivalent of nine bathtubs of water can pour in and cause significant interior damage. By sealing the seams of your roof deck, you can reduce that water-intrusion by up to 95%!" Locked down roof edges: "Roof damage often begins when wind gets underneath the roof edge and begins ripping it away from the home. To help protect this vulnerable area, FORTIFIED requires specific materials and installation methods, including a wider drip edge and a fully adhered starter strip, that when used together create a stronger edge system." Impact-resistant shingles rated by IBHS: "In hail-prone areas, FORTIFIED requires shingles tested by IBHS to show they can withstand hail up to 2 inches in diameter. These shingles outperform typical Class 4 shingles when tested against realistic hailstones and will better protect your home." Wind- and rain-resistant attic vents: "During severe-weather events, high winds can pull typical attic vents loose, giving the storm a pathway into your home. Even when it doesn't pull vents loose, wind can drive almost sideways, allowing it to enter your home through vents that are not designed to prevent it. To keep this from happening, FORTIFIED requires attic vents that are wind and rain resistant."	https://fortifiedhome.org/solutions/	Yes	Yes	maybe	maybe - are these measures possible with a retrofit or more appropriate with major renovation/new constrcution?	Yes	Yes	

Extreme wind (hurricane, micro bursts, derecho)	Prevent roof damage	**Achieve FORTIFIED Silver standard**	Enhanced roof deck attachment: "When severe weather hits, keeping your roof deck attached to your home is key to blocking storm pressure and rain from entering your home. IBHS testing shows that switching from common smooth nails to 8D ring-shank nails and decreasing the space between nails can double the uplift your roof can withstand." Sealed roof deck: "If the wind rips off your roof covering (like shingles, metal panels or tiles), it exposes the wood beneath and allows water to pass through the gaps and enter your home. IBHS testing shows that for every inch of rain to hit an exposed roof deck, the equivalent of nine bathtubs of water can pour in and cause significant interior damage. By sealing the seams of your roof deck, you can reduce that water-intrusion by up to 95%!" Locked down roof edges: "Roof damage often begins when wind gets underneath the roof edge and begins ripping it away from the home. To help protect this vulnerable area, FORTIFIED requires specific materials and installation methods, including a wider drip edge and a fully adhered starter strip, that when used together create a stronger edge system." Impact-resistant shingles rated by IBHS: "In hail-prone areas, FORTIFIED requires shingles tested by IBHS to show they can withstand hail up to 2 inches in diameter. These shingles outperform typical Class 4 shingles when tested against realistic hailstones and will better protect your home." Wind- and rain-resistant attic vents: "During severe-weather events, high winds can pull typical attic vents loose, giving the storm a pathway into your home. Even when it doesn't pull vents loose, wind can drive almost sideways, allowing it to enter your home through vents that are not designed to prevent it. To keep this from happening, FORTIFIED requires attic vents that are wind and rain resistant." Impact protection for windows and doors: "When rain and storm pressures penetrate a home, damage quickly escalates. That is why it is so important to defend openings like doors and windows. FORTIFIED requires window and door protection that is tested to withstand both pressure and impact." Impact and pressure-rated garage doors: "Keeping winds and pressure from entering your home is critical for its survival in a storm. Both can easily come through a failed garage door, and once this happens, it's common to see blown-out walls and collapsed roofs.	https://fortifiedhome.org/solutions/	Yes	Yes	maybe	maybe - are these measures possible with a retrofit or more appropriate with major renovation/new constrcution?	Yes, seald roof deck already required in code.	Yes	
Flood	Reduce or prevent water intrusion	**Build amphibious buildings**	- "Amphibious buildings are an alternative to permanently elevating structures, as they rise with floodwaters (English et al., 2015). There is a long history of such buildings and various examples can be found worldwide depending on the climatic conditions, the culture and construction materials available (Strangfeld & Stopp, 2014). Materials such as hollow concrete pontoons or polystyrene blocks are used as a foundation to create buoyancy (Zevenbergen et al., 2011). Guidance posts prevent the house from floating away, making only vertical movements possible (English et al., 2015). In many cases, buildings are also rested upon poles or concrete slab foundations (Zevenbergen et al., 2011). Compared to elevated buildings, amphibious buildings are not as exposed to high wind velocities and can withstand larger flood events."	https://wires.onlinelibrary.wiley.com/doi/epdf/10.1002/wat2.1404	No - too expensive	No	no	no	No	No	No
Flood	Reduce or prevent water intrusion	**Clean gutters and/or install gutter guards**	- ensuring water can flow freely away from a critical area of the façade (where roof and wall meet) ensures no backup of water can recede up into the wall cavity	fema.gov/media-library/assets/documents/13261	Yes	Maybe	no	no		Maybe	
Flood	Reduce or prevent water intrusion	**Elevate the building**	- "Elevating, by raising a building above the flood level, is a permanent and effective method to reduce flood risk... It can be achieved if either the entire home is elevated or there is a newly raised floor within the house. In the United States, a government-promoted retrofitting strategy in flood-prone areas is permanent static elevation (FEMA,2014). If raising a building retrospectively, it firstly has to be separated from its foundation. Thereafter, a new foundation or extension of the foundation is constructed which can consist of piers, posts, columns, continuous walls, or piles (Aertset al., 2013)." '- "Another measure used to avoid floodwaters is building on elevated ground. This can successfully be done during the development process of newly constructed buildings. Hereby, the landscape design has to be taken into consideration during the planning process of new developments (Eşli, 2005)."	https://wires.onlinelibrary.wiley.com/doi/epdf/10.1002/wat2.1404 https://wires.onlinelibrary.wiley.com/doi/epdf/10.1002/wat2.1404	No - too expensive and low adoption in CT	Yes - with cap	maybe	yes, but very expensive measure - also should be done to FEMA standards to get insurance rate reduction	Yes - with cap	Maybe	
Flood	Reduce or prevent water intrusion	**Floodproof basement windows**	- "These are implemented to open outwards, as the pressure from the floodwater presses the window into its frame, additionally sealing it (Trebersburg et al., 2012). Some windows can be tilted and include an automatic closing system, whereas others have to be closed manually... Such [automatically closing] windows are installed for inundation depths of 1 to 1.8 m. The materials used for the frames are aluminum and galvanized steel as these are the most water resistant materials."	https://wires.onlinelibrary.wiley.com/doi/epdf/10.1002/wat2.1404	Yes	Yes	yes	yes	Yes	Yes	Yes
Flood	Reduce or prevent water intrusion	**Install a levee barrier system**	- Levee of compacted fill with sump pump; Levee would be constructed of riprap (pieces of rock or crushed stone added to the surface of a fill slope to prevent erosion)	https://www.fema.gov/sites/default/files/2020-07/fema_homeowners-guide-to-retrofitting_guide.pdf	Yes	Yes	maybe	yes		Maybe	
Flood	Reduce or prevent water intrusion	**Install automatic flood or water-resisting doors and windows**	"Flood doors automatically create a water resistant seal when closed. This provides a benefit over flood barriers which have to be manually fitted into place when required. Flood windows are also available and can be used to replace standard windows at flood risk."	https://www.befloodready.uk/pfr-products	Maybe - confirm residential application in US market	Yes	maybe	yes	Yes	Maybe, but should be consistent with the local flood damage prevention regulations and the State Building Code	
Flood	Reduce or prevent water intrusion	**Install flood gates**	"Standard garden gates can be replaced with flood resistant flood gates. Like a flood door, once shut and locked, a water resistant seal is formed. Gates can be used around a property perimeter to keep water away from a building."	https://www.befloodready.uk/pfr-products	Yes	Yes	no	maybe	Yes	No	
Flood	Reduce or prevent water intrusion	**Install free standing barriers (stop logs) (permeant flood wall)**	"Homeowners can protect objects at risk by installing permanent attachment measures and storing temporary stop logs (BMNT, 2019). Stop logs are usually made of aluminum and can protect large areas of several hundred square meters (Suda et al., 2012). The implementation process of stop logs often requires two people, as one stop log can weigh approximately 6–10 kg per meter (personal communication)."	https://wires.onlinelibrary.wiley.com/doi/epdf/10.1002/wat2.1404	No - not done in residential applications in US	Maybe	maybe	maybe	Maybe	Maybe	
Flood	Reduce or prevent water intrusion	**Install French drainage system**	- "Drain channels beneath the floor around the perimeter of the room, directing water."	https://bregroup.com/expertise/resilience/flood-resilience/bre-flood-resilient-repair-house/	Yes	Yes	yes	yes		Yes	Yes
Flood	Reduce or prevent water intrusion	**Install gravel pathways**	- added benefit of reducing runoff to stormwater system - "Pathways of gravel over weed-suppressant fabric." - in high winds, gravel may become a projectile and result in damage to house or surrounding structures/vehicles - In a flooding event gravel can be swept away - requires owner upkeep - in winters, if this is a walkable/vehicle pathway this prevents snow removal	https://marydhonau.com/wp-content/uploads/2022/02/Landmark-KYFR-Guide-jan-2021-v4.pdf	Maybe	No	no	no	No	No	No
Flood	Reduce or prevent water intrusion	**Install groundwater recharge systems**	- "Tubes sunk into ground vertically improve soil absorbency. Devices themselves have no moving parts, and require no external energy source."	https://marydhonau.com/wp-content/uploads/2022/02/Landmark-KYFR-Guide-jan-2021-v4.pdf	No - not done in residential applications in US	No	no	no		No	No
Flood	Reduce or prevent water intrusion	**Install internal tanking, including cavity drain membrane systems**	- "Designed to be completely waterproof. Offers groundwater protection... Needs sump and pump. Vulnerable to damage due to later alterations. Primarily designed to protect against groundwater."	https://marydhonau.com/wp-content/uploads/2022/02/Landmark-KYFR-Guide-jan-2021-v4.pdf	No - unsure of US application	No	no	no		No	No

Flood	Reduce or prevent water intrusion	**Install one-way valves**	- "One-way valves in the main drains to prevent water coming up into the home via the sewers." - "During flood events, water levels in the sewage system may rise and lead to an overload in the system (BMNT,2019). To prevent contaminated water to enter buildings, nonreturn valves can be implemented (Bowker, 2007)." - "Flood water can flow up through wastewater pipes leading to flooding within a property. Non-return valves can be fitted to these pipes so wastewater can flow out, but flood water cannot enter. Non-return valves can also be fitted to the foul sewer, preventing sewage backing up through the system if the main sewer network is also impacted by flooding. If a non-return valve cannot be fitted, a bung can be used to block the toilet."	https://bregroup.com/expertise/resilience/flood-resilience/bre-flood-resilient-repair-house/ https://marydhonau.com/wp-content/uploads/2022/02/Landmark-KYFR-Guide-jan-2021-v4.pdf https://wires.onlinelibrary.wiley.com/doi/epdf/10.1002/wat2.1404 fema.gov/media-library/assets/documents/13261 https://www.fema.gov/sites/default/files/2020-07/fema_homeowners-guide-to-retrofitting_guide.pdf	Yes	Yes	maybe	yes - may also be something wastewater utility installs	Yes	Maybe	
Flood	Reduce or prevent water intrusion	**Install permanent floodwall**	- "Permanent barrier walls with demountable gates / concealed gates /permanent swing gates" - "Structure of building is not a limiting factor." - "They are made of reinforced concrete and typically surround either an entire object at risk or smaller objects or openings (doors, windows, etc.). It can be integrated in the architecture of a building by using materials such as decorative blocks or bricks. Moreover, floodwalls are more resistant to erosion than structures made of compacted earth. Usually, this type of protection is used for areas where there is too little space for levees (FEMA, 2007)." - floodwall reinforced and anchored to withstand flood load - "Permanent barrier walls with demountable gates / concealed gates /permanent swing gates"	https://marydhonau.com/wp-content/uploads/2022/02/Landmark-KYFR-Guide-jan-2021-v4.pdf https://wires.onlinelibrary.wiley.com/doi/epdf/10.1002/wat2.1404 https://www.fema.gov/sites/default/files/2020-07/fema_homeowners-guide-to-retrofitting_guide.pdf	Yes	Yes	maybe	maybe - hard to picture for single home	Yes	Maybe, but should be consistent with the local flood damage prevention regulations and the State Building Code	
Flood	Reduce or prevent water intrusion	**Install permanent outdoor pumps**	- May require draining system to be installed in conjunction or already exist - "Unit fits into French drain to remove water from lawns, gardens or sports grounds. Care needed in directing flow away from housing."	https://marydhonau.com/wp-content/uploads/2022/02/Landmark-KYFR-Guide-jan-2021-v4.pdf	Yes	Yes	maybe	Yes	Yes	Maybe	
Flood	Reduce or prevent water intrusion	**Install permeable pavers/driveways/patios**	- added benefit of reducing runoff to stormwater system - "Permeable pavers are a self-draining system that allows rainwater to seep around individual pavers, soaking naturally into the ground underneath. Removing impervious surfaces and replacing them with permeable pavers is common for patios, driveways, and parking lots." - "Impervious surface removal entails replacing hard surfaces that do allow water to penetrate with vegetation that allows rainwater to soak into the ground natural. Common impervious surfaces replaced with vegetation include unused parking pads, driveways, patio, sheds, and other structures with roofs." -"Replace asphalt with porous surface. How: Pave your driveway and pathways with light color material such as pavers or gravel that let water filter. Why: This will maximize water getting directly into the ground and will reduce your house flooding risk and street flooding. It will also make your yard cooler during extreme heat." - "Permeable surfaces on car parking areas."	https://www.riversmarthomes.org/permeablepavers https://www.riversmarthomes.org/isr https://www.cambridgema.gov/-/media/Files/CDD/Climate/resilientcambridge/toolkithomeowners.pdf https://marydhonau.com/wp-content/uploads/2022/02/Landmark-KYFR-Guide-jan-2021-v4.pdf	Yes	Yes	yes	yes	Yes	Yes	Yes
Flood	Reduce or prevent water intrusion	**Install sump pump**	- "A sump in the corner of the home fitted with automatic pumps to remove the water, pumping it outside, before it can reach up to the floor." - "Sump pumps, for example, are installed at a low point in a building in order to be effective. This system has the goal to assist during a flood event. These pumps usually automatically start and thus require power supply. The water should not be pumped out of the building until the water level on the outside has decreased, since basement walls could collapse (FEMA, 2007). Sump pumps can be implemented as a retrofitting measure or during the construction process of a new building. On the other hand, flood adapted interior typically refers to moving valuables, electrics, sewage, and heating systems to higher levels. This measure is less costly and easy to apply during the construction process of new buildings, as the interior design can be planned appropriately (Kreibich, Thieken, Petrow, Müller, & Merz, 2005). - "Where a property has a basement or a suspended floor, flood water can enter these voids and cause damage. A sump pump can be installed to control the water level by pumping water out at a faster rate than it is entering. This manages the water level and stops it from rising significantly which could cause damage to the building." - "Rapid deployment. Relatively low cost. Helps where a resistance product leaks. Can remove flood water in an emergency... Must be positioned and sized correctly. May require ancillary power supply. Will need servicing and maintenance."	https://bregroup.com/expertise/resilience/flood-resilience/bre-flood-resilient-repair-house/ https://wires.onlinelibrary.wiley.com/doi/epdf/10.1002/wat2.1404 https://www.befloodready.uk/pfr-products https://marydhonau.com/wp-content/uploads/2022/02/Landmark-KYFR-Guide-jan-2021-v4.pdf	Yes	Yes	yes	yes	Yes	Yes	Yes
Flood	Reduce or prevent water intrusion	**Install system of integral drains with sump pump**	- "Drains fitted flush with the floor connected direct to the sump and pump (and so independent from the 'mains drainage'), can rapidly clear any flooding that does get into the home, pumping it out above the external floodwater level."	https://bregroup.com/expertise/resilience/flood-resilience/bre-flood-resilient-repair-house/	Yes	Yes	yes	yes		Maybe	Yes
Flood	Reduce or prevent water intrusion	**Install underground rain harvesting tank**	- added benefit of re-releasing during drought conditions - "Below ground rain harvesting tank."	https://marydhonau.com/wp-content/uploads/2022/02/Landmark-KYFR-Guide-jan-2021-v4.pdf	Yes	Yes	maybe	maybe - not sure this is necessary for a home in CT	Yes	Maybe	
Flood	Reduce or prevent water intrusion	**Install water resisting airbricks / permanent airbrick covers**	- "Inexpensive and unobtrusive. Needs careful installation and maintenance. May need measures to deal with seepage... Need to choose correct height from range available to avoid overtopping."	https://marydhonau.com/wp-content/uploads/2022/02/Landmark-KYFR-Guide-jan-2021-v4.pdf	No	No	no	no	Yes	No	No
Flood	Reduce or prevent water intrusion	**Install water-resisting external doors and windows**	- "Some models include 'Escape hatch' option, built in to the top half of the door, to aid rescue/delivery of emergency supplies etc. whilst keeping water out of the property. Unobtrusive - look the same as normal doors. Some types may need measures to deal with seepage. May be difficult to evacuate if people are trapped inside with rising water. A door may keep water out at depths that are dangerous to the structure of the building... These windows still open when required; designed to withstand collision from floating debris." "External flood doors act as an alternative to temporary door protection measures and can be made of unplasticized polyvinyl chloride (uPVC), fiberglass, or metal with rubber gaskets (Bowker, 2007)."	https://marydhonau.com/wp-content/uploads/2022/02/Landmark-KYFR-Guide-jan-2021-v4.pdf https://wires.onlinelibrary.wiley.com/doi/epdf/10.1002/wat2.1404	Yes	Yes	yes	yes	Maybe	Maybe, but should be consistent with the local flood damage prevention regulations and the State Building Code	
Flood	Reduce or prevent water intrusion	**Install/implement window and door guards**	- "This measure can be implemented on the exterior of a building and is implemented using water-proof steel frames which are fastened to the shutters. The windowsills are made using steel, timber, or stainless steel and provide effective protection against the impact of solids. Temporary elements are then used as a protection in case of a flood event (stop logs, aluminum boards, etc.)... (Treberspurg et al., 2012)."	https://wires.onlinelibrary.wiley.com/doi/epdf/10.1002/wat2.1404	Maybe - for temporary how to ensure homeowners deploy the measure and are capable of deploying; unsure US market for permeant guards that are architecturally sufficient	Maybe	no	maybe	Maybe	No	
Flood	Reduce or prevent water intrusion	**Maintain external drains**	"Clean storm drain(s) close to your home before the next predicted rainstorm. How: Remove leaves and dirt that clog the grates. Why: This will allow for the City's infrastructure to best capture stormwater and reduce flooding risk."	https://www.cambridgema.gov/-/media/Files/CDD/Climate/resilientcambridge/toolkithomeowners.pdf	Yes	Yes	no	no - people should do this, but not sure how it is part of a loan	Yes	Maybe	

Flood	Reduce or prevent water intrusion	**Purchase deployable floodwall**	- Note, barrier systems redirect the water, could cause issues with other homes (i.e. less equitable) or overload drainage/stormwater systems causing more damage to public infrastructure - types include auto-barriers: "Powered by floodwater itself, no electrics… Unobtrusive. Structure of building is not the limiting factor. High initial cost, including below-ground work; May need additional seepage measure." - Type: Tubes (air and water filled): "These systems are temporary barriers, which are made of geomembranes or reinforced polyvinyl chloride (PVC) tubes. Tubes can either be air-filled or water-filled, the first needing anchoring using pins or weighted skirts, the latter using the dead load of water as a stabilization measure, both types are made of an impermeable membrane and need pumps to be filled (Ogunyoye et al., 2011)." -Type: Filled containers (permeable and impermeable): "These temporary barriers can be filled with water or aggregates. They are either permeable or impermeable, and the dead load of the containers is used as means of stabilization (Ogunyoye et al.,2011). Permeable barriers are made of geotextiles or geosynthetic fabrics. Wire meshes, pins, and frames are used to stabilize them. The waterproofness of the measures is also dependent on the materials that are filled in the containers. Sandbags are a common example of this category (Ogunyoye et al., 2011; Reeve & Badr, 2003). However, sand bags are quite low in effectiveness and can collapse or be overtopped during floods (Poussin, Botzen, & Aerts, 2015). In addition, the process of filling sandbags is time-consuming and labor-intensive. As sandbags are nonreusable and can often retain contaminants from sewage after flood events, they cause large disposal problems (Reeve & Badr, 2003). An advantage of these systems is that they can adapt to uneven terrain and solely require relatively unskilled labor. The impermeable option is usually made of polyester, polyethylene, or plastic. Such containers are filled with water or other aggregates to create stability. Compared to sandbags, impermeable containers are rather rigid and do not adapt to uneven terrain (Ogunyoye et al., 2011)	https://marydhonau.com/wp-content/uploads/2022/02/Landmark-KYFR-Guide-jan-2021-v4.pdf https://wires.onlinelibrary.wiley.com/doi/epdf/10.1002/wat2.1404 https://www.fema.gov/sites/default/files/2020-07/fema_homeowners-guide-to-retrofitting_guide.pdf	Maybe - how to ensure homeowners deploy the measure and are capable of deploying	Maybe	no	maybe - sand bags are reasonable for homeowner to have available, but these are temporary measures	yes especially items noted in the second link may be excellent features in underserved flood exposed areas.	Maybe, but should be consistent with the local flood damage prevention regulations and the State Building Code	
Flood	Reduce or prevent water intrusion	**Purchase/install floodproof seals and locks**	- "Enhanced seals and locks to the doors and windows to make them floodproof."	https://bregroup.com/expertise/resilience/flood-resilience/bre-flood-resilient-repair-house/	Maybe - possibly too low of a price tag	Yes	yes	yes	Yes	Yes	Yes
Flood	Reduce or prevent water intrusion	**Raise porch/ threshold**	- "Unobtrusive, but disabled access may need to be considered. Low flood depths only; waterproof door may also be needed."	https://marydhonau.com/wp-content/uploads/2022/02/Landmark-KYFR-Guide-jan-2021-v4.pdf	No - niche market	Maybe	no	no	Maybe	No	
Flood	Waterproofing	**Apply bitumen sealing**	- "Buildings can be made waterproof from the outside by sealing basements using polymer bituminous seal, usually in new buildings. In the case of retrofitting, sealants are applied on the inside which is technically challenging and very costly (Manojlovic & Pasche, 2007). In practice, this type of sealing is often used, as basements can thus be used more effectively, compared to when sealing using waterproof concrete. The measure has an average lifetime of 75 years."	https://wires.onlinelibrary.wiley.com/doi/epdf/10.1002/wat2.1404	Maybe - confirm US application	Maybe	maybe	maybe - question on how expensive this is compared to home elevation. May be a cheaper alternative for floodproofing	Maybe new const definitly	Maybe, but should be consistent with the local flood damage prevention regulations and the State Building Code	
Flood	Waterproofing	**Apply wall sealant**	- sealing walls with waterproofing compounds, water-resistant exterior sheathing - "Aquastop = For painting DPC joints and below; dries to cement color… 'Water repellent coatings' (also called 'damp-proofing masonry creams') are not intended for under-water use." - "Coatings: waterproof membrane (above grade), asphalt (up to 2' below grade), sprayed-on cement (above grade)" - Not recommended for CMU or Brick above a height of 3' without engineering analysis demonstrating walls can withstand the expected hydrostatic and hydrodynamic loads and impact forces; slab floors must also be considered for buoyancy effects - "If flood water stays in contact with a building for a long period of time, it can soak through the wall. A waterproof breathable spray can be applied to external walls to reduce this."	https://marydhonau.com/wp-content/uploads/2022/02/Landmark-KYFR-Guide-jan-2021-v4.pdf fema.gov/media-library/assets/documents/13261 https://www.fema.gov/sites/default/files/2020-07/fema_homeowners-guide-to-retrofitting_guide.pdf https://www.befloodready.uk/pfr-products	Yes	Yes	yes	yes	Yes	Yes	Yes
Flood	Waterproofing	**Apply waterproof concrete**	- "Waterproof concrete can be applied to the inside area of base-ments. Since this measure is not completely waterproofing a building because of a possible seeping of moisture into the walls through capillarity and resulting water vapor diffusing inside the building, additional measures might be needed especially in areas with high groundwater levels (Suda & Rudolf-Miklau, 2012). Implementing waterproof concrete is only pos-sible for new buildings (Egli, 2002). The measure has an average lifetime of 75 years (Kreibich et al. 2011b)."	https://wires.onlinelibrary.wiley.com/doi/epdf/10.1002/wat2.1404	No - new construction	Yes - Check with Larry Janesky	yes	maybe - say only new buildings?	Yes - Check with Larry Janesky	Yes	Yes
Flood	Waterproofing	**Conduct re-pointing**	"Gaps or cracks in walls can allow flood water to enter. Re-pointing helps to seal these ingress routes, improving the overall condition of the wall and reducing water ingress."	https://www.befloodready.uk/pfr-products	Yes	Yes	yes	yes	Yes	Yes	Yes
Flood	Waterproofing	**Enact dry-floodproofing measures**	- Many measures are considered under "dry floodproofing", which is any floodproofing measure that does not purposefully flood a space. This is a note of the materials and appropriate buildings from the Homeowner's Handbook: - Replace materials with floodwater resistant (72-hours): concrete, ceramic tiles, pressure-treated lumber, steel, metal, brick, epoxy paint, foam, and closed-cell insulation - Dry Floodproofing (appropriate primarily for slab-on-grade buildings with concrete or solid masonry walls)	https://www.smarthomeamerica.org/resources/homeowners-handbook-to-prepare-for-natural-disasters	Yes	Yes	maybe	yes	Yes	Maybe, but should be consistent with the local flood damage prevention regulations and the State Building Code	
Flood	Waterproofing	**Install brick-facing using engineering bricks**	- "Note 'Clay Engineering bricks' are made to a lower standard. More effective than sealing existing wall. Needs good workmanship; below-ground work involved… May just reduce penetration rate. May need planning approval – visually alters building."	https://marydhonau.com/wp-content/uploads/2022/02/Landmark-KYFR-Guide-jan-2021-v4.pdf	Maybe - not enough homes fit the bill	No	no	no	No	No	No
Flood	Waterproofing	**Install seal penetrations**	- Utility penetrations, light shafts, etc. - "Many buildings have basement windows for ventilation and lighting purpose. Light shafts are needed and should be sealed from potential water inlet during flood events by using moveable steel covers with rubber sealants. These shafts can then be closed manually in case of a flood event. When protection is not needed, shafts can be left open for air ventilation and lighting. Alternatively, light shafts can also be sealed using glass bricks. Reinforced concrete has to be used in cases where floodwaters carry large amounts of sediments and bear erosion processes, as synthetic materials cannot withstand the impact of solid materials (Trebersburg et al., 2012)."	https://wires.onlinelibrary.wiley.com/doi/epdf/10.1002/wat2.1404 fema.gov/media-library/assets/documents/13261	Yes	Yes	yes	yes	Yes	Yes	Yes
Flood	Waterproofing	**Install wall and floor membranes**	- "Membranes installed under the floor and in the walls to divert water… The membrane in the wall means that if the adjoining property floods, water that seeps through the wall from next door is channeled away to prevent damage on your side. This allows repairs to start even if the neighboring property is still affected."	https://bregroup.com/expertise/resilience/flood-resilience/bre-flood-resilient-repair-house/	Yes	Yes	yes	yes	Yes	Maybe	Yes
Flood	Waterproofing	**Renovate exterior walls and cladding building materials**	- Unsuitable building materials (not water-resistant): - Not water-resistant timber and wood panels Suitable building materials (water-resistant): - Yellow foundation insulation board - expanded polystyrene foam and extruded polystyrene foam - Mineral plaster based on cement or hydraulic lime - Organically bound plasters - Silicate plasters - Artificial resin plaster - Fiber cement board - Stainless steel sheets	https://wires.onlinelibrary.wiley.com/doi/epdf/10.1002/wat2.1404	No - more applicable to additions or new construction	Maybe	no	maybe	Maybe	No	

Flood	Waterproofing	**Renovate flooring building materials**	Unsuitable building materials (not water-resistant): - Parquet - Wood plaster - Textile coverings - Linoleum - Cork Suitable building materials (water-resistant): - Concrete - Screed - Tiling - Mastic asphalt "Also fireproof/thermal insulation. Permanently in place. There are still cleaning and drying costs following a flood. Probably only cost effective as part of flood damage repair work."	https://wires.onlinelibrary.wiley.com/doi/epdf/10.1002/wat2.1404 https://marydhonau.com/wp-content/uploads/2022/02/Landmark-KYFR-Guide-jan-2021-v4.pdf	Maybe	Yes	no	maybe	Yes	No	
Flood	Waterproofing	**Renovate interior walls and covering building materials**	Unsuitable building materials (not water-resistant): - Gypsum plaster - Gypsum plasterboard - Wallpapers - Wood paneling - Cork cladding Suitable building materials (water-resistant): - Mineral plasters based on cement or hydraulic limestone - Wall tiles - Clinker	https://wires.onlinelibrary.wiley.com/doi/epdf/10.1002/wat2.1404	Maybe	Yes	no	maybe	Yes	No	
Flood	Waterproofing	**Renovate wall building materials**	Unsuitable building materials (not water-resistant): - Gypsum plasterboard - Wooden walls, beams and planks - Aerated concrete, autoclaved aerated concrete - Steel girder Suitable building materials (water-resistant): - Concrete, lightweight concrete - Conventional stone on stone construction (sand-lime brick, brick, etc.) - Glass bricks	https://wires.onlinelibrary.wiley.com/doi/epdf/10.1002/wat2.1404	Maybe	Yes	no	maybe	Yes	No	
Flood	Waterproofing	**Renovate window and door building materials**	Unsuitable building materials (not water-resistant): - Wood (unsealed, untreated) Suitable building materials (water-resistant): - Wood (sealed, pretreated) - Synthetic materials - Aluminum	https://wires.onlinelibrary.wiley.com/doi/epdf/10.1002/wat2.1404	Maybe	Yes	no	maybe	Yes	Maybe	
Flood	Waterproofing	**Replace basement or flood-prone area flooring and wall coverings**	"Use flood-resistant materials. How: When rebuilding your basement, use water resistant material such as terrazzo, or ceramic tile floor and cement board. Why: This will reduce flooding damage to your home and will allow you to recover/be back to normal faster. These materials are also often mold-resistant and would protect from condensation." - replace carpet with tile to reduce damage	https://www.cambridgema.gov/-/media/Files/CDD/Climate/resilientcambridge/toolkithomeowners.pdf fema.gov/media-library/assets/documents/13261	Yes	Yes	no	yes	Yes	Yes	Yes
Flood	Waterproofing	**Replace existing or install new water resistant wall insulation**	- "Water resistant insulation in the walls and under the floor (such as spray-applied PUR foam or injected foamed cavity insulation)."	https://bregroup.com/expertise/resilience/flood-resilience/bre-flood-resilient-repair-house/ fema.gov/media-library/assets/documents/13261	Yes	Yes	yes	yes	Yes	Yes	Yes
Flood	Waterproofing	**Replace flooring with water resilient materials**	"Suspended timber floors, which are more susceptible to damage, can be replaced with solid concrete floors. Tiled floors and skirting boards are also easier to clean compared to carpet and laminate which usually need replacing after a flood event."	https://www.befloodready.uk/pfr-products	Yes	Yes	maybe	maybe - for areas prone to flooding	Yes	Maybe	
Flood	Waterproofing	**Retrofit interior wall material**	- "Waterproof magnesium oxide wall boards instead of plasterboard, or, if plasterboard is used, this fitted horizontally so that in future only the lower boards need replacement if damaged ceramic tiled floor and loose rugs in place of fitted carpets." - "The use of water resilient products, materials and paints on walls can reduce the severity of internal damage. Plasterboard can also be installed horizontally, so only the lowest sections are affected if flooding occurs."	https://bregroup.com/expertise/resilience/flood-resilience/bre-flood-resilient-repair-house/ https://www.befloodready.uk/pfr-products	Yes	Yes	maybe	maybe	Yes	Maybe	

Total Yes	**36**
Total No	**6**

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CONNECTICUT GREEN BANK

Memo

To: Deployment Committee, Connecticut Green Bank

From: Desiree Miller, Senior Manager, Clean Energy Finance

CC: Bryan Garcia, President and CEO; Bert Hunter, EVP and CIO; Brian Farnen, General Counsel and CLO; Mackey Dykes, Vice President, Financing Programs

Date: November 14, 2022

Re: Capital Solutions RFP: $2.5 Million Debt Facility for Energy Resources USA to Finance Energy Efficiency Retrofits at Bradley International Airport

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Investment Summary

This credit memorandum sets out the rationale for creating a $2.5 million construction debt facility for Energy Resources USA LLC ("Energy Resources"), which has been awarded a $2,862,502 contract with Eversource under the Small Business Energy Advantage ("SBEA") program to install energy efficiency ("EE") retrofits at Bradley International Airport. Energy Resources submitted an application under the Green Bank's Capital Solutions Open RFP ("Capital Solutions") program (approved by the Board in July 2021). Bradley is owned and operated by the Connecticut Airport Authority and funds from the proposed debt facility would specifically be earmarked for equipment and labor in the Bradley energy efficiency retrofit and any other state energy efficiency project approved by Green Bank.

Thanks to Green Bank's expansion of financing availability for the state through the SBEA program, Energy Resources has or will be contracting for several large EE projects at state facilities. These projects are larger than the scope of their normal projects and will strain their financial resources. Eversource doesn't pay out the financing and incentives until the project is complete and equipment suppliers that vendors like Energy Resources rely upon for the EE measures to install are requiring more and more money up front. Bank financing is too costly and the advance rate (the percentage advanced against the receivables) too low.

According to the project agreement between Energy Resources and Eversource, Energy Resources would install a total of 12 energy efficiency measures across Bradley International Airport, including lighting, refrigeration and HVAC retrofits. The retrofits are expected to save the Connecticut Airport Authority $5,131,137 over the measures' effective useful lives. Under its contract with Eversource, Energy Resources would not be paid until completion and final approval of the energy efficiency installation. As the project is expected to take approximately 18 months from commencement of installation, with full payment coming

at the end of installation completion following successful inspection, Energy Resources faces a clear need for construction financing.

Open RFP Capital Solutions Request

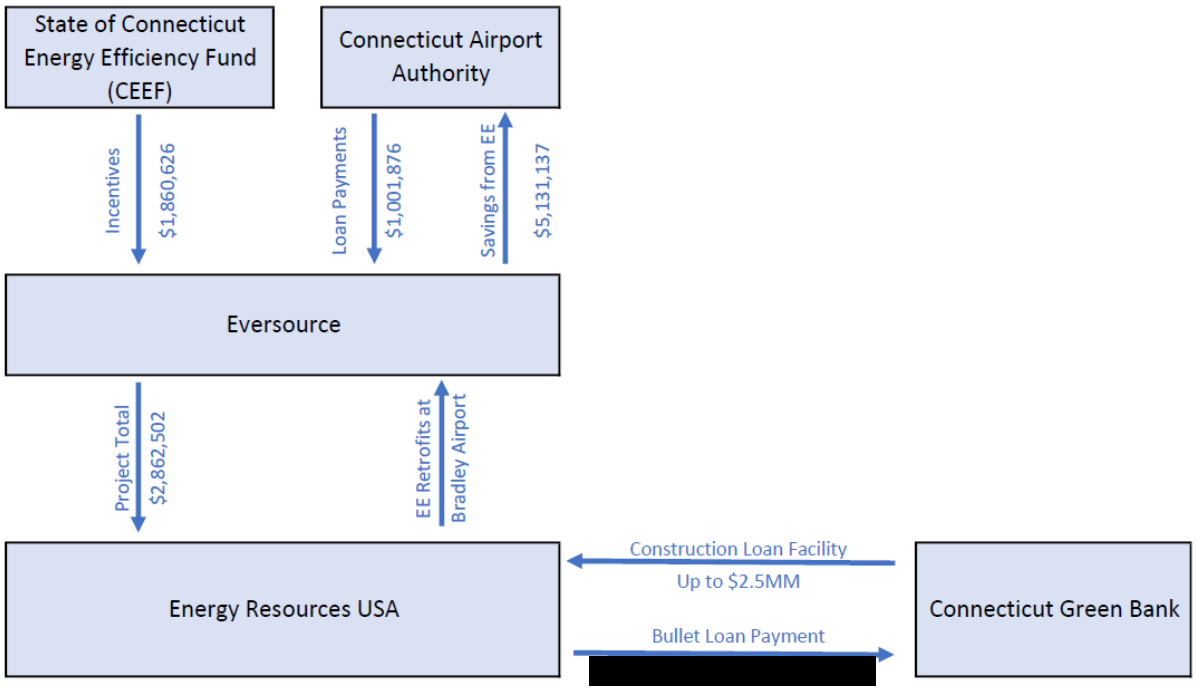
Energy Resources is currently under contract with the State of CT to complete a large energy efficiency project at Bradley Airport. They are also in the process of finalizing another large project with the Dept of Correction (DOC). These projects are facilitated through the Master Agreement between the State of CT and Eversource, which leverages the SBEA program. The airport project is approximately $3M, and the DOC is approximately $3.5M.

In the case of Bradley Airport, the project will generate almost 4M kWh in annual savings. Full project payment will be made to Energy Resources directly from Eversource. Eversource has indicated a willingness to assign these payments to facilitate Green Bank financing. This project is based on the utility program providing the incentives and interest free financing, in accordance with the Master Agreement and SBEA program, to fund the projects. The project has many components, including a large mechanical portion, and will take approximately 18 months to complete. The same circumstances exist for the pending DOC project. This creates a cash flow challenge since Eversource's flexibility with partial payments has constraints associated with the comprehensive bonus aspect of the incentive.

Energy Resources has been a financially self-sustainable company for many years. As a CT small business, supporting these projects, along with the many small to medium sized energy efficiency projects they complete, will create a major strain on its balance sheet. The debt facility under consideration by the Deployment Committee will enable Energy Resources to keep paying all of its vendors in a timely manner. The State is eager to get these projects completed in a timely manner to start enjoying the large amount of energy savings. The market is experiencing increased lead times and increased material/equipment costs. Energy Resources needs to start purchasing equipment as soon as possible. There will be a cost of waiting based on lost energy savings and increased material costs. Energy Resources is appealing to the Green Bank because, as opposed to a commercial lender, Green Bank can offer a reasonable rate and recognizes the sense of urgency behind the work to be performed and streamline the approval process. Commercial banks have recently tightened credit standards in response to expectations for a contraction in economic conditions. These increased standards make it much more difficult to secure credit on reasonable terms. Also, with every increase in the federal funds rate – the "prime rate" which is available to borrowers like Energy Resources (plus a spread over this rate) – increases in lock-step. This makes it increasingly uneconomic for companies like Energy Resources trying to help the state reduce energy consumption to do its job affordably. Finally, Energy Resources has requested the Green Bank advance 100 cents on the dollar – as these funds will be repaid to us 100 cents on the dollar by the utilities. Commercial banks, in contrast, will lend only a fraction of this – often 60 cents or possibly 70 cents. Accordingly, Energy Resources has requested approval from the Green Bank for a $2.5M loan with an initial closing of $1M, with the ability to increase up to a total of $2.5M.

Transaction Structure

Under the proposed $2.5 million debt facility, Energy Resources would have up to one draw per month, up to approximately [redacted]% of the value of the Eversource receivables as explained below. As proposed, the debt facility would target closing on December 1, 2022, and would be repaid potentially in uneven installments (should Eversource make a partial payment) or in full at maturity (discussed later). Given the uncertainty of payment flow until project final completion, the Green Bank has proposed a bullet loan, where principal and all interest are due at maturity but with a "cash sweep" of Eversource payments to Energy Resources should these payments come in sooner than following the completion of *all* projects and upon final inspection. Accordingly, staff will model the loan advances, repayments and the applicable interest rate to determine the level of advance supported by the Eversource receivable. Based on a forecast Energy Resources has supplied Green Bank, staff estimates the advance rate could be in the [redacted]% range. The debt facility would mature on the sooner to occur of (a) disbursement by Eversource of total funding associated with the Bradley project or (b) two years from the closing date of the facility (approximately November 30, 2024). Interest would be assessed on the outstanding balance in a given month at a fixed [redacted]% per annum rate (360-day basis) with any unpaid interest being capitalized into the loan monthly. At its choice, Energy Resources may make early interest and/or principal payments. Energy Resources would be permitted to enter into the financing facility with Green Bank with a minimum $[redacted] MM facility size with the ability to request increases in the facility in increments of $[redacted] (up to a maximum facility of $2.5 MM) in the sole discretion of Green Bank and subject to an additional facility fee.



Eversource is funding the $2.8 million installation costs through a combination of $1,860,626 of state incentives and an 84-month 0% loan to the Connecticut Airport Authority in the amount of $1,001,876 under the SBEA program. In total, the energy efficiency retrofits are expected to save the Connecticut Airport Authority $4,129,262, on net. The incentives are funded by the State of Connecticut Energy Efficiency Fund. The energy efficiency retrofit is part of a larger master agreement (MA 9PSX0026) where Eversource manages the installation of energy efficiency products and services at various Connecticut state agencies.

Overview of Energy Resources USA

Based in Thomaston, CT, Energy Resources is an energy efficiency and solar installer, with commercial-scale customers in state, municipal, industrial, retail, and non-profit sectors. For over 10 years, Energy Resources has been a contractor for Eversource and United Illuminating in Connecticut, as well as NGRID and Eversource in Massachusetts. Energy Resources has completed projects for Connecticut state agencies including DAS, DOC, DOL, DOT, Dept of Mental Health, CT State Police, and CT State Library. Since 2017, Energy Resources has completed seven C-PACE projects in the State of Connecticut. The projects range in size from $312,121 to $3.1 million. Three of the projects were financed directly by the Connecticut Green Bank, while the other four were financed by third party C-PACE capital providers.

[redacted]

[redacted]

[1] Under the general rule of section 481, a taxpayer that changes from the cash method of accounting to an accrual method of accounting is permitted to take into account ratably over four taxable years any positive section 481(a) adjustment (i.e., an adjustment that increases taxable income). The Section 179D deduction allows for up to $1.80 per square foot for taxpayers — or the designer if the building is government-owned—that improve the efficiency of their commercial and residential rental buildings that are four stories high or more, above certain thresholds.

[redacted]

Risks and Mitigants

[redacted]

Ratepayer Payback

How much clean energy is being produced (i.e. kWh over the projects lifetime) from the project versus the dollars of ratepayer funds at risk?

The energy efficiency measures are expected to save 90,135 mmBTU of energy over their effective useful life, and the debt facility is up to $2.5 million. The mmBTU/$ ratepayer funds at risk is forecast to be $0.036.

Capital Extended

How much of the ratepayer and other capital that Green Bank manages is being expended on the project?

The debt facility will not exceed $2.5 million.

Capital Solutions RFP Evaluation

Capital Solutions RFP Proposals are evaluated on the following criteria:

A. Meeting Green Bank Goals

Providing the capital necessary for Energy Resources to complete the energy efficiency retrofit of Bradley International airport, will help the Green Bank achieve the following goal formalized in the Comprehensive Plan:

- **Scaling Up Investment and Impact in Connecticut and Beyond** – in order to achieve the climate change goals set forth, more investment from private capital sources leveraged by innovative public sector financing will be needed to scale-up and scale-out the Green Bank model's impact.

B. Green Bank Essentiality – to what extent is participation by the Green Bank essential to the success of the project?

Green Bank staff sees its participation as supplementary and complementary to the existing financial support from other Connecticut government funding (i.e., State of Connecticut Energy Efficiency Fund and Connecticut Airport Authority) in order to achieve a quick payback energy efficiency project at Bradley Airport. As explained by the applicant (see: "Open RFP Capital Solutions Request" earlier in this memo) the size of the project relative to the applicant's financial resources and the tightened credit standards and terms and conditions of bank financing, and given the urgent timing of the funding for ordering equipment so that the state project at Bradley Airport can stay on track speaks to the essentiality of Green Bank financing.

C. Project Feasibility – How feasible is the project to achieve its stated goals?

Barring the scenarios outlined above in the Risk Section, Energy Resources is expected to successfully install the energy efficiency measures promised in the agreement. Energy Resources has a successful history in installing extensive energy efficiency retrofits in large government buildings as well as several C-PACE projects.

D. Project Replicability – Could a similar project be replicated in Connecticut or elsewhere, or is this a unique opportunity?

Staff believes the structure it has designed with Eversource and Energy Resources is replicable for other strong vendors like Energy Resources for Eversource and UI service areas. Energy Resources is already in the contracting process with the Department of Corrections for another energy efficiency retrofit. If this application is approved and the loan is successful, it is possible the Green Bank could expand the offering into a formal program and seek private capital partners as necessary.

E. Project timetable – total development and construction timeline.

Construction is expected to take 18 months. The Green Bank has built in an extra 6 months of contingency until the debt facility matures.

F. Relevant Experience – Does the proposer offer relevant and sufficient experience for the type of project being proposed?

Yes. As explained elsewhere in this memo, Energy Resources has been operational for over 10 years and specializes in performing large energy efficiency retrofits for government entities and for C-PACE.

G. References

The Connecticut Green Bank has had positive experiences working with Energy Resources on its four C-PACE projects.

H. Pending Litigation

I. Energy Resources management and character review

Recommendation

Based on the diligence of the proposed debt facility transaction meeting Green Bank underwriting and program criteria, Staff recommends approval of this transaction by the Deployment Committee..

Resolutions

WHEREAS, the Connecticut Green Bank ("Green Bank") has significant experience in the development and financing of commercial energy efficiency projects in Connecticut;

WHEREAS, the Green Bank continually seeks new ways to facilitate the deployment of energy efficiency and renewable energy in the State; and

WHEREAS, the Green Bank has established the Capital Solutions Open RFP Program (the "Capital Solutions Program") to accommodate clean energy and environment infrastructure capital needs not met by other existing Green Bank programs; and

WHEREAS, Energy Resources USA LLC ("Energy Resources") has applied to the Capital Solutions Program and staff is recommending approval of Energy Resources' application for a construction loan facility (the "Construction Loan"), substantially on the terms and conditions explained in a memorandum to the Deployment Committee of the Green Bank Board of Directors (the "Deployment Committee") dated November 14, 2022 (the "Deployment Committee Memo");

NOW, therefore be it:

RESOLVED, that the Green Bank approves the Capital Solutions application of Energy Resources and the establishment of a construction line of credit for funding its obligations under contracts for energy efficiency retrofits for state projects pursuant to the Eversource Small Business Energy Advantage program in an amount not to exceed $2.5 million on terms substantially similar to those described in the Deployment Committee Memo; and

RESOLVED, that the proper Green Bank officers are authorized and empowered to do all other acts and negotiate and deliver all other documents and instruments as they shall deem necessary and desirable to effect the above-mentioned legal instruments.

Submitted by: Bert Hunter, EVP and CIO and Desiree Miller, Sr Manager, Clean Energy Finance

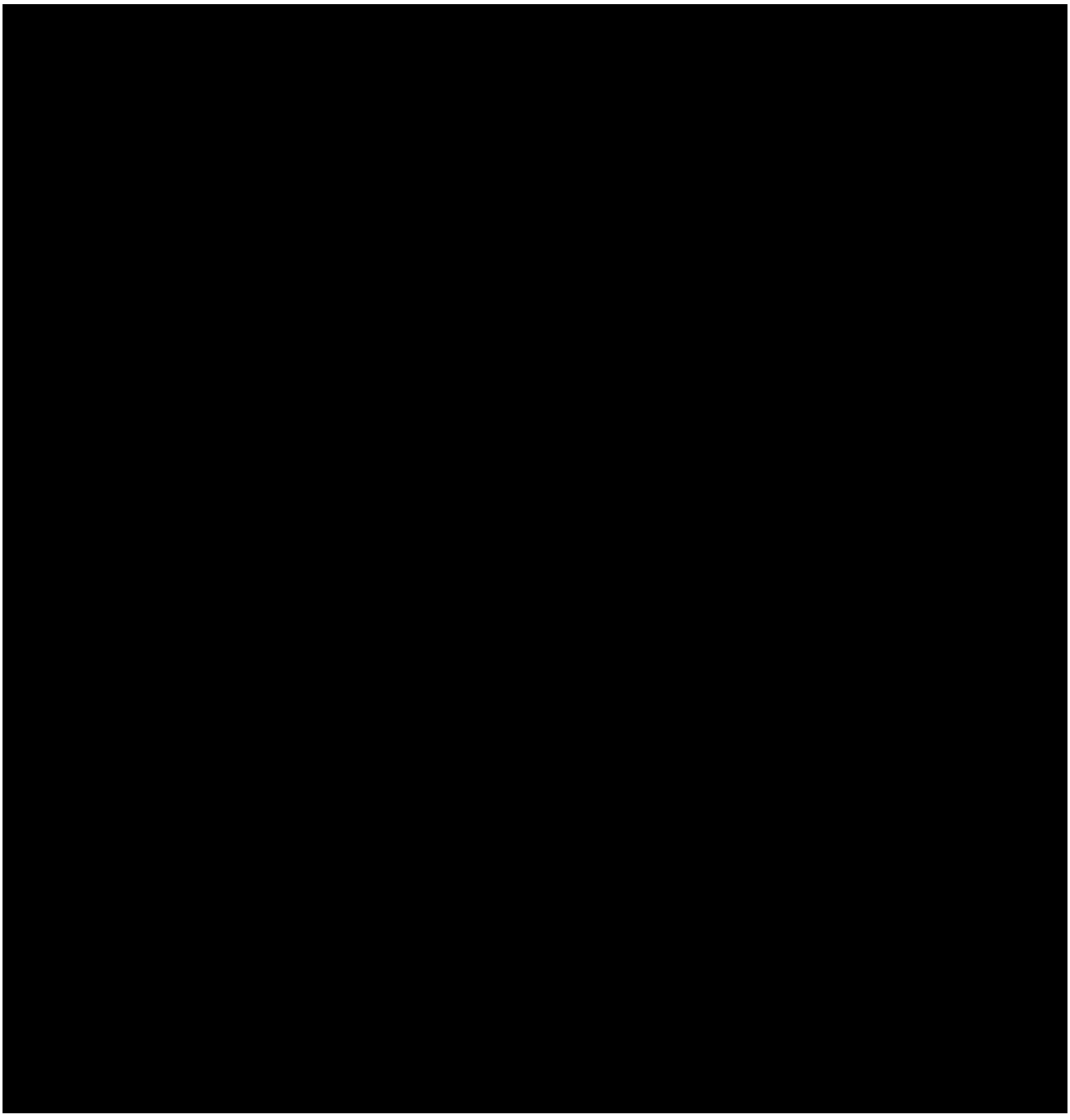
Appendix A: Term Sheet

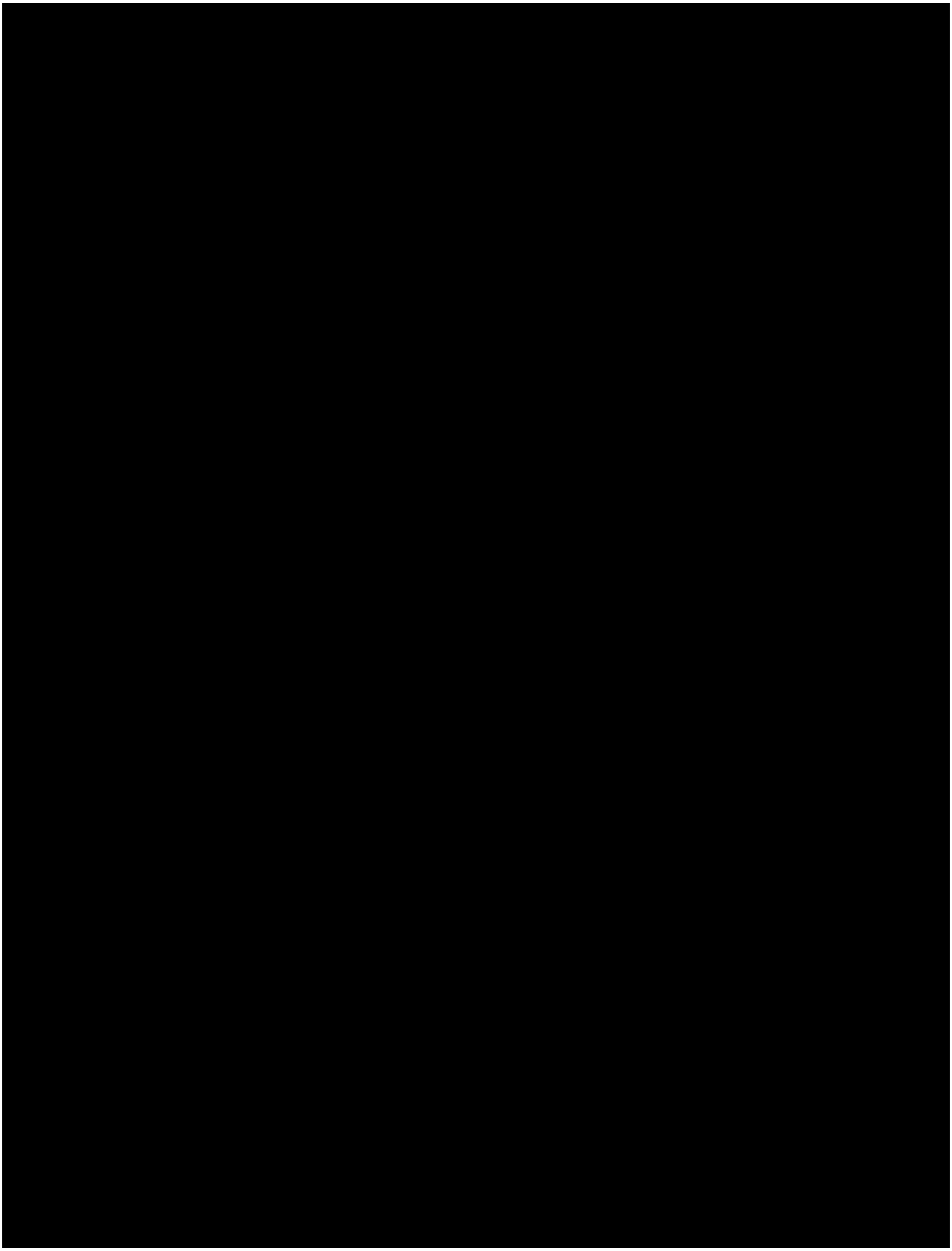
Proposed Term Sheet

Indicative Summary of Terms and Conditions

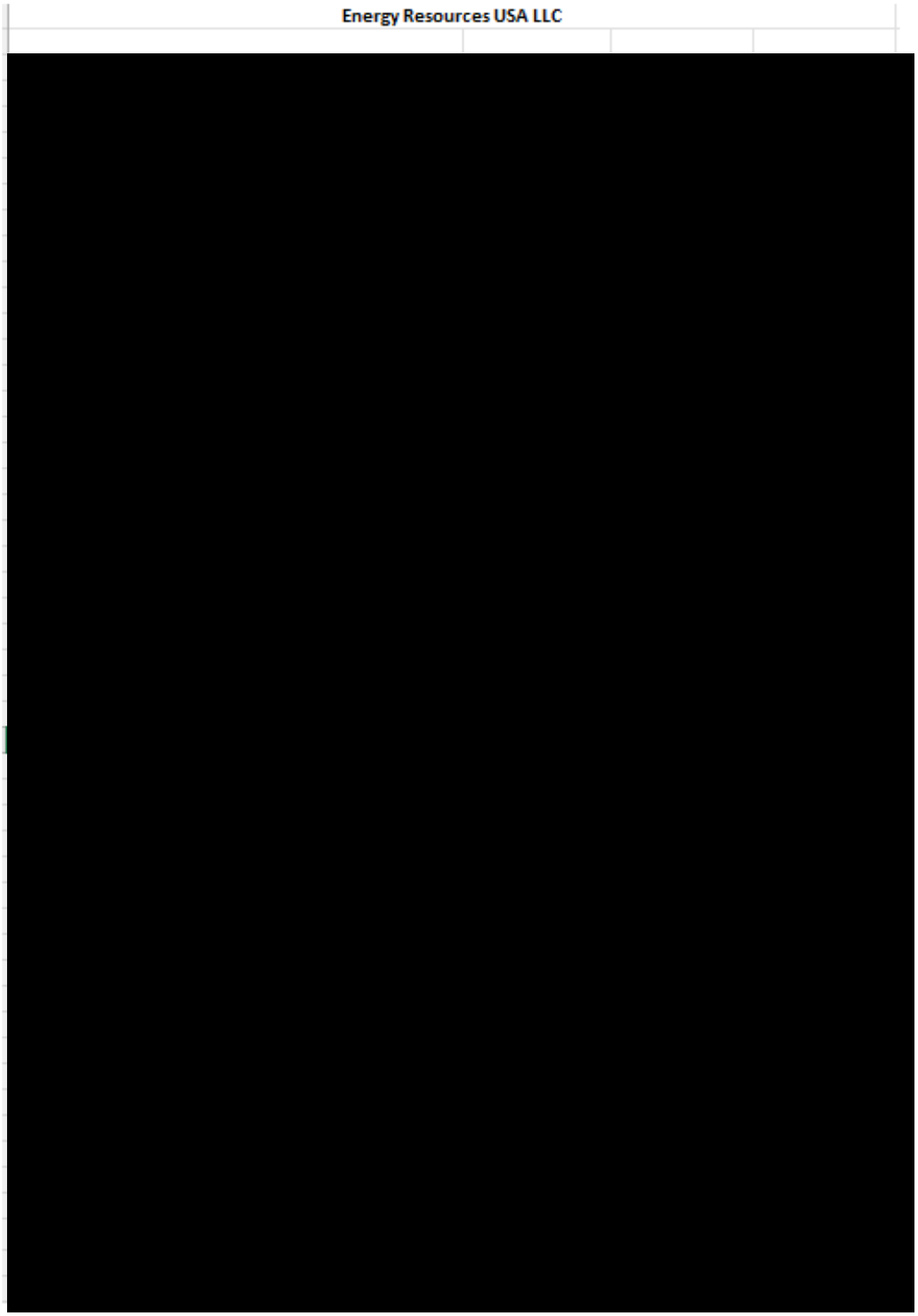
Energy Resources USA LLC
Up to $2,500,000 Construction Debt Facility
November 16, 2022

For Discussion Purposes Only – Confidential – This is Not a Commitment

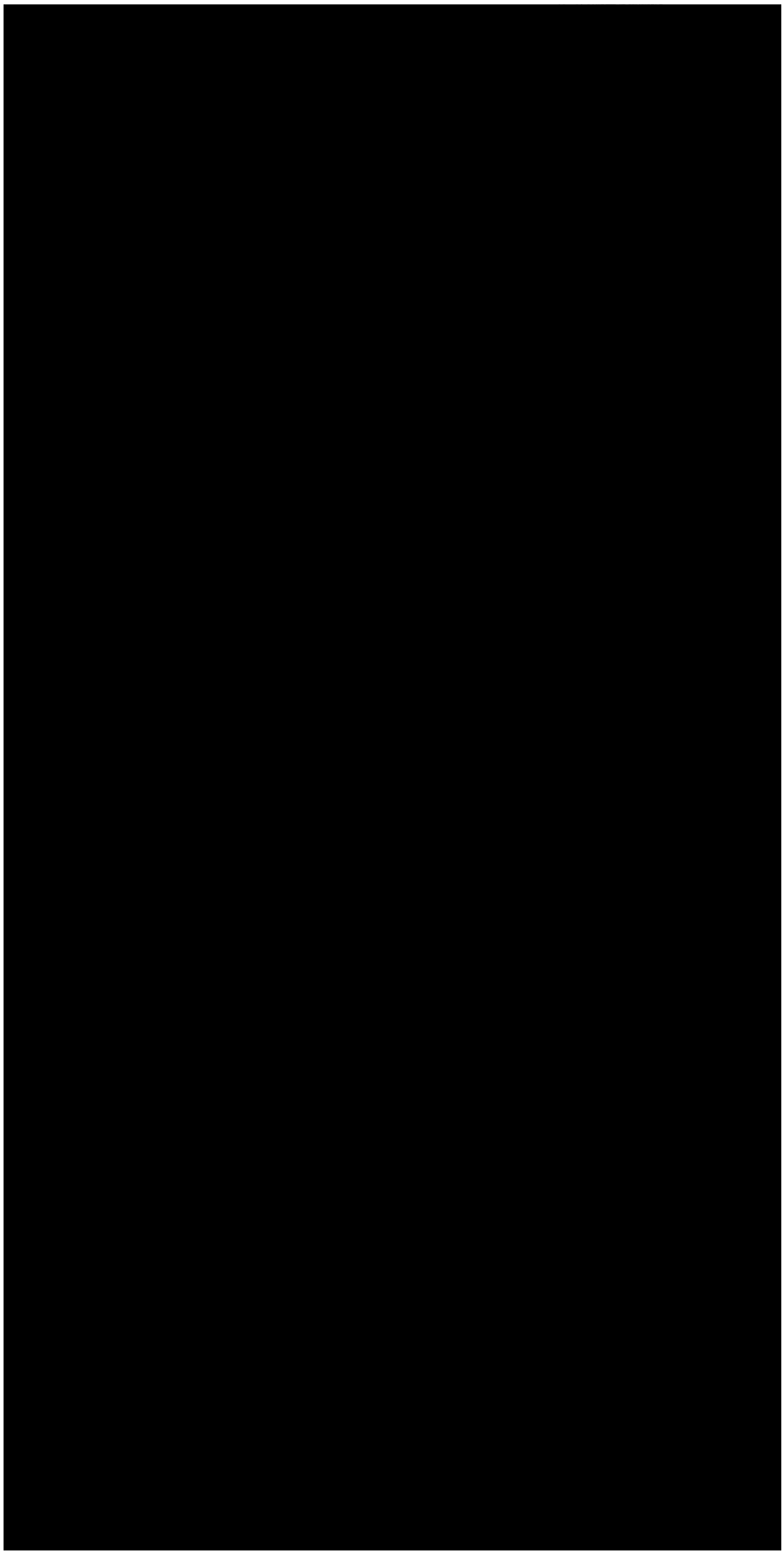




Appendix B: Financials



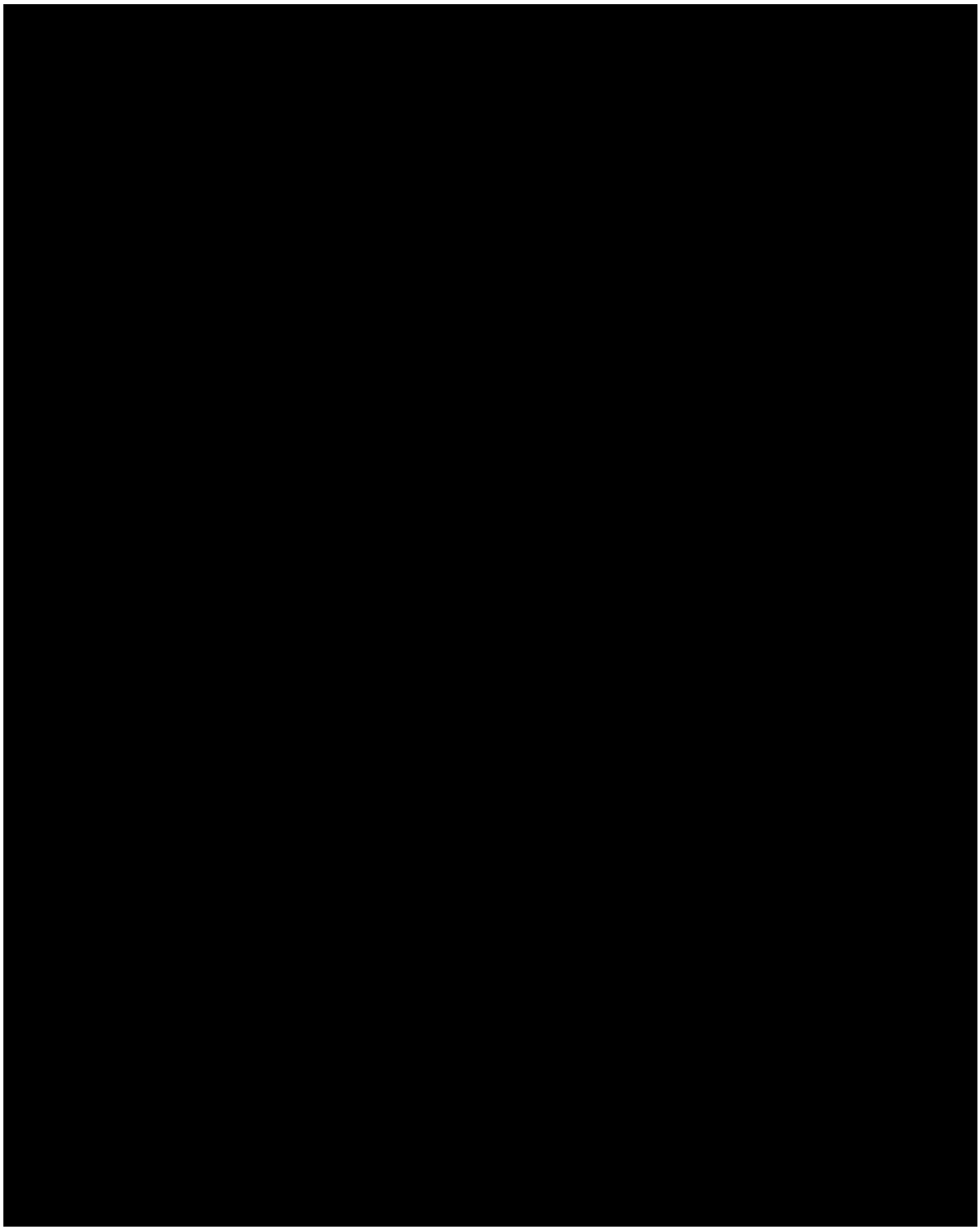
Appendix C: Summary of Energy Efficiency Measures



Appendix D: Proposed Loan Disbursement Schedule

[AWAITING FROM ENERGY RESOURCES]

Appendix E: Energy Resources Organizational Chart



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